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(54) BOTTOM-MOUNTED MARINE DRIVE AND ASSEMBLY METHOD

(57) The present invention relates to a bottom-mounted marine drive (1) comprising an upper part (2) to be fastened to the inside of a hull (4), a lower part (3) to be mounted outside the hull (4) and a flange interface (5) which is arranged between the upper part (2) and the lower part (3). The flange interface (5) comprises at least a body (10), a first clamp element (6, 7), a first elastic ring (8) and a second elastic ring (9). The flange interface (5) is configured to be mounted to the hull (4) from inside the hull (4) as a preassembled unit.

The invention relates further to a boat (100) and a method to mount such a bottom-mounted marine drive (1) to a hull (4) of a boat (100).

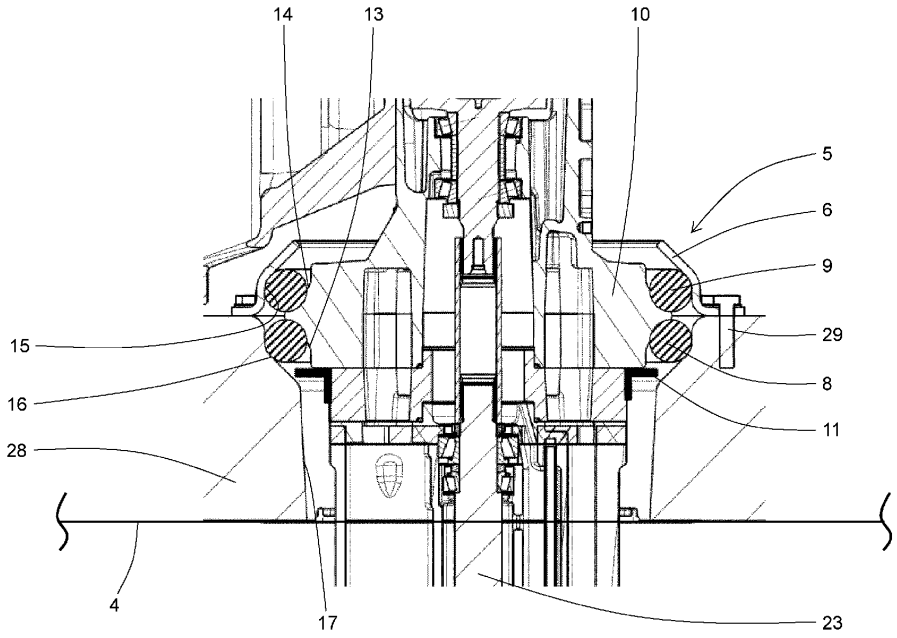

Fig. 2

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Description

[0001] The present invention relates to a bottom-mounted marine drive and to a corresponding assembly method for such a bottom-mounted marine drive. Besides a boat with such a bottom-mounted marine drive is proposed.

[0002] A bottom-mounted marine drive extends through an opening in the bottom of a hull. Such a marine drive unit is also called a POD-drive. Such a POD-drive typically has an upper part which is stationary mounted inside a boat hull and a lower part which is mounted below the bottom of the hull. The lower part supports a propeller shaft. A propeller is mounted to one end of the propeller shaft and imparts a propulsive thrust in the water during operation. A flange interface is arranged between the upper part and the lower part. The flange interface serves for different purposes. It is used to mount the marine drive unit to the bottom of the hull and to seal off the opening in the bottom of the hull.

[0003] An example of a bottom-mounted marine drive has been disclosed in US 2015/0038028 A1. This marine drive comprises a lower housing section, an upper housing section and an intermediate housing section, the intermediate housing section having an outwardly extending retention portion. Said retention portion being clamped to the hull by means of a hull support ring mounted to the bottom of the hull on the upper side of the retention portion and by means of a clamp ring fastened to the hull support ring from the lower side of the retention. A compressible upper ring seal and a lower ring seal are disposed in between said support ring respectively the clamp ring and the retention in order to provide a water-tight seal to prevent leakage when the watercraft is disposed and operated in the water. The compressible ring seals further transmit forces from the marine drive to the hull.

[0004] Another example of a bottom-mounted marine drive has been proposed in WO 03/093105 A1. This marine drive comprises a mounting plate rigidly joined to an underwater housing or to a gear housing, a screw-down plate, an upper elastic ring and a lower elastic ring for clamping the drive unit against a peripheral flange in a well in the bottom of a boat hull. The screw down plate and the upper elastic ring can be mounted from inside the hull, whereas the mounting plate and the lower elastic ring are mounted from outside of the hull.

[0005] The purpose of the present invention is to provide a bottom-mounted marine drive which can be easily assembled and mounted to a hull of a boat. The bottom-mounted marine drive shall reliably be supported in the hull, transmit the driving forces from the marine drive to the hull and seal off the opening in the bottom of the hull.

[0006] These purposes are achieved by a bottom-mounted marine drive according to claim 1 and by a method according to claim 8. Further preferred embodiments are claimed in dependent claims.

