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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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— *with international search report (Art. 21(3))*

(54) Title: NON-WELDED SUCTION CHAMBER FOR SURFACE PUMPING SYSTEM

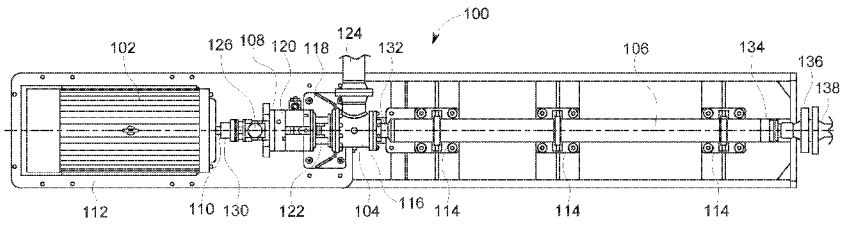


FIG. 1

(57) Abstract: A suction chamber for use in a surface pumping system includes a central housing that is substantially cylindrical and has a motor end and a pump end opposite the motor end. The suction chamber includes a motor-end plate bolted to motor end of the central housing and a pump-end plate bolted to the pump end of the central housing. The suction chamber also includes an inlet branch connected to the central housing. A method for assembling a non-welded suction chamber is also disclosed.

WO 2017/117181 A1

NON-WELDED SUCTION CHAMBER FOR SURFACE PUMPING SYSTEM

Field of the Invention

[001] This invention relates generally to the field of surface pumping systems, and more particularly to a cost-effective suction chamber for use in multistage surface pumping systems.

Background

[002] Horizontal pumping systems are used in various industries for a number of different purposes. Horizontal pumping systems are often used in the oil and gas industry to move fluids between wells and surface facilities. Typically these horizontal pumping systems include a pump, a motor, and a suction chamber positioned between the pump and the motor. Often a thrust bearing chamber is also included between the motor and the suction chamber.

[003] The suction chamber typically includes a cylindrical housing, a pair of end plates and an inlet branch. One of the end plates is configured to be attached to the thrust bearing and the opposite end plate is secured to the pump. The inlet branch connects the suction chamber to the source of fluid to be pumped by the horizontal pumping system. In many cases, the pumped fluid must be provided to the horizontal pumping system under significant pressure to supply the net positive suction head (NPSH) needed for proper operation of the pump. Accordingly, the suction chamber must be manufactured to operate under elevated fluid pressures.

[004] In the past, the suction chamber has been manufactured by welding the end plates and inlet branch to the housing. To satisfy industry standards, the welding process must be meticulously performed and strenuously examined. The complexity of the welding process significantly increases the cost of the suction chamber. There is, therefore, a need for a more cost-effective suction chamber and an improved method of manufacturing a suction chamber. It is to these and other deficiencies in the prior art that the present invention is directed.

Summary of the Invention

[005] In an embodiment, the present invention includes a suction chamber for use in a surface pumping system. The suction chamber includes a central housing that is substantially cylindrical

and has a motor end and a pump end opposite the motor end. The suction chamber includes a motor-end plate bolted to motor end of the central housing and a pump-end plate bolted to the pump end of the central housing. The suction chamber also includes an inlet branch connected to the central housing.

[006] In another aspect, the embodiments include a surface pumping system that includes a suction chamber for use in a surface pumping system. The suction chamber includes a central housing that is substantially cylindrical and has a motor end and a pump end opposite the motor end. The suction chamber includes a motor-end plate bolted to motor end of the central housing and a pump-end plate bolted to the pump end of the central housing. The suction chamber also includes an inlet branch connected to the central housing.

[007] In yet another aspect, the embodiments include a method for assembling a suction chamber. The method begins with the step of inserting an inlet branch through an inlet branch recess in a central housing. Next, the method continues with the step of locating the inlet branch against an inlet branch land in the central housing. Next, the method includes a step of installing a locking collar on the inlet branch from the inside of the central housing. The method concludes with the steps of securing a motor-end plate to the central housing; and securing a pump-end plate to the central housing.

Brief Description of the Drawings

[008] FIG. 1 is a top view of a surface pumping system constructed in accordance with an embodiment.

[009] FIG. 2 is a side view of the surface pumping system of FIG. 1.

[010] FIG. 3 is a perspective view of the suction chamber from the surface pumping system of FIG. 1.

[011] FIG. 4 is a view of the motor-end of the suction chamber of FIG. 3.

[012] FIG. 5 is a view of the pump-end of the suction chamber of FIG. 3.

[013] FIG. 6 is a cross-sectional view of the suction chamber of FIG. 3.

[014] FIG. 7 is a partial exploded view of the suction chamber of FIG. 3.

[015] FIG. 8 is a process flow diagram illustrating a method of assembling the suction chamber of FIG. 3.

