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

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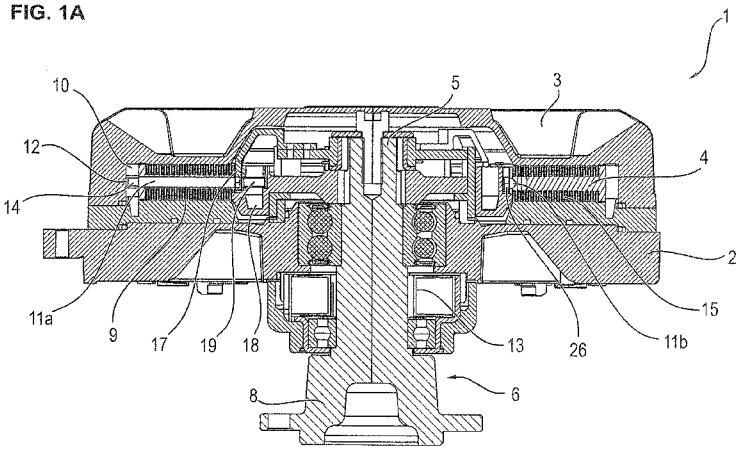
(54) **Title**: FLUID FRICTION CLUTCH

FIG. 1A



(57) **Abstract**: The invention relates to a fluid friction clutch (1) having a housing (2, 3); having a clutch plate (4) which can be rotated with respect to the housing (2, 3), and which is arranged rotatably at one end (5) of a shaft (6) which is mounted centrally within the housing (2, 3); having a working chamber (9) between the housing (2, 3) and the clutch plate (4); having a reservoir chamber (10) for clutch fluid; and having a feed channel (11a, 11b) which leads from the reservoir chamber (10) to the working chamber (9), distinguished by an oil cooler (31) which comprises the following parts: an oil-cooler delivery pump (32) which can be rotated with the housing (2, 3) relative to the clutch plate (4), and an oil feed channel (33) which is flow-connected with its one end (33A) to the oil-cooler delivery pump (32) and with its other end (33B) to a first end (34A) of an oil cooling channel (34) which extends through the housing (2, 3), at least substantially transversely with respect to its longitudinal axis (L), and the ends (34A and 34B) of which are flow-connected to the reservoir chamber (10).

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FLUID FRICTION CLUTCH

DESCRIPTION

The invention relates to a fluid friction clutch in accordance with the preamble of claim 1.

A fluid friction clutch of this type is known from EP 1 731 787 B1, the content of disclosure of which is hereby made the content of disclosure of the present application by explicit reference.

It is an object of the present invention to provide a fluid friction clutch of the type specified in the preamble of claim 1, by way of which it is possible in a simple way to increase the clutch efficiency.

This object is achieved by the features of claim 1.

The provision of an oil cooler improves the slip heat capacity with the aid of a cooling circuit which runs through the housing parallel to the main fluid circuit which connects the working chamber and the reservoir chamber. This additional fluid circuit serves exclusively for the purpose of cooling the fluid, in particular oil, but has no function at all relating to the emptying of the working chamber.

The arrangement and/or position of the oil-cooler delivery pump causes said oil-cooler delivery pump to operate only when the system is situated in the range of medium slip heat, with the result that no further idling losses of the fluid friction clutch according to the invention are produced.

Since it is possible to expose the oil circuit to the surrounding air as a result of the arrangement of the oil cooler of the fluid friction clutch according to the invention, this results in a maximization of the heat reduction of the fluid.

For this purpose, the oil cooler is preferably arranged in the cover of the housing.

The dependent claims contain advantageous developments of the invention.

As a result of the provision of a rotatably mounted supply pump element which defines a shear gap with the housing, it is made possible in a simple way, by utilization of a differential speed between the pump element and the housing or the secondary side of the fluid friction clutch, to generate a volumetric flow from the reservoir chamber into the working chamber, which volumetric flow is dependent on the differential speed.

One of the special advantages of the fluid friction clutch according to the invention is first of all that only a small quantity of clutch fluid is required, since an active delivery pump is formed in the oil reservoir on account of the above-described arrangement, which is advantageous with regard to the clutch fluid quantity in comparison with the known utilization of centrifugal forces to fill the working chamber.

Furthermore, the response behavior of the fluid friction clutch according to the invention becomes more rapid on account of the lower clutch fluid component.

Furthermore, it results in an extremely compact design, since the external diameter of the reservoir chamber and/or the reservoir can be made larger than the internal diameter of the working chamber.

It is to be noted in summary that excellent clutch performance can be achieved on account of the circumstance that the supply pump element rotates at primary speed (speed of the shaft) and strips off clutch fluid with respect to the housing.

The clutch performance can be improved further by virtue of the fact that a recirculating pump is provided which rotates at secondary or primary speed and strips off clutch fluid on account of its arrangement between the clutch plate and housing.

Further details, advantages and features of the present invention will emerge from the following description of exemplary embodiments with reference to the drawing, in which:

fig. 1A shows a sectional illustration of a fluid friction clutch according to the invention from a first viewing direction,

fig. 1B shows a perspective, sectioned illustration of the fluid friction clutch according to fig. 1A,

figs. 1C-1E show illustrations of an alternative embodiment of the fluid friction clutch according to the invention,

fig. 2A shows an illustration, corresponding to fig. 1A, of the fluid friction clutch from a second viewing direction,

fig. 2B shows an illustration, corresponding to fig. 1B, of the fluid friction clutch from the viewing direction according to fig. 2A,

fig. 3 shows a perspective plan view of the fluid friction clutch without housing cover,

fig. 4 shows a partial illustration, corresponding to fig. 3, of the fluid friction

clutch,

fig. 5 shows a partial illustration, corresponding to fig. 4, of another region of the fluid friction clutch,

fig. 6 shows a detailed illustration of a valve element which is shown in fig. 5,

fig. 7 shows a first embodiment of a hydraulic circuit diagram for the fluid friction clutch according to the invention, and

fig. 8 shows an illustration, corresponding to fig. 3, of a second embodiment of the hydraulic circuit diagram for the fluid friction clutch according to the invention.

Fig. 1A shows a sectional illustration of a fluid friction clutch 1 according to the invention which has a housing which is usually constructed from a housing body 2 and a cover 3.

A clutch plate 4 which can be rotated with respect to the housing 2, 3 is arranged in the housing 2, 3. Here, the clutch plate 4 which can be rotated with respect to the housing 2, 3 is arranged in a rotationally fixed manner at one end 5 of a shaft 6 which is mounted centrally within the housing 2, 3. A drivable active element 7 which is shown diagrammatically in a slightly simplified form and can be configured, for example, as a fan wheel is fixed on the housing 2, 3.

A working chamber 9 is arranged between the housing 2, 3 and the clutch plate 4, which working chamber 9 has working gaps 15, as can be seen from fig. 1A, which make a transmission of torque possible on account of a shearing action on the clutch fluid which is fed to the working chamber 9.

Furthermore, a reservoir chamber 10 is provided for said clutch fluid, a feed channel 11a, 11b leading from the reservoir chamber 10 to the working chamber 9 and therefore forming the supply.

Furthermore, according to the invention, a return pump system or a recirculating pump 16 is provided which serves to return clutch fluid from the working chamber 9 to the reservoir chamber 10. Said recirculating pump is either formed by the centrifugal force which is produced and pumps fluid to the reservoir chamber 10 to the outside in order to evacuate the working chamber 9. As an alternative, it is possible to provide a separate component in the form of an active recirculating pump, as is indicated diagrammatically in the hydraulic diagram of figs. 7 and 8, which acts via shearing force.

Furthermore, the fluid friction clutch 1 has a stationary clutch part 13 which

can be rotated with respect to the housing 2, 3 and is preferably configured as a magnet, in particular an electromagnet.

As results from the illustration of figs. 1A, 1B, 2A and 2B and 4, an inner reservoir 18 is provided, furthermore, which is connected via the feed channel 11 to the reservoir chamber 10. Here, the valve 17 is connected into the feed channel 11a, 11b, and the reservoir chamber 10 is arranged so as to lie on the outside, as results in detail from figs. 1A to 2B.

Furthermore, a non-return valve 19 is provided which is arranged between the valve 17 and the reservoir 18. Said non-return valve 19 can be, for example, a small tube which protrudes beyond the fluid level into the reservoir 18.

