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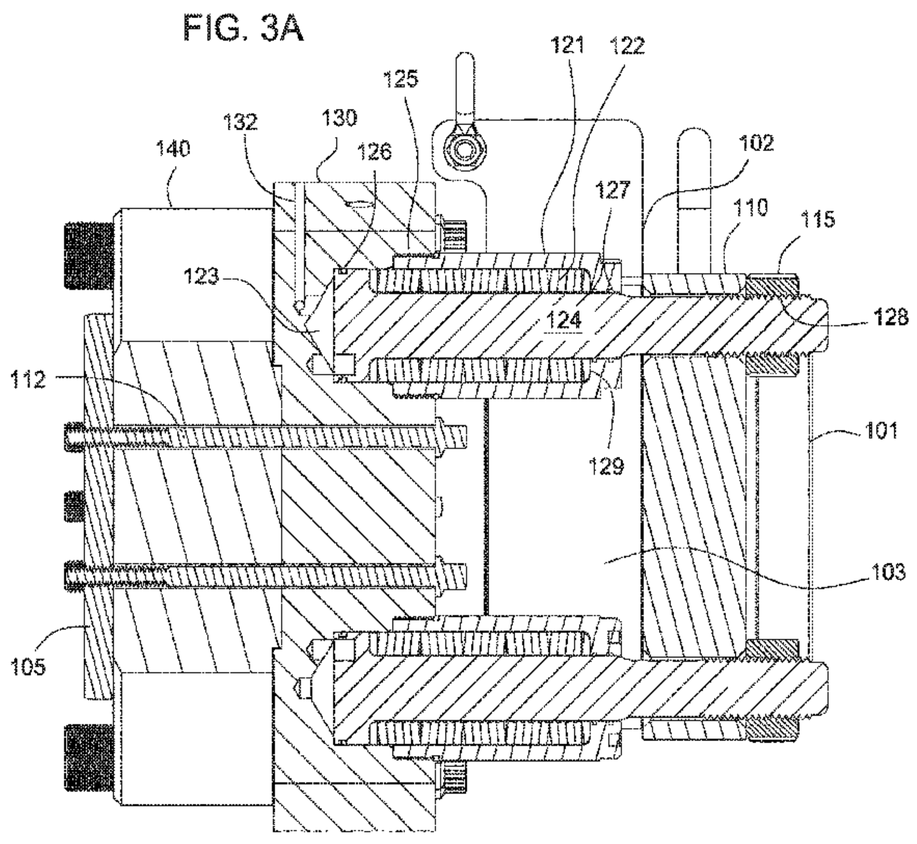
(56) Documents Cited:
WO 2000/014406 A2 **US 4277229 A**
US 20150101681 A1

(58) Field of Search:
INT CL **F04B, F16L**
Other: **WPI, EPODOC**

(54) Title of the Invention: **Cartridge retention system**
Abstract Title: **Cartridge retention system**

(57) A cartridge retention system comprising a retention body 130, a cartridge assembly having a housing 121 coupled to the retention body, a biasing member 122 within the housing, a piston 124 biased towards the retaining body, the housing, biasing member and piston being at least partially disposed within the retention body, and a retaining flange 110 coupled to the retaining body by the cartridge. A flange of the piston may be disposed in the retention body. The housing may be threaded in a bore. The biasing member may be disposed between an inner housing shoulder and a piston flange. A chamber may be formed within the retention body below the piston flange, wherein pressurised fluid may apply a force against the piston counter to the biasing force. The piston may extend through the housing and through an opening in the retaining flange. A flange retaining nut may be threaded on the piston, and the biasing member may bias the piston, flange retaining nut and retaining flange into engagement with an outer liner shroud.

