



(11)

EP 3 808 946 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:

21.04.2021 Bulletin 2021/16

(21) Application number: **19820469.5**

(22) Date of filing: **07.06.2019**

(51) Int Cl.:

F01M 1/02 (2006.01)

F04C 14/22 (2006.01)

F04C 2/10 (2006.01)

F04C 15/00 (2006.01)

(86) International application number:

PCT/KR2019/006881

(87) International publication number:

WO 2019/240437 (19.12.2019 Gazette 2019/51)

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

(30) Priority: **15.06.2018 KR 20180068540**

(71) Applicant: **Myung HWA Ind. Co., Ltd.**
Seoul 08524 (KR)

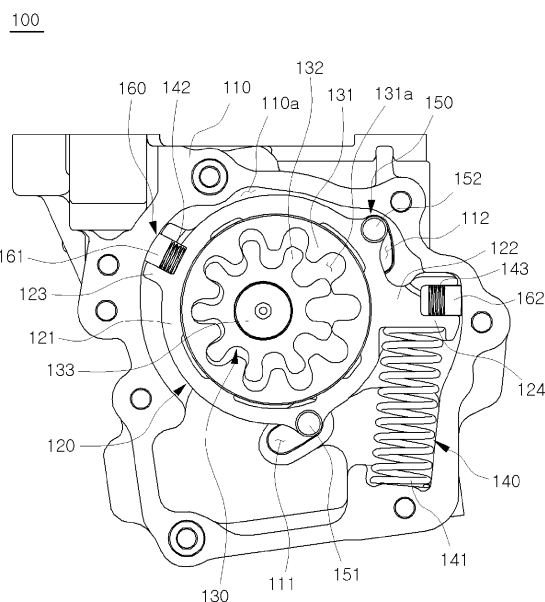
(72) Inventor: **MOON, Sun Joo**
Incheon 22222 (KR)

(74) Representative: **Roos, Peter**
c/o Roospatent
Noldinstrasse 7
81545 München (DE)

(54) **OIL PUMP**

(57) The present invention provides an oil pump that sucks and discharges oil, including: a housing portion; a stator portion including an outer ring that is accommodated inside the housing portion and forms a variable chamber into which oil flows between the housing portion and the stator portion, and a main pressing end that is formed to protrude outward from an outer circumferential surface of the outer ring; a rotor portion accommodated inside the outer ring, and sucking and discharging oil through rotation; a spring portion including a main spring that presses the stator portion, and movably supporting the outer ring inside the housing portion; a guiding portion including a first guiding member that is installed on the outer circumferential surface of the outer ring, slidably installed in a first guiding groove formed in an inner wall of the housing portion, and guides a movement of the outer ring as the outer ring is pressed by the oil flowing into the variable chamber, and guiding the movement of the outer ring; and a sealing portion interposed between the housing portion and a stator portion to prevent the oil flowing into the variable chamber from leaking into another space between the housing portion and the stator portion.

FIG. 1



EP 3 808 946 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an oil pump, and more particularly, to an oil pump that sucks and discharges oil.

BACKGROUND

[0002] In general, an oil pump refers to a device that sucks oil through rotation of a rotor portion, compresses the oil, and discharges the oil to the outside to circulate the oil to various engines such as an engine. An internal combustion engine has an average internal temperature of about 800 degrees Celsius, and a maximum temperature is about 2,000 degrees Celsius as an instantaneous value during an explosive stroke. In addition, in the internal combustion engine, friction is continuously generated between an inner wall of a cylinder and a sliding surface of a piston, bearings of a crankshaft, bearings of a camshaft, and the like. Therefore, it can be said that the oil pump cools the engine by causing the oil to circulate through the engine and reduces friction generated between various components constituting the engine.

[0003] There are two types of oil pumps of a vane type and a gear type. The vane type oil pump includes an outer ring, an inner rotor installed inside the outer ring, and a vane installed on an outer circumferential surface of the inner rotor. In addition, the vane type oil pump operates such that the oil is sucked and discharged by the vane as the inner rotor rotates. The gear type oil pump includes an outer ring, and an outer rotor and an inner rotor which are installed inside the outer ring and each have gear teeth formed on inner and outer circumferential surfaces thereof. In addition, the gear type oil pump causes the oil sucked between the inner rotor and the outer rotor to be pressed and discharged to the outside as the inner rotor rotates to engage with the outer rotor.

[0004] Meanwhile, the oil pump is characterized in that a pressure of the oil discharged from the oil pump continuously increases as the number of rotations of the inner rotor increases. In a case where the pressure discharged from the oil pump is excessively high, each engine may suffer mechanical damage, as well as the pressure is a factor that lowers an overall efficiency of the system. Accordingly, in order to prevent this, Korean Patent Registration No. 10-1491175 discloses a variable oil pump capable of selectively reducing a space between an outer ring and an inner rotor.

[0005] In the conventional variable oil pump as described above, it is characterized in that the outer ring is hinge-coupled to an inside of a housing portion, and the outer ring moves as being pressed by the oil flowing between the outer ring and the housing portion, so that an oil compression space between the outer ring and the inner rotor is reduced.

[0006] In this case, the conventional variable oil pump

described above has a structure in which the outer ring moves along a certain trajectory inside the housing portion on the basis of the hinge-coupled portion of the inner wall of the housing portion. Such a conventional variable oil pump has a problem that an amount of oil supplied to the engine through the oil pump is not effectively and stably adjusted in response to a change in an amount of oil required by the engine in accordance with a change in a speed of the engine.

SUMMARY OF INVENTION

Technical Problem

[0007] The present invention is created to solve the problems described above, and an object thereof is to provide an oil pump in which an amount of oil supplied to an engine is effectively and stably adjusted in response to a change in an amount of oil required by the engine.