Detailed Description

[016] In accordance with an embodiment of the present invention, FIGS. 1 and 2 show top and side views, respectively, of a surface pumping system 100. The surface pumping system 100 includes a motor 102, a suction chamber assembly 104, a pump 106, a thrust bearing assembly 108, and a drive shaft 110. The motor 102 may be mounted to a platform 112. The pump 106 may be supported by one or more pump supports 114.

[017] For the purposes of this disclosure, positional references may be made with respect to the motor 102 or pump 106 to refer to components within the pumping system 100 that are closer to the motor 102 or pump 106, respectively. Similarly, positional references may be made to upstream and downstream components based on their relative positions within the flow of fluid through the surface pumping system 100. For example, upstream components may refer to components closer to the suction chamber 104, while downstream components may refer to components more proximate to the pump 106. Although the form and function of the surface pumping system 100 is disclosed and shown in a horizontal configuration, it will be appreciated that the surface pumping system 100 might also be oriented in vertical and other non-vertical configurations.

[018] The suction chamber assembly 104 includes a suction chamber 116, a bearing chamber adapter 122 mounted to the suction chamber 116, and a vertical bracket 118. The thrust bearing assembly 108 of the surface pumping system 100 includes a thrust bearing chamber 120 supported by the bearing chamber adapter 122. The suction chamber 116 is mounted to the vertical bracket 118 and has an inlet pipe 124. The surface pumping system 100 may also include a vibration sensor 126.

[019] The drive shaft 110 may include a plurality of drive shaft segments connected together via one or more couplings 130 or by other means known in the art. It will be understood that the plurality of drive shaft segments and the one or more couplings 130 may be of different sizes and of any type known in the art. The drive shaft 110 extends from the motor 102, through the thrust bearing chamber 120, through the suction chamber 116 and into the pump 106. The pump 106 has an inlet end 132 and a discharge end 134. The inlet end 132 is connected to the suction chamber 116. A discharge head 136 may be connected to the discharge end 134 of the pump

106. A drop off element 138 may be connected to the discharge head 136. The drop off element 138 may be a rigid conduit, a flexible hose, a flexible coupling or any other type of suitable piping component known in the art. During operation, the inlet pipe 124 delivers fluid to the surface pumping system 100. The fluid may be water, liquid petroleum products, fluids separated from petroleum products, or any other fluid capable of being pumped. The fluid passes through the suction chamber 116 into the inlet end 132 of the pump 106, through the pump 106, out of the discharge end 134 of the pump 106 and into the drop off element 138.

[020] Turning to FIGS. 3-5, shown therein are perspective, motor-end and pump-end views, respectively, of the suction chamber assembly 116. The suction chamber 116 includes a central housing 140, a pump-end plate 142, a motor-end plate 144, and an inlet branch 146 that extends into the central housing 140. Unlike prior art suction chambers, the pump-end plate 142, motor-end plate 144 and inlet branch 146 are not welded to the central housing 140. Instead, these components of the suction chamber 116 are secured to the central housing 140 with fasteners and locking mechanisms, which obviates the need for expensive, time-consuming and technically difficult welding.

[021] The pump-end plate 142 is secured to the central housing 140 with pump-end bolts 148. The motor-end plate 144 is secured to the central housing 140 with motor-end bolts 150. The pump-end plate 142 includes a central bore 152 and a series of inlet end holes 154 for connecting the pump-end plate 142 to the inlet end 132 of the pump 106. The drive shaft 110 and pumped fluid pass through the central bore 152 into the pump 106. The motor-end plate 144 includes a bearing package aperture 156 and a series of bearing chamber adapter holes 158 for connecting the motor-end plate 144 to the bearing chamber adapter 122. The larger bearing package aperture 156 is sized to admit a portion of the bearing package (not shown) from the bearing chamber adapter 122. When connected to the suction chamber 116, the bearings within the bearing chamber adapter 122 prevent fluid from passing from the suction chamber 116 into the thrust bearing chamber 120.

[022] Turning to FIGS. 6 and 7, shown therein are cross-sectional and partial exploded views, respectively, of the suction chamber 116. The central housing 140 has been partially removed in FIG. 7 to reveal additional components of the suction chamber 116. As illustrated in FIGS. 6 and 7, the central housing 140 includes an outer inlet branch recess 160 and an inner inlet branch recess 162 that are machined flat within the wall of the central housing 140. The outer inlet branch recess 160 is larger than the inner inlet branch recess 162 and the together they form an inlet branch land 164. As depicted in FIG. 6, bolt holes 166a extend into the central housing 140

from both the pump-end and motor-end and align with bolt holes 166b in the pump-end plate 142 and bolt holes 166c in the motor end plate 144. Certain bolt holes 166a that are proximate the end stub 146 intersect the outer stub recess 160.