As results from figs. 1A to 2B and 4 and 5, furthermore, a return valve 20 is provided which is operatively connected to the valve 17 and opens and closes a return channel 23 to the reservoir chamber 10.

The valve 17 which is preferably configured as a multiway valve has a valve element 24 which has a through bore 25 and a fluid inlet recess 26 for introducing fluid into the working chamber 9, which results above all from fig. 5 and the detailed illustration of fig. 6.

Furthermore, an actuator 27 is provided for actuating the valve 17 and the return valve 20. The actuator 27 preferably has an armature 28 which can be rotated relative to the shaft 26 and a flux ring 29 which can be rotated with the shaft 6 and can be excited by the stationary clutch part in the form of the magnet 13 (see fig. 3).

The actuator 27 can also be moved by a bimetallic strip (not shown) instead of the armature and the magnet.

In one particularly preferred embodiment, the reservoir chamber 10 is provided on the secondary side of the fluid friction clutch 1 and the inner chamber 18 is provided on the primary side of the fluid friction clutch 1.

Finally, in an alternative embodiment according to fig. 7, the fluid friction clutch 1 has a return bore 30 for pressure relief which connects the feed channel or feed channel section 11a via a further fluid inlet opening (not shown) of the valve 17 to the reservoir chamber 10. In this embodiment, no inner volume is provided, with the result that the oil is not conveyed back via the inner reservoir. This embodiment of the fluid friction clutch 1 according to the invention can be used in relatively small clutch designs which do not require an inner volume, since the drag moments are low in said

designs.

Figs. 1C to 1E show a further embodiment of a fluid friction clutch 1 according to the invention. All components which correspond to those of figs. 1A and 1B are labeled with the same designations, with the result that reference can be made to their description above.

The embodiment according to figs. 1C to 1E is distinguished by the provision of an oil cooler 31. The oil cooler 31 is arranged in the housing 2, 3, the illustration which is selected in figs. 1C to 1E showing a particularly preferred embodiment, in which the oil cooler 31 is arranged in the cover 3.

The oil cooler 31 has first of all an oil-cooler delivery pump 32 which can be rotated with the housing, with the cover 3 in the case of the example, relative to the clutch plate 4, adjacently to which the oil-cooler delivery pump 32 is arranged, as results from figs. 1C to 1E. The oil-cooler delivery pump is arranged in the reservoir chamber 10.

Furthermore, the oil cooler 31 has an oil feed channel 33. A first end 33A of said oil feed channel is flow-connected to the oil-cooler delivery pump 32. A second end 33B of the oil feed channel 33 is flow-connected to a first end 34A of an oil cooling channel 34.

As results, in particular, from the illustration of figs. 1C and 1D, said oil cooling channel 34 extends at least substantially transversely with respect to the longitudinal axis L of the fluid friction clutch 1 and runs through the entire cover 3 in this transverse direction in the case of the example which is shown. The second end 34B of the oil cooling channel 34 is again flow-connected to the reservoir chamber 10. In the embodiment which is shown in figs. 1C and 1D, this further flow connection to the reservoir chamber 10 is brought about via a feed channel 35 which adjoins the second end 34B.

As has already been explained at the outset, the fluid circuit which is formed by the oil-cooler delivery pump 32, the oil feed channel 33 and the oil cooling channel 34 is formed parallel to the main actuation fluid circuit which connects the working chamber 9 and the reservoir chamber 10 to one another and has been explained using the preceding embodiment.

The oil cooler 31 acts only in the medium slip heat range of the fluid friction clutch 1 according to the invention, since the fluid or the oil can only reach the delivery

pump 32 at all in this range, since there is a sufficient quantity of oil in the reservoir chamber 10 in this operating state in order to supply the delivery pump 32 with oil. In this case, the oil-cooler delivery pump 32 pumps hot oil into the oil cooling channel 34, from which cooled oil is conveyed back into the working chamber 9.

In addition to the above written disclosure of the invention, reference is made hereby explicitly to the diagrammatic illustration of the invention in figs. 1 to 4 in order to complete the disclosure of the invention.

LIST OF REFERENCE SIGNS

1	Fluid friction clutch
2, 3	Housing (2: housing body, 3: cover)
4	Clutch plate
5	End of the shaft 6
6	Shaft
7	Active element (for example, impeller, fan wheel, etc.)
8	Second end of the shaft 6
9	Working chamber
10	Reservoir chamber
11a, 11b	Feed channel
12	Shear gap
13	Stationary clutch parts (magnet)
14	Supply pump element
15	Working gaps
16	Recirculating pump
17	Valve
18	Inner reservoir
19	Non-return valve
20	Return valve
21	Valve arm
22	Connecting bore
23	Return channel
24	Valve element
25	Through bore
26	Fluid inlet recess
27	Actuator
28	Armature
29	Flux ring
30	Return bore
31	Oil cooler
32	Oil-cooler delivery pump

33 Oil feed channel

34 Oil cooling channel

35 Feed channel

CLAIMS

1. A fluid friction clutch (1)

- having a housing (2, 3);
- having a clutch plate (4)
  - which can be rotated with respect to the housing (2, 3), and
  - which is arranged at one end (5) of a shaft (6) which is mounted centrally within the housing (2, 3);
- having a working chamber (9) between the housing (2, 3) and the clutch plate (4);
- having a reservoir chamber (10) for clutch fluid; and
- having a feed channel (11a, 11b) which leads from the reservoir chamber (10) to the working chamber (9), distinguished
- by an oil cooler (31) which comprises the following parts:
  - an oil-cooler delivery pump (32) which can be rotated with the housing (2, 3) relative to the clutch plate (4), and
  - an oil feed channel (33) which is flow-connected with its one end (33A) to the oil-cooler delivery pump (32) and with its other end (33B) to a first end (34A) of an oil cooling channel (34) which extends through the housing (2, 3), at least substantially transversely with respect to its longitudinal axis (L), and the second end (34B) of which is again flow-connected to the reservoir chamber (10).

2. The fluid friction clutch as claimed in claim 1, wherein the fluid circuit which is formed by the oil-cooler delivery pump (32), the oil feed channel (33) and the oil cooling channel (34) is arranged parallel to the main actuation fluid circuit and leads from the reservoir chamber (10) into the reservoir chamber (10) again.

3. The fluid friction clutch as claimed in claim 1 or 2, wherein the oil cooler (31) is preferably arranged in the cover (3) of the housing (2, 3).

4. The fluid friction clutch as claimed in one of claims 1 to 3, distinguished
- by a supply pump element (14) which can be rotated with respect to the housing (2, 3),

- which is arranged in a rotationally fixed manner on the shaft (6), and
- which defines a shear gap (12) with the housing (2, 3); and

- by a valve (17) which is arranged in the feed channel (11a, 11b), and wherein

- an active element (7) is arranged on the housing (2, 3).

5. The fluid friction clutch as claimed in claim 4, wherein a stationary clutch part (13) is provided, with respect to which the housing (3) can be rotated.

6. The fluid friction clutch as claimed in claim 4 or 5, distinguished by an inner reservoir (18) which is connected to the reservoir chamber (10) via the feed channel (11a, 11b) with the valve (17) connected in between.

7. The fluid friction clutch as claimed in claim 6, distinguished by a non-return valve (19) which is arranged between the valve (17) and the reservoir (18).

8. The fluid friction clutch as claimed in one of claims 4 to 7, wherein the valve (17) is a multiway valve.

9. The fluid friction clutch as claimed in one of claims 4 to 8, distinguished by a return valve (20) which is operatively connected to the valve (17) and opens and closes a return channel (23) to the reservoir chamber (10).

10. The fluid friction clutch as claimed in claim 9, wherein the multiway valve (17) has a valve element (24) which has a through bore (25) and a fluid inlet recess (26) for introducing fluid into the working chamber (9).

11. The fluid friction clutch as claimed in one of claims 4 to 10, distinguished by a recirculating pump (16) for recirculating clutch fluid from the working chamber (9) to the reservoir chamber (10).

12. The fluid friction clutch as claimed in one of claims 4 to 11, distinguished by an actuator (27) for actuating the valve (17) and the return valve (20).

13. The fluid friction clutch as claimed in claim 12, wherein the actuator (27) has an armature (28) which can be rotated relative to the shaft (6) and a flux ring (29) which can be rotated with the shaft (6) and is excited by the stationary clutch part (13).