Solution to Problem

[0008] The present invention provides an oil pump that sucks and discharges oil, including: a housing portion; a stator portion including an outer ring that is accommodated inside the housing portion and forms a variable chamber into which oil flows between the housing portion and the stator portion, and a main pressing end that is formed to protrude outward from an outer circumferential surface of the outer ring; a rotor portion accommodated inside the outer ring, and sucking and discharging oil through rotation; a spring portion including a main spring that presses the stator portion, and movably supporting the outer ring inside the housing portion; a guiding portion including a first guiding member that is installed on the outer circumferential surface of the outer ring, slidably installed in a first guiding groove formed in an inner wall of the housing portion, and guides a movement of the outer ring as the outer ring is pressed by the oil flowing into the variable chamber, and guiding the movement of the outer ring; and a sealing portion interposed between the housing portion and a stator portion to prevent the oil flowing into the variable chamber from leaking into another space between the housing portion and the stator portion.

[0009] The first guiding groove may be formed on a side opposite to the variable chamber on the basis of the outer ring, and the first guiding member may be installed on the outer circumferential surface of the outer ring on a side opposite to the variable chamber. The spring portion may further include a first auxiliary spring having one end that is in contact with the outer circumferential surface of the outer ring on a side opposite to the main spring and the other end that is in contact with the inner wall of the housing portion.

[0010] The stator portion may further include a first auxiliary pressing end formed to protrude from the outer circumferential surface of the outer ring to surround the

first auxiliary spring. The sealing portion may include a first sealing member interposed between the inner wall of the outer ring and the first auxiliary spring.

[0011] The spring portion may further include a second auxiliary spring having one end that is in contact with the main pressing end and the other end that is in contact with the inner wall of the housing portion. The stator portion may further include a second auxiliary pressing end formed to protrude from the main pressing end to surround the second auxiliary spring.

[0012] The main spring may be disposed such that one end is in contact with the main pressing end and the other end is in contact with the inner wall of the housing portion, and the oil flowing into the variable chamber may press the stator portion toward a side opposite to a direction in which the outer ring is pressed.

[0013] The housing portion may be formed of a second guiding groove on the inner wall on a side opposite to the main spring on the basis of the main pressing end. The guiding portion may further include a second guiding member installed on the outer circumferential surface of the outer ring and slidably installed in the second guiding groove.

[0014] The first guiding groove may be formed along a direction away from the main spring at a position adjacent to the main spring, and may be formed along a direction opposite to a direction of a force applied to the main pressing end by the main spring. The second guiding groove may be formed to face the main pressing end side from the inner wall of the housing portion in which the variable chamber is formed.

[0015] The housing portion may be formed of a second guiding groove on the inner wall on the first auxiliary pressing end side. The guiding portion may further include a second guiding member installed on the outer circumferential surface of the outer ring and slidably installed in the second guiding groove.

[0016] The stator portion may further include a third auxiliary pressing end protruding outward from a portion of the outer circumferential surface of the outer ring between the first guiding member and the main pressing end. The main spring may be disposed such that one end is in contact with the third auxiliary pressing end and the other end is in contact with the portion of the inner wall of the housing portion on the main pressing end side to pressurize the stator portion.

[0017] The housing portion may be formed of a second guiding groove on the inner wall on a side adjacent to the variable chamber. The guiding portion may further include a second guiding member installed on the outer circumferential surface of the outer ring and slidably installed in the second guiding groove. The main spring may be disposed such that one end is in contact with the main pressing end and the other end is in contact with the inner wall portion of the housing portion on the second guiding groove side to pressurize the stator portion.

Advantageous Effects

[0018] According to the oil pump according to the present invention, the guide portion including the first and second guide members for guiding the movement of the outer ring at different positions, and the spring portion including the first and second auxiliary springs for movably supporting the outer ring at different positions are provided, and thereby the outer ring can be moved along various trajectories inside the housing portion.

[0019] Accordingly, according to the oil pump according to the present invention, it is possible to effectively and stably adjust the amount of oil supplied to the engine in response to a change in the amount of oil required by the engine in accordance with a change in the speed of the engine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a view illustrating a state before oil is introduced into a variable chamber of an oil pump according to a first example of the present invention.

FIG. 2 is a view illustrating a state after oil is introduced into the variable chamber of the oil pump according to the first example of the present invention.

FIG. 3 is a view illustrating an oil pump according to a second example of the present invention.

FIG. 4 is a view illustrating an oil pump according to a third example of the present invention.

FIG. 5 is a view illustrating an oil pump according to a fourth example of the present invention.

BEST MODE FOR INVENTION

[0021] The present invention is described with reference to the examples illustrated in the drawings, but these are merely exemplary, and those of ordinary skill in the art will appreciate that various modifications and equivalent other examples are possible therefrom. Therefore, the true technical protection scope of the present invention should be determined by the technical spirit of the appended claims.

[0022] Referring to FIGS. 1 and 2, an oil pump 100 according to an example of the present invention includes a housing portion 110, a stator portion 120, a rotor portion 130, a spring portion 140, a guiding portion 150, and a sealing portion 160.

[0023] The housing portion 110 has a suction port and a discharge port through which oil is sucked and discharged, and accommodates the stator portion 120, the rotor portion 130, the spring portion 140, the guiding portion 150, and the sealing portion 160 inside thereof. Further, a variable chamber 110a in which some of the oil discharged to the outside through the discharge port of the housing portion 110 is bypassed and introduced is formed between the housing portion 110 and the stator

portion 120.

[0024] The stator portion 120 includes an outer ring 121, a main pressing end 122, a first auxiliary pressing end 123, and a second auxiliary pressing end 124. The outer ring 121 is accommodated inside the housing portion 110 and forms the variable chamber 110a with the housing portion 110 therebetween. The main pressing end 122 is formed to protrude radially outward from an outer circumferential surface of the outer ring 121.

[0025] The first auxiliary pressing end 123 is formed to protrude from the outer circumferential surface of the outer ring 121 corresponding to a side opposite to the main pressing end 122. In addition, the second auxiliary pressing end 124 is formed to protrude from an end portion of the main pressing end 122 toward the outside on the basis of the radial direction of the outer ring 121. Here, the first auxiliary pressing end 123 may be formed in a pair that are disposed to be spaced apart from each other along a circumferential direction of the outer ring 121. In addition, the second auxiliary pressing end 124 may be formed in a pair that are disposed to be spaced apart from each other.