[023] The inlet branch 146 includes an exterior face 168, an upper shoulder 170 and a connection flange 172 that is sized to press against the upper shoulder 170 of the inlet branch 146. The connection flange 172 is configured to be attached to a mating flange on the inlet pipe 124 to secure the exterior face 168 against the inlet pipe 124 (shown in FIG. 1). In some embodiments, the connection flange 172 is a lap joint flange or a weld neck flange.

[024] The inlet branch 146 further includes a lower shoulder 174, a threaded end 176 and a locking collar 178. The inlet branch 146 is sized to fit in close tolerance with the outer inlet branch recess 160 and inner inlet branch recess 162. The lower shoulder 174 of the inlet branch 146 is configured to abut the inlet branch land 164 within the central housing 140. The locking collar 178 is configured to be threaded onto the threaded end 176 of the inlet branch 146 inside the central housing 140. In this way, the inlet branch 146 can be inserted into the central housing 140 through the outer inlet branch recess 160 to allow the threaded end 176 to pass through the inner inlet branch recess 162. The insertion of the inlet branch 146 within the central housing 140 is stopped when the lower shoulder 174 contacts the inlet branch land 164. The locking collar 178 and threaded end 176 draw the inlet branch 146 into a press fit against the inlet branch land 164.

[025] To prevent the inlet branch 146 from movement relative the central housing 140, the suction chamber 116 includes outer set screws 180 that lock the inlet branch 146 and central housing 140 together. In some embodiments, the outer set screws 180 are inserted through the exterior bolt holes 166b and 166c, through interior bolt holes and into position against the inlet branch 146. It will be appreciated that one or more set screws 180 may be used to lock the inlet branch 146 into position within the central housing 140. To prevent the locking collar 178 from rotating with respect to the threaded end 176, the inlet branch 146 is provided with inner set screws 182 that extend through the locking 176 collar to engage the threaded end 176.

[026] To prevent leakage of fluid out of the suction chamber 116, the suction chamber 116 may be fitted with one or more seals 184. In some embodiments, o-ring seals 184 are positioned between the pump-end plate 142 and the central housing 140, between the motor-end plate 144 and the central housing 140 and between the inlet branch 146 and the central housing 140.

[027] Turning to FIG. 8, shown therein is a process flow diagram illustrating a method 200 for assembling the suction chamber 116. The method of assembly 200 begins at step 202 by inserting the inlet branch 146 into the central housing 140 through the outer inlet branch recess 160. At step 204, the inlet branch 146 is placed against the inlet branch land 164. Next, at step 206, the locking collar 178 is threaded onto the threaded end 176 of the inlet branch 146 and torqued to the desired extent. At step 208, the inner set screws 182 are installed through the locking collar 178. Next, at step 210, the outer set screws 180 are installed through bolt holes 166 to lock the inlet branch 146 into the central housing 140.

[028] The method 200 continues at steps 212 and 214 by securing the pump-end plate 142 and motor-end plate 144 onto the central housing 140. As indicated in FIG. 8, step 212 may be performed before, during or after step 214. The method 200 continues at steps 216 and 218 by connecting the suction chamber 116 to the pump 106 and to the bearing chamber adapter 122. Step 216 may be performed before, during or after step 218. Next, at step 220, the connection flange 170 is connected to a mating flange on the inlet pipe 124. In an alternate embodiment, step 220 takes place before steps 216 and 218. In yet another alternate embodiment, steps step 220 takes place before steps 212 and 214.

[029] It is to be understood that even though numerous characteristics and advantages of various embodiments of the present invention have been set forth in the foregoing description, together with details of the structure and functions of various embodiments of the invention, this disclosure is illustrative only, and changes may be made in detail, especially in matters of structure and arrangement of parts within the principles of the present invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed. It will be appreciated by those skilled in the art that the teachings of the present invention can be applied to other systems without departing from the scope and spirit of the present invention.

What is claimed is:

1. A suction chamber useable in a surface pumping system having a pump driven by a motor, the suction chamber comprising:

a central housing, wherein the central housing is substantially cylindrical and has a motor end and a pump end opposite the motor end;

a motor-end plate bolted to motor end of the central housing;

a pump-end plate bolted to the pump end of the central housing; and

an inlet branch connected to the central housing.

2. The suction chamber of claim 1, wherein the central housing comprises:

an outer inlet branch recess;

an inner inlet branch recess; and

an inlet branch land between the outer inlet branch recess and inner inlet branch recess.

3. The suction chamber of claim 2, wherein the inlet branch comprises:

a lower shoulder in contact with the inlet branch land;

a threaded end that extends through the inner inlet branch recess; and

a locking collar threaded onto the threaded end, wherein the locking collar is interior to the central housing.

4. The suction chamber of claim 3, wherein the inlet branch further comprises:

an upper shoulder; and

a connection flange adjacent the upper shoulder.

5. The suction chamber of claim 3, wherein the locking collar further comprises at least one inner set screw.

6. The suction chamber of claim 3, wherein central housing further comprises at least one outer set screw in contact with the inlet branch.

