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Lubrication system for a gear box

TECHNICAL FIELD OF THE INVENTION

5 The present invention relates to a lubrication system for a gear box, which system comprises

- a pump configured to pump lubrication oil to components like shafts and bearings inside a casing for the gear box,
- a lubrication oil sump configured to provide lubrication oil to
10 be sucked therefrom by said pump and receive such oil returned thereto after lubrication of said components,
- an oil filter arranged in an oil conducting path from the pump to said components at a discharge side of the pump to filter out debris from the oil before reaching said components,
15 and
- a module with a base plate to which the pump and filter are attached,

in which the base plate is configured to form a part of an outer gear box casing and to be removably attached to walls of the gear
20 box casing to allow the module to be lifted out therefrom for maintenance and/or repair of parts belonging to the module.

The invention relates to lubrication systems for gear boxes used in any type of power transmission, such as industrial applications
25 and all types of motor vehicles, although the invention is particularly applicable to motor vehicles and especially wheeled utility vehicles, such as trucks or lorries and buses. This is the reason for below discussing the invention for this particular use without for that sake restricting it thereto.

Thus, a lubrication system for a gear box needs a number of different members and these are in most gear boxes located in different regions inside the gear box casing. This results in complications when trying to reach the different members of the lubrication system for maintenance and/or repair thereof making such measures time consuming and by that costly to carry out.

BACKGROUND ART

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US 2016/0069446 A1 discloses a lubrication system for a gear box of the type defined in the introduction trying to address the problem mentioned above by providing the module with a base plate to which the pump and the filter of the lubrication system are attached and arranging the base plate so that the module is allowed to be lifted out of the gear box casing. This facilitates maintenance and/or repair of the pump and filter of such a lubrication system. However, there is of course an ongoing attempt to improve such a lubrication system with respect to the efficiency to reliably carry out maintenance and/or repair of parts belonging to the system.

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SUMMARY OF THE INVENTION

The object of the present invention is to provide a lubrication system of the type defined in the introduction being improved in at least some aspect with respect to such lubrication systems already known.

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This object is according to the invention obtained by providing such a system with the features listed in patent claim 1.

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Thus, the base plate of the module is designed to be attached to walls of a gear box casing in a bottom region of the casing to by at least base plate portions be in contact with oil in said lubrication
5 oil sump. This means that the pump and the filter will when the module is arranged in place in a gear box casing be in a position close to the oil of the system in form of the oil sump favourable for disconnecting these lubrication system members from the oil conducting path when there is a need of maintenance and/or repair
10 thereof.

According to an embodiment of the invention the base plate of the module has a bottom and a wall surrounding this bottom which together with the bottom forms a volume configured to receive and
15 contain oil of the lubrication oil sump. It is preferred for the members of the lubrication system belonging to the module to have the module providing at least a part of the lubrication oil sump.

According to another embodiment of the invention the module is
20 configured to be attached to portions of a bottom wall of a gear box casing while participating in forming this bottom wall and said volume is configured to contain a part of the oil of said lubrication oil sump.

25 According to another embodiment of the invention the base plate is configured to have dimensions corresponding to dimensions of an opening in a gear box casing through which the module is configured to be introduced for arranging it in the gear box and lifted out for said maintenance and/or repair.

According to another embodiment of the invention the pump has a member connectable to a shaft of a gear box for driving the pump by said shaft. Providing power to drive the pump by using a said shaft for this, such as through a gear wheel on said shaft engaging
5 a gear wheel of the pump, is advantageous.

According to another embodiment of the invention said member of the pump is configured to be connected to a countershaft of a gear box to be driven thereby. This constitutes a suitable way of
10 designing a pump arranged in a said module in a lubrication system for a gear box.

According to another embodiment of the invention the system comprises a heat exchanger arranged at the discharge side of the
15 pump in said oil conducting path allowing cooling of the oil before reaching the components, and the heat exchanger is a part of the module and attached to the base plate. This means that the heat exchanger will be close to the pump and easily removed from a gear box with the module for maintenance and/or repair.