[0026] The rotor portion 130 is accommodated inside the outer ring 121 to suck and discharge oil through rotation, and includes an outer rotor 131, an inner rotor 132, and a rotation shaft 133. The outer rotor 131 is fixedly coupled to the outer ring 121 such that an outer circumferential surface is in contact with an inner circumferential surface of the outer ring 121. The inner rotor 132 is installed inside the outer rotor 131, and is formed of a pressing chamber 131a in which oil is sucked and pressed with the outer rotor 131 therebetween. In addition, the outer rotor 131 and the inner rotor 132 are installed such that gear teeth formed on inner and outer circumferential surfaces thereof are engaged with each other.

[0027] The rotation shaft 133 is rotatably fixed to the housing portion 110 and is installed to penetrate through a central portion of the inner rotor 132 thereby being fixedly coupled to the inner rotor 132. In addition, the rotation shaft 133 receives power from the engine and rotates together with the inner rotor 132.

[0028] The spring portion 140 is provided such that the stator portion 120 is movably supported inside the housing portion 110, and includes a main spring 141, a first auxiliary spring 142, and a second auxiliary spring 143. The main spring 141 is disposed on a side opposite to the variable chamber 110a on the basis of the main pressing end 122. In addition, the main spring 141 is disposed such that one end is in contact with the main pressing end 122 and the other end is in contact with an inner wall of the housing portion 110. Accordingly, the main spring 141 presses the stator portion 120 toward a side opposite to a direction in which the oil flowing into the variable chamber 110a presses the stator portion 120.

[0029] The first auxiliary spring 142 is disposed between the pair of first auxiliary pressing ends 123, has one end that is in contact with the outer circumferential surface of the outer ring 121 and the other end that faces

the inner wall of the housing portion 110. The second auxiliary spring 143 is disposed between the pair of second auxiliary pressing ends 124, and has one end that is in contact with the end portion of the main pressing end 122 and the other end that faces the inner wall of the housing portion 110.

[0030] On the other hand, the housing portion 110 is formed of a first guiding groove 111 on the inner wall on a side opposite to the variable chamber 110a on the basis of the stator portion 120. In addition, the housing portion 110 is formed of a second guiding groove 112 on the inner wall on a side opposite to the main spring 141 on the basis of the main pressing end 122.

[0031] The guiding portion 150 is provided to guide the movement of the stator portion 120, and includes a first guiding member 151 and a second guiding member 152. The first guiding member 151 is fixedly installed on an outer circumferential surface on a side opposite to the variable chamber 110a in the outer circumferential surface of the outer ring 121. In addition, the first guiding member 151 is slidably inserted into the first guiding groove 111. Accordingly, the first guiding member 151 guides the movement of the stator portion 120 as the outer ring 121 is pressed by the oil flowing into the variable chamber 110a.

[0032] The second guiding member 152 is fixedly installed on the outer circumferential surface of the outer ring 121 on the variable chamber 110a side, that is, on the outer circumferential surface of the outer ring 121 on a side where the main spring 141 is not disposed on the basis of the main pressing end 122. In addition, the second guiding member 152 is slidably inserted into the second guiding groove 112. Accordingly, the second guiding member 152 guides the movement of the stator portion 120 together with the first guiding member 151.

[0033] According to the oil pump 100 according to the present invention described above, the stator portion 120 may be disposed inside the housing portion 110 while maintaining structural stability. That is, a pressure applied to the stator portion 120 upwardly by the main spring 141 may be supported by a pressure applied to the stator portion 120 by the oil flowing into the second guiding member 152 inserted into the second guiding groove 112 and the variable chamber 110a. In addition, a pressure applied by the first auxiliary spring 142 to the stator portion 120 may be supported by a pressure applied to the stator portion 120 by the first guiding member 151 inserted into the first guiding groove 111 and the second auxiliary spring 143. Accordingly, the oil pump 100 according to an example of the present invention can maintain a structurally stable state of the stator portion 120 inside the housing portion 110.

[0034] In addition, the oil pump 100 according to the present invention is designed in a structure in which a force is applied to the stator portion 120 in a state where the first and second auxiliary springs 142 and 143 disposed at different positions are not fixed to the inner wall of the housing portion 110, and the stator portion 120 is

supported in a state where the first and second guiding members 151 and 152 disposed at different positions are in sliding contact with the first and second guiding grooves 111 and 112. Therefore, as the stator portion 120 is pressed by the oil flowing into the variable chamber 110a, the stator portion 120 can be moved along various trajectories inside the housing portion 110. Thus, according to the oil pump 100 according to the present invention, in response to a change in the amount of oil required by the engine in accordance with a change in the speed of the engine, the amount of oil supplied to the engine can be effectively and stably adjusted.

[0035] On the other hand, the first guiding groove 111 is formed along a direction away from the main spring 141 at a position adjacent to the main spring 141, and may be formed along a direction opposite to a direction of the force applied to the main pressing end 122 by the main spring 141. That is, as illustrated in FIGS. 1 and 2, the first guiding groove 111 may be formed in a diagonal direction toward a lower left at a position adjacent to the main spring 141.

[0036] The second guiding groove 112 may be formed to face the main pressing end 122 side on the inner wall of the housing portion 110 in which the variable chamber 110a is formed. That is, as illustrated in FIGS. 1 and 2, the second guiding groove 112 may be formed in a diagonal direction toward a lower right on the inner wall of the housing portion 110 in which the variable chamber 110a is formed.

[0037] In a case where the first and second guiding grooves 111 and 112 are formed with such a structure, the first and second guiding members 151 and 152, and the stator portion 120, in which the first and second guiding members 151 and 152 are fixedly installed, may be smoothly guided downward along the first and second guiding grooves 111 and 112.

[0038] However, this is only one of several examples of the present invention, and it will be said that the first and second guiding grooves 111 and 112 may be formed in various shapes in accordance with a movement type of the stator portion 120 desired by a practitioner.