FIG. 3A



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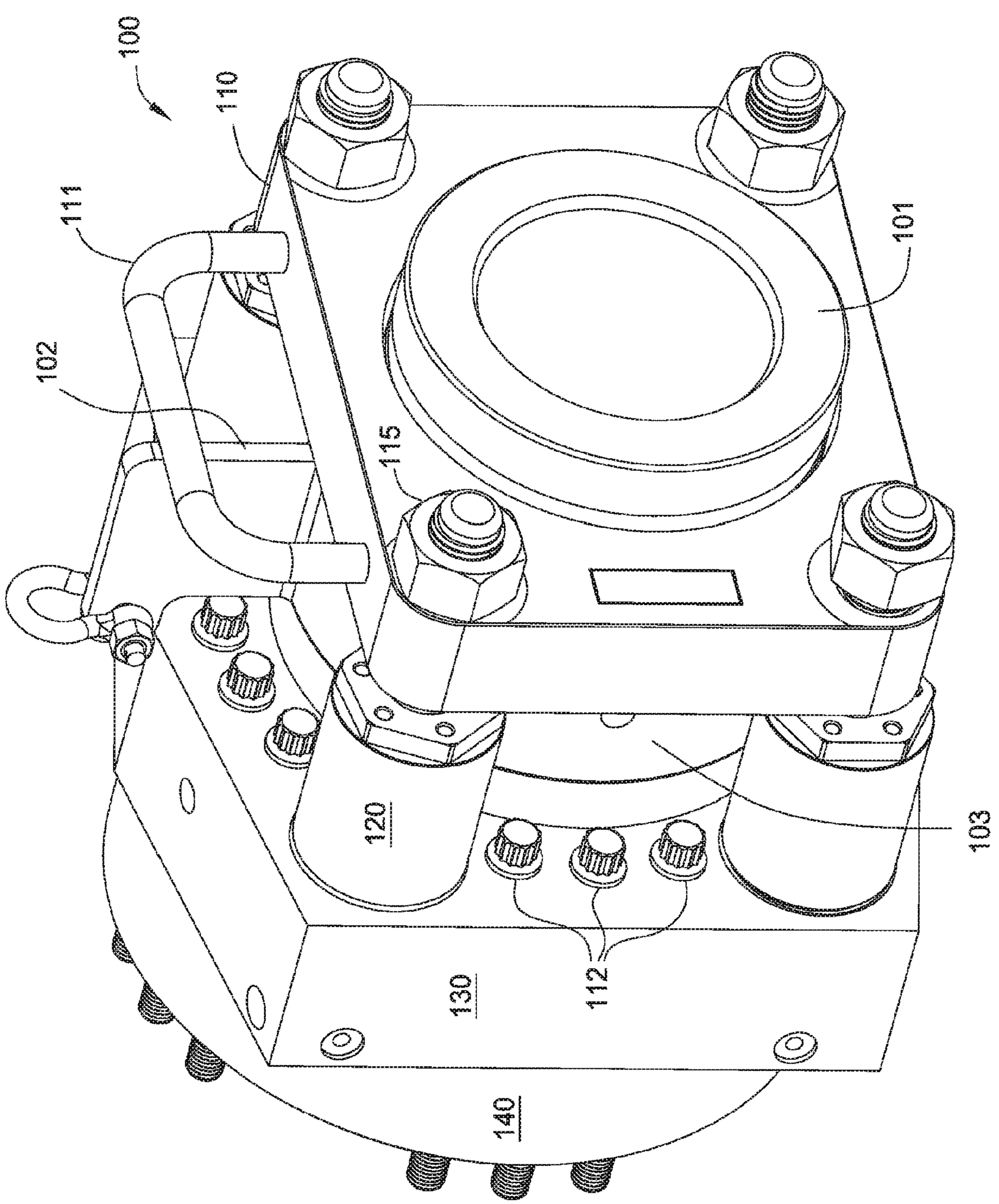


