

DEVICE FOR LUBRICATING SHAFT BEARINGS

TECHNICAL FIELD OF THE INVENTION

The invention concerns a device for lubricating a bearing for a rotatably
5 journaled shaft sealed in a housing according to the preamble to claim 1. The
invention also concerns a motor vehicle.

BACKGROUND

In vehicles such as goods vehicles, shafts for, for example, propulsion are
10 rotatably journaled by means of shaft bearings in a housing. Such bearings
require lubrication. Lubricants such as oil are thus arranged so as to be
conducted to and removed from the shaft bearing in order to lubricate same.
Such lubricants are normally arranged so as to be supplied during operation
by means of, for example a pump or via splash lubrication by means of a
15 gearwheel or the equivalent.

In addition, such lubricants are arranged so as to be removed via a return
channel arranged downstream of the shaft bearing. To prevent the shaft
bearing from being left dry during non-operation, the return channel is
arranged at a certain angle so that a lubricant bath of a certain level is kept in
20 contact with the shaft bearing.

In order to prevent oil and dust or the like from leaking out to sensitive
components or the equivalent in the housing, the shaft is sealed and
rotatably journaled, whereupon a sealing section arranged on the shaft and a
therewith interworking sealing section on the housing are arranged so as to
25 form a seal. The lubricant bath is thereby arranged between the shaft bearing
and the sealing sections, which results in an increased risk of lubricant
leakage.

To prevent the lubricant from leaking out via the sealing sections, it is necessary for them to be pressed against one another with a certain heavy force, which results in high friction between the sealing sections. Such a high-friction seal between the sealing sections causes the seal to exhibit
5 correspondingly high torque loss when the shaft rotates.

OBJECT OF THE INVENTION

One object of the present invention is to provide a device for lubricating a bearing for a rotatably journaled shaft sealed in a housing, which device
10 enables decreased torque loss in the seal.

SUMMARY OF THE INVENTION

These and other objects, which are specified in the description below, are achieved by means of a device of the type described above and that further
15 exhibits the features specified in the characterizing portions of the accompany independent claims. Preferred embodiments of the device are defined in the accompanying non-independent claims.

These objects are achieved according to the invention by means of a device wherein the lubricant bath is disposed separate from the sealing sections by
20 means of a level-regulating element arranged in a space between the shaft bearing and the sealing sections, and wherein said space comprises at least one drain opening.

The lubricant bath can thereby be arranged with contact maintained with the shaft bearing without the lubricant bath coming into contact with the sealing
25 sections. The risk that lubricant will leak out via the sealing sections is thereby significantly reduced, whereupon the friction between the sealing sections can be reduced so that the torque loss can be reduced in turn. Dust

and dirt do not require the same level of sealing as a lubricant such as oil, with the result that a low-friction seal can be achieved so that dirt and dust or the like are prevented from passing through the sealing sections.

According to one embodiment of the device, a radially extending space is
5 formed between the level-regulating element and the shaft for said level regulation. An effective means of keeping the lubricant bath in contact with the shaft bearing separate from the sealing sections is achieved thereby.

According to one embodiment of the invention, the sealing section comprises an annular section, and the level-regulating element is enclosed by an annual
10 section of the housing. This facilitates the design and mounting of the sealing section and level-regulating element. Efficient sealing and efficient level regulation are also made possible.

According to one embodiment of the invention, the level-regulating element constitutes an integral part of the sealing section of the housing. As a result,
15 only one piece is required for the sealing section and level-regulating element of the housing, which reduces the number of components.

According to one embodiment of the device, the respective annular sections are integrated into one unit. As a result, only one piece is required for the sealing section of the housing and the level-regulating element, which
20 reduced the number of components.

According to one embodiment of the device, said annular sections consist of separate units.

According to one embodiment of the device, said at least one drain opening is arranged so as to run essentially radially relative to the axial direction of
25 the shaft. Efficient level regulation of the lubricant is achieved hereby.

According to one embodiment of the device, said at least one drain opening is arranged in the housing essentially in the bottom of the space for draining the lubricant that has passed the level-regulating element. Accumulation of

lubricant bath in abutment to the sealing sections is hereby prevented. Efficient removal of the lubricant following lubrication of the shaft bearing is also achieved.