7. The suction chamber of claim 3, further comprising:

a first o-ring seal between the motor-end plate and the central housing;

a second o-ring seal between the pump-end plate and the central housing; and

a third o-ring seal between the inlet branch and the central housing.

8. A surface pumping system comprising:

a motor;

a pump driven by the motor; and

a suction chamber connected to the pump, wherein the suction chamber comprises:

a central housing;

a motor-end plate bolted to the central housing;

a pump-end plate bolted to the central housing; and

an inlet branch connected to the central housing.

9. The surface pumping system of claim 8, wherein the central housing comprises:

an outer inlet branch recess;

an inner inlet branch recess; and

an inlet branch land between the outer inlet branch recess and inner inlet branch recess.

10. The surface pumping system of claim 9, wherein the inlet branch comprises:

a lower shoulder in contact with the inlet branch land;

a threaded end that extends through the inner inlet branch recess; and

a locking collar threaded onto the threaded end, wherein the locking collar is interior to the central housing.

11. The surface pumping system of claim 10, wherein the inlet branch further comprises:

an upper shoulder; and

a connection flange adjacent the upper shoulder.

12. The surface pumping system of claim 10, wherein the locking collar further comprises at least one inner set screw.

13. The surface pumping system of claim 10, wherein central housing further comprises at least one outer set screw in contact with the inlet branch.

14. The surface pumping system of claim 10, further comprising:

a first o-ring seal between the motor-end plate and the central housing;

a second o-ring seal between the pump-end plate and the central housing; and

a third o-ring seal between the inlet branch and the central housing.

15. A method of assembling a suction chamber for use in a surface pumping system, the method comprising the steps of:

inserting a inlet branch through an inlet branch recess in a central housing;

locating the inlet branch against an inlet branch land in the central housing;

installing a locking collar on the inlet branch from the inside of the central housing;

securing a motor-end plate to the central housing; and

securing a pump-end plate to the central housing.

16. The method of claim 15, wherein the step of installing a locking collar further comprises threading the locking collar onto a threaded end of the inlet branch.

17. The method of claim 16, wherein the step of installing a locking collar further comprises the step of installing set screws to prevent the disengagement of the locking collar from the threaded end of the inlet branch.

18. The method of claim 15, further comprising a step of installing set screws through the central housing to prevent the rotation of the inlet branch.

19. The method of claim 15, wherein the step of securing a motor-end plate to the central housing further comprises bolting the motor-end plate to the central housing with motor-end bolts.

20. The method of claim 15, wherein the step of securing a pump-end plate to the central housing further comprises bolting the pump-end plate to the central housing with pump-end bolts.