FIG. 1

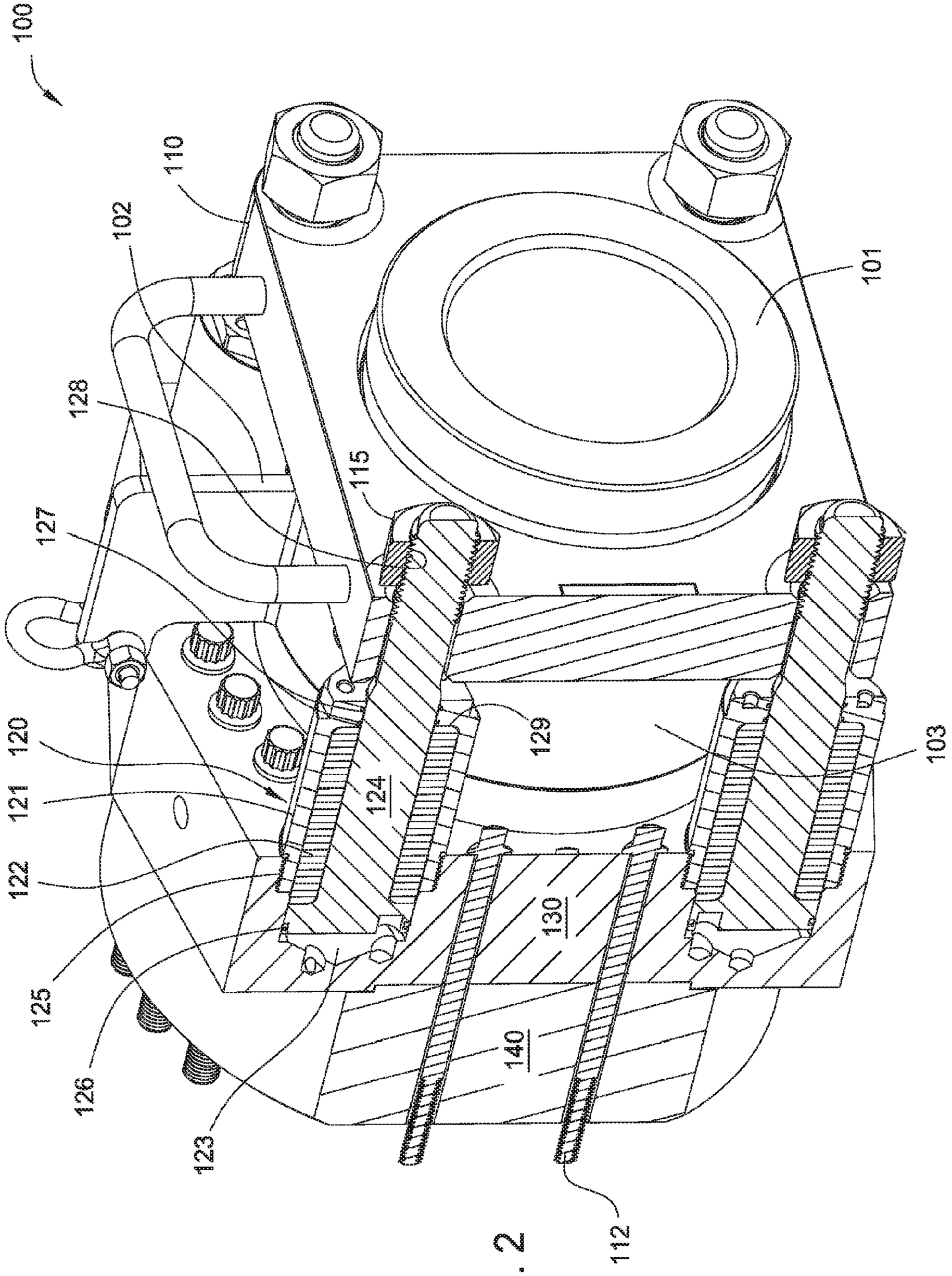
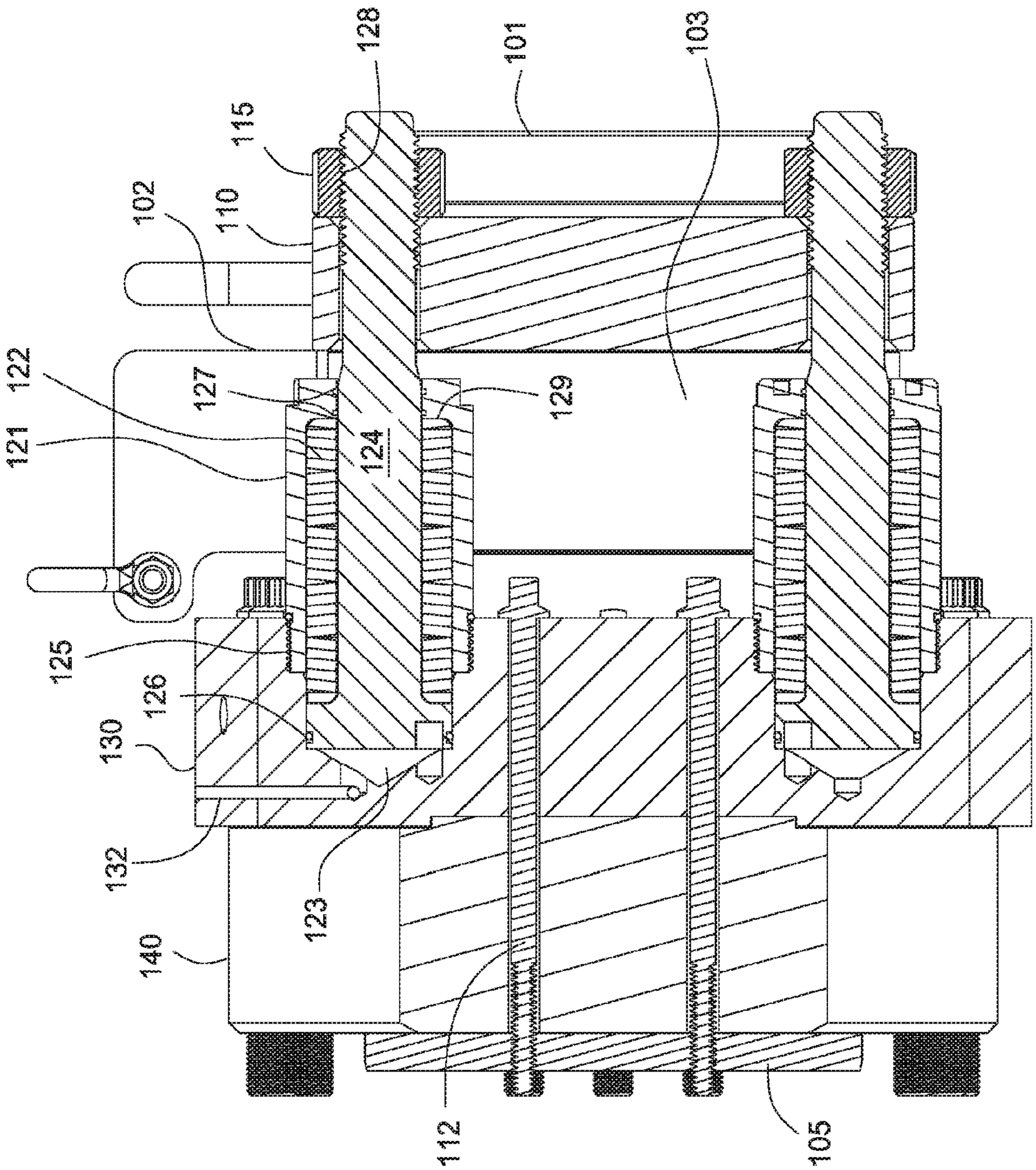