5 FIGURE DESCRIPTION

The present invention will be better understood with reference to the following detail description read in conjunction with the accompanying drawings, in which the same reference designations refer to the same parts consistently in the various views, and in which:

- 10 Fig. 1 schematically illustrates a motor vehicle according to one embodiment of the invention;
- Fig. 2 schematically illustrates a cross-section view of a device for lubricating a bearing according to one embodiment of the invention;
- Fig. 3 schematically illustrates a part of the device in Fig. 2; and
- 15 Fig. 4 schematically illustrates a part of a device for lubricating a bearing according to an alternative embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

- The following description of the exemplary embodiments of the invention has
- 20 been provided for illustrative and descriptive purposes. It is not intended to limit the invention to the described embodiments.

- Fig. 1 schematically illustrates a motor vehicle 1 exemplified by a heavy vehicle in the form of a goods vehicle. The vehicle can alternatively be a car, a bus, a work vehicle or the equivalent. The vehicle is equipped in the
- 25 conventional manner with a combustion engine to propel it via a drivetrain

comprising a transmission and shafts connected thereto. The vehicle comprises a device I for lubricating a bearing for a rotatably journaled shaft sealed in a housing.

Fig. 2 schematically illustrates a cross-section view of a device I for lubricating a shaft bearing 10 for a rotatably journaled shaft 30 sealed in a housing 20, while Fig. 3 depicts a part of the device in Fig. 2.

The shaft 30 can consist of any suitable rotatable shaft intended to be journaled in a housing. The shaft 30 according to this embodiment comprises a carrier 32 connected to one end area of a shaft section 34 of the shaft 30 via a spline joint 35. The carrier 32 is consequently arranged around the shaft section 34 and arranged so as to run along the shaft section 34. According to one variant the shaft 30 is arranged in a motor vehicle. According to one variant the shaft 30 is included in the drivetrain of the motor vehicle.

The shaft 30 is journaled on the housing 20 by means of the shaft bearing 10. According to one variant the shaft bearing 10 consists of a conical roller bearing.

The shaft 30 is further arranged in sealed fashion on the housing 20 by means of a sealing configuration 40.

The sealing configuration 40 comprises a first sealing section 42 arranged on the shaft 30. The first sealing section 42 is fixedly connected to the shaft 30. The first sealing section 42 is enclosed in an annular section of the shaft 30 arranged externally around the shaft 30.

According to this embodiment, the first sealing section 42 is arranged on and fixedly connected to the carrier 32.

The sealing configuration 40 comprises a second sealing section 44 arranged on the housing 20. The second sealing section 44 is fixedly connected to the housing 20. The second sealing section 44 is enclosed by an annular section of the housing 20 that is arranged internally around the

housing 20. The second sealing section is fixedly connected to the housing via a sealing element 44a.

The first sealing section 42 arranged on the shaft 30 and the second sealing section 44 arranged on the housing are arranged so as to sealingly interwork with one another and thereby form a seal. The first sealing section 42 is
5 herein arranged rotatably in relation to the second sealing section 44. The first sealing section 42 and the second sealing section 44 are arranged so as to sealingly abut one another, wherein the abutment is shaped like a labyrinth, here schematically illustrated as a radially protruding section of the
10 first sealing section 42 arranged so as to fit into an opposing radial recess of the second sealing section 44, which recess runs circumferentially. This makes it more difficult for dirt and dust to be conducted through the sealing configuration 40.

The shaft bearing 10 is arranged so as to be lubricated by means of lubricant O. According to one variant the lubricant O consists of oil. The lubricant O is
15 arranged so as to be conducted to and removed from the shaft bearing 10 to lubricate same. The lubricant also contributes to the cooling of the shaft bearing 10.

The device I for lubricating a shaft bearing 10 comprises means 100 for
20 supplying lubricant O in the direction toward the shaft bearing 10. According to one variant, the means 100 for supplying lubricant O comprise at least one pump arranged so as to pump lubricant from a lubricant sump in the housing 20. When the lubricant O consists of oil, the lubricant sump consequently consists of an oil sump.

25 According to one variant, the pump is connected to the shaft 30 in such a way that the pump is activated when the shaft is driven, so that lubricant O can be supplied to shaft bearing 10 when the need exists, i.e. when the vehicle is driven so that the shaft 30 rotates.

The lubricant O is then arranged so as to be led via the shaft bearing 10 for, in the event that the shaft bearing consists of a conical roller bearing, utilization of a pump effect generated by means of the conical rollers of the conical roller bearing.

- 5 According to an alternative or supplemental variant, the means 100 for supplying lubricant O comprise gears or the equivalent that are arranged so as to splash lubricant in the direction toward the shaft bearing to lubricate same.