[0007] The present invention provides a bottom-mounted marine drive comprising an upper part to be fastened to the inside of a hull of a boat, a lower part to be mounted outside the hull and a flange interface which is arranged between the upper part and the lower part. The lower part may be rotatable about a vertical axis to constitute a steerable marine drive.

[0008] The flange interface comprises a body, a at least a first clamp element, a first elastic ring and a second elastic ring. The flange interface is configured to be mounted to the hull from inside the hull as a preassembled unit. This means that all parts of the flange interface including the two elastic rings can be assembled before mounting it into the hull. Further it means, that the complete flange interface is mounted from inside the hull. These features simplify and minimize the efforts during the installation on the boat, because no single part of the flange interface needs to be mounted from outside or underneath the hull bottom. An opening in the bottom of the hull can be formed and dimensioned to fit to the flange interface and its components. The flange interface with its body can be fastened directly to the hull by means of the first clamp element.

[0009] The elastic rings may have multiple functions. They seal off the opening in the hull bottom against water leakage, they transmit the force from the marine drive to the hull and they damp vibrations caused by the marine drive. Consequently no additional fastening or damping means like silent blocks are required. The elastic rings may have circular cross-sections, if they are not compressed between any contact surfaces to form seals there between. The ring shape of the elastic rings can be circular. However, the ring form of the elastic rings can also have another shape. For example an elongated, oblong, or oval shape. The ring shape of the elastic rings can be adopted to the shape of the opening in the hull bottom.

[0010] In one embodiment the flange interface may comprise a second clamp element and the first and the second clamp element are to be fastened to the hull. The second clamp element can be a metal insert that supports the load from the marine drive through the first elastic ring and transmit it to the hull. The second clamp element can be formed and machined to provide an appropriate contact surface in contact with the first elastic ring. The second clamp element can be a kind of an adapter which allows to fasten the flange interface to different hulls with openings of different shape and size in the bottom of a hull. For this the second clamp element can easily be produced and/or adapted in dimension and shape to fit for each specific application in a production site before the assembly of the flange interface and before the installation in the hull. The hull includes structural elements like an engine bed, frames and ribs which can be used to fasten the elements of the bottom-mounted marine drive.

[0011] In one embodiment an elastic ring retainer is arranged to hold the first elastic ring in place. Such an elastic ring retainer further enhances the quick and easy assembly and installation of the bottom-mounted marine

drive in the hull, because it allows the pre-assembly of the first elastic ring and maintain it in the correct position during the drive installation in the hull and during the duty cycle. The geometry of the elastic ring retainer is designed to avoid the wear of the first elastic ring and damage of adjacent components when the first elastic ring is deformed during the duty cycle. The elastic ring retainer can preferably be made of a rubber element molded to an aluminum or steel metal profile that will be fix to the body of the flange interface.

[0012] To further enhance the easy assembly, the first elastic ring and the second elastic ring can be connected to each other by an elastic connection. The elastic connection may be produced from the same elastic material than the first and second elastic ring. The two elastic rings can be produced together with the elastic connection as one single component. The elastic connection can be a continuous elastic band around the circumference of the elastic rings, or it can be built by elastic joints arranged with a distance from each other around the circumference of the first and second elastic ring. By means of the elastic connection, the elastic rings can be attached to the flange interface, so that they hold in a desired position during assembly and installation without any further effort and without any retaining element or tool. Another benefit is an increase of the hull sealing resistance because the elastic connection improves the continuous contact with the corresponding contact surfaces. Hence, even with some movement and vibration between the bottom-mounted marine drive and the hull during operation a steady contact and sealing can be achieved.

[0013] In one embodiment said body of the flange interface comprises a first contact surface to be in contact with the first elastic ring and a second contact surface to be in contact with the second elastic ring, the first clamp element comprises a third contact surface to be in contact with the second elastic ring and either the hull or the second clamp element comprises a fourth contact surface being in contact with the first elastic ring. Such configurations ensure reliable and effective sealing and force transmission between the bottom-mounted marine drive and the hull. Said contact surfaces can be formed and machined in a way to enable effective sealing and force transmission via the elastic rings causing a minimum of strain to the elastic rings.

[0014] The configuration with the fourth contact surface directly at the hull may provide a groove in an engine bed of the hull which can be made of fiberglass, as an example. This configuration does not need a second clamp element, because the flange interface with the two elastic rings is clamped and hold in place by the first clamp element which is fastened to the hull. The first clamp element may be fastened to the hull by means of screws or threaded bolts.

[0015] The alternative configuration, wherein the second clamp element comprises a fourth contact surface being in contact with the first elastic ring enables the manufacturing of the second clamp element with the fourth contact surface outside the hull. Thus, the manufacturing, particularly of the fourth contact surface, can be done outside the hull with less efforts compared to the manufacturing of the contact surface inside the hull and as a part of the hull.

[0016] In one embodiment a washer is provided between the first clamp element and the second clamp element, wherein the washer comprises a sealing element. The washer can be co-molded together with the sealing element, wherein the sealing element can be vulcanized on the washer. After assembly the sealing element can be compressed by screws which fasten the first clamp element to the second clamp element. Such a washer further increases the reliability of the hull sealing against water leakage.