100
110
102
101
128
115
127
120
121
122
125
126
123
129
103
124
130
140
112

FIG. 2


128
101
103
115
102
110
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129
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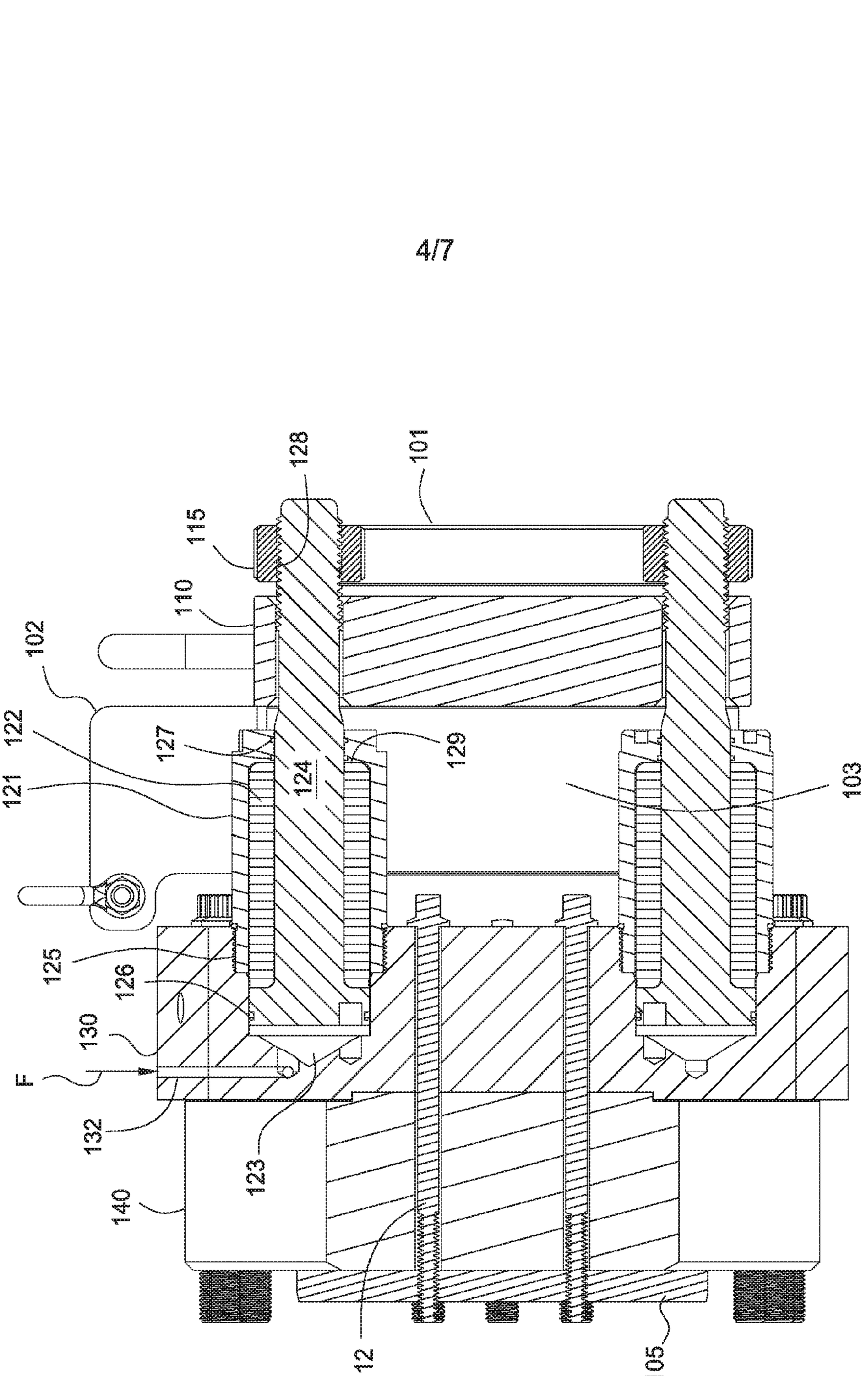
126
130
132
123
140
112
105

FIG. 3A


128
101
115
110
102
122
127
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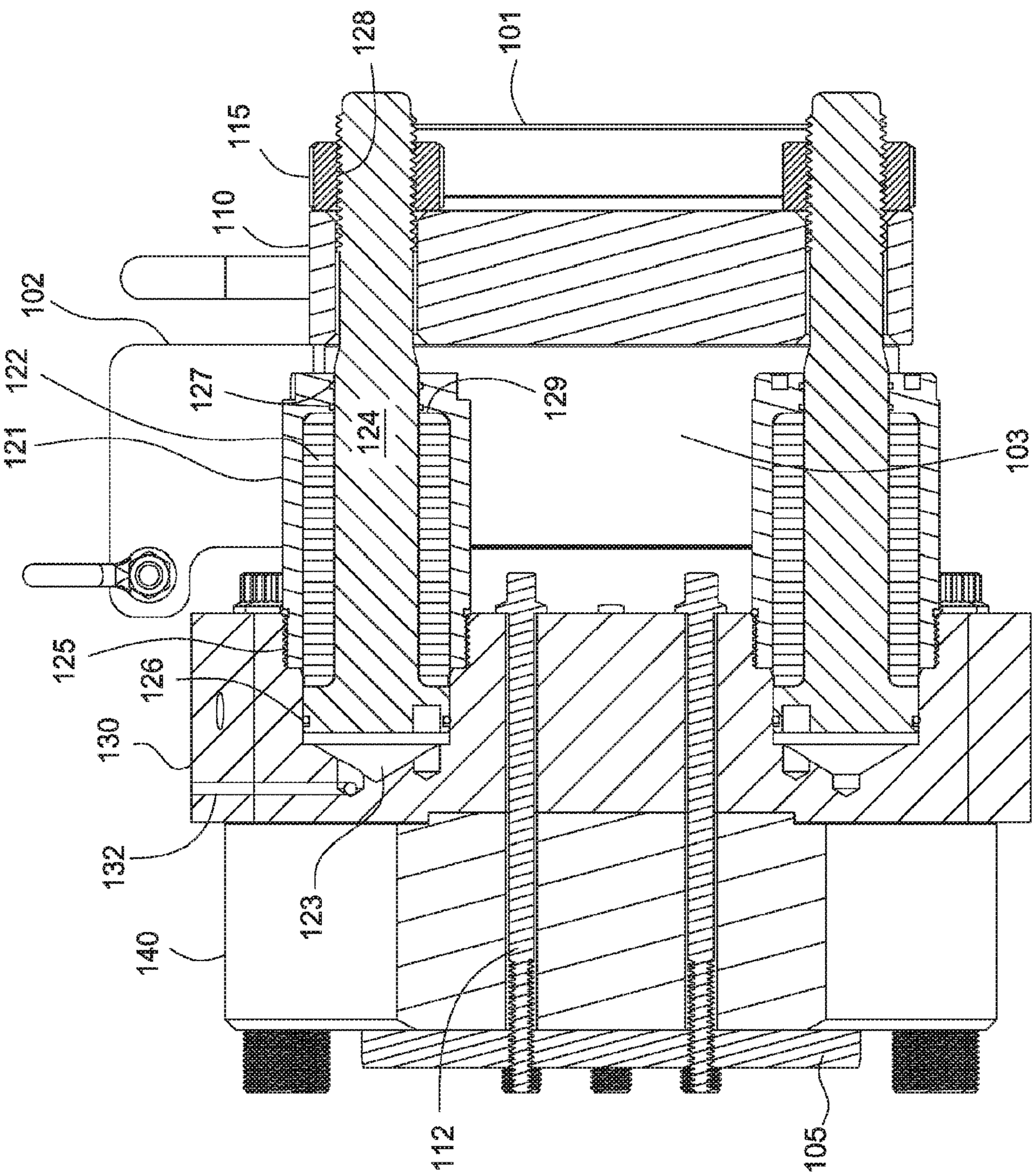
124
121
103
125
126
130
F
132
123
140
112
105