20

According to another embodiment of the invention the system comprises within the module a by-pass loop configured to conduct oil to the components to pass the heat exchanger without flowing therethrough and means configured to control the relation of flow
25 of oil through the heat exchanger and flow passing it. It is favourable to have also such a loop within the module allowed to be lifted out from a gear box casing facilitating this action of lifting out.

According to another embodiment of the invention the system comprises within the module a by-pass loop configured to conduct oil to the components to pass the filter without flowing therethrough and means configured to control the relation of flow of oil through the filter and the flow passing it. It is favourable to have also such a loop within the module allowed to be lifted out from a gear box casing facilitating this action of lifting out.

According to another embodiment of the invention the system comprises within the module an oil conducting loop diverting oil from the oil conducting path directly at the discharge of the pump to the suction side of the pump and a member controlling the relation of flow of oil from the pump to said components and the flow of oil recirculated to the suction side of the pump as a function of the temperature and by that the viscosity of the oil. It is favourable to have also such a loop within the module allowed to be lifted out from a gear box casing facilitating this action of lifting out.

The invention also relates to a gear box for transmission of mechanic power and a motor vehicle according to the appended claims directed thereto.

Further advantages as well as advantageous features of the invention will appear from the description following below.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a specific description of an embodiment of the invention cited as an example.

In the drawings:

Fig 1 is a schematic view used to illustrate a lubrication
5 system according to an embodiment of the invention,

Fig 2 is a perspective view of parts of a lubrication system
according to the embodiment of the invention
10 illustrated in Fig 1,

Fig 3 is an exploded view used to illustrate how the module
of a lubrication system shown in Fig 1 and 2 may be
lifted out of a gear box casing for maintenance and/or
15 repair of members arranged therein, and

Fig 4 is a view showing the module secured to the gear box
casing shown in Fig 3.

20 DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

A lubrication system according to an embodiment of the invention
is very schematically illustrated in Fig 1, and this has all members
included in a module 1 having a base plate 2 to which a pump 3 is
25 attached. The pump 3 is configured to pump lubrication oil to
components 4 like shafts and bearings inside a gear box casing.
A lubrication oil sump 5 is configured to provide lubrication oil to
be sucked therefrom by the pump 3 and receive such oil returned
thereto after lubrication of the components 4. In this embodiment
30 of the invention the base plate 2 will be immersed in the oil sump

5 although not shown so in Fig 1 illustrating the function of the lubrication system.

An oil filter 6 is arranged in the oil conducting path 7 from the pump
5 to the components 4 at a discharge side of the pump to filter out debris from the oil before reaching the components 4. Furthermore, a heat exchanger 8 is arranged in the oil conducting path 7 from the pump to the components 4 downstream the filter 6 allowing cooling of the oil before reaching the components. The
10 pump, the filter and the heat exchanger are all attached to the base plate 2 of the module 1. It is shown how an oil conducting loop 9 diverting oil from the oil conducting path directly at the discharge of the pump to the suction side of the pump is included in the module, and a member 10 is configured to control the relation of
15 flow of oil from the pump 3 to the components 4 and the flow of oil recirculated to the suction side of the pump as a function of the temperature and by that the viscosity of the oil. Such recirculation of oil may be used when starting an engine connected to a gear box at a low temperature, such as for instance – 30°C, which
20 means that the oil will be cold and have a high viscosity.

A further by-pass loop 11 is arranged within the module to conduct oil to the components 4 to pass the filter 6 without flowing therethrough, and means 12 is configured to control the relation of
25 flow of oil through the filter and the flow passing it. If the filter starts to be full of debris and form a high resistance to the flow of oil through the lubrication system an increasing part of the oil flow may be led in the loop 11.

A lubrication system further comprises within the module a by-pass loop 13 configured to conduct oil to the components 4 to pass the heat exchanger 8 without flowing therethrough and means 14 configured to control the relation of flow of oil through the heat exchanger and flow passing it. When there is no need to cool the oil it may by this be directed to pass the heat exchanger through the loop 13.

The module 1 with pump 3, filter 6 and heat exchanger 8 attached to the base plate 2 according to a preferred embodiment of the invention is shown in Fig 2. The base plate 2 has a bottom 15 and a wall 16 surrounding this bottom which together with the bottom forms a volume 17 configured to receive and contain a part of the oil of the lubrication oil sump 5.