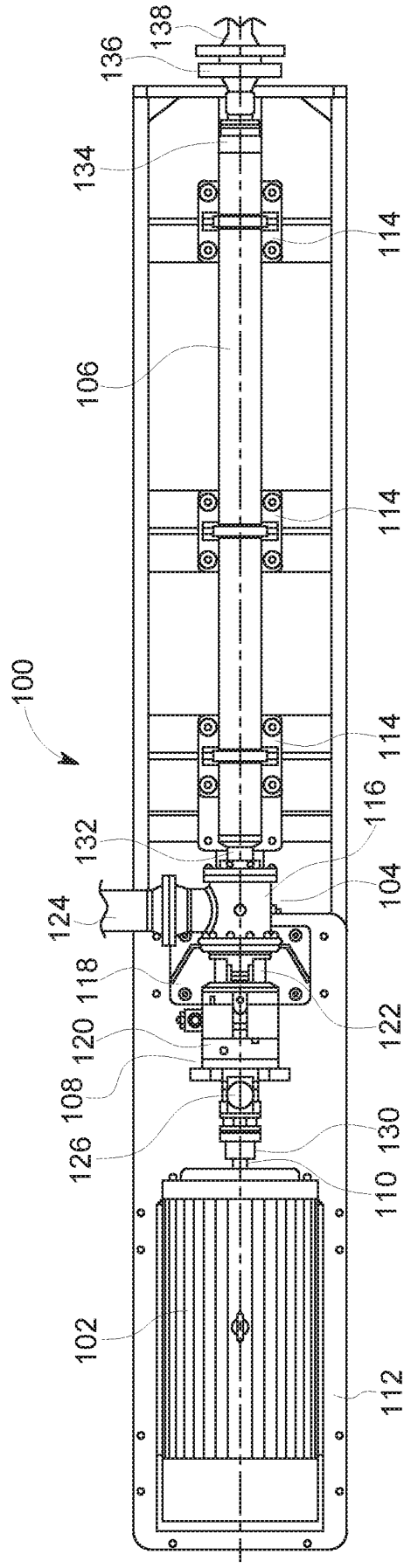

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FIG. 1

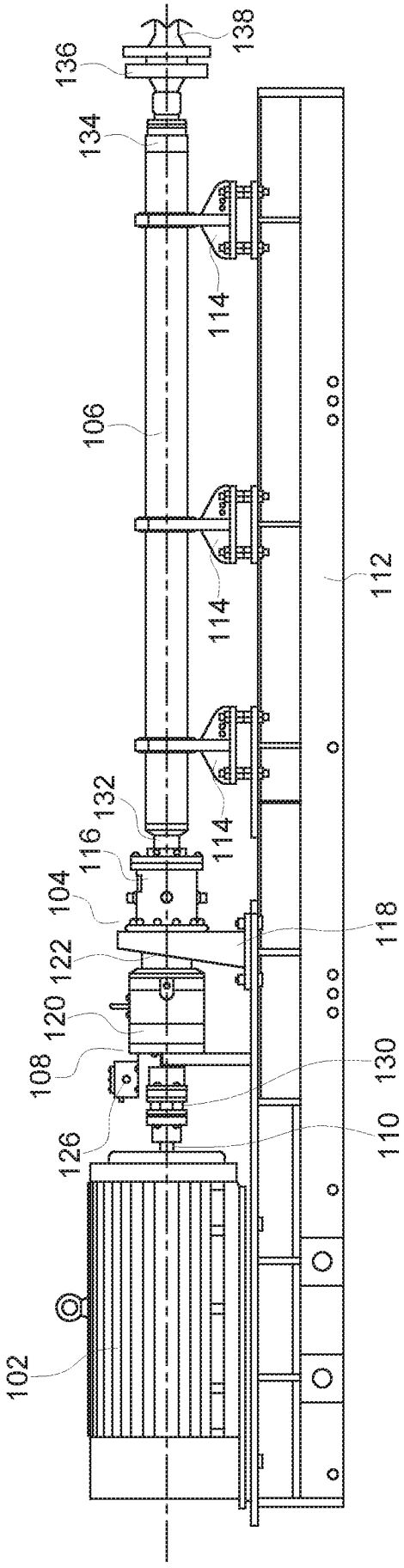

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FIG. 2

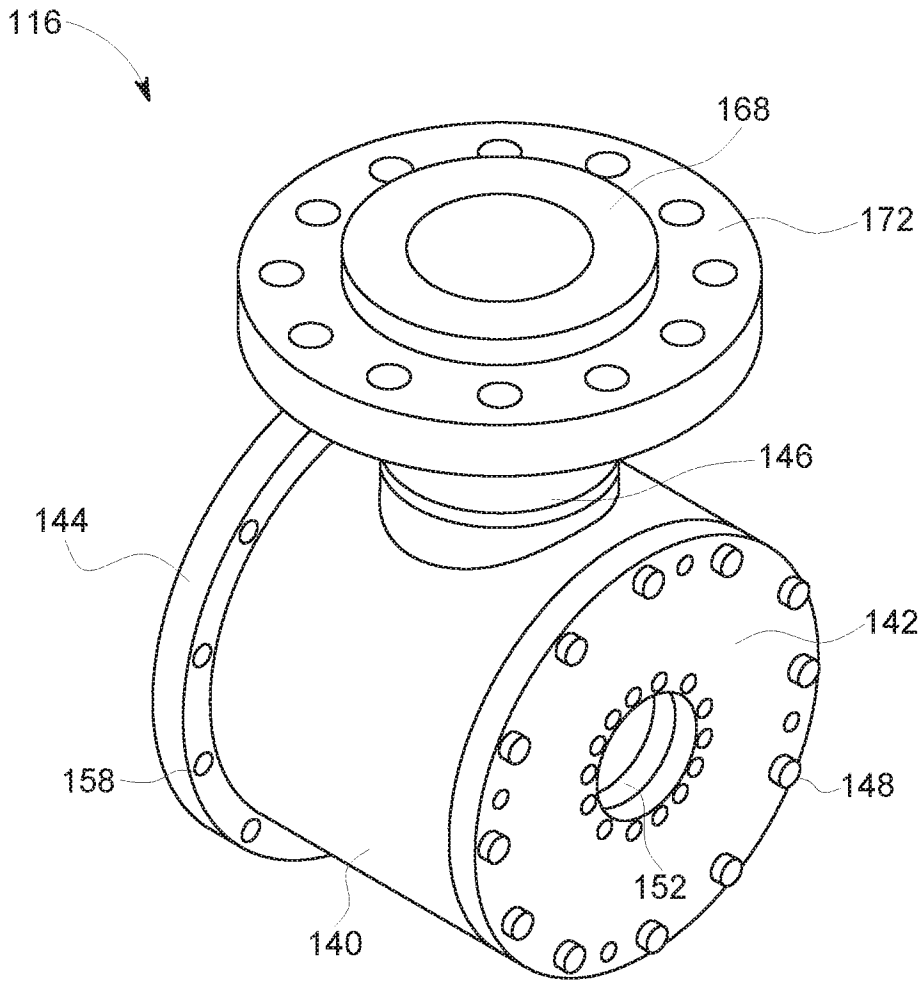


FIG. 3

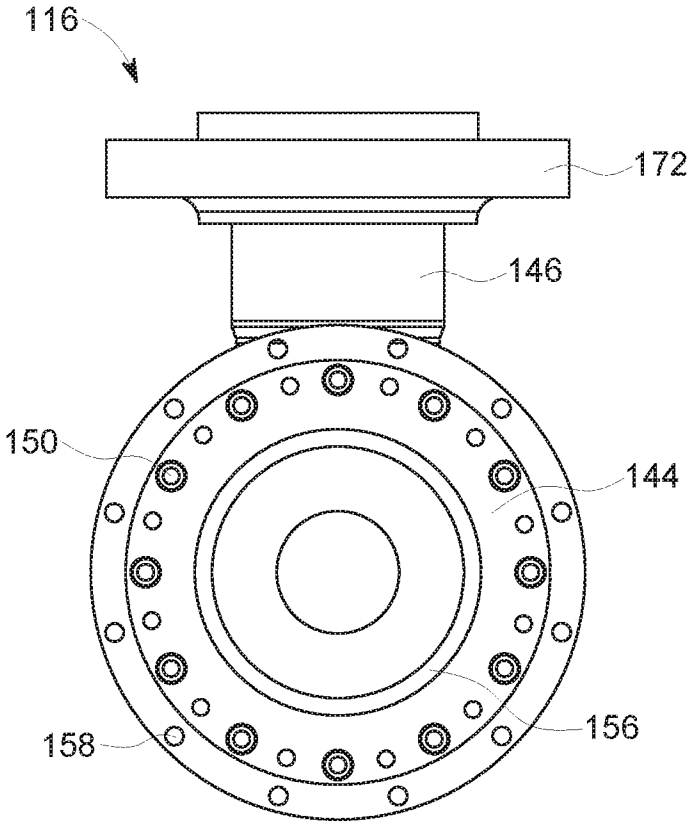


FIG. 4

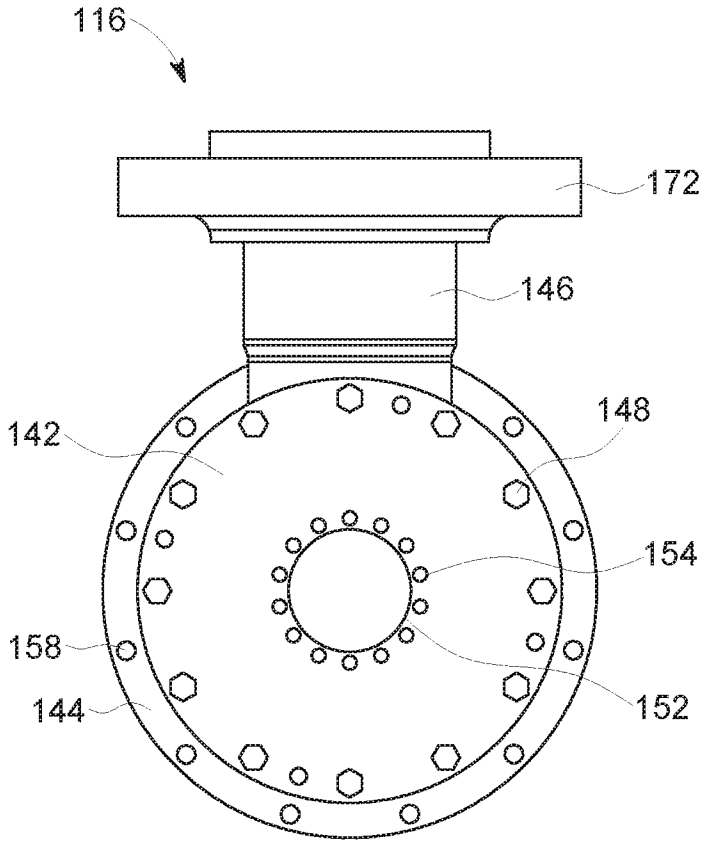


FIG. 5

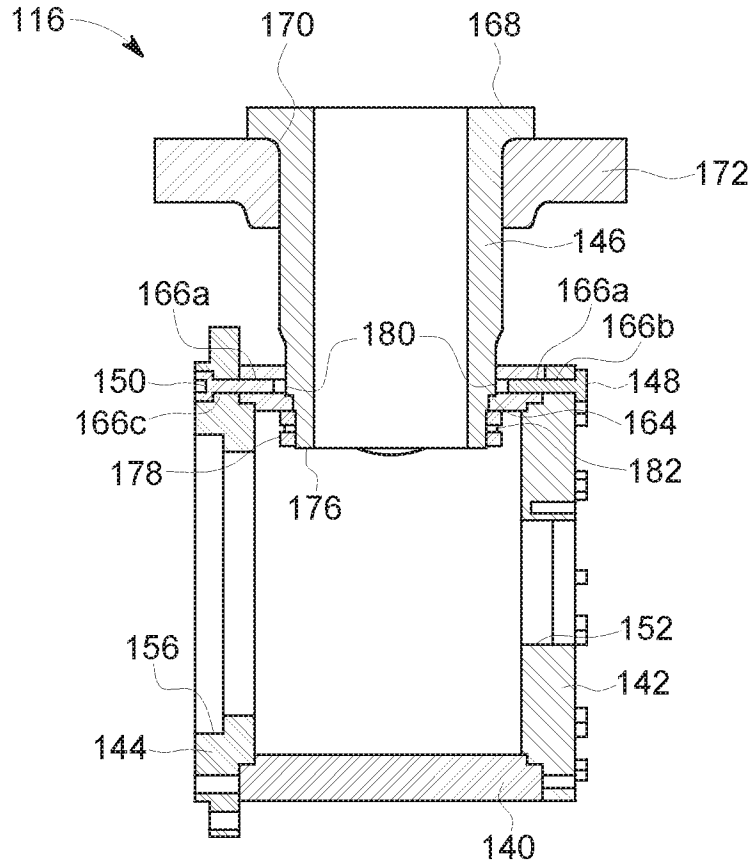

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FIG. 6

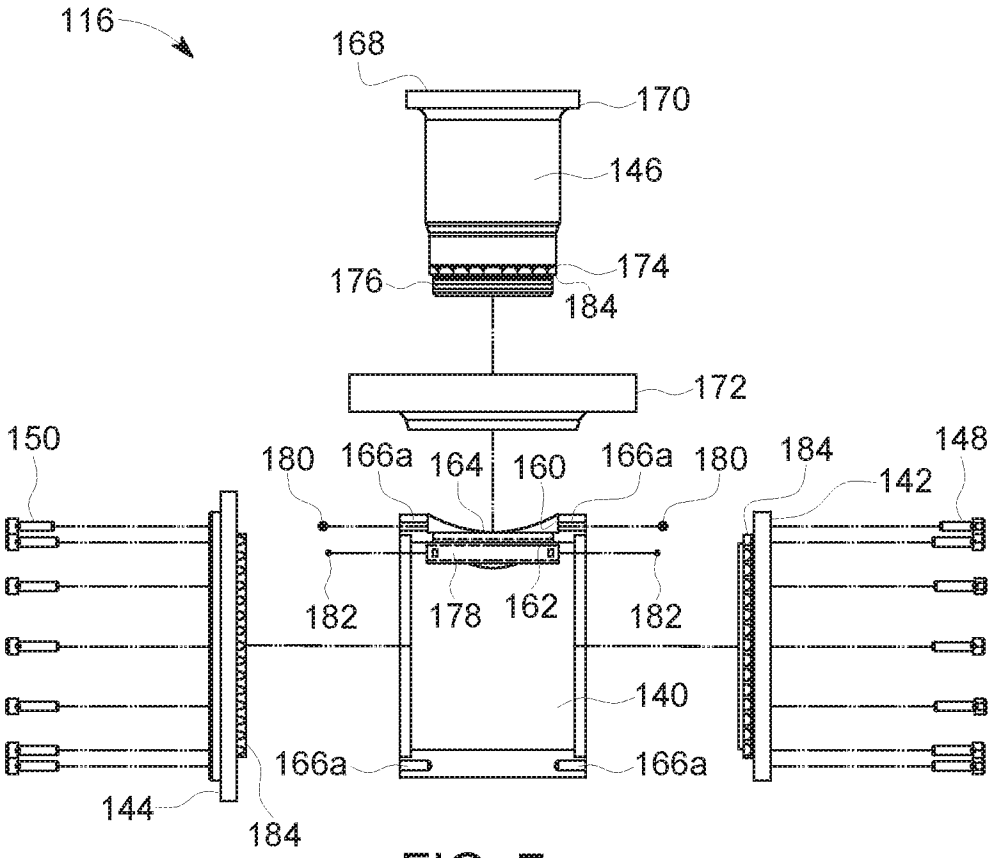

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FIG. 7

