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(54) Title: PRESSURE RELIEF LATCH

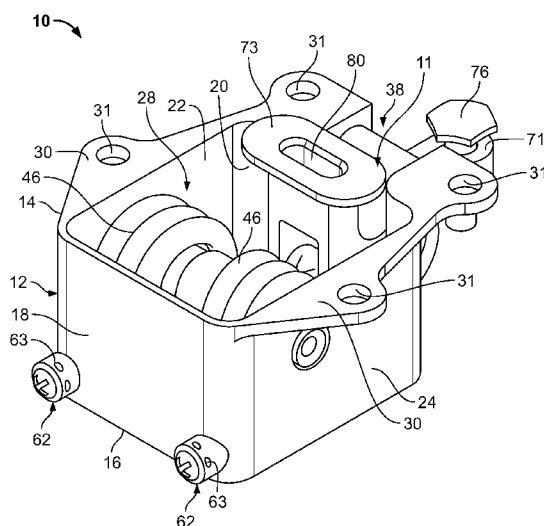


FIG. 1

(57) Abstract: A latch (10) having a housing (12) and a latch mechanism (11) located within an interior portion (28) of the housing (12). The latch mechanism (11) includes an arm (48), a pair of socket screws (62), a pair of torsion springs (46), each of which is connected rotatably to the arm (48) and engages a corresponding one of the pair of socket screws (62), a bolt mechanism (72) attached rotatably to the housing (12), and a link (66) attached pivotally to the arm (48) and attached to the bolt mechanism (72). The socket screws (62) are utilized to adjust loads on the springs (46). The bolt mechanism (72) is movable between a first position, in which the arm (48) and the link (66) are toggled with one another under the loads of the springs (46) and the bolt mechanism (72) is adapted to engage an external structure (102), and a second position, in which the link (66) and the arm (48) are untoggled with one another and the bolt mechanism (72) is disengaged with the external structure (102).

PRESSURE RELIEF LATCH

Cross-Reference to Related Application

This application relates to and claims the benefit of commonly-owned, co-
5 pending U.S. Provisional Patent Application Serial No. 62/248,355, filed October 30,
2015, entitled "FINE-TUNED, ADJUSTABLE LOAD, TOGGLE PRESSURE RELIEF
LATCH," the entirety of which is incorporated herein by reference.

Technical Field

10 The present invention relates to latches and, more particularly, to fine-tuned,
adjustable load, toggle pressure relief latches.

Background of the Prior Art

Removable and moveable elements installed on exterior surfaces of aerospace
15 vehicles, such as hatches, doors, access panels, engine cowlings, nacelles, and
radomes employ latches. What is desirable is a latch that has an adjustable, fine-tuned
pressure relief load.

Disclosure of the Invention

20 In an embodiment, a latch includes a housing having a top end, a bottom end
opposite the top end, a front wall extending from the top end to the bottom end, a rear
wall opposite the front wall and extending from the top end to the bottom end, a pair of
sidewalls, each of which extends from the top end to the bottom end and between the
front wall and the rear wall, and a floor located at the bottom end and extending

between the front wall, the rear wall, and the sidewalls, the front wall, rear wall, the pair of sidewalls, and the floor forming an interior portion; and a latch mechanism located within the interior portion of the housing, the latch mechanism including an arm, a pair of socket screws, each of which is positioned rotatably within the rear wall of the housing, 5 a pair of torsion springs, each of which is connected rotatably to the arm and engages a corresponding one of the pair of socket screws, a bolt mechanism attached rotatably to the housing proximate to the rear wall and having a first end and a second end opposite the first end, and 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 arm, and the second end of 10 the link being attached to the bolt mechanism, wherein each of the pair of socket screws being adapted to adjust a load on a corresponding one of the torsion springs, and wherein the bolt mechanism is movable rotatably between a first position, in which the arm and the link are toggled with one another under the loads from the pair of torsion springs and the first end of the bolt mechanism is adapted to engage an external 15 structure, and a second position, in which the link and the arm are untoggled with one another and the first end of the bolt mechanism is disengaged with the external structure.

In an embodiment, the housing includes a pair of ledges, one of the pair of ledges being located between and extends from a first corner formed by one of the pair 20 of sidewalls, the rear wall, and the floor of the housing, and the other of the pair of ledges being located between and extends from a second corner formed by the other of the pair of sidewalls, the rear wall, and the floor of the housing, and wherein one of the pair of torsion springs rests on one of the pair of ledges, and the other of the pair of

torsion springs rests on the other of the pair of ledges. In an embodiment, the housing includes a pair of holes formed within the front wall thereof, one of the pair of holes being located within one of the pair of ledges, and the other of the pair of holes being located within the other of the pair of ledges, and wherein each of the pair of holes
5 being sized and shaped to receive a corresponding one of the pair of socket screws. In an embodiment, the arm includes a middle portion having a pair of side members extending outwardly and opposed to one another and a slot formed between the side members, the slot being sized and shaped to receive the first end of the link.