[0017] Besides the invention relates to a boat with a hull and a bottom-mounted marine drive as described above.

[0018] The invention further belongs to a method to mount a bottom-mounted marine drive to a hull. The method comprising the steps of preassembling an upper part of the bottom-mounted marine drive together with a flange interface, positioning the upper part together with the flange interface from inside the hull at an opening in the bottom of the hull, fastening the flange interface to the hull, positioning a lower part of the bottom-mounted marine drive outside the hull at the opening, and fastening the lower part to the flange interface. The positioning of the lower part outside the hull can also be done before the steps mentioned before that.

[0019] All the components of the flange interface, namely a body, a first clamp element, a second clamp element, a first seal element and a second seal element can be preassembled together to the flange interface before positioning it inside the hull and before fastening it to the hull.

[0020] A difference to the existing methods is the possibility to preassemble the complete flange interface in an appropriate place like a shop floor. In such a place, the assembly can be done more easily compared to the constricted space inside a hull. Afterwards the preassembled flange interface can be simply positioned and installed it inside the hull of a boat without the requirement to position or fasten any element of the flange interface from underneath the hull. Only the lower part of the bottom-mounted marine drive has to be positioned and mounted from below the hull. The terms above, below, vertical, horizontal, upper and lower are used with regard to a bottom-mounted marine drive operatively installed in a boat which is afloat in calm water, unless otherwise specified in the text.

[0021] The invention will be further and more particularly described in the following, by way of example only, and with reference to the accompanying drawings, in which:

Fig. 1 shows a section view of a bottom-mounted marine drive according to the invention,

Fig. 2 shows a detail of a first embodiment of a flange interface of a bottom-mounted marine drive,

Fig. 3 shows a detail of a second embodiment of a flange interface of a bottom-mounted marine drive,

Fig. shows a detail of a third embodiment of a flange interface of a bottom-mounted marine drive and

Fig. 5 shows schematically the steps of a method according to the invention.

[0022] Fig. 1 shows a bottom-mounted marine drive 1. The bottom-mounted marine drive 1 comprises an upper part 2 which is fastened to the inside of a hull 4 of a boat 100 and a lower part 3 which is mounted outside of the hull 4. The upper part 2 comprises a combustion engine 20 as a prime mover. The combustion engine 20 is supported inside the hull 4 by means of an engine bed 28. The engine bed 28 can be an integral part of the hull 4 and made of fiberglass, as an example.

[0023] A crank shaft of the combustion engine 20 is drivingly connected to an input shaft 21 of an upper transmission 26. The upper transmission 26 is a bevel gear transmission which transmits the driving force from the input shaft 21 to a vertical shaft 23. The vertical shaft 23 is supported in a vertical section 22 of the lower part 3 which extends through an opening 17 in the bottom of the hull 4. The flange interface 5 is formed and dimensioned to fit to the opening 17. Said vertical section 22 extends from the bottom of the hull 4 downwards to a horizontal section 24 of the lower part 3. A propeller shaft 25 is supported in the horizontal section 24. A lower transmission 27 in form of another bevel gear transmits the driving force from the vertical shaft 23 to the horizontally arranged propeller shaft 25. The trailing end of the propeller shaft 25 is configured to carry a propeller which generates a thrust during operation of the bottom-mounted marine drive 1. The terms vertical and horizontal are meant to be approximate designations. In real applications the arrangements may deviate by a few degrees from an exact vertical or horizontal direction.

[0024] A flange interface 5 is mounted between the upper part 2 and the lower part 3. The flange interface 5 comprises a body 10. The flange interface 5 further comprises a first clamp element 6, a first elastic ring 8 and a second elastic ring 9. The body 10 transmits the thrust from the lower part 3 via the first and second elastic rings 8 and 9 to the hull 4. In this embodiment the first elastic ring 8 is positioned below the second elastic ring 9. The body 10 mechanically connects the upper part 2 to the lower part 3. The flange interface 5 is a preassembled unit which is completely mounted to the hull 4 from inside the hull 4.

[0025] Fig. 2 shows a section of a bottom-mounted marine drive 1 with a first embodiment of a flange interface 5 as described in Fig. 1. The body 10 of the flange interface 5 comprises a first contact surface 13 which is in contact with the first elastic ring 8. The body further comprises a second contact surface 14 which is in contact with the second elastic ring 9. A third contact surface 15 is in contact with the second elastic ring 9. The third contact surface 15 is a surface of the first clamp element 6. A fourth contact surface 16 is a surface of the hull 4 on the inner side of opening 17. The fourth contact surface 16 in contact with the first elastic ring 8. The first clamp element 6 is fastened to the engine bed 28 of the hull 4 by fastening screws 29. The first clamp element 6 holds the flange interface 5 in place with regard to the hull 4, while allowing certain movements enabled by the elasticity of the elastic rings 8 and 9. Thus the whole bottom-mounted marine drive 1 is fastened to the hull 4 by means of the first clamp element 6.