[0039] The sealing portion 160 is interposed between the housing portion 110 and the stator portion 120 so that the oil flowing into the variable chamber 110a is prevented from leaking into a space other than the variable chamber 110a among spaces between the housing portion 110 and the stator portion 120. To this end, the sealing portion 160 includes a first sealing member 161 and a second sealing member 162.

[0040] The first sealing member 161 is interposed between the inner wall of the housing portion 110 and the other end of the first auxiliary spring 142. The second sealing member 162 is interposed between the inner wall of the housing portion 110 and the other end of the second auxiliary spring 143. As described above, since the first and second sealing members 161 and 162 are provided on both sides of the variable chamber 110a, respectively, it is possible to prevent the oil flowing into the variable

chamber 110a from leaking into other spaces.

[0041] Hereinafter, oil pumps 100 according to second to fourth examples of the present invention will be described in detail with reference to FIGS. 3 to 5. In this case, the oil pumps 100 according to the second to fourth examples of the present invention will be described focusing only on a portion different from that of the oil pump 100 according to the first example.

[0042] Referring to FIG. 3, in the oil pump 100 according to the second example of the present invention, the housing portion 110 is formed of the second guiding groove 112 on the inner wall on the first auxiliary pressing end 123 side, and the guiding portion 150 may further include the second guiding member 152 installed on the outer circumferential surface of the outer ring 121 and slidably installed in the second guiding groove 112.

[0043] In a case where the second guiding groove 112 and the second guiding member 152 are disposed in such a structure, a force transmitted to the main pressing end 122 by the main spring 141 is not directly transmitted to the guiding member 152, so that the second guiding member 152 can be protected. Further, in this case, the main spring 141 presses the stator portion 120 in a direction opposite to the direction in which the oil flowing into the variable chamber 110a presses the outer ring 121.

[0044] Referring to FIG. 4, in the oil pump 100 according to the third example of the present invention, the stator portion 120 may further include a third auxiliary pressing end 125 protruding outward from a portion of the outer circumferential surface of the outer ring 121 between the first guiding member 151 and the main pressing end 122. In addition, the main spring 141 is disposed such that one end is in contact with the third auxiliary pressing end 125 and the other end is in contact with a portion of the inner wall of the housing portion 110 on the main pressing end 122 side.

[0045] In a case where the main spring 141 is disposed in such a structure, as reference to FIG. 4, while the oil flowing into the variable chamber 110a applies a force to the stator portion 120 in a counterclockwise direction, the main spring 141 may apply a force to the stator portion 120 in a clockwise direction corresponding to the opposite direction. Accordingly, the oil pump 100 according to the present invention can more flexibly adjust the amount of discharged oil in accordance with the oil flowing into the variable chamber 110a.

[0046] Referring to FIG. 5, in the oil pump 100 according to the fourth example of the present invention, the main spring 141 is disposed such that one end is in contact with the main pressing end 122 and the other end is in contact with a portion of the inner wall portion of the housing portion 110 on the second guiding groove 122 side. Accordingly, the main spring 141 presses the main pressing end 122 in a direction away from the second guiding groove 112.

[0047] As the oil pump 100 according to the present invention is designed with various structures as de-

scribed above, the stator portion 120 can be moved along various trajectories inside the housing portion 110 as the stator portion 120 is pressed by the oil flowing into the variable chamber 110a. Therefore, according to the oil pump 100 according to the present invention, in response to a change in the amount of oil required by the engine in accordance with a change in the speed of the engine, the amount of oil supplied to the engine can be effectively and stably adjusted.

Claims

1. An oil pump that sucks and discharges oil, comprising:

a housing portion;

a stator portion including an outer ring that is accommodated inside the housing portion and forms a variable chamber into which oil flows between the housing portion and the stator portion, and a main pressing end that is formed to protrude outward from an outer circumferential surface of the outer ring;

a rotor portion accommodated inside the outer ring, and sucking and discharging oil through rotation;

a spring portion including a main spring that presses the stator portion, and movably supporting the outer ring inside the housing portion;

a guiding portion including a first guiding member that is installed on the outer circumferential surface of the outer ring, slidably installed in a first guiding groove formed in an inner wall of the housing portion, and guides a movement of the outer ring as the outer ring is pressed by the oil flowing into the variable chamber, and guiding the movement of the outer ring; and

a sealing portion interposed between the housing portion and a stator portion to prevent the oil flowing into the variable chamber from leaking into another space between the housing portion and the stator portion.

2. The oil pump according to claim 1, wherein the first guiding groove is formed on a side opposite to the variable chamber on the basis of the outer ring, and the first guiding member is installed on the outer circumferential surface of the outer ring on a side opposite to the variable chamber, and wherein the spring portion further includes a first auxiliary spring having one end that is in contact with the outer circumferential surface of the outer ring on a side opposite to the main spring and the other end that is in contact with the inner wall of the housing portion.

3. The oil pump according to claim 2,

wherein the stator portion further includes a first auxiliary pressing end that is formed to protrude from the outer circumferential surface of the outer ring to surround the first auxiliary spring, and

wherein the sealing portion includes a first sealing member interposed between the inner wall of the outer ring and the first auxiliary spring.

4. The oil pump according to claim 2, wherein the spring portion further includes a second auxiliary spring having one end that is in contact with the main pressing end and the other end that is in contact with the inner wall of the housing portion, and wherein the stator portion further includes a second auxiliary pressing end that is formed to protrude from the main pressing end to surround the second auxiliary spring.

5. The oil pump according to claim 2, wherein the main spring is disposed such that one end is in contact with the main pressing end and the other end is in contact with the inner wall of the housing portion, and the oil flowing into the variable chamber presses the stator portion toward a side opposite to a direction in which the outer ring is pressed.

6. The oil pump of claim 5, wherein the housing portion is formed of a second guiding groove on the inner wall on a side opposite to the main spring on the basis of the main pressing end, and wherein the guiding portion further includes a second guiding member installed on the outer circumferential surface of the outer ring and slidably installed in the second guiding groove.