In an embodiment, the latch mechanism include a pair of bushings, each of the
10 pair of torsion springs being positioned around a corresponding one of the bushings, and wherein the bushings are connected to the middle portion of the arm by a rivet. In an embodiment, each of the pair of torsion springs includes a first leg and a second leg, the first leg of each of the pair of torsion springs engages its corresponding one of the pair of the socket screws, and the second leg of each of the pair of torsion springs
15 engages a corresponding one of side members of the arm. In an embodiment, each of the socket screws includes a periphery and a plurality of holes formed within the periphery, each of the plurality of holes being sized and shaped to receive a lock wire.

In an embodiment, the bolt mechanism includes a bolt positioned at the first end of the bolt mechanism, and a nut engaged threadedly with the bolt for adjusting the
20 position of the bolt. In an embodiment, the second end of the bolt mechanism includes a slot formed therein and sized and shaped to receive an external tool for manually rotating the bolt mechanism. In an embodiment, the housing includes at least one mounting bracket. In an embodiment, the housing includes a pair of mounting brackets.

In an embodiment, the housing includes a pair of support brackets, one of which extends obliquely from the rear wall and the bottom end to the top end and one of the mounting brackets proximate to one of the sidewalls, and the other of which extends obliquely from the rear wall and the bottom end to the top end and one of the mounting
5 brackets proximate to other of the sidewalls. In an embodiment, the rear wall includes an opening positioned between the support brackets, the opening being sized and shaped to enable movement of the bolt mechanism between its first position to its second position.

In an embodiment, the latch is a fine-tuned/adjustable load, toggle-pressure relief
10 latch which provides a fine-tuned load-range capability. The latch ensures a door of a structure can be opened when a high pressure is built up so as to prevent any loss of an internal component housed within the structure, such as an aircraft engine. The latch can be fine-tuned to a required load at an assembly level. In an embodiment, the latch is adapted for use in the aerospace field, such as aerospace doors, nacelles, etc. In
15 other embodiments, the latch can be used in other fields and applications.

Brief Description of the Drawings

FIG. 1 is a top perspective view of a pressure relief latch in accordance with an embodiment;

FIG. 2 is a bottom perspective view of the pressure relief latch shown in **FIG. 1**;

FIG. 3 is an exploded perspective view of the pressure relief latch shown in **FIG.**

1;

FIG. 4 is side cross-sectional view of the pressure relief latch shown in **FIG. 1**, the latch being shown in a closed position; and

FIG. 5 is side cross-sectional view of the pressure relief latch shown in **FIG. 1**, the latch being shown in an open position.

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Best Mode for Carrying Out the Invention

Referring to **FIGS. 1** through **3**, in an embodiment, a pressure relief latch **10** includes a housing **12** and a latch mechanism **11** located within the housing **12**. In an embodiment, the housing **12** is generally cubed-shape and hollow. In an embodiment, the housing **12** includes a top end **14**, a bottom end **16** opposite the top end **14**, a front wall **18** extending from the top end **14** to the bottom end **16**, a rear wall **20** opposite the front wall **18** and extending from the top end **14** to the bottom end **16**, a pair of sidewalls **22, 24**, each of which extends from the top end **14** to the bottom end **16** and between the front wall **18** and the rear wall **20**, and a floor **26** located at the bottom end **16** and extending between the front wall **18**, the rear wall **20**, and the sidewalls **22, 24**, all of which define an interior portion **28** of the housing **12**. In an embodiment, the housing **12** includes a pair of mounting brackets **30**, one of which extends outwardly at the top end **14** and the sidewall **22** from the front wall **18** to the rear wall **20**, and the other of which extends outwardly at the top end **14** and the side wall **24** from the front wall **18** to the rear wall **20**. In an embodiment, each of the mounting brackets **30** includes a pair of mounting holes **31**, each being is sized and shaped to receive a fastener, such as a bolt, screw, rivet, or the like, for mounting the latch **10** to the structure. In an embodiment, each of the sidewalls **22, 24** includes a rivet hole **32** extending

therethrough and is sized and shaped to receive a rivet, which shall be described hereinafter. In an embodiment, the floor **26** includes a pair of drainage holes **34** extending therethrough, one of which is located proximate to a corner formed by the front wall **18** and the sidewall **22**, and the other of which is located proximate to a corner
5 formed by the front wall **18** and the sidewall **24**. In an embodiment, the housing **12** includes a pair of support brackets **36**, one of which extends obliquely from the rear wall **20** and the bottom end **16** to the top end **14** and one of the brackets **30** and is located proximate to the sidewall **22**, and the other of which extends obliquely from the rear wall **20** and the bottom end **16** to the top end **14** and one of the brackets **30** and is located
10 proximate to the sidewall **24**. In an embodiment, each of the support brackets **36** is connected integrally its corresponding one of the brackets **30**. In an embodiment, each of the support brackets **36** includes a hole **37** formed therein and is sized and shaped to receive a rivet, which shall be described hereinafter. In an embodiment, an opening **38** is formed within the rear wall **20** and is positioned between the support brackets **36**.