FIG. 3B


128
101
115
110
102
122
121
127
124
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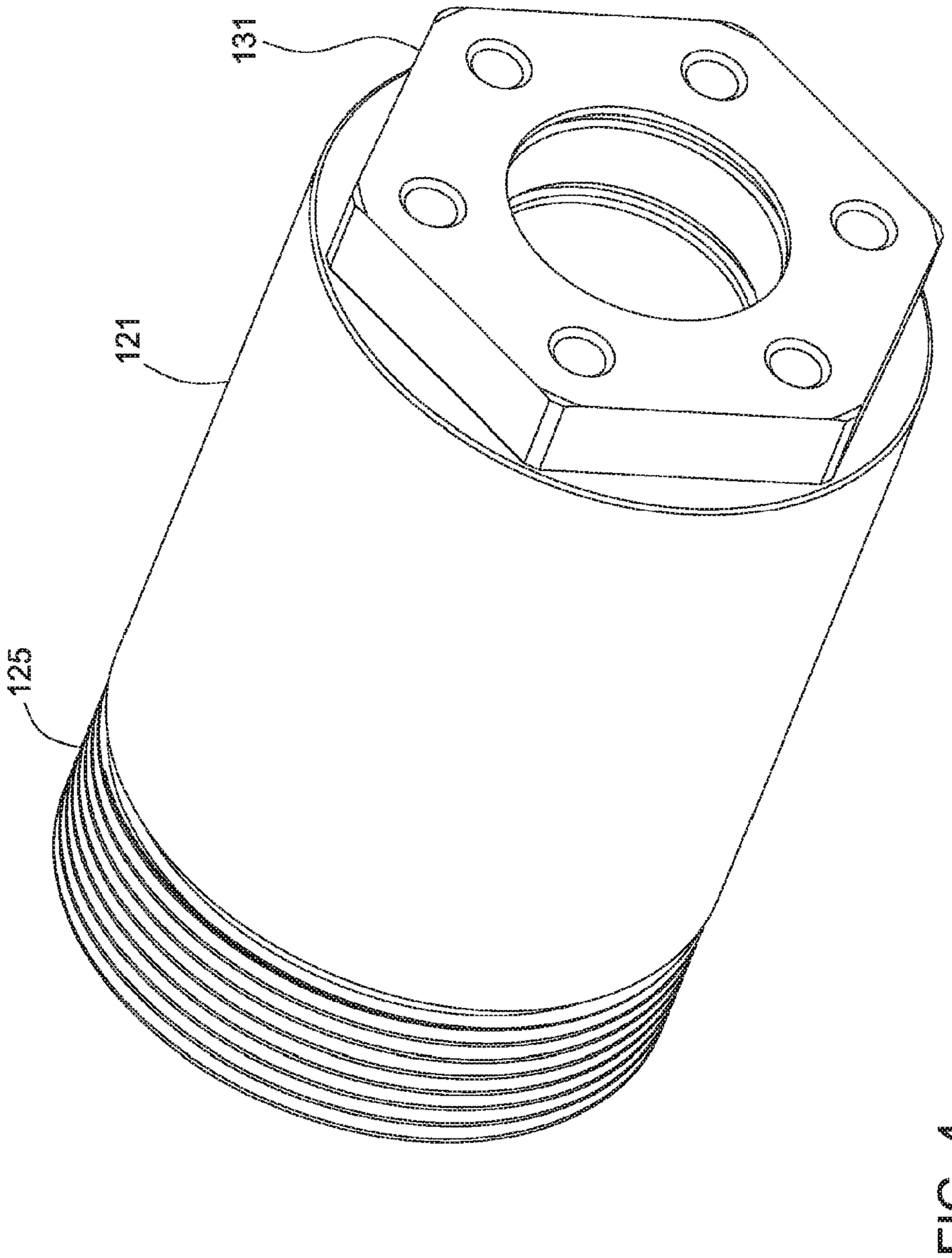
103
125
126
130
132
123
140
112
105