10 The lubricant O is arranged so as to be conducted and removed from the shaft bearing 10 to lubricate same in such a way that a lubricant bath 50 of a certain level is kept in contact with the shaft bearing 10. The lubricant bath 50 is disposed separate from the sealing sections 42, 44 by means of a level-regulating element 60 arranged between the shaft bearing 10 and the sealing sections 42, 44 of the sealing configuration 40, whereupon a space 70 is
15 formed between the level-regulating element 60 and the sealing configuration 40.

The space comprises a drain opening 72. The drain opening 72 is arranged in the housing 20 essentially in the bottom of the space 70 to drain the lubricant O that has passed the level-regulating element 60. The drain
20 opening 72 is arranged so as to run essentially radially in relation to the axial direction X of the shaft 30.

A radially extending space S is formed between the level-regulating element 60 and the shaft 10 for said level regulation.

25 The level-regulating element 60 comprises a section 60a protruding from the housing and arranged at a distance from the shaft bearing 10 to form the space S. The protruding section 60a is arranged in connection to the drain opening 72 so that lubricant O that flows over the protruding section 60a from the lubricant bath 50 is led down into the drain opening 72. The space S

between the protruding section 60A and the shaft 30 is consequently present to enable lubricant O to flow there between for said level regulation.

The protruding section 60a is arranged so as to protrude essentially radially in the direction towards the shaft 30 and at a distance from the shaft 30 so
5 that the lubricant O in the lubricant bath 50 is allowed to flow over and down into the space 70 for the drain opening 72.

The device I comprises a return channel 74 arranged in the housing 20 in connection to the drain opening 72 and arranged so as to return lubricant O to, for example, a lubricant sump. The return channel 74 is consequently
10 arranged in the bottom of the space 70. The return channel 74 is preferably arranged so as to initially run essentially vertically from the drain opening 72 in the bottom of the space 70.

According to the embodiment show in Figs. 2 and 3, the level-regulating element 60 constitutes an integral part of the sealing section of the housing.
15 The level-regulating element 60 and the second sealing section 44 thus form a level-regulating sealing arrangement 80.

The level-regulating element 60 is enclosed by an annular section of the housing 20 that is arranged internally in the housing 20. The level-regulating element 60 is fixedly and sealingly connected to the housing 20. The level-
20 regulating element 60 is fixedly connected to the housing via a sealing element 60b.

The level-regulating sealing arrangement 80 comprises a section 82 that is present between the level-regulating element 60 and the second sealing section 44. The level-regulating element 60 and the second sealing section
25 44 together form a single piece or a single unit with the intermediate section 82, as is shown in Fig. 3.

According to the embodiment in Fig. 3, the intermediate section 82 is annular, and fixedly and sealingly connected to the housing 20. The annular

intermediate section 82 has openings 82a arranged around it, one of which is intended to constitute a drain opening/connection to a drain opening 72 for connection to the return channel 74 and is to be oriented in the bottom of the space. The presence of a set of preferably uniformly distributed throughgoing
5 openings 82a along the orbit of the intermediate section 82a simplifies the mounting of said mutually integrated level-regulating element 60 and second sealing section 44, in that it simplifies the orientation of the intermediate section for localizing the drain opening.

The level-regulating element 60 of the level-regulating sealing arrangement
10 80 forms a collar section that runs internally around and protrudes radially from the housing 20.

According to one embodiment, the level-regulating sealing arrangement 80 comprising the level-regulating element 60 and the second sealing section 44 consist of one and the same material.

15 According to one embodiment, the level-regulating sealing arrangement 80 comprising the level-regulating element 60 and the second sealing section 44 comprise a steel core around which rubber is arranged for said sealing.

Fig. 4 schematically illustrates a part of a device for lubricating a bearing for a rotatably journaled shaft sealed in a housing according to an alternative
20 embodiment of the present invention.

The embodiment according to Fig. 4 differs from the embodiment according to Figs. 2 and 3 in that the level-regulating element 160 constitutes a separate unit and consequently is separate from the second sealing section 144.

25 The level-regulating element 160 thus consists of an annular section that is intended to be arranged internally in the housing 20. The level-regulating element 160 is intended to be fixedly and sealingly connected to the housing. The second sealing section 144 further consists of an annular section that is

intended to be arranged internally in the housing. The second sealing section 144 is intended to be fixedly and sealingly connected to the housing.

The annular level-regulating element 160 and the annular second sealing section 144 are consequently arranged at a distance from one another, whereupon a space 170 is formed between them. The drain opening is thus intended to be arranged between the level-regulating element 160 and the second sealing section 144, wherein the opening is arranged directly in the housing for the return channel.