15 Referring to **FIG. 3**, in an embodiment, within the interior portion **28** of the housing **12**, one of a pair of ledges **40** is located between and extends from a corner formed by the sidewall **22**, the front wall **18**, and the floor **26**, and the other of the pair of ledges **40** is located between and extends from a corner formed by the sidewall **24**, the front wall **18**, and the floor **26** (only one of the ledges **40** being shown in **FIG. 3**). In an
20 embodiment, a pair of threaded holes **42** is formed within the front wall **18** and extending therethrough proximate to the floor **26**, each of which are located within a corresponding one of the ledges **40**.

Referring to **FIGS. 1** and **3**, the latch mechanism **11** includes a pair of bushings **44** and a pair of torsion springs **46**, which are mirrored with one another. In an embodiment, each of the torsion springs **46** is positioned around a corresponding one of the bushings **44** and rests on a corresponding one of the ledges **40** of the housing **12**.

5 Referring to **FIG. 3**, in an embodiment, the latch mechanism **11** includes an arm **48** having an elongated middle portion **50** with a hole **52** and a pair of side members **54** each of which includes a hole **56**, and a slot **58** formed therebetween. The bushings **44** and the springs **46** are connected rotatably to the arm **48** by a rivet **60** which is inserted through the hole **52** of the middle portion **50** of the arm **48**. In an embodiment, the latch
10 mechanism **11** includes a pair of socket screws **62** each of which is inserted within a corresponding one of the threaded holes **42** in the rear wall **20** of the housing **12**. Each of the socket screws **62** includes a plurality of holes **63** about its periphery for receiving lock wires, and a countersink portion **64**. One end of a leg **65** of each of the torsion springs **46** engages with the countersink **64** of a corresponding one of the socket
15 screws **62**, while the other leg **67** of each of the torsion springs **46** reacts against the arm **48**.

Still referring to **FIG. 3**, in an embodiment, the latch mechanism **11** includes a link **66**, one end of which is positioned within the slot **58** of the arm **48** and attached rotatably thereto by a rivet **68** in a scissor-like manner. In an embodiment, the latch
20 mechanism **11** includes a bolt mechanism **72** positioned within and attached to the housing **12** by a rivet **74**, which is positioned within the holes **37** and extending through the opening **38** of the housing intermediate the support brackets **36**. In an embodiment, an opposite end of the link **66** pivots around a rivet **70** through the bolt mechanism **72**,

which is inserted within holes of the link **66**. The bolt mechanism **72** pivots around the rivet **74** through the housing **12**. In an embodiment, the bolt mechanism **72** includes a hex bolt **76** installed at one end **71** thereof and secured by a nut **78**. In an embodiment, the bolt mechanism **72** includes a slot **80** formed at an opposite end **73** thereof, which is
5 sized and shaped to receive a tool, such as a screwdriver.

Referring to **FIGS. 4** and **5**, in an embodiment, the latch **10** is attached to a panel **100** of a structure **102**. As shown in **FIG. 4**, when the latch **10** is in a closed position, the arm **48** and the link **66** are toggled under a spring load from the springs **46**, in which the link **66** pushes the bolt mechanism **72** to a stop by the housing **12** in a first, closed
10 position. A load from the hex bolt **76** of the bolt mechanism **72** is applied on the structure **102**. When a force on the end **73** of the bolt mechanism **72** reaches or exceeds the required load, the bolt mechanism **72** un-toggles the link **66** and the arm **48** which, in turn, disengages the hex bolt **76** from the structure **102** until the bolt mechanism **72** is stopped against the arm **48** in a second, open position. In an
15 embodiment, each of the socket screws **62** is adapted to be adjusted independently from the other, such that turning each of the screws **62** will adjust the loads of the corresponding springs **46** and, in turn, the load from the hex bolt **76**. In an embodiment, the socket screws **62** can be adjusted with a standard hex wrench or other tools known in the art. Once the applied load on each of the springs **46** is reached, the socket
20 screws **62** can be secured in place with lock-wires through their holes **63** (not shown in the Figures). In an embodiment, the bolt mechanism **72** can be moved manually from its closed position to its open position by inserting a tool in the slot **80** thereof, such as a screwdriver, in order to manually open and close the latch **10**.

It should 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. All such variations and modifications are intended to be included within the scope of the
5 invention as defined in the appended claims.