Fig. 3C


131
121
125
FIG. 7

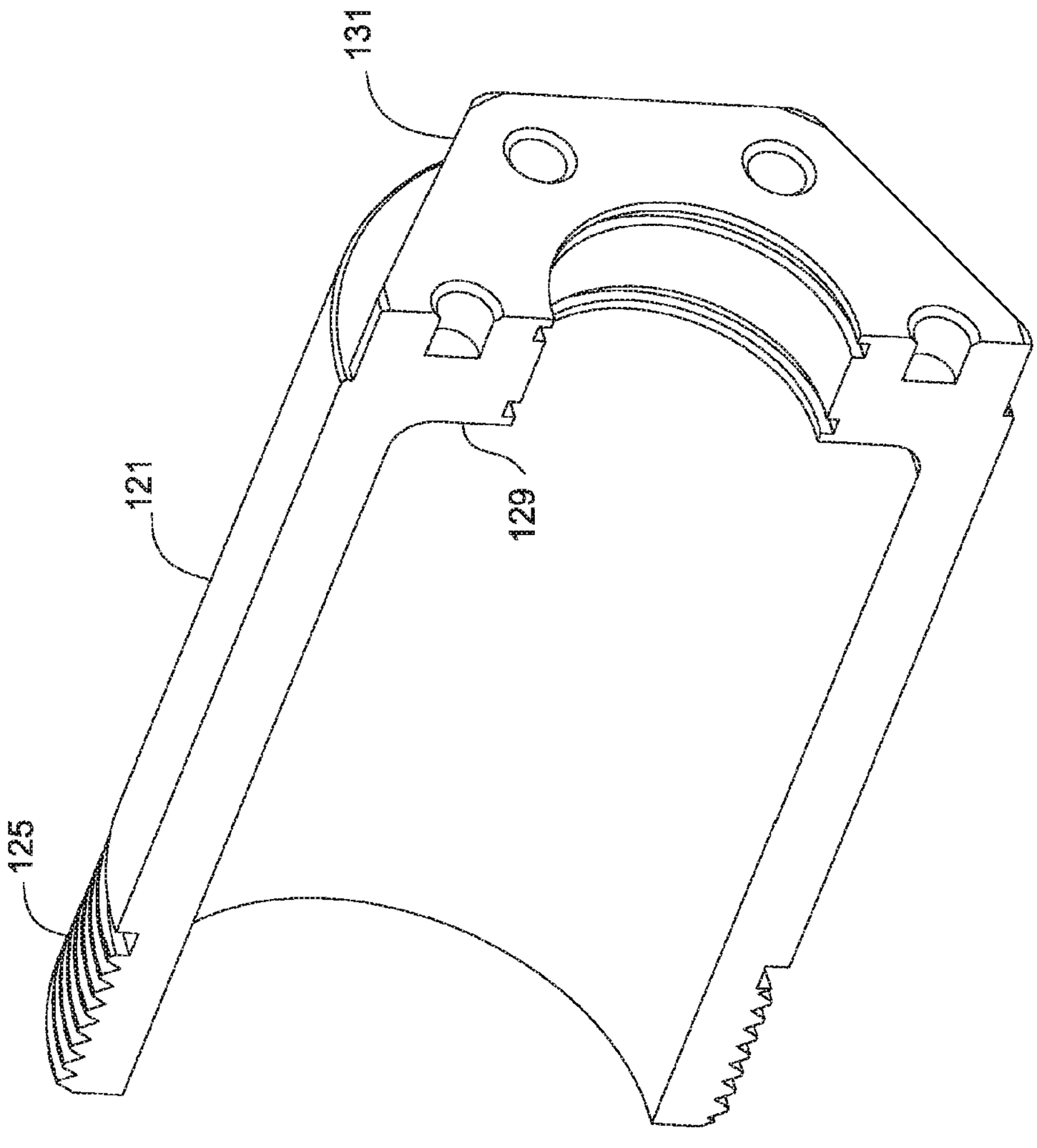


FIG. 5

CARTRIDGE RETENTION SYSTEM

BACKGROUND

Field of the Disclosure

[0001] Embodiments of the present disclosure generally relate to a cartridge retention system.

Description of the Related Art

[0002] Multiplex reciprocating pumps are commonly used in the oil and gas industry. The pumps are used to pump fluids at high pressure into one or more wells comprising boreholes that are drilled into the ground. Multiplex pumps comprise a power end housing a crankshaft and a crosshead, and a fluid end having fluid bores in which individual plungers having intake and discharge valves reciprocate. Connecting rods connect the crosshead to the plungers to cause reciprocating motion of the plungers in the fluid bores to move fluid from a suction end to a discharge end of the fluid bores.

[0003] The fluid end components such as valve covers and liners have to be securely retained to the fluid end because fluids are pumped through the fluid end at high pressures and flow rates. Some retention mechanisms are completely formed within the body of the fluid end, which limits the possibility of using such retention mechanism on different fluid end designs. In addition, the retention mechanism being formed within the body of the fluid end further increase the weight of the overall fluid end design.

[0004] Therefore, there is a continuous need for new and improved retention systems.

SUMMARY OF THE DISCLOSURE

[0005] According to one embodiment, a cartridge retention system comprises a retention body, a cartridge assembly, and a retaining flange. The cartridge assembly has a housing coupled to the retention body, a biasing member disposed within the

housing, and a piston biased by the biasing member toward the retention body. The retaining flange is coupled to the retention body by the cartridge assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] So that the manner in which the above recited features can be understood in detail, a more particular description of the embodiments, briefly summarized above, may be had by reference to embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments and are therefore not to be considered limiting of its scope, for the embodiments may admit to other equally effective embodiments.

[0007] FIG. 1 illustrates a cartridge retention system, according to one embodiment disclosed herein.