14. The fluid friction clutch as claimed in claim 12, wherein the actuator (27) can be moved by means of a bimetallic strip arrangement.

15. The fluid friction clutch as claimed in one of claims 4 to 14, wherein the reservoir chamber (10) is preferably arranged on the secondary side.

16. The fluid friction clutch as claimed in one of claims 4 to 15, wherein the inner reservoir (18) is arranged on the primary side.

17. The fluid friction clutch as claimed in claim 4, distinguished by a return bore (30) for pressure relief, which return bore (30) connects a feed channel section (11a) of the feed channel (11a, 11b) via a further fluid inlet opening of the valve (17) to the reservoir chamber (10).

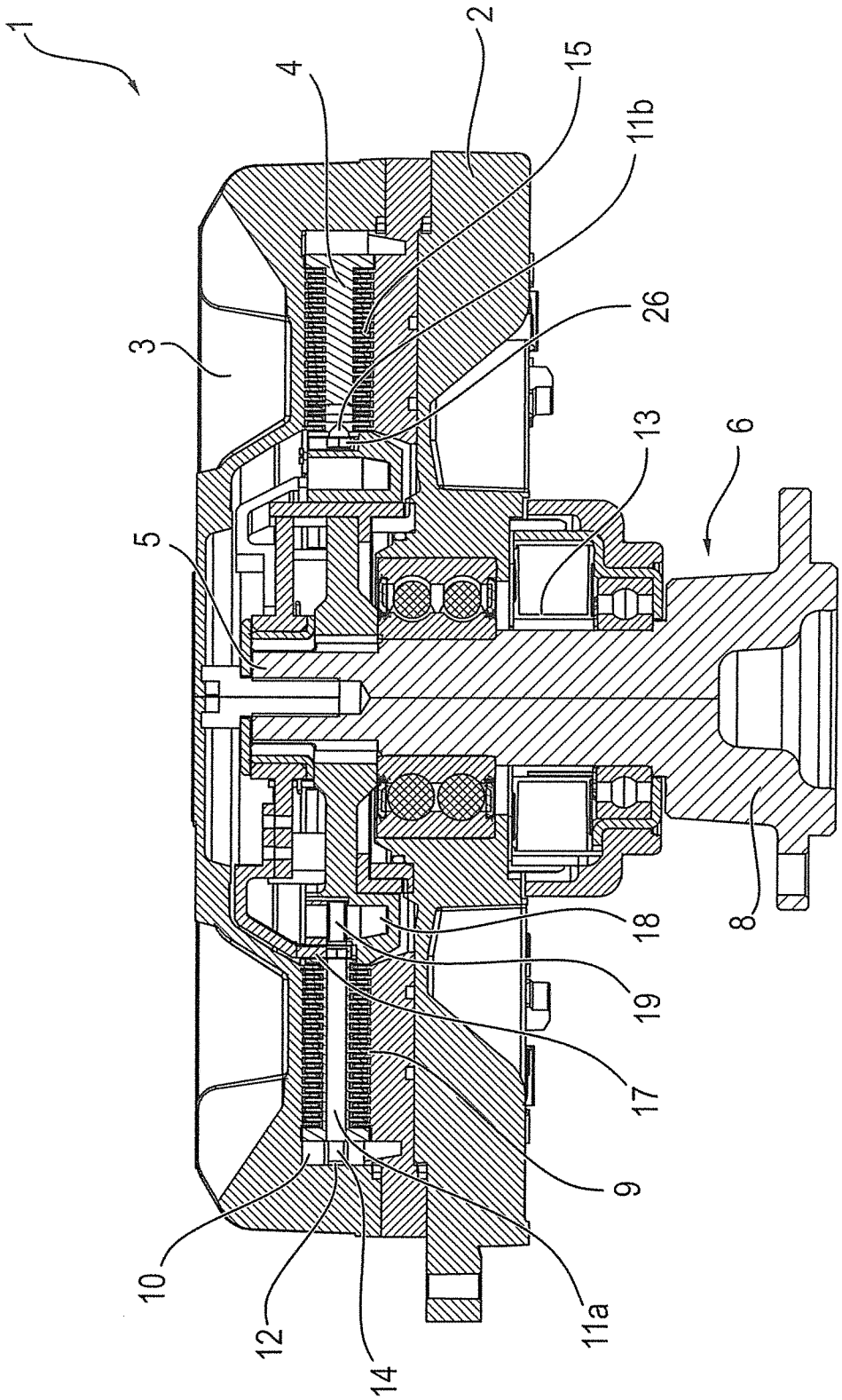

FIG. 1A

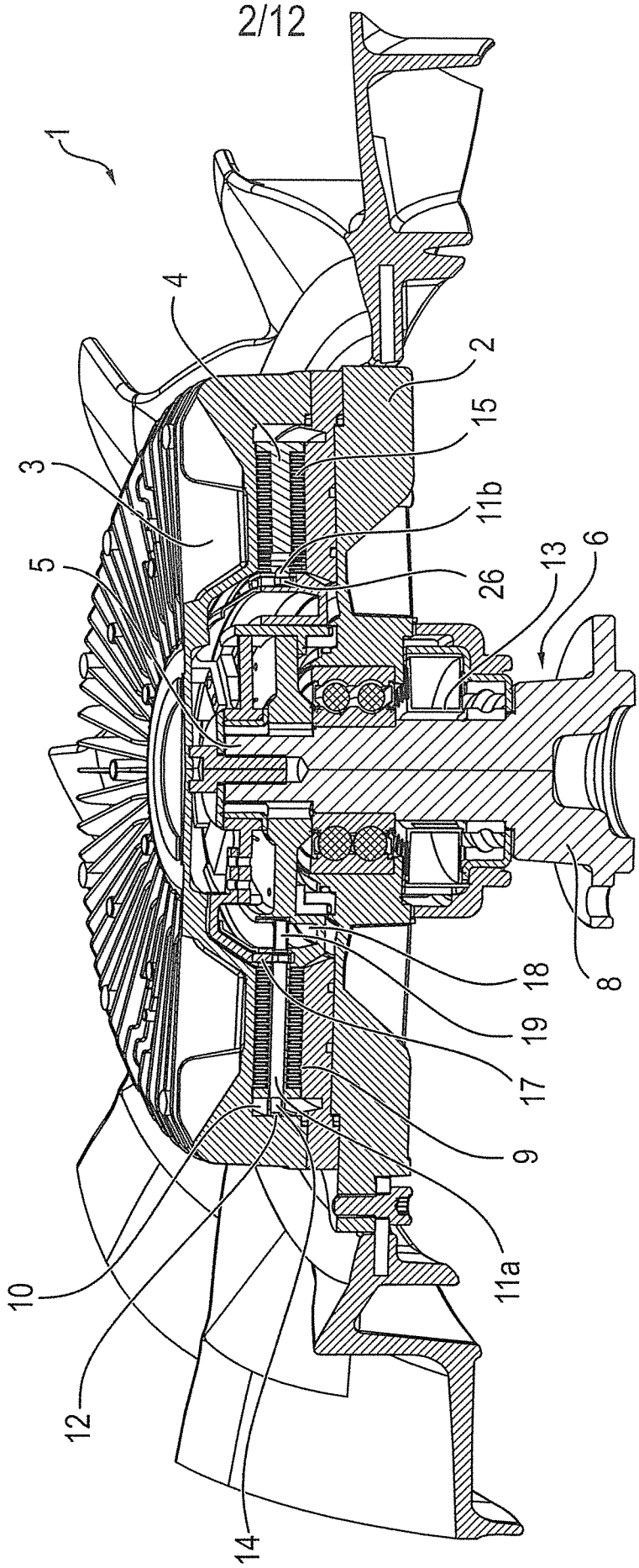

FIG. 1B

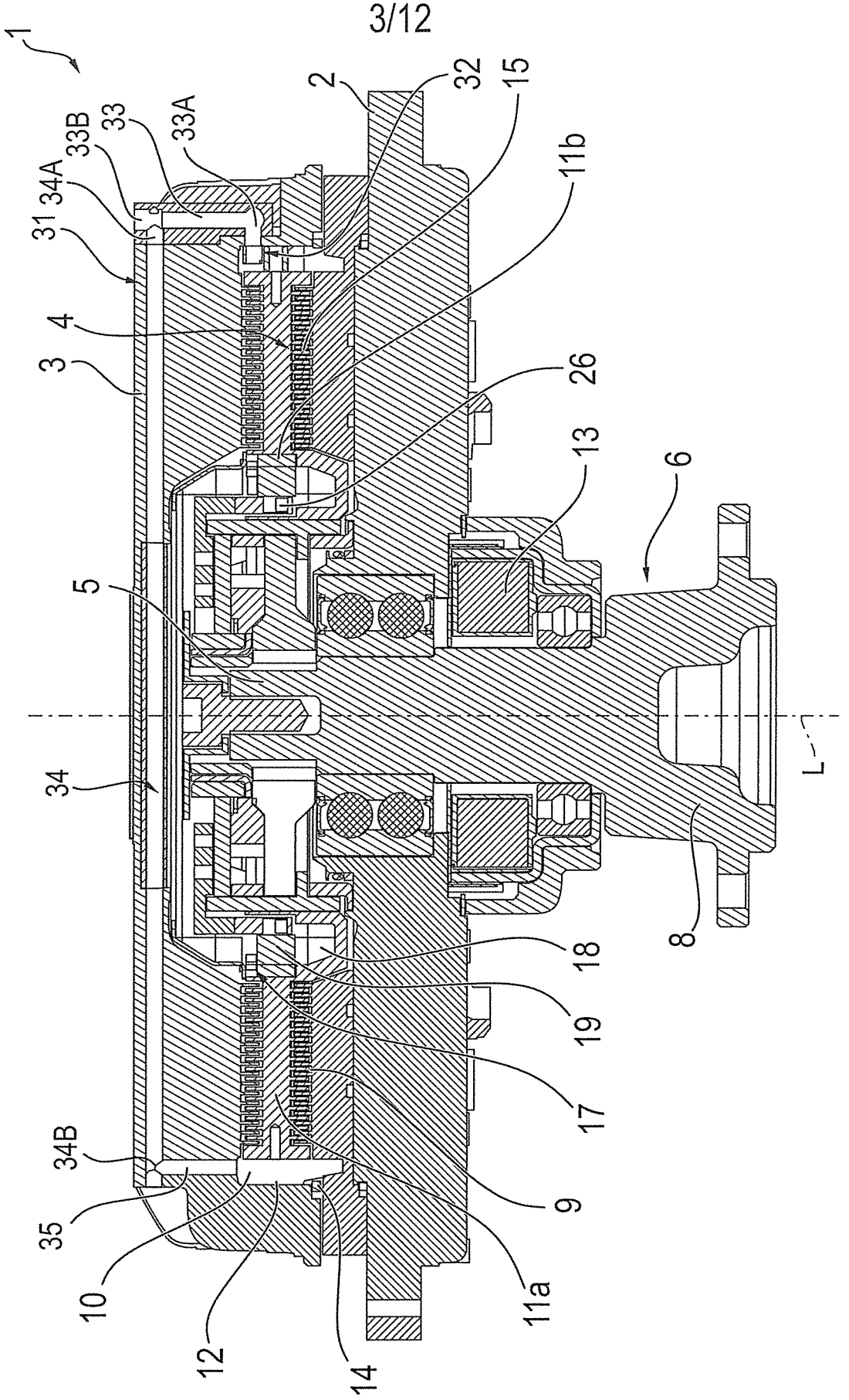
1
2
32
15
33B
33
33A
34A
31
11b
4
3
26
13
6
5
34
L
8
18
19
17
34B
35
9
10
11a
12
14