CLAIMS

What is claimed is:

1. A latch, comprising:

a housing having a top end, a bottom end opposite the top end, a front wall
5 extending from the top end to the bottom end, a rear wall opposite the front wall and
extending from the top end to the bottom end, a pair of sidewalls, each of which extends
from the top end to the bottom end and between the front wall and the rear wall, and a
floor located at the bottom end and extending between the front wall, the rear wall, and
the sidewalls, the front wall, rear wall, the pair of sidewalls, and the floor forming an
10 interior portion; and

a latch mechanism located within the interior portion of the housing, the latch
mechanism including an arm, a pair of socket screws, each of which is positioned
rotatably within the rear wall of the housing, a pair of torsion springs, each of which is
connected rotatably to the arm and engages a corresponding one of the pair of socket
15 screws, a bolt mechanism attached rotatably to the housing proximate to the rear wall
and having a first end and a second end opposite the first end, and 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 arm, and the second end of the link being attached to the bolt
mechanism,

20 wherein each of the pair of socket screws being adapted to adjust a load on a
corresponding one of the torsion springs, and

wherein the bolt mechanism is movable rotatably between a first position, in
which the arm and the link are toggled with one another under the loads from the pair of

torsion springs and the first end of the bolt mechanism is adapted to engage an external structure, and a second position, in which the link and the arm are untoggled with one another and the first end of the bolt mechanism is disengaged with the external structure.

5

2. The latch of Claim 1, wherein the housing includes a pair of ledges, one of the pair of ledges being located between and extends from a first corner formed by one of the pair of sidewalls, the rear wall, and the floor of the housing, and the other of the pair of ledges being located between and extends from a second corner formed by the other
10 of the pair of sidewalls, the rear wall, and the floor of the housing, and wherein one of the pair of torsion springs rests on one of the pair of ledges, and the other of the pair of torsion springs rests on the other of the pair of ledges.

3. The latch of Claim 2, wherein the housing includes a pair of holes formed within
15 the front wall thereof, one of the pair of holes being located within one of the pair of ledges, and the other of the pair of holes being located within the other of the pair of ledges, and wherein each of the pair of holes being sized and shaped to receive a corresponding one of the pair of socket screws.

20 4. The latch of Claim 3, wherein the arm includes a middle portion having a pair of side members extending outwardly and opposed to one another and a slot formed between the side members, the slot being sized and shaped to receive the first end of the link.

5. The latch of Claim 4, wherein the latch mechanism include a pair of bushings, each of the pair of torsion springs being positioned around a corresponding one of the bushings, and wherein the bushings are connected to the middle portion of the arm by a rivet.

5

6. The latch of Claim 5, wherein each of the pair of torsion springs includes a first leg and a second leg, the first leg of each of the pair of torsion springs engages its corresponding one of the pair of the socket screws, and the second leg of each of the pair of torsion springs engages a corresponding one of side members of the arm.

10

7. The latch of Claim 6, wherein each of the socket screws includes a periphery and a plurality of holes formed within the periphery, each of the plurality of holes being sized and shaped to receive a lock wire.

15

8. The latch of Claim 6, wherein the bolt mechanism includes a bolt positioned at the first end of the bolt mechanism, and a nut engaged threadedly with the bolt for adjusting the position of the bolt.

20

9. The latch of Claim 8, wherein the second end of the bolt mechanism includes a slot formed therein and sized and shaped to receive an external tool for manually rotating the bolt mechanism.

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

25

11. The latch of Claim 10, wherein the housing includes a pair of mounting brackets.

12. The latch of Claim 11, wherein the housing includes a pair of support brackets, one of which extends obliquely from the rear wall and the bottom end to the top end and one of the mounting brackets proximate to one of the sidewalls, and the other of which
5 extends obliquely from the rear wall and the bottom end to the top end and one of the mounting brackets proximate to other of the sidewalls.

13. The latch of Claim 12, wherein the rear wall includes an opening positioned between the support brackets, the opening being sized and shaped to enable
10 movement of the bolt mechanism between its first position to its second position.