[0008] FIG. 2 illustrates a sectional view of the retention system, according to one embodiment disclosed herein.

[0009] FIG. 3A, 3B, and 3C illustrate enlarged sectional views of a portion of the retention system, according to one embodiment disclosed herein.

[0010] FIG. 4 illustrates a housing of the retention system, according to one embodiment disclosed herein.

[0011] FIG. 5 illustrates a sectional view of the housing, according to one embodiment disclosed herein.

DETAILED DESCRIPTION

[0012] FIG. 1 illustrates a cartridge retention system 100, according to one embodiment disclosed herein. The embodiments of the system 100 described herein can be used with a multiplex reciprocating pump as described in U.S. Patent Application Publication No. 2013/0263932, filed on March 15, 2013, the contents of which are herein incorporated by reference in its entirety. Although the embodiments of

the system 100 are described herein as retaining a liner of a multiplex reciprocating pump, the system 100 can be used to retain other types of components and/or with other types of equipment.

[0013] Referring to FIG. 1, the system 100 includes a retaining flange 110 that is coupled to a retention body 130 by a cartridge assembly 120 via a flange retaining nut 115. Although four cartridge assemblies 120 are shown, the system 100 may include one or more cartridge assemblies 120. A retaining flange spacer 103, which includes outer lifting shoulders 102, is positioned between the retaining flange 110 and the retention body 130 according to one embodiment. Alternatively, the retaining flange 110 and the retaining flange spacer 103 may be formed as a single piece. The retaining flange 110 has one or more handles 111 for ease of handling during installation and removal. Another spacer 140 is coupled to the retention body 130 for connection to a structure, such as a fluid end module of a multiplex reciprocating pump. One or more bolts 112 may be used to couple the retention body 130 and the spacer 140 to the structure.

[0014] The retaining flange 110, the retaining flange spacer 103, the retention body 130, and the spacer 140 include a bore through which a liner 101 is positioned to secure 24 within the module 210. The liner 101 includes an outer shoulder that engages an inner shoulder of the retaining flange spacer 103 to retain the liner 101. The retaining flange 110, retaining flange spacer 103, the retention body 130, the spacer 140, and the liner 101 are configured to contain pressurized fluid.

[0015] Referring to FIG. 2, each cartridge assembly 120 is at least partially disposed within and coupled to the retention body 130. Specifically, each cartridge assembly 120 includes a piston 124 biased inwardly toward the retention body 130 by one or more biasing members 122, such as springs. The biasing members 122 are disposed within a housing 121, which is coupled to the retention body 130 by threads 125 that are threaded into engagement with a threaded bore formed in the retention body 130. The

housing 121, the biasing members 122, and the piston 124 are at least partially disposed within the retention body 130 according to one embodiment.

[0016] The biasing members 122 contact an inner shoulder 129 of the housing 121 at one end and contact a flange portion of the piston 124 at an opposite end. A chamber 123 is formed below the flange portion of the piston 124 within the retention body 130. According to one embodiment, the flange portion of the piston 124 is entirely disposed within the retention body 130 below the biasing members 122. Alternatively, the flange portion of the piston 124 can be partially disposed within the retention body 130 or entirely disposed within the housing 121. One or more seals 126, 127 can be disposed between the piston 124 and the retention body 130, as well as between the piston 124 and the housing 121, to form a seal between adjacent surfaces.

[0017] An upper portion of the piston 124 extends through the biasing members 122 and an opening formed in the upper end of the housing 121, and into corresponding openings formed in the retaining flange 110 for connection to the flange retaining nut 115. The flange retaining nut 115 is threaded into engagement with threads 128 formed on the upper ends of the piston 124 until the flange retaining nut 115 contacts the upper surface of the retaining flange 110. The biasing members 122 apply a bias against the flange portion of the piston 124, which pulls the flange retaining nut 115 and the retaining flange 110 against the retaining flange spacer 103, which thereby forces and retains the liner 101 in place, as further described below with respect to FIG. 3A-3C.

[0018] FIG. 3A, FIG. 3B, and FIG. 3C illustrate sectional views of the system 100 during installation, according to one embodiment. Referring to FIG. 3A, the spacer 140 and the retention body 130 may be coupled to a structure, such as a module of a multiplex plunger pump, via the bolts 112. A wear plate 105 is positioned at the end of the liner 101 and separates the liner 101 from the structure to which the system 100 is attached. The threads 125 of each housing 121 are threaded into the corresponding threaded bore formed in the retention body 130 such that each piston 124 is biased

inwardly by the biasing members 122 and extend through the upper end of the housing 121. After the liner 101 is inserted in place, the retaining flange spacer 103 and the retaining flange 115 are positioned over the liner 101 such that the upper end of each piston 124 extends through the corresponding opening formed in the retaining flange 110. The flange retaining nuts 115 are threaded onto the threads 128 of each piston 124 and into contact with the upper end of the retaining flange 110.

[0019] Referring to FIG. 3B, a pressurized fluid (identified by reference arrow "F") is supplied into the chamber 123 via one or more fluid paths 132 formed in the retention body 130 and acts on the flange portion of the piston 124. The pressurized fluid forces the piston 124 to extend outwardly from the retention body 130 against the force of the biasing members 122, which moves the flange retaining nut 115 away from the retaining flange 110. The pressurized fluid is supplied at a pressure sufficient to generate a force on the flange portion of the piston 124 that compresses the biasing members 122 between the flange portion of the piston 124 and the inner shoulder 129 of the housing 121. While the chamber 123 is pressurized and the piston 124 is compressing the biasing members 122, the flange retaining nut 115 is then threaded further onto the upper end of the piston 124 and back into contact with the upper surface of the retaining flange 110.