[0026] The first elastic ring 8 is clamped between the first contact surface 13 and the fourth contact surface 16 while the second elastic ring 9 is clamped between the second contact surface 14 and the third contact surface 15. In this position the first elastic ring 8 is configured to seal off the opening 17 from water leakage and to transmit forces from the bottom-mounted marine drive 1 to the hull 4 of the boat 100. The first and the second elastic rings 8 and 9 will not remain in their original circular cross-section when assembled in the flange interface 5. Instead the cross-sections of the elastic rings 8 and 9 will be deformed between the corresponding contact surfaces.

[0027] The embodiment of Fig. 2 shows an elastic ring retainer 11 which is arranged to hold the first elastic ring 8 in place. The elastic ring retainer 11 in this embodiment is a ring extending around the circumference of the body 10. The elastic ring retainer 11 is fastened to the body 10. The elastic ring retainer 11 is located below the first elastic ring 8 to reduce the free area of the ring gap between the body 10 and the opening 17. This function of the elastic ring retainer 11 is particularly useful to simplify the assembly of the flange interface 5 and the installation inside the hull 4. Beside the elastic ring retainer 11 holds the first elastic ring 8 in place during a duty cycle of the bottom-mounted marine drive 1, when significant forces are transmitted through the first and second elastic rings 8 and 9 and the elastic rings 8, 9 tend to be further deformed and dislocated.

[0028] Fig. 3 shows a section of a bottom-mounted marine drive 1 with a second embodiment of a flange interface 5. The flange interface 5 comprises a body 10, a first clamp element 6, a first elastic ring 8 and a second elastic ring 9. The first elastic ring 8 is positioned below the second elastic ring 9. The body 10 of the flange interface 5 comprises a first contact surface 13 which is in contact with the first elastic ring 8 and a second contact surface 14 which is in contact with the second elastic ring 9. A third contact surface 15 is in contact with the second elastic ring 9. The third contact surface 15 is a surface of the first clamp element 6.

[0029] Insofar the second embodiment of the flange

interface 5 in Fig. 3 comprises the same components as the first embodiment in Fig. 2. An essential difference of the second embodiment is a second clamp element 7 which is fastened to the engine bed 28. The second clamp element 7 is a metal insert which is fastened in a recess 30 in the engine bed 28 of the hull 4. The dimensions and shapes of the recess 30 and the second clamp element 7 are chosen in a way to fulfill the described functions. This is particularly, to support the load from the first elastic ring 8 and to transmits it to the hull 4. The second clamp element 7 therefore provides a fourth contact surface 31 which is in contact with the first elastic ring 8.

[0030] The first clamp element 6 is fastened to the second clamp element 7 by fastening screws 29. Hence, the first clamp element 6 and the second clamp element 7 are stationary with regard to the hull 4.

[0031] Another component of the second embodiment in Fig. 3 is an elastic connection 12 which connects the first elastic ring 8 and the second elastic ring 9. The elastic connection 12 is made from the same elastic material than the first and second elastic ring 8, 9. The elastic connection 12 enables an assembly of the flange interface 5 and the upper part 2 while the elastic rings 8 and 9 are hold in the required position at the body 10 of the flange interface 5. During operation of the bottom-mounted marine drive 1 the elastic connection 12 enhances the contacts of the elastic rings 8 and 9 at the contact surfaces 13, 14, 15 and 16 and significantly increases the sealing effect at the flange interface 5.

[0032] A third embodiment of the flange interface 5 in Fig. 4 comprises the same components as the second embodiment in Fig. 3. There is one additional feature in the embodiment of Fig. 4, namely a washer 18 with a sealing element 19 which is provided between the first clamp element 6 and the second clamp element 7. The washer 18 with sealing element 19 further increases the reliability of the sealing at the interface 5 in the opening 17 of the hull 4. The sealing element 19 may be made of rubber and co-molded and vulcanized on a metallic part of the washer 18. The sealing element 19 is compressed by the force of the fastening screws 29 which fasten the first clamp element 6 to the second clamp element 7.

[0033] Fig. 5 shows the steps of a method to assemble and mount a bottom-mounted marine drive 1 to a hull 4 of a boat. The method comprises a first step S1 wherein an upper part 2 and a flange interface 5 a bottom-mounted marine drive 1 are preassembled. In a following step S2 the upper part 2 and the flange interface 5 are positioned inside a hull 4, wherein the flange interface 5 is positioned at an opening 17 in the bottom of the hull 4. The upper part 2 and the flange interface 5 can be preassembled outside the hull 4 and can be connected to each other during the installation inside the hull 4. This means, that the upper part 2 including a combustion engine 20 can be preassembled and mounted separately from the flange interface 5 in the hull 4. After a step S3, wherein the flange interface 5 is fastened to the hull, the upper part 2 and the flange interface 5 can be fastened to each other.

[0034] In step S4 a lower part 3 of the bottom-mounted marine drive 1 is positioned outside the hull 4 at the opening 17. Eventually in step S5 the lower part 3 is fastened to the flange interface 5. The positioning of the lower part 3 outside or below the hull 4 in step S4 can be done at any time before, independent from the sequential process of steps S1 to S3.