7. The oil pump of claim 6, wherein the first guiding groove is formed along a direction away from the main spring at a position adjacent to the main spring, and is formed along a direction opposite to a direction of a force applied to the main pressing end by the main spring, and wherein the second guiding groove is formed to face the main pressing end side from the inner wall of the housing portion in which the variable chamber is formed.

8. The oil pump of claim 5, wherein the housing portion is formed of a second guiding groove on the inner wall on the first auxiliary pressing end side, and wherein the guiding portion further includes a second guiding member installed on the outer circumferential surface of the outer ring and slidably installed in the second guiding groove.

9. The oil pump according to claim 1, wherein the stator portion further includes a third

auxiliary pressing end that protrudes outward from a portion of the outer circumferential surface of the outer ring between the first guiding member and the main pressing end, and

wherein the main spring is disposed such that one end is in contact with the third auxiliary pressing end and the other end is in contact with the inner wall portion of the housing portion on the main pressing end side to pressurize the stator portion.

5

10

10. The oil pump according to claim 1, wherein the housing portion is formed of a second guiding groove on the inner wall on a side adjacent to the variable chamber,

wherein the guiding portion further includes a second guiding member installed on the outer circumferential surface of the outer ring and slidably installed in the second guiding groove, and

15

wherein the main spring is disposed such that one end is in contact with the main pressing end and the other end is in contact with a portion of the inner wall of the housing portion on a second guiding groove side to press the stator portion.