FIG. 1C

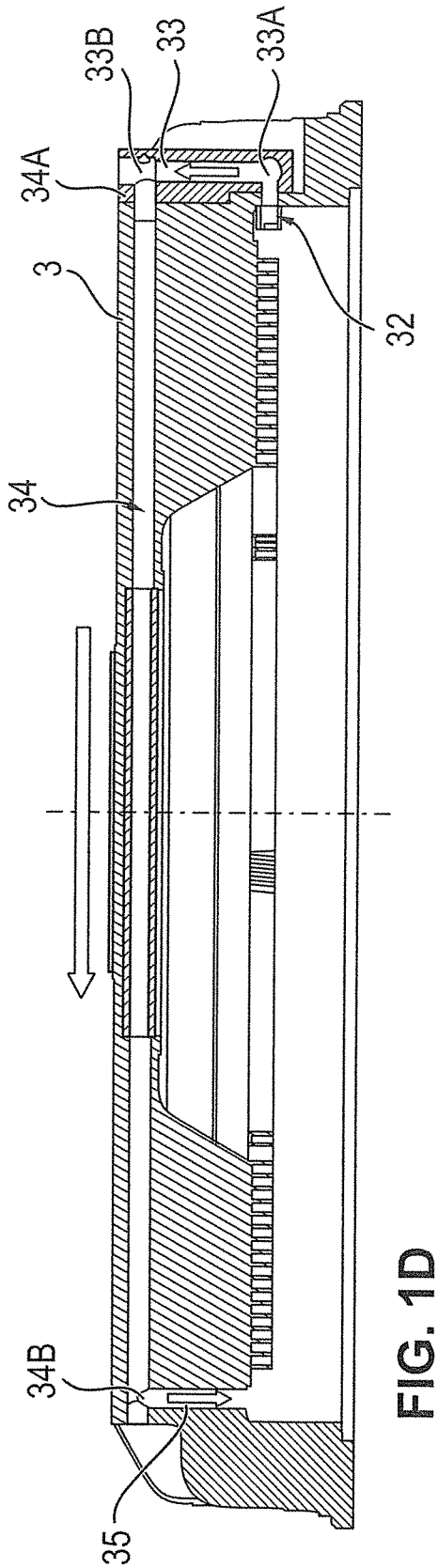

FIG. 1D

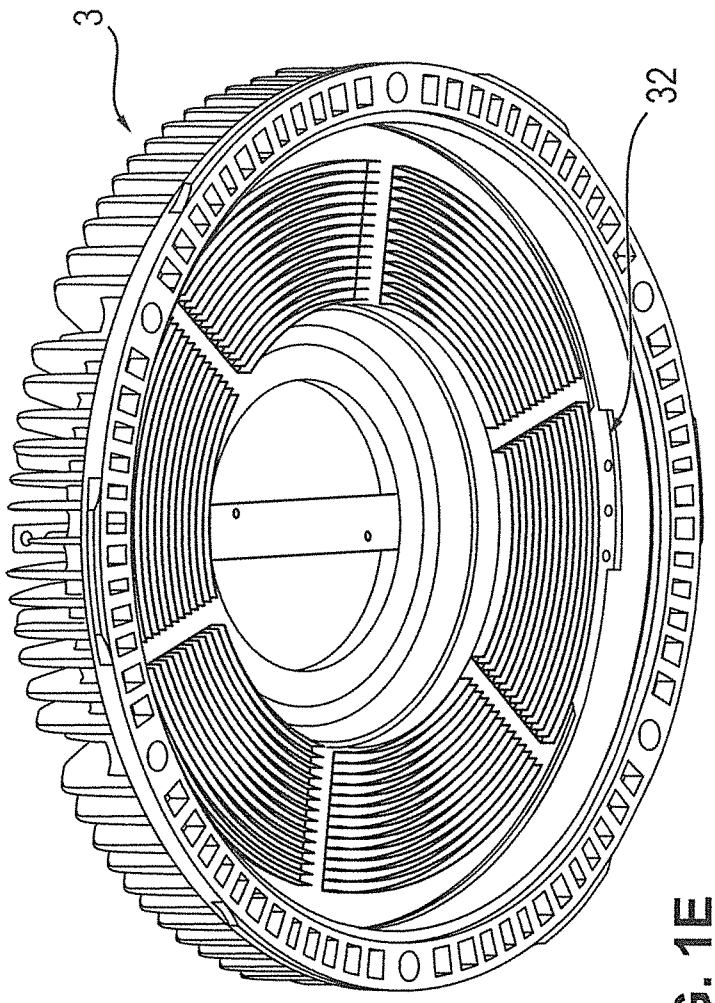

FIG. 1E

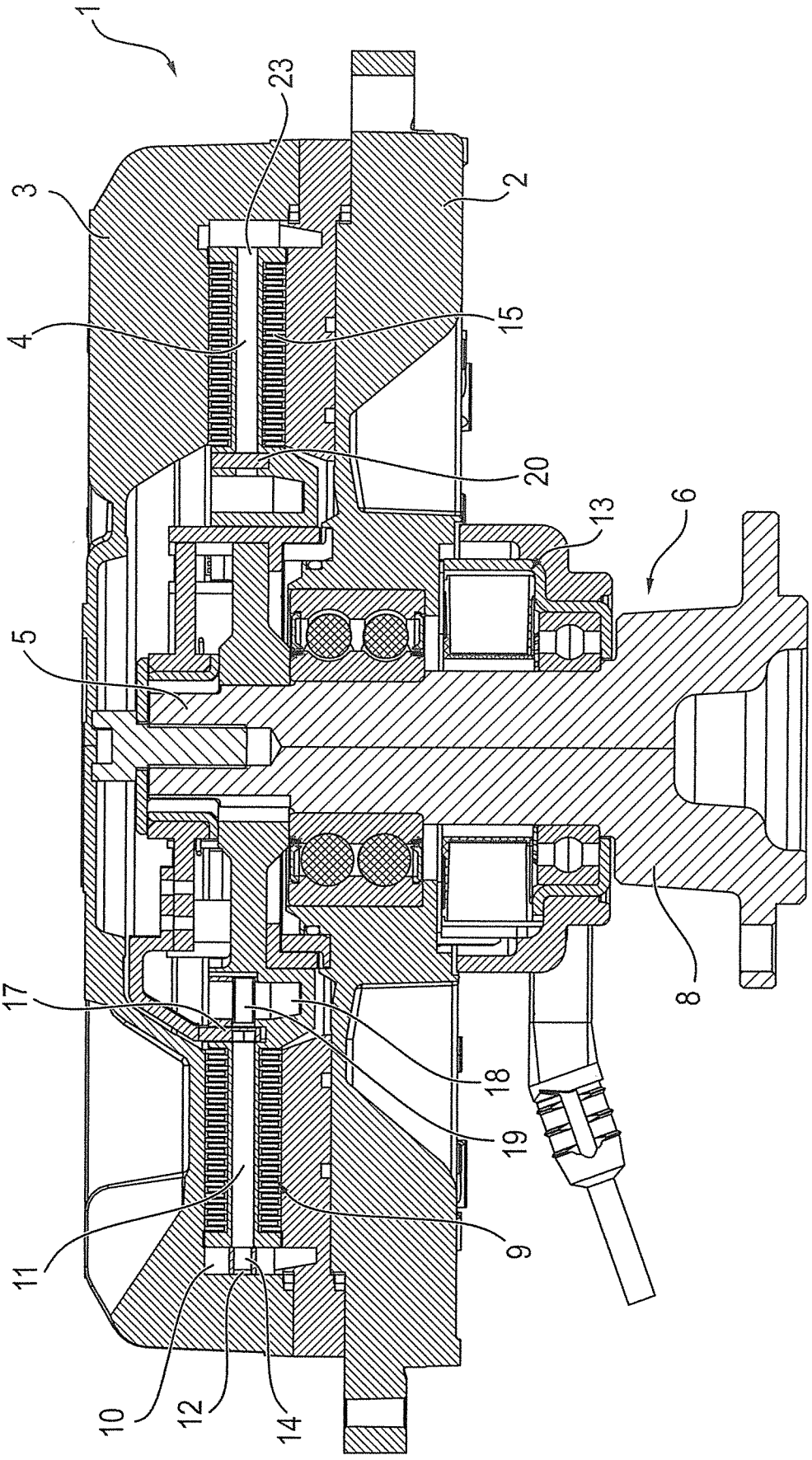

FIG. 2A

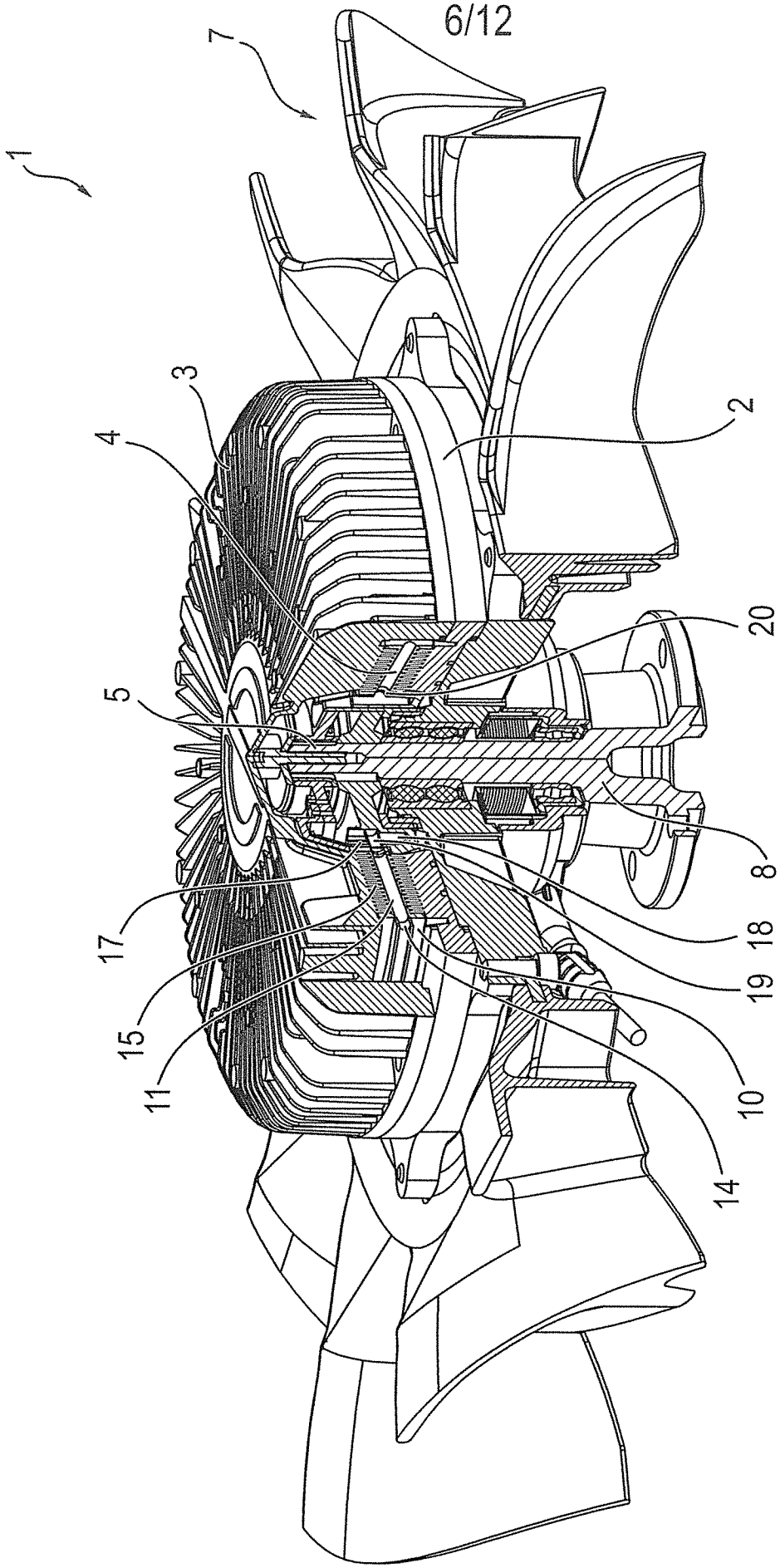

FIG. 2B

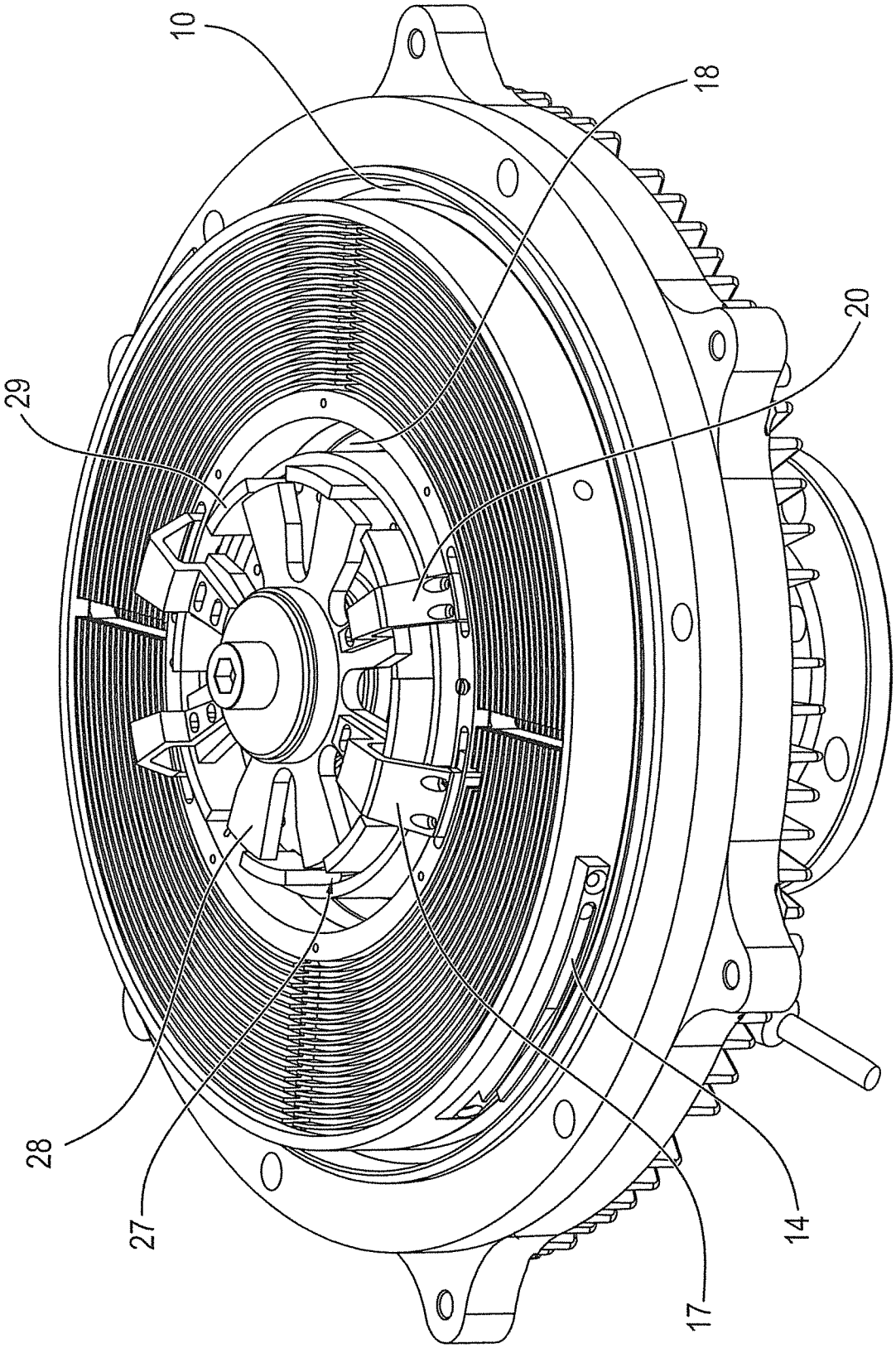

FIG. 3

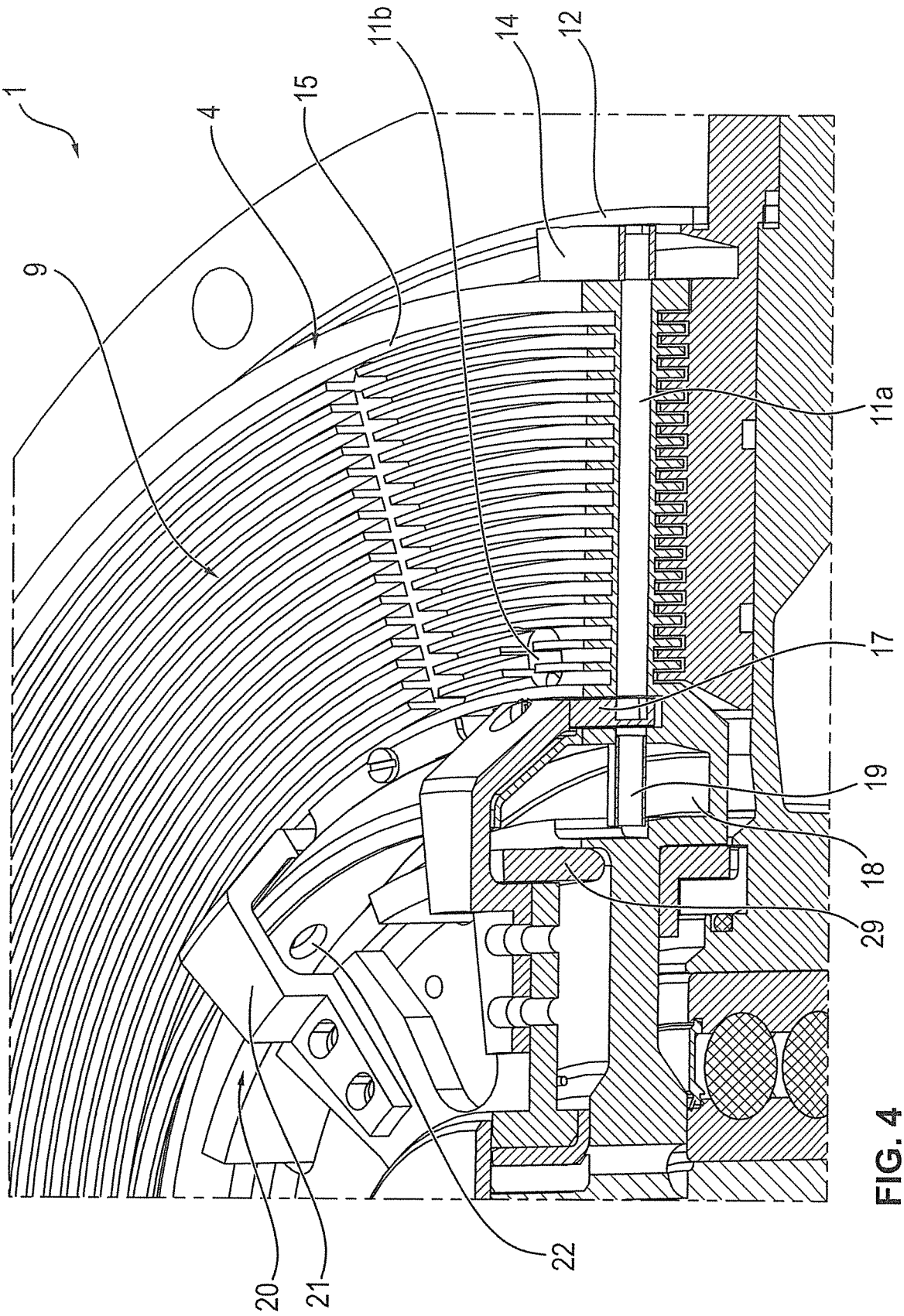

FIG. 4

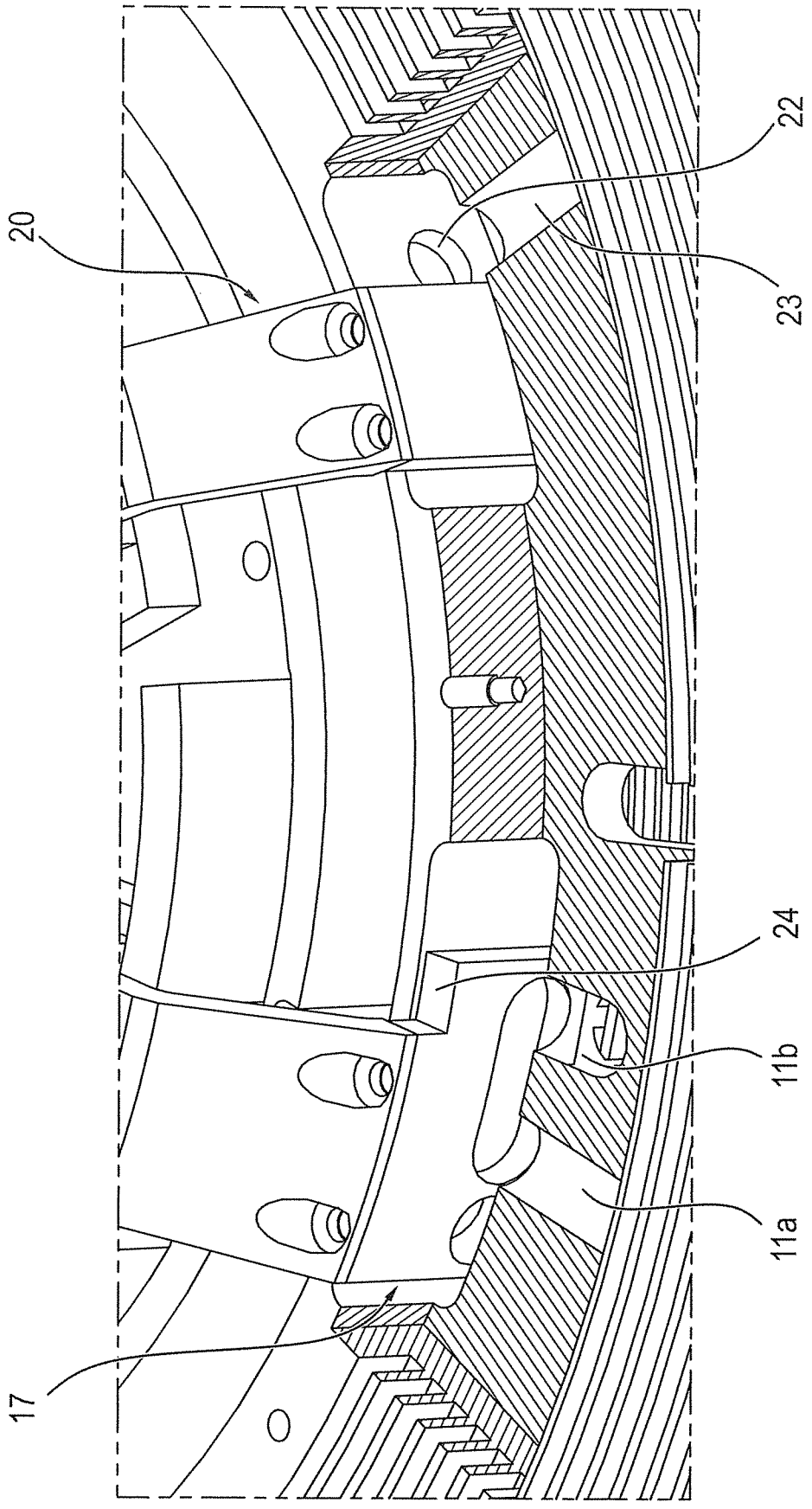

FIG. 5

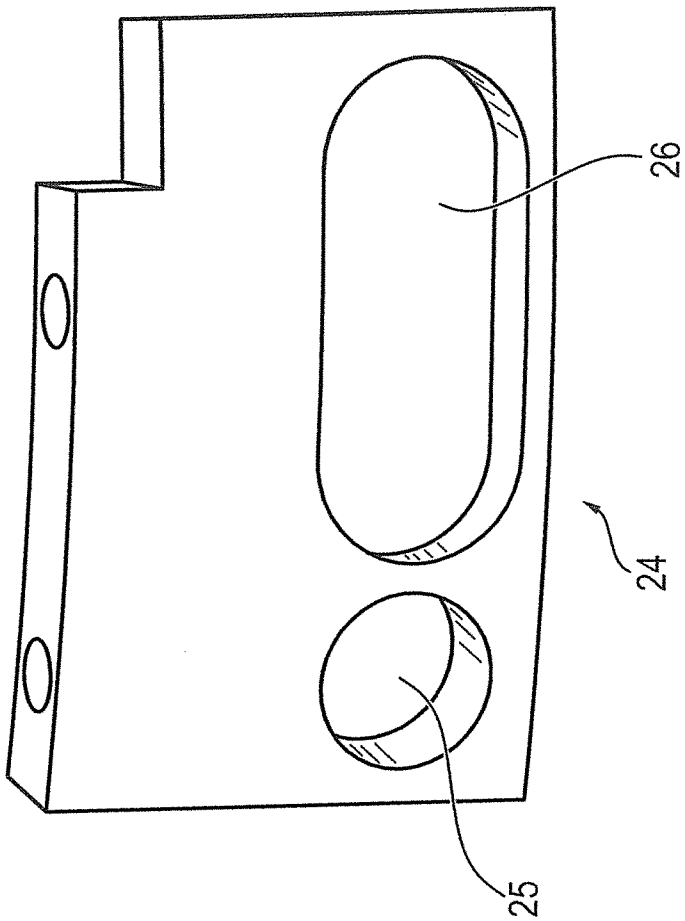

FIG. 6

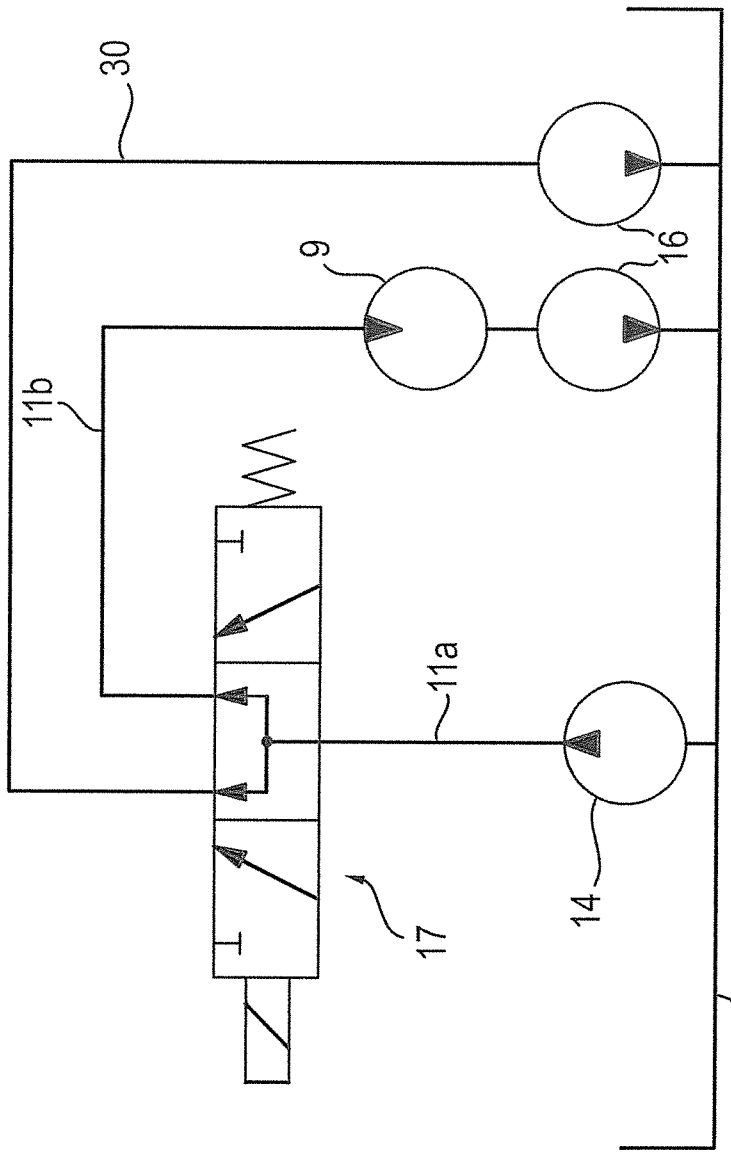

FIG. 7

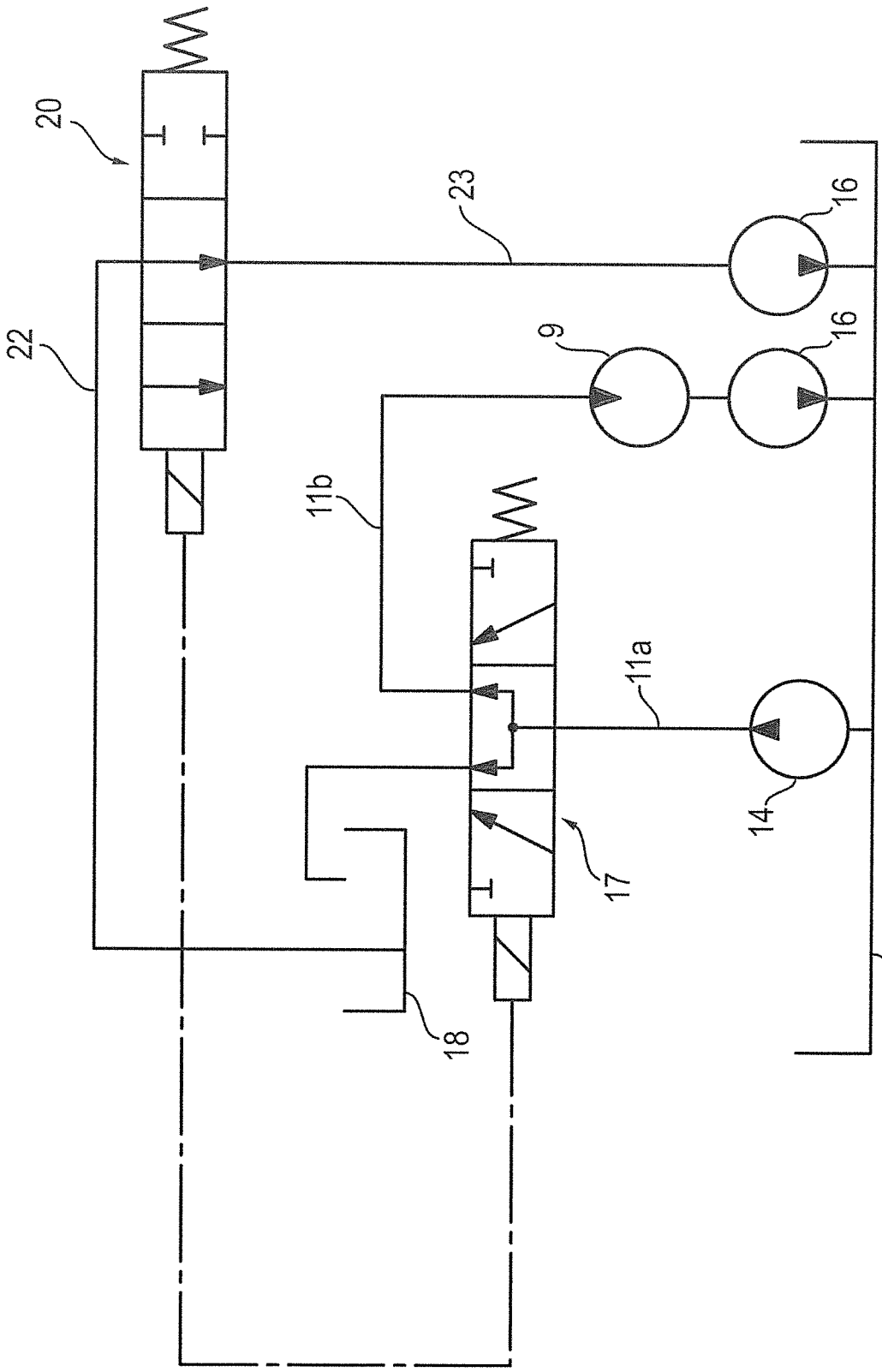

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/013315

A. CLASSIFICATION OF SUBJECT MATTER

F16D 33/06(2006.01)i, F16D 33/10(2006.01)i, F16D 33/18(2006.01)i, F16D 33/20(2006.01)i, F16H 57/04(2010.01)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)
F16D 33/06; F16D 35/02; F16K 31/02; F16D 25/08; F16D 48/02; F16D 33/10; F16D 33/18; F16D 33/20; F16H 57/04