Various embodiments of level-regulating elements in a device for lubricating a bearing for a rotatably journaled shaft sealed in a housing have been described with reference to Figs. 2-4 above.

According to one alternative variant, the level-regulating element constitutes an integral part of the housing. The level-regulating element thus consists of a radially projecting section of the housing for said level regulation.

According to the example above, the shaft is a rotatably journaled shaft sealed in a housing in a vehicle. However, the shaft can consist of any suitable rotatably journaled shaft in a housing where lubrication of bearings is needed.

The intermediate space between the level-regulating element and the shaft is formed above in that the level-regulating element protrudes radially outward toward the shaft to a distance from the shaft. According to one variant, the shaft has a recess or a step corresponding to the radially protruding level-regulating element so that the radially protruding level-regulating element protrudes into the recess at a distance from the bottom of the recess or is on the level of the surface of the shaft on the side of the recess, wherein the recess has an axial extent such that the lubricant is allowed to pass the level-regulating element via the recess and to the space in order to be conducted away to the drain opening.

CLAIMS

1. A device (I) for lubricating a bearing (10) for a rotatably journaled shaft (30) sealed in a housing (20), wherein a sealing section (42) arranged on the shaft (30) and a therewith interworking sealing section (44; 144) in the housing (2) form a seal, wherein lubricant (O) is arranged so as to be conducted to and removed from the shaft bearing (10) in such a way that a lubricant bath (50) with a certain level is kept in contact with the shaft bearing (10), **characterized in that** the lubricant bath (50) is disposed separate from the sealing sections (42, 44) by means of a level-regulating element (60; 160) arranged in a space (70) between the shaft bearing (10) and the sealing sections (42, 44), and in that the space (70) comprises at least one drain opening (72).
2. A device according to claim 1, wherein a radially extending space (S) is formed between the level-regulating element (60; 160) and the shaft (30) for said level regulation.
3. A device according to claim 1 or 2, wherein said sealing section (44) is enclosed by an annular section of the housing (20) and the level-regulating element (60; 160) is enclosed by an annular section of the housing (20).
4. A device according to any of claims 1-3, wherein the level-regulating element (60) constitutes an integral part of the sealing section of the housing.
5. A device according to 3 or 4, wherein each respective annular section is integrated into a unit.
6. A device according to claim 3, wherein said annular sections constitute separate units.
7. A device according to any of claims 1-6, wherein said at least one drain opening (72) is arranged so as to run essentially radially relative to the axial direction (X) of the shaft (30).

8. A device according to any of claims 1-7, wherein said at least one drain opening (72) is arranged in the housing (20) essentially in the bottom of the space (70) for draining lubricant (O) that has passed the level-regulating element (60; 160).
- 5 9. A motor vehicle (1) comprising a device (I) according to any of claims 1-8.

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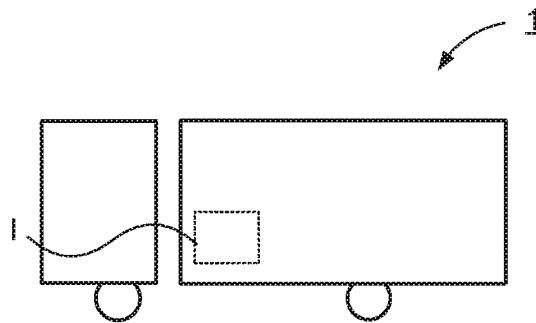