20

25

30

35

40

45

50

55

FIG. 1

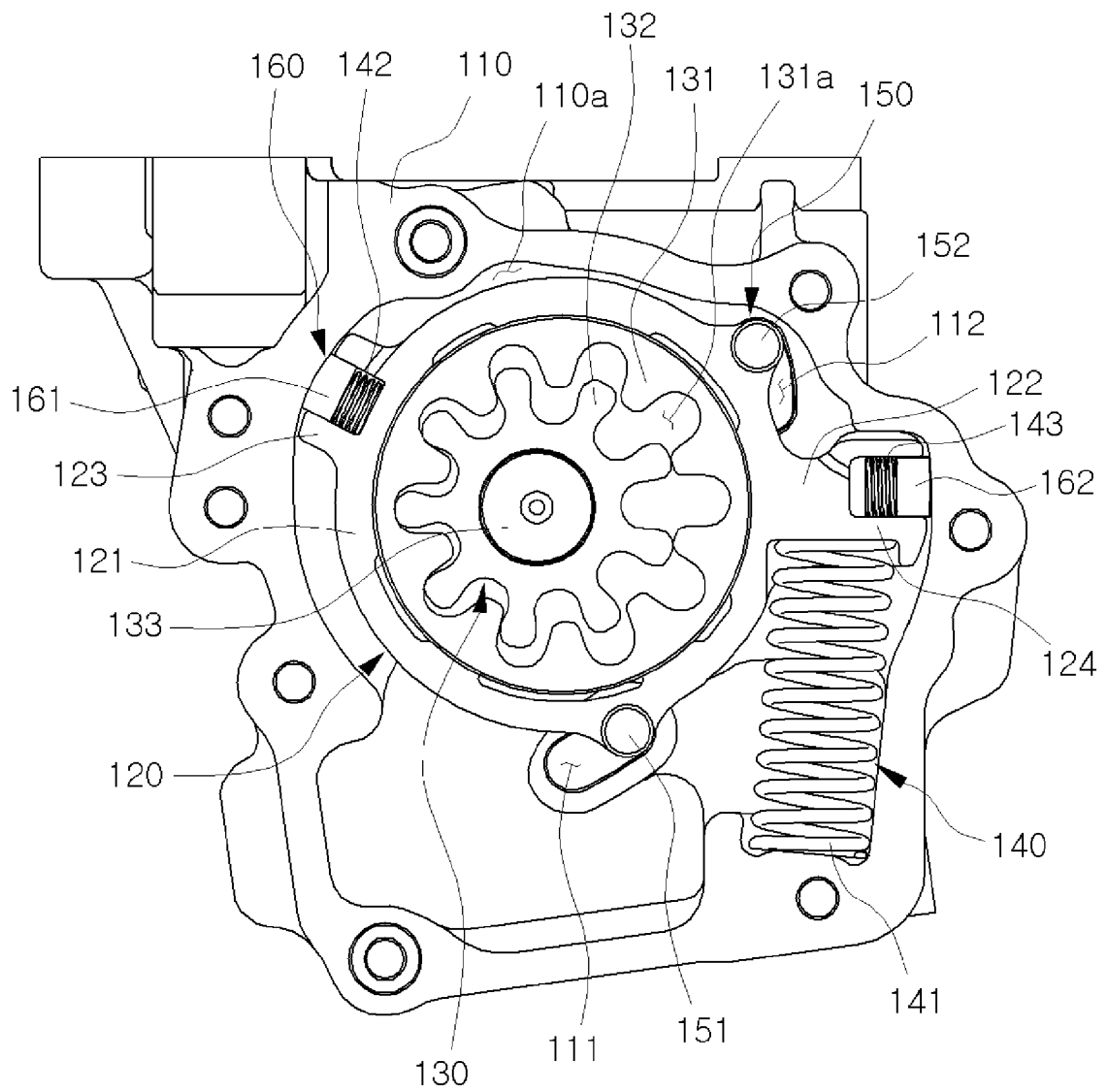


FIG. 2

100

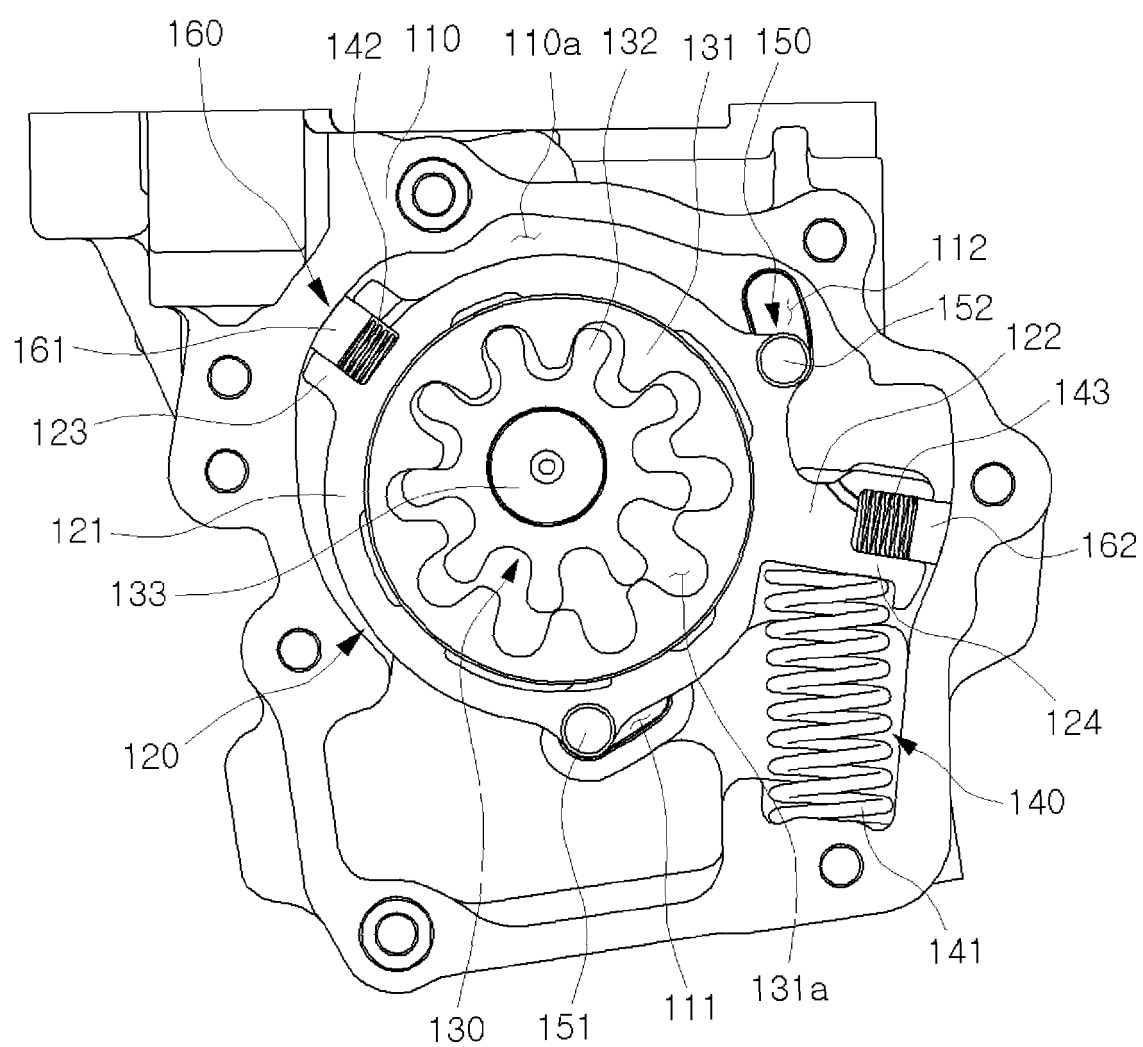