Furthermore, it is shown how a gear wheel 18 is arranged to drive the pump 3 by engaging a gear wheel not shown arranged on a countershaft of a gear box.

The module 1 is configured to be removably attached to walls of a gear box casing 19 (see also Figs 3 and 4) by bolts 20 arranged around the base plate 2 of the module allowing the module to be lifted out from the gear box casing, as shown in Fig 3, for maintenance and/or repair of parts belonging to the module. Thus, the base plate 2 has for this sake dimensions corresponding to dimension of an opening 21 in a gear box casing 19, as in a motor vehicle 22.

Accordingly, in the embodiment shown in the figures all essential members of the lubrication system may be lifted out as one unit

from a gear box casing for maintenance and/or repair of any of said members.

5 The invention is of course in no way restricted to the embodiment described above, since many possibilities for modifications thereof are likely to be obvious to one skilled in the art without having to deviate from the scope of the invention defined in the appended claims.

10 The heat exchanger may be arranged outside and distant to the module, although it is advantageous to have it included in the module.

Claims

1. A lubrication system for a gear box, which system comprises
- a pump (3) configured to pump lubrication oil to components (4) like shafts and bearings inside a casing for the gear box,
 - a lubrication oil sump (5) configured to provide lubrication oil to be sucked therefrom by said pump (3) and receive such oil returned thereto after lubrication of said components,
 - an oil filter (6) arranged in an oil conducting path (7) from the pump to said components at a discharge side of the pump to filter out debris from the oil before reaching said components, and
 - a module (1) with a base plate (2) to which the pump (3) and filter (6) are attached,
- in which the base plate (2) is configured to form a part of an outer gear box casing (19) and to be removably attached to walls of the gear box casing to allow the module (1) to be lifted out therefrom for maintenance and/or repair of parts belonging to the module,
- characterized** in that said base plate (2) is designed to be attached to walls of a gear box casing (19) in a bottom region of the casing to by at least base plate portions be in contact with oil in said lubrication oil sump (5).
2. A system according to claim 1, **characterized** in that the base plate (2) of the module (1) has a bottom (15) and a wall (16) surrounding this bottom which together with the bottom forms a volume configured to receive and contain oil of the lubrication oil sump (5).

3. A system according to claim 2, **characterized** in that the module (1) is configured to be attached to portions of a bottom wall of a gear box casing (19) while participating in forming this bottom wall and said volume is configured to contain a part of the oil of said lubrication oil sump (5).
4. A system according to any of the preceding claims, **characterized** in that the base plate (2) is configured to have dimensions corresponding to dimensions of an opening (21) in a gear box casing (19) through which the module (1) is configured to be introduced for arranging it in the gear box and lifted out for said maintenance and/or repair.
5. A system according to any of the preceding claims, **characterized** in that the pump (3) has a member (18) connectable to a shaft of a gear box for driving the pump by said shaft.
6. A system according to claim 5, **characterized** in that said member (18) of the pump (3) is configured to be connected to a countershaft of a gear box to be driven thereby.
7. A system according to any of the preceding claims, **characterized** in that the system comprises a heat exchanger (8) arranged at the discharge side of the pump (3) in said oil conducting path (7) allowing cooling of the oil before reaching the components (4), and that the heat exchanger (8) is a part of the module (1) and attached to the base plate (2).

8. A system according to claim 7, **characterized** in that the system comprises within the module (1) a by-pass loop (13) configured to conduct oil to the components to pass the heat exchanger (8) without flowing therethrough and means (14) configured to control the relation of flow of oil through the heat exchanger and flow passing it.
9. A system according to any of the preceding claims, **characterized** in that the system comprises within the module (1) a by-pass loop (11) configured to conduct oil to the components to pass the filter (6) without flowing therethrough and means (12) configured to control the relation of flow of oil through the filter and the flow passing it.
10. A system according to any of the preceding claims, **characterized** in that the system comprises within the module (1) an oil conducting loop (9) diverting oil from the oil conducting path (7) directly at the discharge of the pump (3) to the suction side of the pump and a member (10) controlling the relation of flow of oil from the pump (3) to said components (4) and the flow of oil recirculated to the suction side of the pump as a function of the temperature and by that the viscosity of the oil.
11. A gear box for transmission of mechanic power, **characterized** in that it has a lubrication system according to any of the preceding claims.
12. A gear box according to claim 11, **characterized** in that it is a gear box configured to be arranged in a motor vehicle (22),

such as a wheeled heavy motor vehicle, especially a truck or a bus.