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
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: viscous, fluid, clutch, cooling, pump, line, and valve

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5992594 A (HERRLE et al.) 30 November 1999 See column 3, line 11 - column 6, line 5 and figure 1.	1-3
A		4-17
A	US 2009-0084650 A1 (HENNESSY et al.) 02 April 2009 See paragraphs [0020],[0021],[0024],[0025],[0028],[0036] and figures 1-3.	1-17
A	US 7581627 B2 (MCDERMOTT et al.) 01 September 2009 See column 3, line 20 - column 4, line 62 and figure 1.	1-17
A	US 2009-0127051 A1 (BUCHHOLZ, THOMAS) 21 May 2009 See paragraphs [0018],[0019],[0022] and figure 2.	1-17
A	WO 2012-024497 A2 (HORTON, INC.) 23 February 2012 See page 3, lines 4-28 and figures 1,2B.	1-17

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 April 2014 (25.04.2014)	**28 April 2014 (28.04.2014)**

Name and mailing address of the ISA/KR
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5992594 A	30/11/1999	US 5992594 A	30/11/1999
US 2009-0084650 A1	02/04/2009	AU 2006-275566 A1	08/02/2007
		AU 2006-275566 B2	08/03/2012
		AU 2006-275569 A1	08/02/2007
		AU 2006-275569 A2	25/09/2008
		AU 2006-275569 B2	23/02/2012
		AU 2006-275748 A1	08/02/2007
		AU 2006-275748 A8	15/05/2008
		AU 2006-275748 B2	29/03/2012
		BR PI0613890 A2	15/02/2011
		BR PI0614618 A2	12/04/2011
		CA 2615785 A1	08/02/2007
		CA 2615807 A1	08/02/2007
		CA 2615811 A1	08/02/2007
		CN 101258336 A0	03/09/2008
		CN 101258336 B	18/05/2011
		CN 101400916 A	01/04/2009
		CN 101400916 B	09/02/2011
		CN 101495770 A	29/07/2009
		CN 101495770 B	20/04/2011
		EP 1913273 A1	23/04/2008
		EP 1913273 A4	23/10/2013
		EP 1913274 A1	23/04/2008
		EP 1913274 A4	23/10/2013
		EP 1913275 A1	23/04/2008
		EP 1913275 A4	14/03/2012