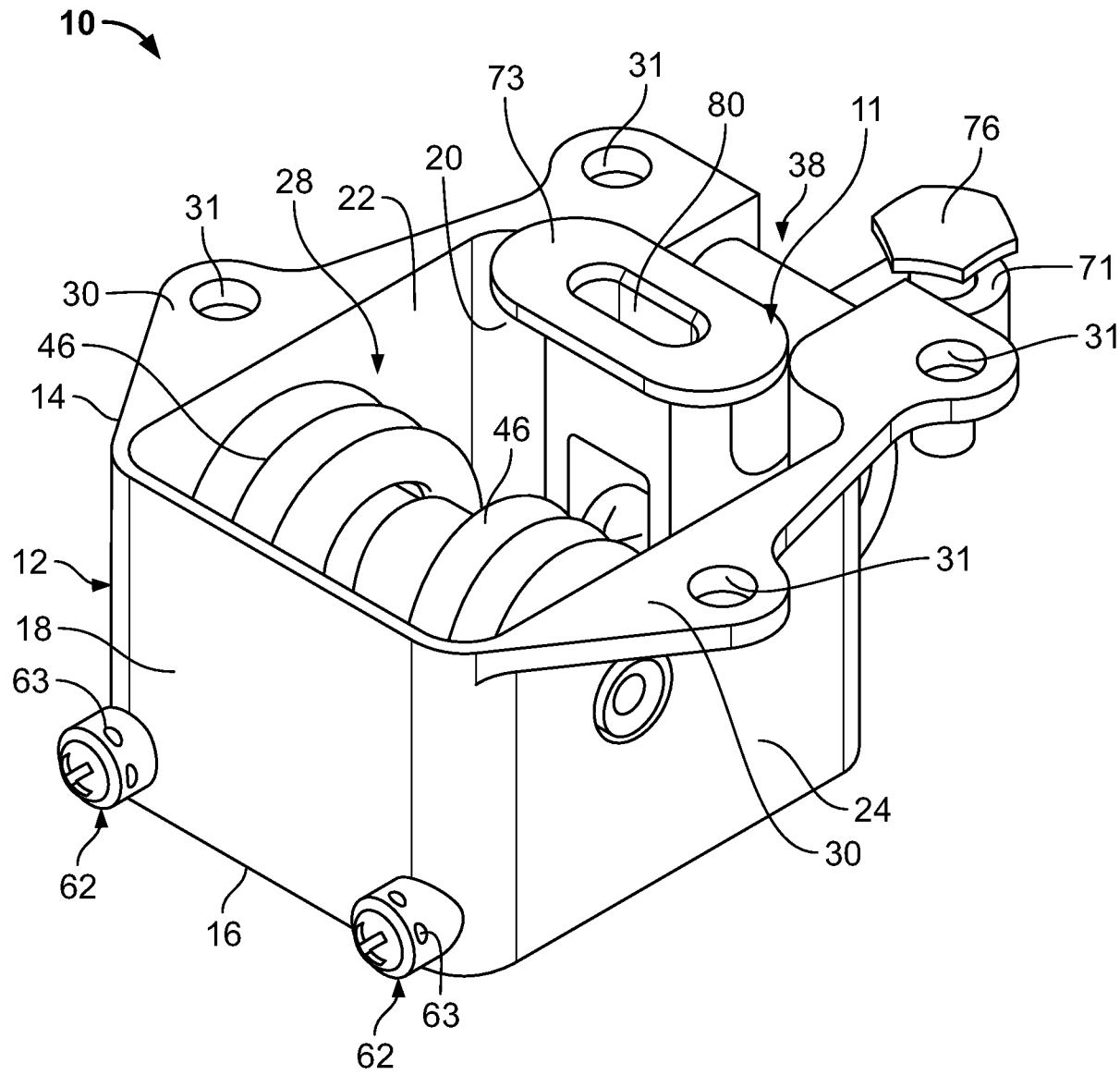


FIG. 1

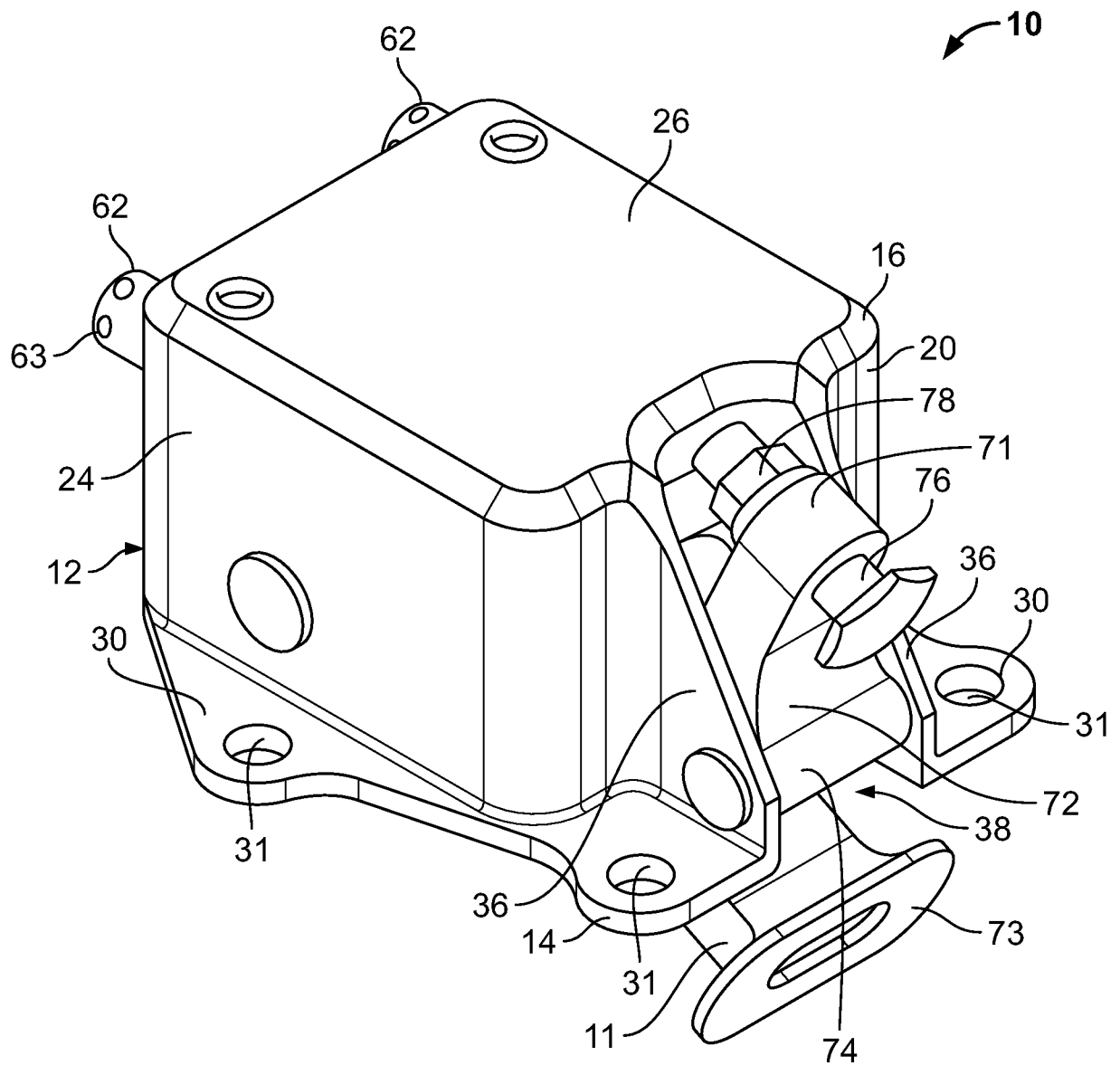


FIG. 2

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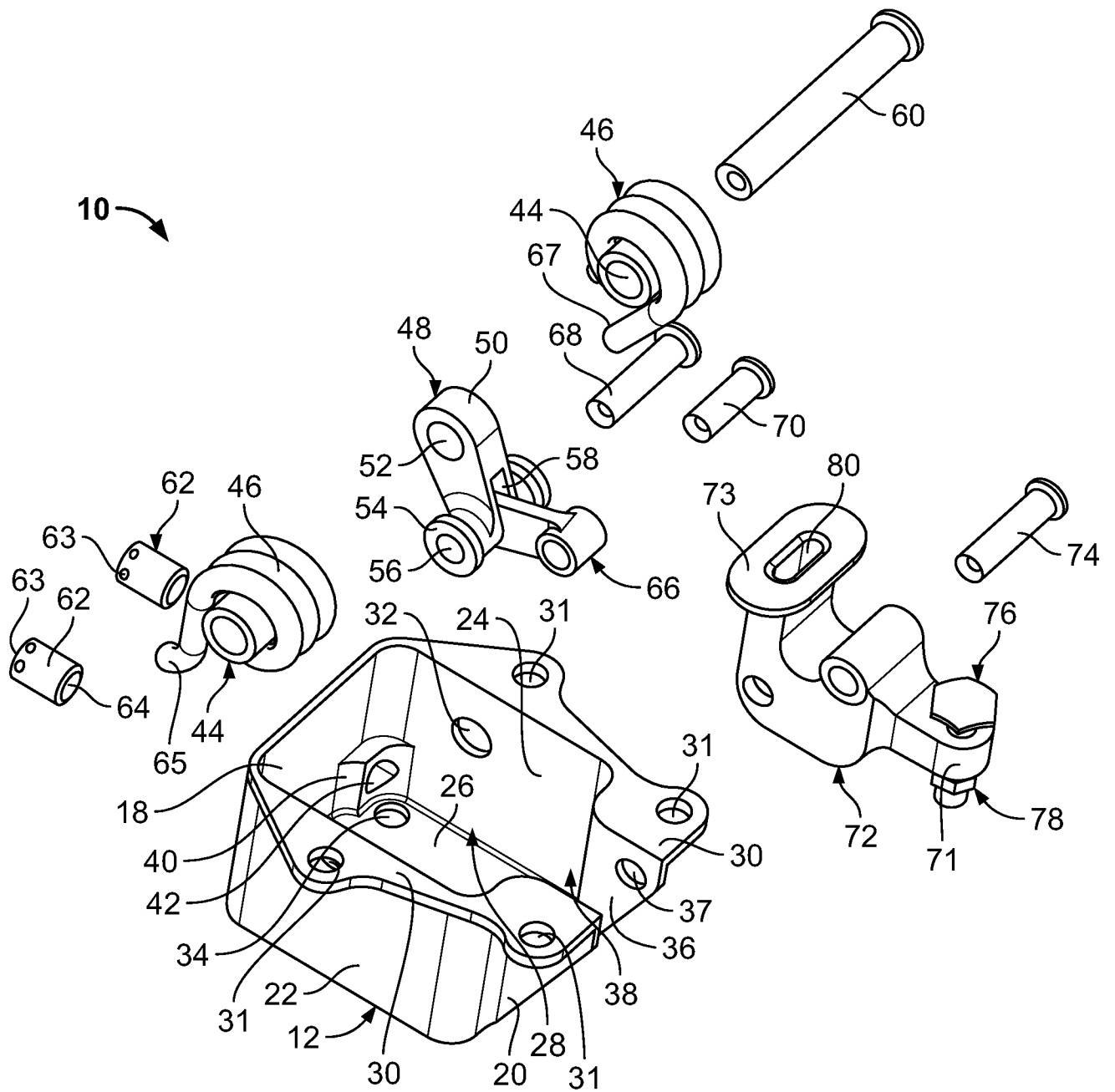
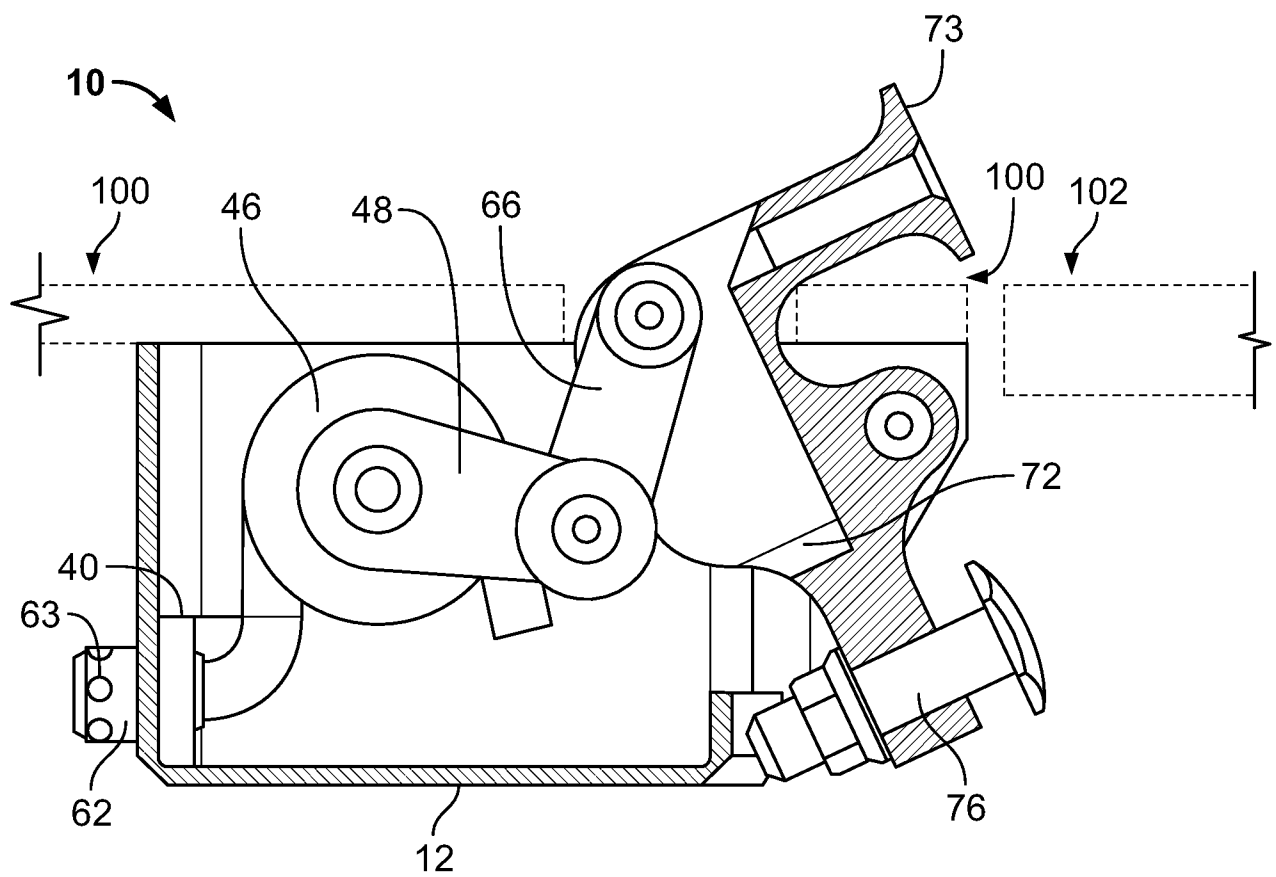
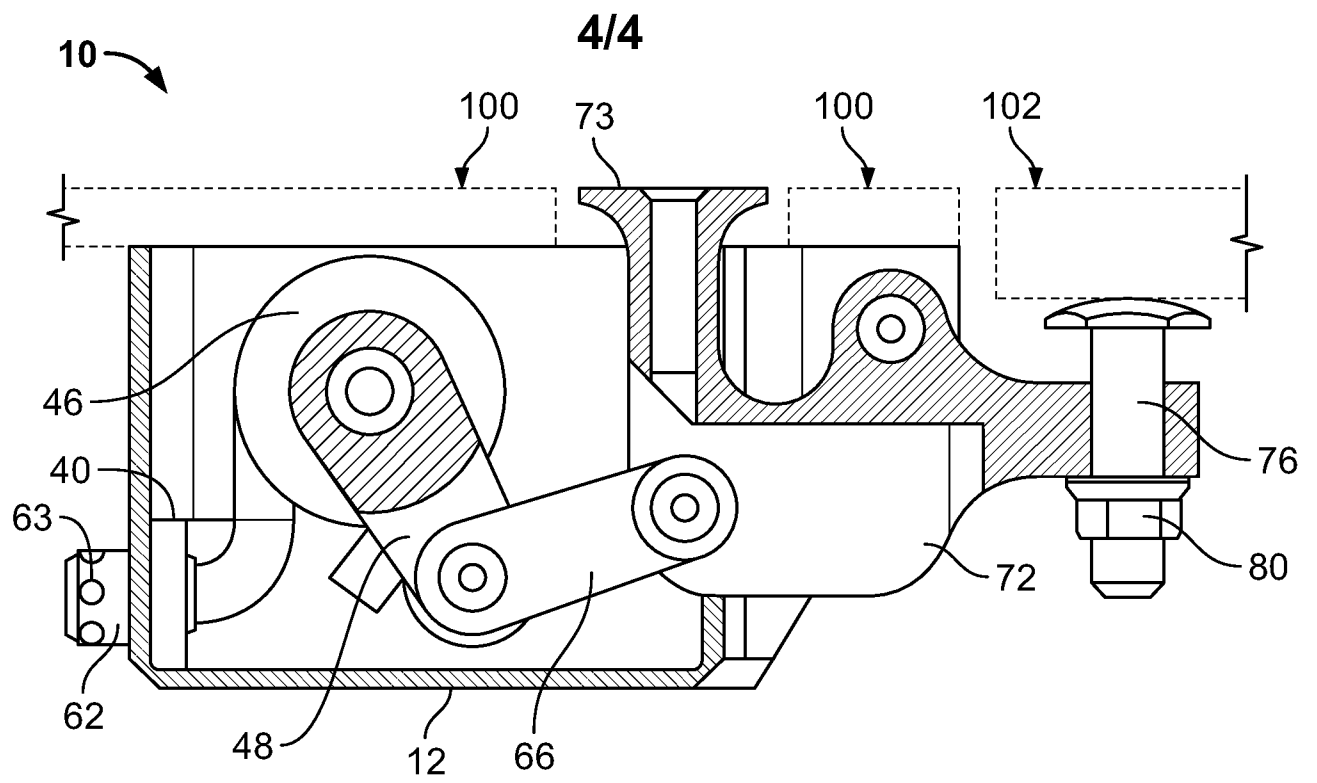


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER
 INV. B64D29/08
 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)

B64D B64C E05B 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)

EPO-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.
X	EP 2 907 946 A1 (QRP INC [US]) 19 August 2015 (2015-08-19) paragraph [0015] - paragraph [0018]; figures 1-5C -----	1-13
A	WO 2006/100654 A2 (HARTWELL CORP [US]; ROZEMA TIMOTHY S [US]; HELSLEY THOMAS J [US]) 28 September 2006 (2006-09-28) page 5 - page 9; figures 4-9 -----	1-13
A	US 4 230 352 A (SEALEY FRANCIS ET AL) 28 October 1980 (1980-10-28) figures 1-7 -----	1-13
A	US 3 571 977 A (ABEEL PETER C) 23 March 1971 (1971-03-23) figures 1-5 -----	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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01/02/2017

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/059313

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2907946	A1	19-08-2015	CN 104929455 A 23-09-2015
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