- 5 13. A motor vehicle, especially a heavy wheeled motor vehicle, such as a truck or a bus, **characterized** in that it has a gear box provided with a lubrication system according to any of claims 1-10.

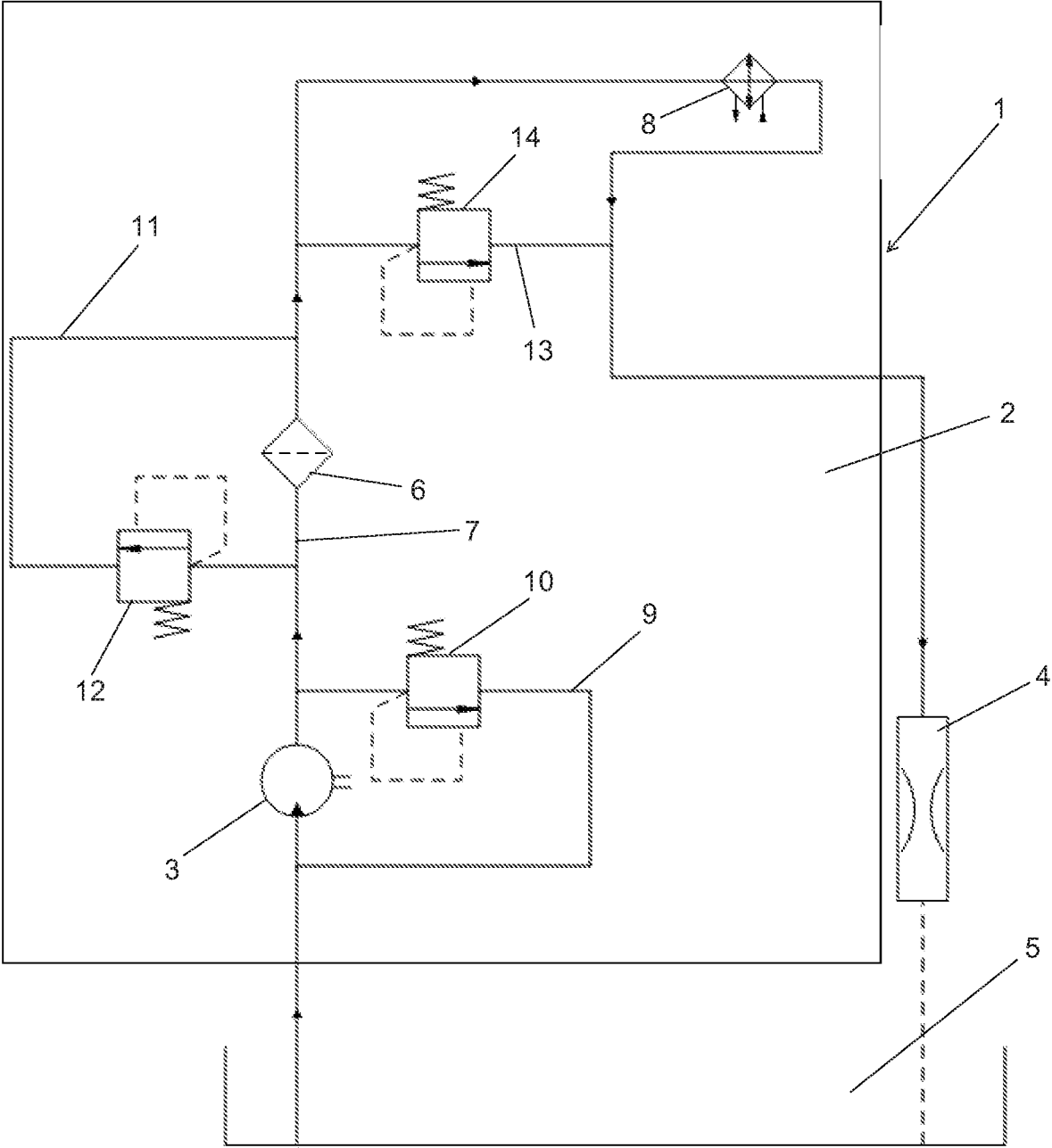


Fig. 1

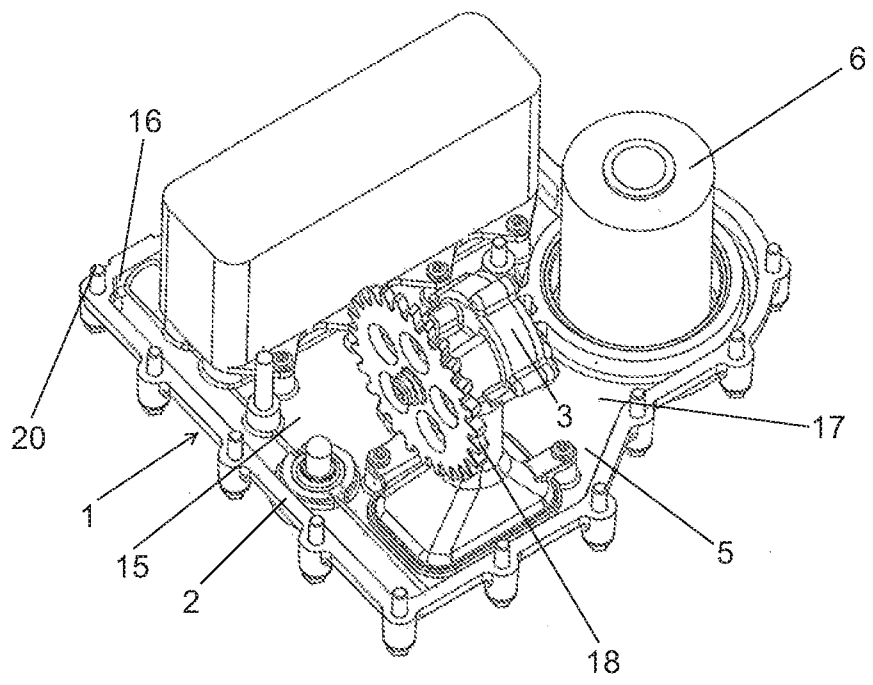


Fig. 2

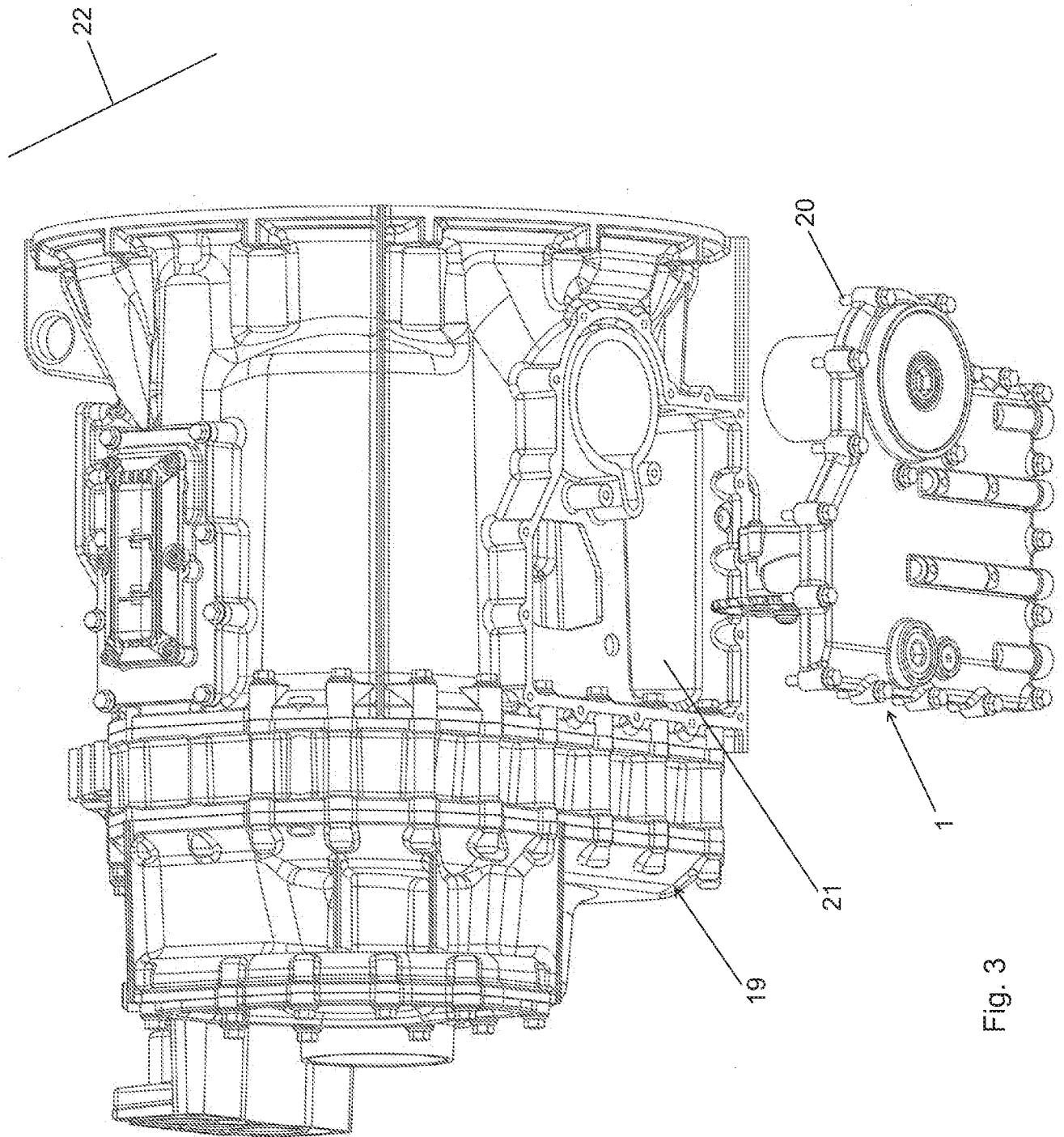


Fig. 3

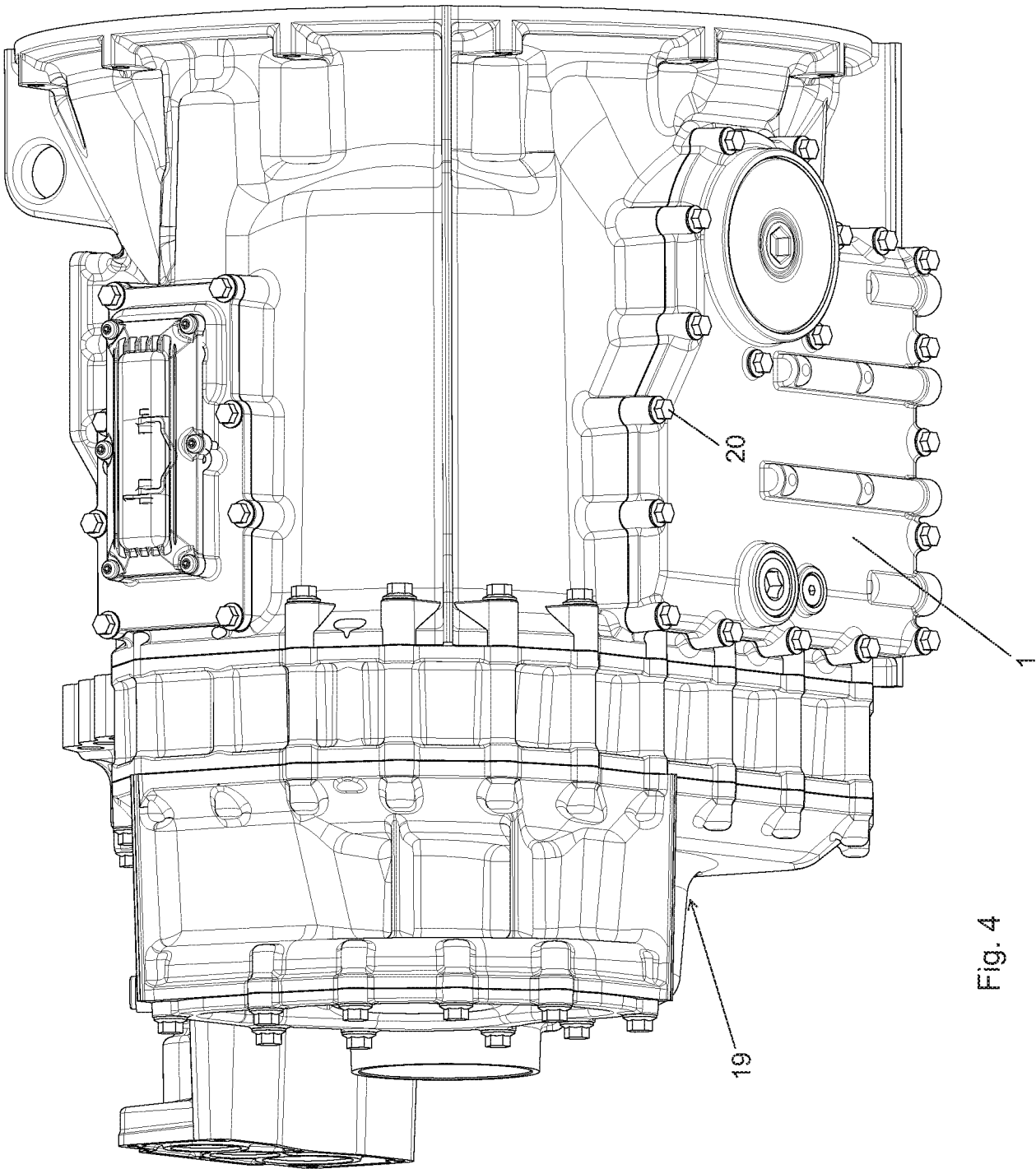


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2019/051105

A. CLASSIFICATION OF SUBJECT MATTER IPC: see extra sheet 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) IPC: B60S, F16H		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched SE, DK, FI, NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, PAJ, WPI data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0284216 A2 (GEN MOTORS CORP), 28 September 1988 (1988-09-28); column 1, line 47 - column 2, line 11; column 3, line 2 - line 27; column 4, line 34 - column 5, line 3; figures 1, 2; claim 2 --	1, 4-13
Y	US 20020032093 A1 (KOPEC MARK ET AL), 14 March 2002 (2002-03-14); paragraphs [0027]-[0028], [0039]-[0042]; figures 5, 6, 12; claim 5 --	1, 4-13
A	US 5599247 A (MATSUFUJI MIZUYA), 4 February 1997 (1997-02-04); abstract; figure 1 --	1-13
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
*	Special categories of cited documents:	
“A”	document defining the general state of the art which is not considered to be of particular relevance	“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
“D”	document cited by the applicant in the international application	“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
“E”	earlier application or patent but published on or after the international filing date	
“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	Date of mailing of the international search report	
06-12-2019	06-12-2019	
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Tomas Lund Telephone No. + 46 8 782 28 00	

INTERNATIONAL SEARCH REPORT

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PCT/SE2019/051105

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 19519227 A1 (KANZAKI KOKYUKOKI MFG CO LTD), 21 December 1995 (1995-12-21); abstract; figures 6, 7 --	1-13
A	EP 1186801 A2 (KANZAKI KOKYUKOKI MFG CO LTD), 13 March 2002 (2002-03-13); abstract; figures 4, 5 --	1-13
A	DE 102010010804 A1 (SEW EURODRIVE GMBH & CO), 15 September 2011 (2011-09-15); abstract; all figures -- -----	1-13

Continuation of: second sheet

International Patent Classification (IPC)

F16H 57/04 (2010.01)

F16H 57/02 (2012.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

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