[0035] While this invention has been illustrated and described in accordance with preferred embodiments, it is recognized that variations and modifications may be made therein without departing from the invention as set forth in the claims. As an example can the washer 18 with sealing element 19 as described in the third embodiment be used as well in the first and second embodiment with the same benefits to the sealing effect.

Referals

[0036]

1	bottom-mounted marine drive
2	upper part
3	lower part
4	hull
5	flange interface
6	first clamp element
7	second clamp element
8	first elastic ring
9	second elastic ring
10	body
11	elastic ring retainer
12	elastic connection
13	first contact surface
14	second contact surface
15	third contact surface
16	fourth contact surface
17	opening
18	washer
19	sealing element
20	combustion engine
21	input shaft
22	vertical section
23	vertical shaft
24	horizontal section
25	propeller shaft
26	upper transmission
27	lower transmission
28	engine bed
29	fastening screw
30	recess
31	fourth contact surface
100	boat

Claims

1. Bottom-mounted marine drive (1) comprising an upper part (2) to be fastened to the inside of a hull

(4), a lower part (3) to be mounted outside the hull (4) and a flange interface (5) which is arranged between the upper part (2) and the lower part (3), wherein the flange interface (5) comprises a body (10), at least a first clamp element (6, 7), a first elastic ring (8) and a second elastic ring (9), **characterized in, that** the flange interface (5) is configured to be mounted to the hull (4) from inside the hull (4) as a preassembled unit.

2. Bottom-mounted marine drive (1) according to claim 1, wherein the flange interface (5) comprises a second clamp element (7), and wherein the first clamp element (6) and the second clamp element (7) are to be fastened to the hull (4).

3. Bottom-mounted marine drive (1) according to claim 1 or 2, wherein an elastic ring retainer (11) is arranged to hold the first elastic ring (8) in place.

4. Bottom-mounted marine drive (1) according to one of the preceding claims, wherein the first elastic ring (8) and the second elastic ring (9) are connected to each other by an elastic connection (12).

5. Bottom-mounted marine drive (1) according to one of the preceding claims, wherein the body (10) comprises a first contact surface (13) to be in contact with the first elastic ring (8) and a second contact surface (14) to be in contact with the second elastic ring (9), wherein the first clamp element (6) comprises a third contact surface (15) to be in contact with the second elastic ring (9), and wherein either the hull (4) or the second clamp element (7) comprises a fourth contact surface (16, 31) being in contact with the first elastic ring (8).

6. Bottom-mounted marine drive (1) according to one of the claims 2 to 5, wherein a washer (18) is provided between the first clamp element (6) and the second clamp element (7), wherein the washer comprises a sealing element (19).

7. Boat (100) with a hull (4) and a bottom-mounted marine drive (1) according to one of the preceding claims.

8. Method to mount a bottom-mounted marine drive (1) to a hull (4) comprising the steps:

preassembling (S1) an upper part (2) and a flange interface (5) of the bottom-mounted marine drive (1),
positioning (S2) the upper part (2) and the flange interface (5) inside the hull (4),
wherein the flange interface (5) is positioned at an opening (17) in the bottom of the hull (4),
fastening (S3) the flange interface (5) to the hull (4),
positioning (S4) a lower part (3) of the bottom-mounted marine drive (1) outside the hull (4) at the opening (17), and
fastening (S5) the lower part (3) to the flange interface (5).

9. Method according to claim 8, wherein the flange interface (5) comprises a body (10), first clamp element (6), a second clamp element (7), a first seal element (8) and a second seal element (9) which are all preassembled together to the flange interface (5) before fastening the flange interface (5) to the hull (4).