FIG. 3

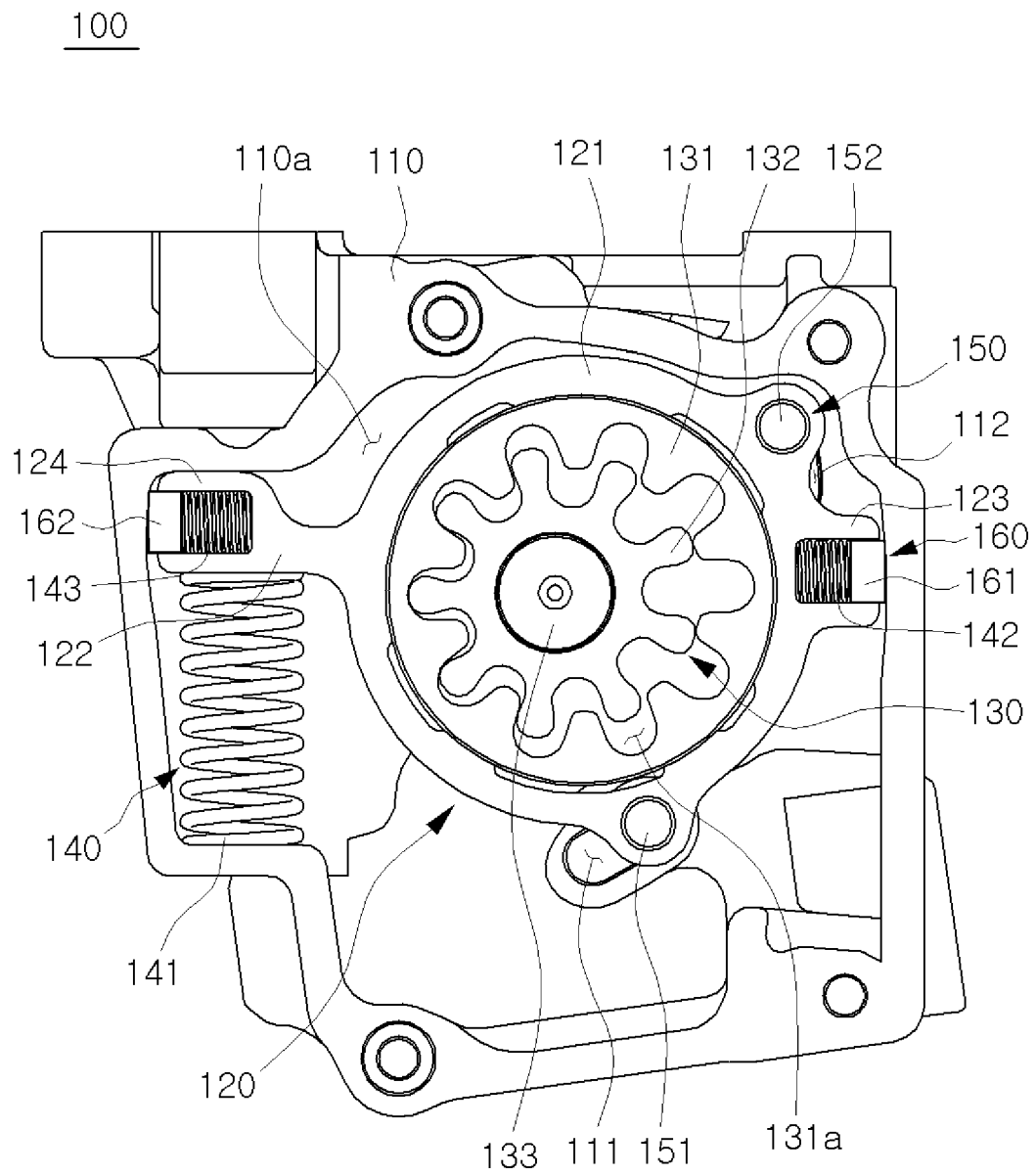


FIG. 4

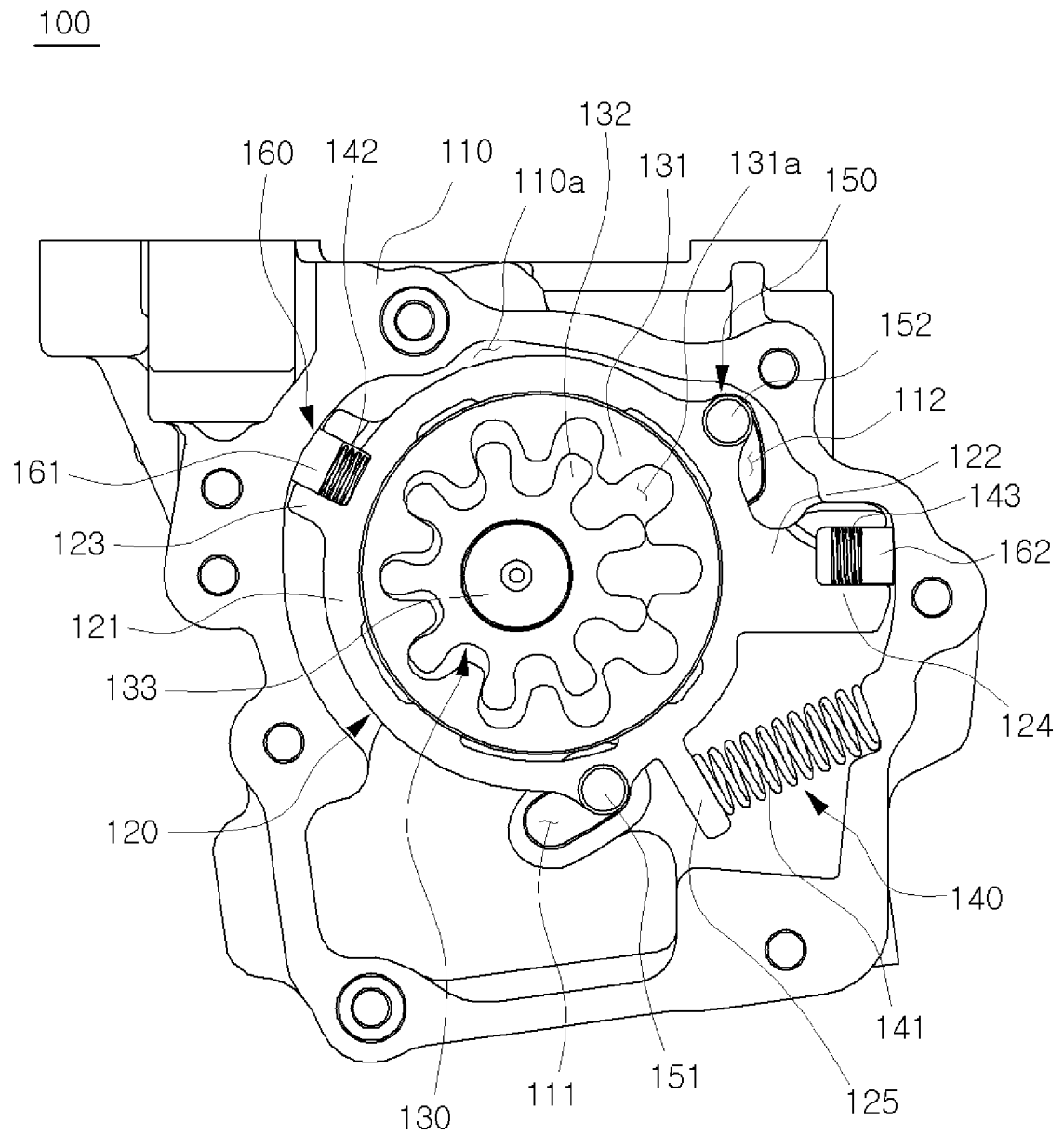
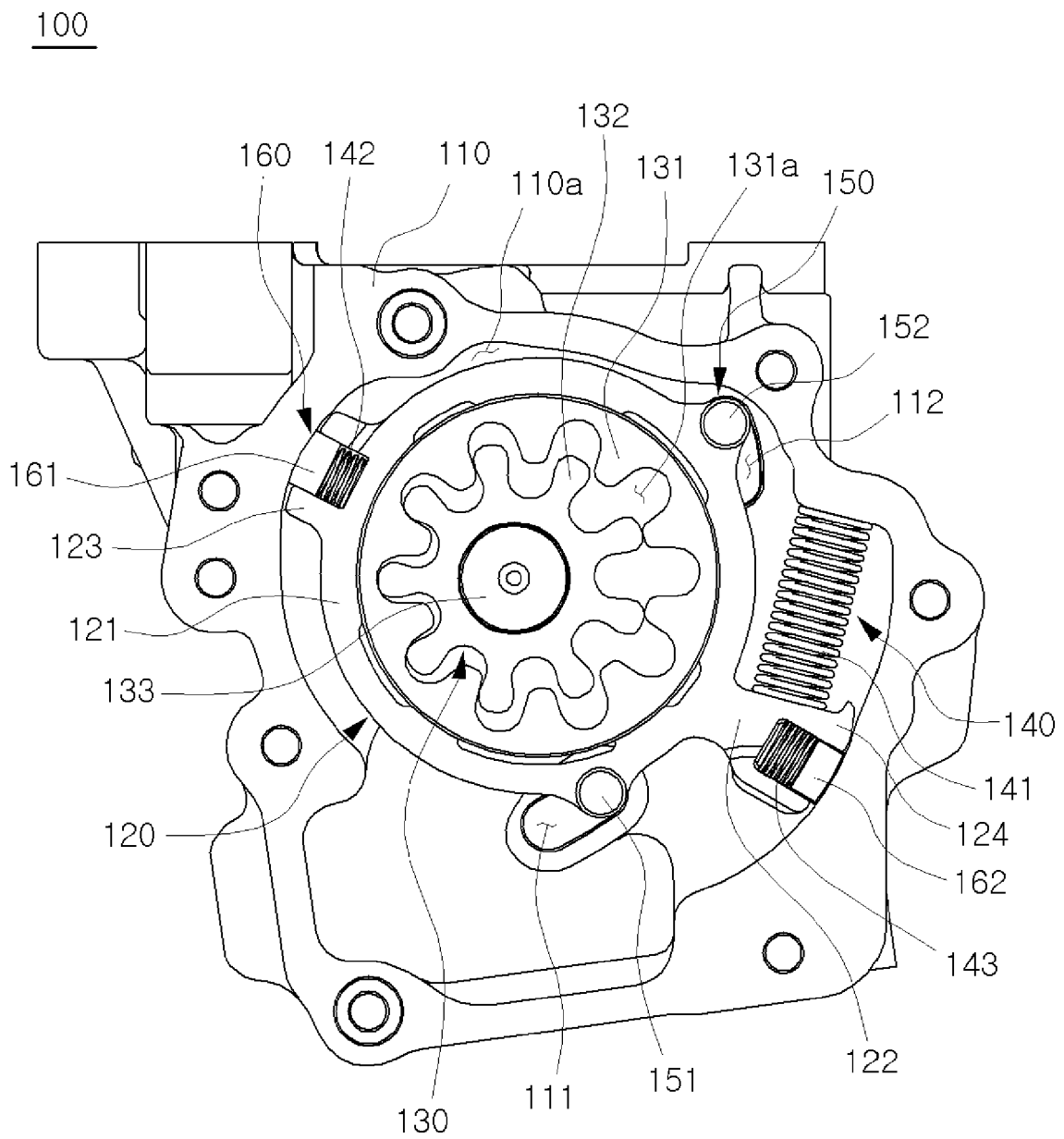