		EP 1913275 B1	03/04/2013
		JP 05113053 B2	09/01/2013
		JP 05188968 B2	24/04/2013
		JP 05363103 B2	11/12/2013
		JP 2009-503407 A	29/01/2009
		JP 2009-507181 A	19/02/2009
		JP 2009-523217 A	18/06/2009
		KR 10-1277057 B1	20/06/2013
		KR 10-1277059 B1	20/06/2013
		KR 10-1319313 B1	16/10/2013
		KR 10-2008-0031495 A	08/04/2008
		KR 10-2008-0032642 A	15/04/2008
		KR 10-2008-0033484 A	16/04/2008
		MX 2008001204 A	19/03/2008
		MX 2008001205 A	19/03/2008
		MX 2008001206 A	19/03/2008
		US 2009-0101463 A1	23/04/2009
		US 2010-0140040 A1	10/06/2010
		US 2011-209962 A1	01/09/2011
		US 7854307 B2	21/12/2010
		US 7938240 B2	10/05/2011
		US 7946400 B2	24/05/2011

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2014/013315

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 8100241 B2	24/01/2012
		WO 2007-016314 A1	08/02/2007
		WO 2007-016314 B1	05/04/2007
		WO 2007-016493 A1	08/02/2007
		WO 2007-016494 A1	08/02/2007
		WO 2007-016494 B1	29/03/2007
		WO 2007-016497 A1	08/02/2007
		WO 2007-016497 B1	29/03/2007
US 7581627 B2	01/09/2009	DE 102007023529 A1	20/12/2007
		US 2007-267267 A1	22/11/2007
US 2009-0127051 A1	21/05/2009	CN 101189445 A0	28/05/2008
		CN 101189445 B	20/04/2011
		DE 502005005032 D1	25/09/2008
		EP 1731787 A1	13/12/2006
		EP 1731787 B1	13/08/2008
		JP 04805348 B2	02/11/2011
		JP 2008-542660 A	27/11/2008
		KR 10-1244858 B1	19/03/2013
		KR 10-2008-0013918 A	13/02/2008
		US 7954616 B2	07/06/2011
		WO 2006-131157 A1	14/12/2006
WO 2012-024497 A2	23/02/2012	AU 2011-291629 A1	28/02/2013
		CA 2803924 A1	23/02/2012
		CN 103154552 A	12/06/2013
		EP 2606251 A2	26/06/2013
		JP 2013-545039 A	19/12/2013
		KR 10-2013-0131315 A	03/12/2013
		MX 2013000290 A	18/03/2013
		US 2013-0284556 A1	31/10/2013
		WO 2012-024497 A3	19/07/2012