Fig. 1

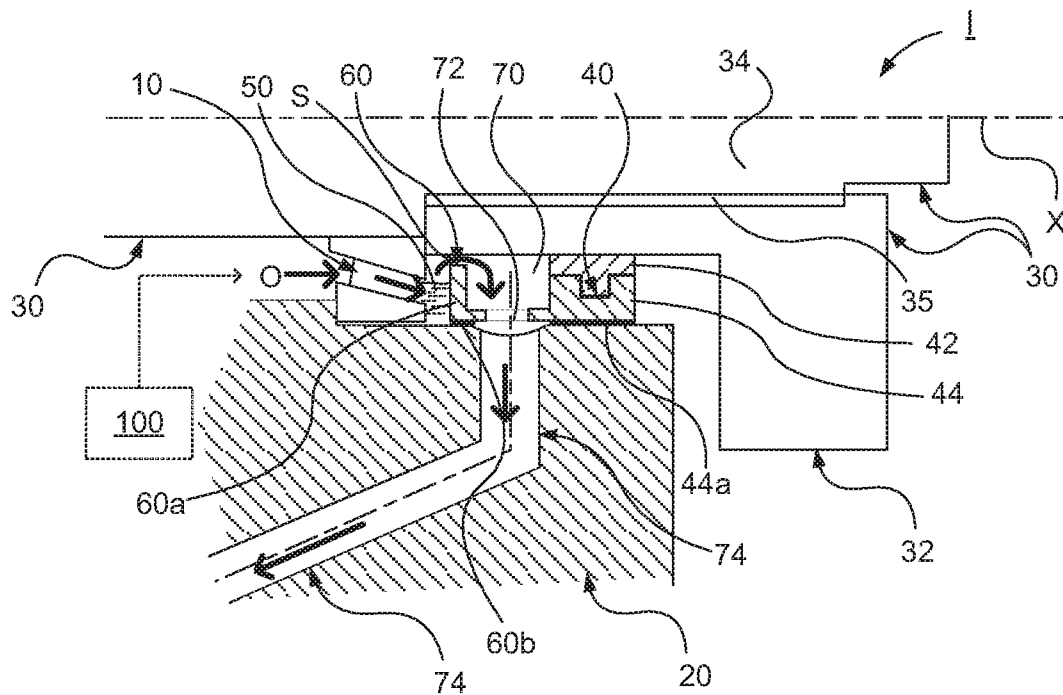


Fig. 2

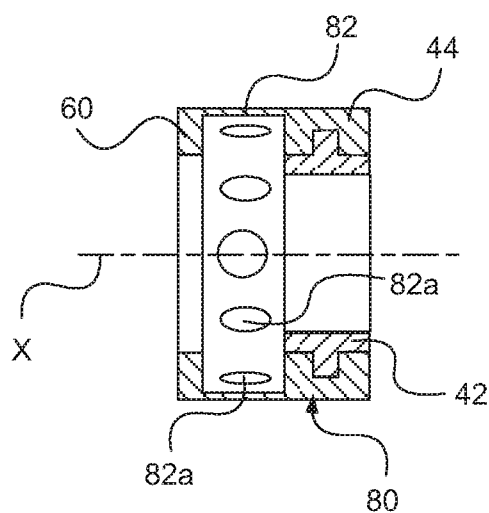


Fig. 3

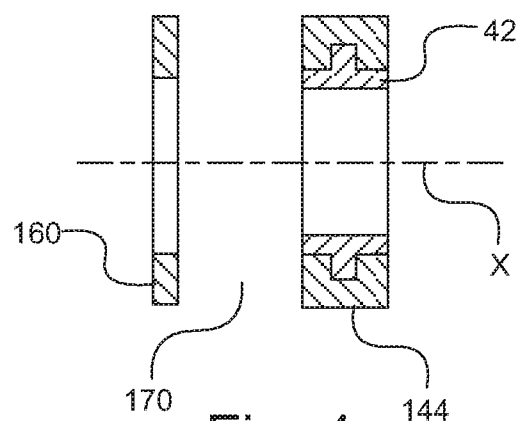


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/051058

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: F16C

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.
X	US 4363490 A (KUEHN HOWARD E), 14 December 1982 (1982-12-14); abstract; column 2, line 41 - column 4, line 12; figure 1 --	1-9
A	EP 0882913 A1 (RFT SPA), 9 December 1998 (1998-12-09); abstract; figures --	1-9
A	US 5150975 A (MAJOR KENNETH E ET AL), 29 September 1992 (1992-09-29); abstract; figures --	1-9
A	EP 0564873 A1 (STOWE WOODWARD AG), 13 October 1993 (1993-10-13); abstract; figures --	1-9

☒ 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

“E” earlier application or patent but published on or after the international filing date

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“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

“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

“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

“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

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Date of the actual completion of the international search

19-12-2013

Date of mailing of the international search report

23-12-2013

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INTERNATIONAL SEARCH REPORT

International application No.
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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 4998600 A (FÜHRER GERD ET AL), 12 March 1991 (1991-03-12); abstract; figures -- -----	1-9

Continuation of: second sheet
International Patent Classification (IPC)
F16C 33/66 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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			SE	8105653 A	27/03/1982
EP	0882913 A1	09/12/1998	IT	TO970494 A1	07/12/1998
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US	5150975 A	29/09/1992	NONE		
EP	0564873 A1	13/10/1993	FI	931258 A0	22/03/1993
US	4998600 A	12/03/1991	BR	8901085 A	31/10/1989