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2019/006881

A. CLASSIFICATION OF SUBJECT MATTER

F01M 1/02(2006.01)i, F04C 2/10(2006.01)i, F04C 14/22(2006.01)i, F04C 15/00(2006.01)i

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)

F01M 1/02; F04C 14/00; F04C 14/20; F04C 14/22; F04C 15/04; F04C 2/10; F04C 2/344; F04C 15/00

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

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: oil, pump, housing, variable, chamber, outer ring, stator, rotor, spring, guide, sliding, sealing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2016-098768 A (AISIN SEIKI CO., LTD.) 30 May 2016 See paragraphs [0016]-[0047]; and figures 1-2.	1-7,9
A		8,10
Y	JP 5141993 B2 (AISIN SEIKI CO., LTD.) 13 February 2013 See paragraphs [0064]-[0090], [0106]-[0116]; and figures 3-7, 13.	1-7,9
Y	JP 08-159046 A (SYST SOGO KENKYUSHO K.K.) 18 June 1996 See paragraphs [0012]-[0018]; and figure 1.	2-7
A	JP 6275021 B2 (AISIN SEIKI CO., LTD.) 07 February 2018 See paragraphs [0013]-[0043]; and figures 1-2.	1-10
A	KR 10-2008-0105168 A (THE GATES CORPORATION) 03 December 2008 See paragraphs [0020]-[0038]; and figures 1-3.	1-10

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"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
"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	"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
"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)	"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
"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	"&" document member of the same patent family

Date of the actual completion of the international search

29 AUGUST 2019 (29.08.2019)

Date of mailing of the international search report

29 AUGUST 2019 (29.08.2019)

Name and mailing address of the ISA/KR



Korean Intellectual Property Office
Government Complex Daejeon Building 4, 189, Cheongsu-ro, Seo-gu,
Daejeon, 35208, Republic of Korea
Facsimile No. +82-42-481-8578

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2019/006881

Patent document cited in search report	Publication date	Patent family member	Publication date
JP 2016-098768 A	30/05/2016	JP 6390379 B2	19/09/2018
JP 5141993 B2	13/02/2013	CN 101978167 A	16/02/2011
		CN 101978167 B	26/02/2014
		EP 2261508 A1	15/12/2010
		EP 2261508 A4	06/11/2013
		EP 2261508 B1	12/04/2017
		US 2011-0014078 A1	20/01/2011
		US 9127671 B2	08/09/2015
		WO 2010-013625 A1	04/02/2010
JP 08-159046 A	18/06/1996	None	
JP 6275021 B2	07/02/2018	JP 2016-102423 A	02/06/2016
KR 10-2008-0105168 A	03/12/2008	AU 2007-241171 A1	01/11/2007
		BR P10709186 A2	28/06/2011
		CA 2647376 A1	01/11/2007
		CN 101443557 A	27/05/2009
		EP 1999373 A1	10/12/2008
		JP 2009-531598 A	03/09/2009
		MX 2008012455 A	10/10/2008
		RU 2008142373 A	10/05/2010
		RU 2396462 C2	10/08/2010
		US 2007-0224067 A1	27/09/2007
		WO 2007-123607 A1	01/11/2007
		WO 2007-123607 A8	10/04/2008

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- KR 101491175 [0004]