[0020] Referring to FIG. 3C, after the flange retaining nuts 115 are threaded back into contact with the retaining flange 110, the pressurized fluid can be released from the chambers 123 and/or the pressure within the chambers 123 can be reduced such that the biasing members 122 create a force on the pistons 124 that biases the retaining flange 110 against the shoulder 102 of the retaining flange spacer 103, which has an inner shoulder that acts on an outer shoulder of the liner 101. In this manner, the liner 101 is retained in place by the force produced by the biasing members 122 acting on the pistons 124 to force the retaining flange 110 against the outer shoulder 102 of the retaining flange spacer 103 and the liner 101. To remove the retaining flange 110, the

installation process described with respect to FIG. 3A-3C can be repeated in reverse order.

[0021] FIG. 4 and FIG. 5 illustrate the housing 121 of the cartridge assembly 120 of the system 100. The housing 121 includes a cylindrical body having threads 125 formed at one end for threading into engagement with a corresponding threaded bore formed in the retention body 130. At the opposite end, the housing 121 include a head 131 for engagement with a tool, such as a wrench, to assist with screwing the housing 121 into the retention body 130. Also shown in FIG. 5 is the inner shoulder 129 of the housing 121 against which one end of the biasing members 122 bear to bias the piston 124 as described above.

[0022] One advantage of the system 100 is that the cartridge assemblies 120 are modular and easy to install by screwing in via a threaded connection. Another advantage of the system 100 is that the cartridge assemblies 120 are not disposed entirely within the retention body 130, which allows a reduction in thickness and weight of the retention body 130. The reduction in thickness and weight reduces the cost of the system 100 and improves ease of assembly of the system 100.

[0023] While the foregoing is directed to certain embodiments, other and further embodiments may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

[0024] The present application is a divisional application of earlier filed patent application number GB 1808064.8. The following clauses correspond to the claims of the earlier patent application as filed and, whether explicitly recited in the claims or not, describe further aspects of the invention:

A. A cartridge retention system, comprising:

a retention body;

a cartridge assembly having a housing coupled to the retention body, a biasing member disposed within the housing, and a piston biased by the biasing member toward the retention body; and

a retaining flange coupled to the retention body by the cartridge assembly.

B. The system of clause A, wherein the piston extends through the housing and through a corresponding opening formed in the retaining flange.

C. The system of clause B, wherein a flange retaining nut is threaded onto the piston and into engagement with an upper surface of the retaining flange.

D. The system of clause C, wherein the biasing member biases the piston, the retaining flange nut, and the retaining flange into engagement with an outer shoulder of a liner.

E. The system of clause D, further comprising a spacer coupled to the retention body by one or more bolts.

F. The system of clause A, wherein the housing is threaded into a threaded bore formed in the retention body.

G. The system of clause F, wherein the biasing member is disposed between an inner shoulder of the housing and a flange portion of the piston.

H. The system of clause G, wherein a chamber is formed within the retention body below the flange portion of the piston.

I. The system of clause H, wherein pressurized fluid supplied into the chamber applies a force to the flange portion of the piston against the bias of the biasing member.

J. The system of clause I, wherein the flange portion of the piston is disposed within the retention body.

K. The system of clause J, wherein the piston extends through the housing and through a corresponding opening formed in the retaining flange.

L. The system of clause K, wherein a flange retaining nut is threaded onto the piston and into engagement with an upper surface of the retaining flange.

M. The system of clause A, wherein the housing, the biasing member, and the piston are at least partially disposed within the retention body.

N. The system of clause M, wherein a flange portion of the piston is disposed within the retention body.

Claims:

1. A cartridge retention system, comprising:

a retention body;

a cartridge assembly having a housing coupled to the retention body, a biasing member disposed within the housing, and a piston biased by the biasing member toward the retention body; wherein the housing, the biasing member, and the piston are at least partially disposed within the retention body; and

a retaining flange coupled to the retention body by the cartridge assembly.

2. The system of claim 1, wherein a flange portion of the piston is disposed within the retention body.

3. The system of claim 1, wherein the housing is threaded into a threaded bore formed in the retention body.

4. The system of claim 3, wherein the biasing member is disposed between an inner shoulder of the housing and a flange portion of the piston.

5. The system of claim 4, wherein a chamber is formed within the retention body below the flange portion of the piston.

6. The system of claim 5, wherein pressurized fluid supplied into the chamber applies a force to the flange portion of the piston against the bias of the biasing member.

7. The system of claim 6, wherein the piston extends through the housing and through a corresponding opening formed in the retaining flange.

8. The system of claim 7, wherein a flange retaining nut is threaded onto the piston and into engagement with an upper surface of the retaining flange.

9. The system of claim 8, wherein the biasing member biases the piston, the flange retaining nut, and the retaining flange into engagement with an outer shoulder of a liner.

Application No: GB2105306.1 **Examiner:** Alexander Bartrip

Claims searched: 1-9 **Date of search:** 22 April 2021

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	WO 00/14406 A2 (SOUTHWEST) See figures, description.
A	-	US 2015/101681 A1 (PSI PRESSURE) See figures, description.
A	-	US 4277229 A (PARTEK) See figures, description.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

F04B; F16L

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
F04B	0053/16	01/01/2006
F04B	0001/2014	01/01/2020
F04B	0053/22	01/01/2006
F16L	0023/036	01/01/2006