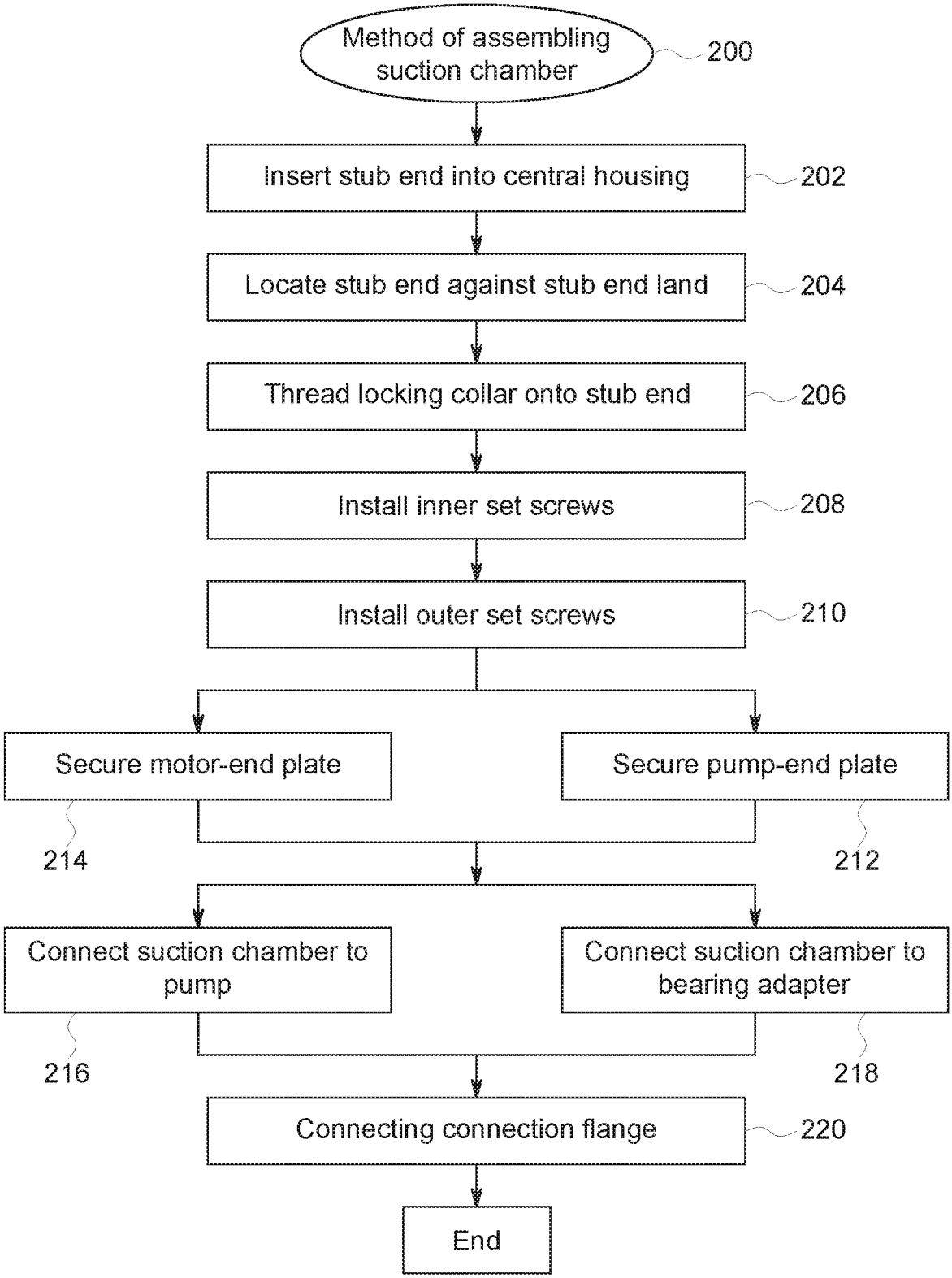

Method of assembling suction chamber
200
Insert stub end into central housing
202
Locate stub end against stub end land
204
Thread locking collar onto stub end
206
Install inner set screws
208
Install outer set screws
210
Secure motor-end plate
214
Secure pump-end plate
212
Connect suction chamber to pump
216
Connect suction chamber to bearing adapter
218
Connecting connection flange
220
End

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/068811

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04B47/02 F04B53/14
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)
F04B

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 6 461 115 B1 (FERRIER NEIL [US] ET AL) 8 October 2002 (2002-10-08) column 3, line 30 - column 5, line 25; figures 2,4	1,8 2-7,9-20
X A	WO 2015/013104 A1 (GE OIL & GAS ESP INC [US]) 29 January 2015 (2015-01-29) paragraph [0033] - paragraph [0040]; figure 6	1,8 2-7,9-20
A	US 2015/093266 A1 (NELSON ANDREW MICHAEL [US] ET AL) 2 April 2015 (2015-04-02) paragraph [0005]	1,8,15
A	GB 2 431 204 A (WEATHERFORD LAMB [US]) 18 April 2007 (2007-04-18) abstract	1,8,15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
5 April 2017	20/04/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Fistas, Nikolaos

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/068811

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2015/211527 A1 (ST JOHN BRENT DAVID [US] ET AL) 30 July 2015 (2015-07-30) claim 17	1,8,15

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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