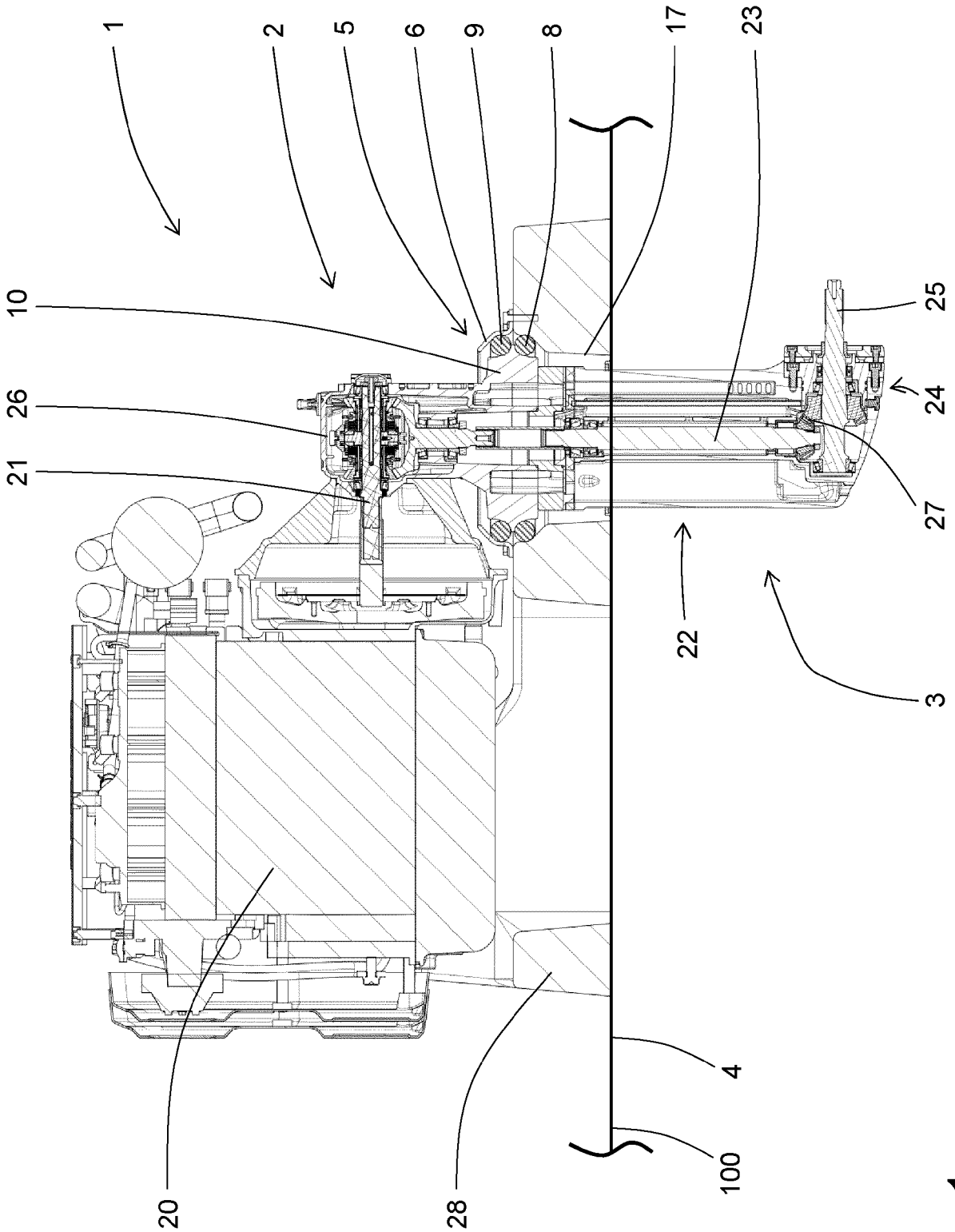

Fig. 1

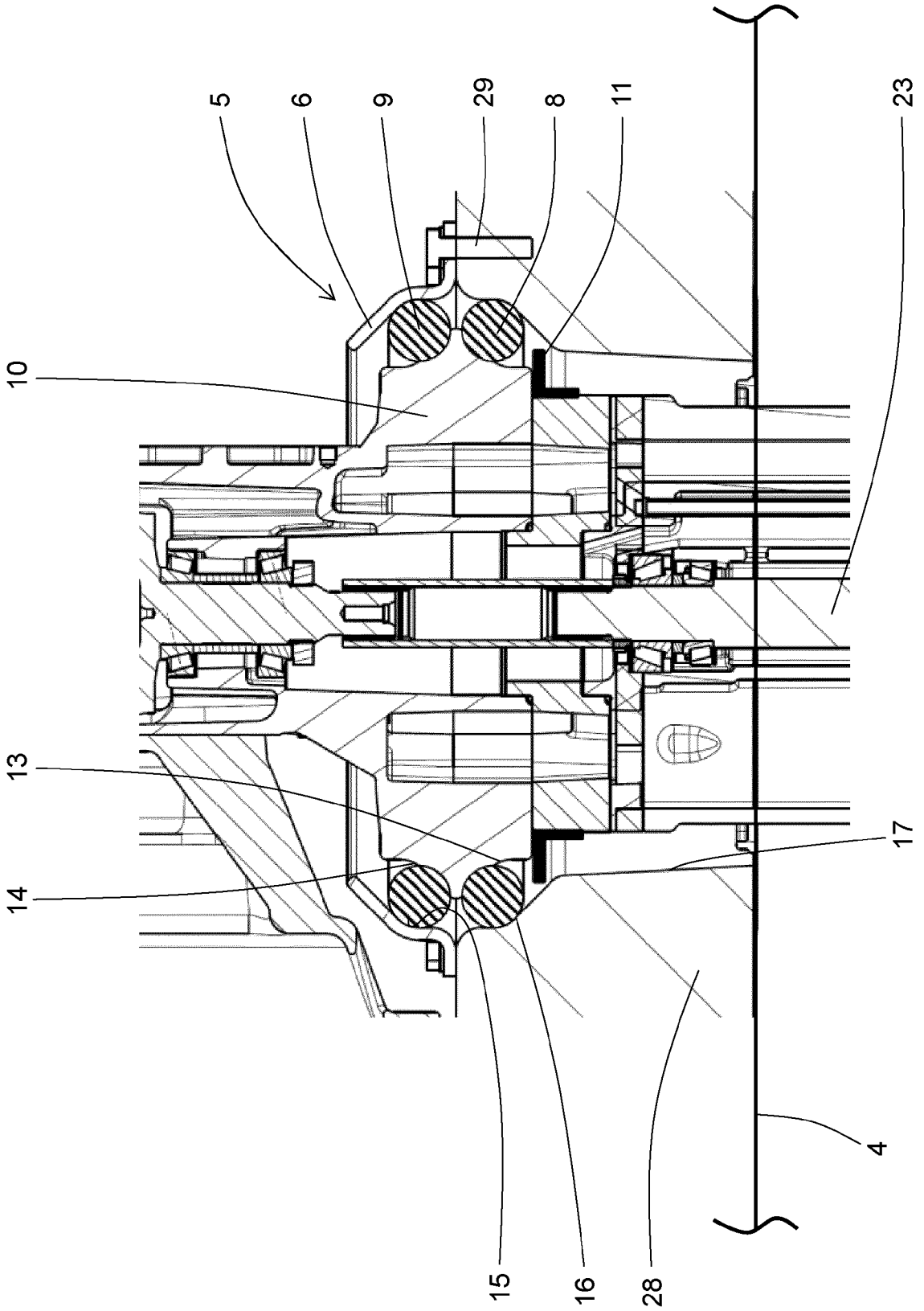

Fig. 2

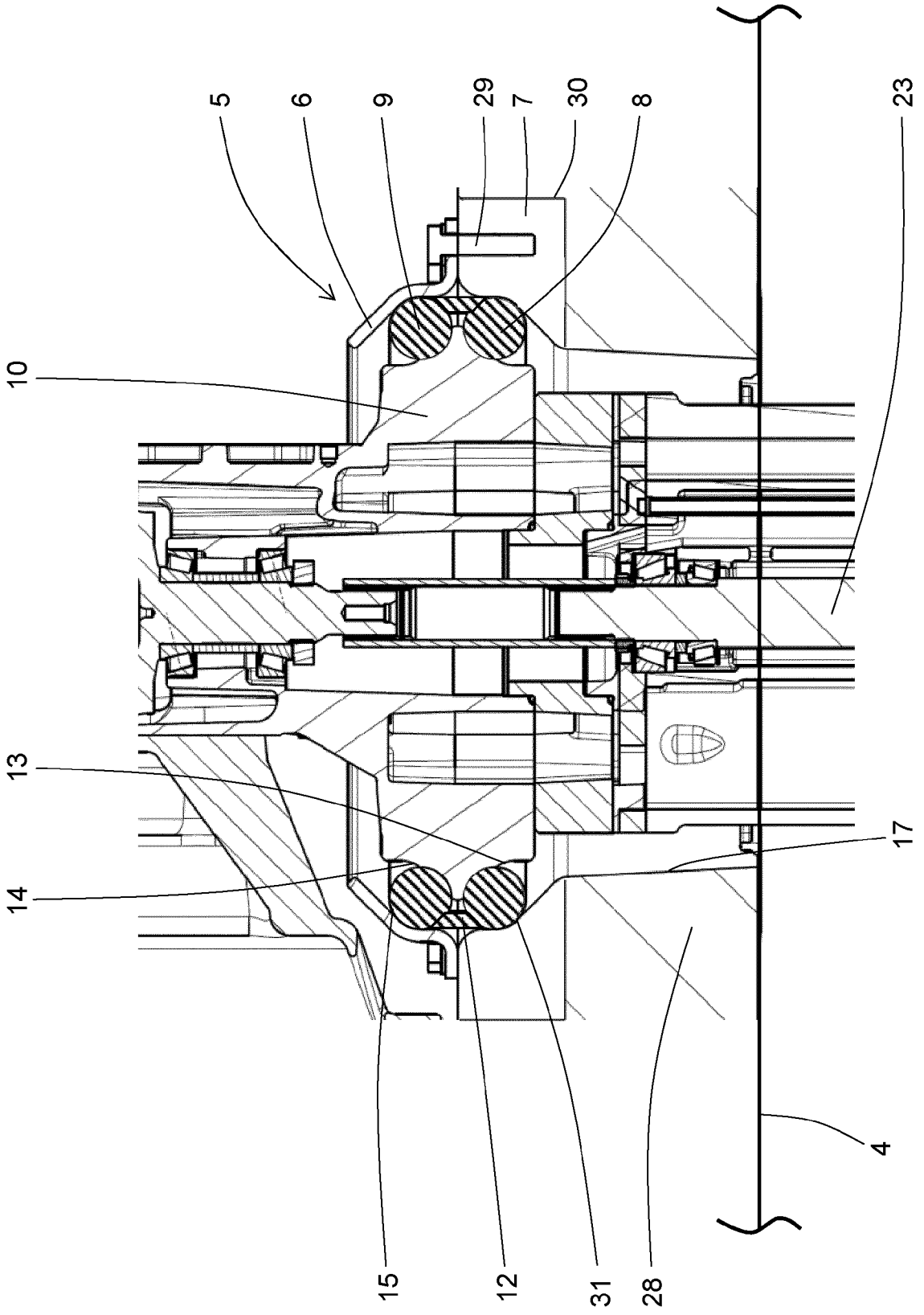

Fig. 3

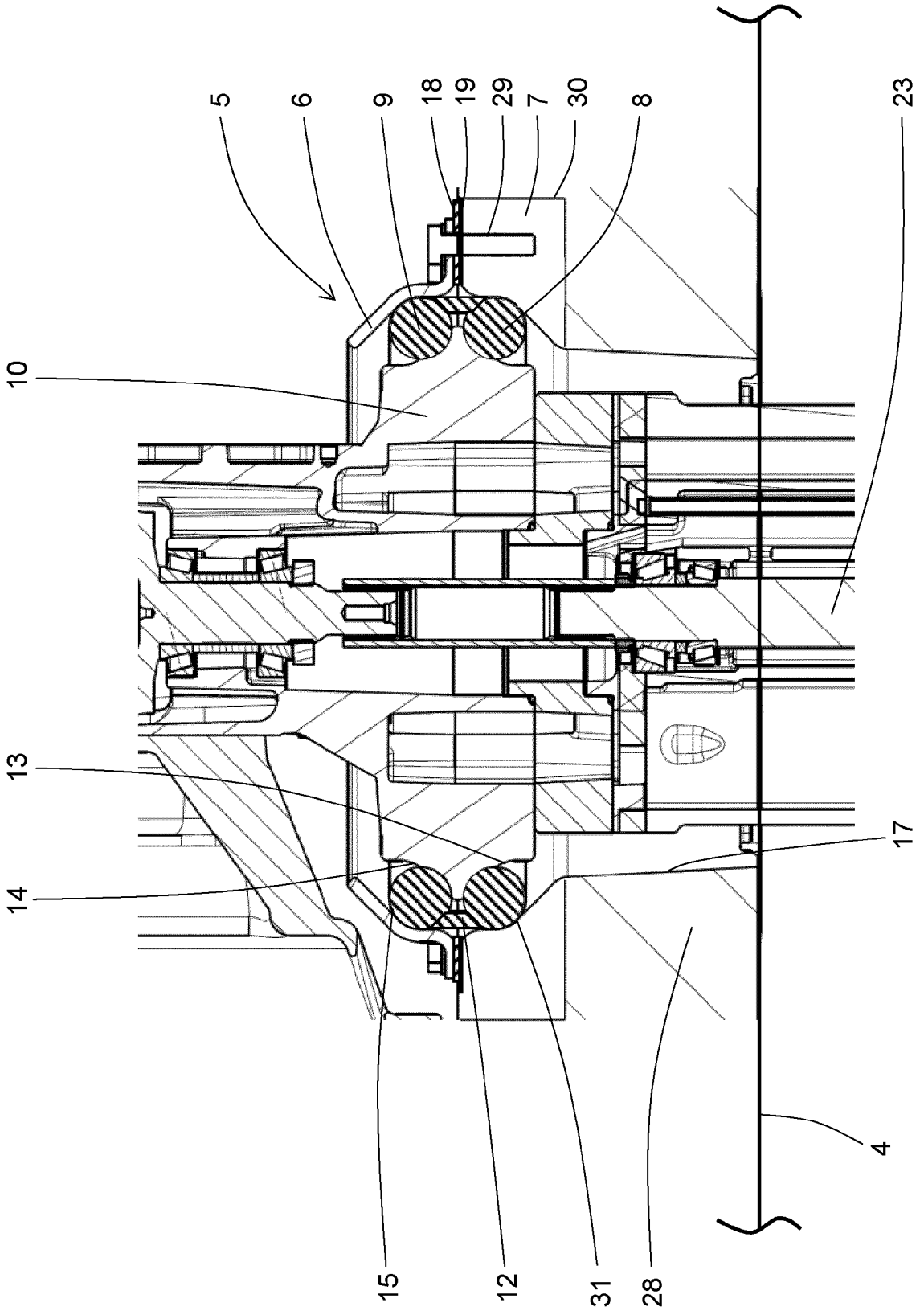

Fig. 4

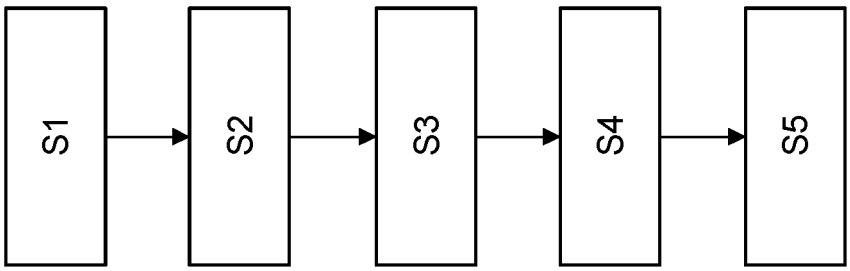

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 24 18 9618

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B63H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 January 2025	Gardel, Antony

CATEGORY OF CITED DOCUMENTS

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