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- **Basurto, Ferruccio**
Caselle di Selvazzano (PD) (IT)
- **Tranquillini, Massimo**
Caselle di Selvazzano (PD) (IT)
- **Straccio, Gianluca**
Caselle di Selvazzano (PD) (IT)
- **Selvaggi, Danilo**
Caselle di Selvazzano (PD) (IT)

(71) Applicants:

- **ZF Friedrichshafen AG**
88046 Friedrichshafen (DE)
- **ZF PADOVA S.r.l**
35030 Caselle di Selvazzano (PD) (IT)

(74) Representative: **ZF Friedrichshafen AG**
Gewerblicher Rechtsschutz
Löwentalerstraße 20
88046 Friedrichshafen (DE)

(72) Inventors:

- **Moruzzi, Paolo**
Caselle di Selvazzano (PD) (IT)

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Amended claims in accordance with Rule 137(2)
EPC.

(54) **CONTROL LEVER ASSEMBLY FOR A MARINE VESSEL**

(57) The present invention relates to a control lever assembly (1) for a marine vessel. Said control lever assembly (1) comprising a stationary base (3), a control lever (2) which is mounted rotatable about a rotation axis (4) on the stationary base (3). The control lever assembly (1) further comprising a rotation sensor (5) which is configured to determine a rotational position of the control lever (2) and a neutral position sensor (6) arranged at the control lever assembly (1) for determining a neutral position of the control lever (2).

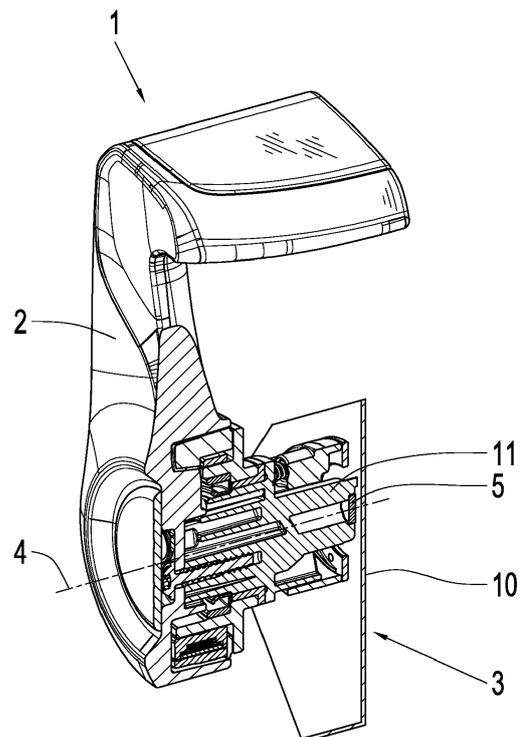


Fig. 1

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Description

[0001] The present invention relates to a control lever assembly for the control of a propulsion system in a marine vessel.

[0002] An example of a control lever assembly for marine vessels has been disclosed in US 2008/0283732 A1. It describes a control lever assembly comprising an optical potentiometer with a light emitter and a light collector. The optical potentiometer further comprises an opaque screen element for transmitting the light through the screen and detecting the light transmitted through the screen. The optical potentiometer is used to convert a rotational motion of the lever into a change in electrical signals. Such electrical signals can be used as control parameters regarding the propulsion system of the marine vessel.

[0003] The purpose of the present invention is to provide an improved control lever assembly for a marine vessel, especially with respect to a simple and compact design and a highly reliable function in a wide range of applicability.

[0004] This purpose is achieved by a control lever assembly for a marine vessel according to claim 1. Further preferred embodiments are claimed in dependent claims.

[0005] The control lever assembly comprising a stationary base, a control lever which is mounted rotatable about a rotation axis on the stationary base and a rotation sensor which is configured to determine a rotational position of the control lever. The control lever assembly comprises further a neutral position sensor which is arranged for determining a neutral position of the control lever. The neutral position may be an indexed position between several forward and several reverse positions of the control lever. The full range of rotation about the rotation axis of the control lever covers a forward range, a reverse range and the neutral position. The neutral position may correspond to a middle position of the control lever between the forward range and the reverse range. The neutral position may further correspond to zero movement of the control lever. While in the forward and reverse range there will be torque provided by the propulsion system of the marine vessel to drive at least one propeller, in the neutral position there will be no torque and driving power provided to drive the propeller.

[0006] The control lever assembly contains at least two sensors. A first sensor, namely the rotation sensor to detect the rotational positioning of the control lever in its full range of rotation, and a second sensor, namely the neutral position sensor to detect the neutral position of the control lever. The neutral position sensor enhancing the reliability and safety of the control system because the neutral position sensor acts independently from the rotation sensor and can be of a different technology.

[0007] Both sensors generating at the output thereof an electric signal which is representative of the movement and/or position of said lever, and the control lever assembly may further comprise signal processing means

for processing the electric signal generated at the output of said converter means.

[0008] To achieve a compact design, the rotation sensor can be positioned in the rotation axis, while the neutral position sensor can be positioned with a radial offset to the rotation axis. This way both sensors can be placed with some space between each other in one radial plane. Hence, space in the axial direction can be saved. The terms axial and radial in this specification refer to the rotation axis of the control lever if no other reference is given.

[0009] The rotation sensor can be a hall sensor, as an example. The rotation sensor may detect the full range of rotation of the control lever including the neutral position. Hence, the additional neutral position sensor is installed for getting a redundant signal for higher reliability.

[0010] In one embodiment the neutral position sensor is an optical sensor and comprises a light emitter a reflector and a light detector to detect a light signal emitted by the light emitter. In this document the term light is used for electromagnetic radiation of any wavelength and not only for visible light. Hence, the neutral range position will be detected with a sensor based on optical reflection. The detector can comprise a silicon phototransistor that is triggered by the detection of reflected light from the reflector. Just as one example the optical sensor can work with infrared light.

[0011] The reflector allows to position the light emitter and the light detector in one plane opposite to the reflector. The light emitter and the light detector can both be positioned stationary with regard to the base, while the reflector is mounted to rotate with the control lever. The reflector is mounted to the control lever in such a position to reflect the light to the light detector when the control lever is in the neutral position. One benefit of such an embodiment is the freedom to regulate the rotation angle of visibility of the reflector just by changing the dimension of the reflector. Additionally, the rotation angle of visibility can be adjusted by signal acquisition in an electronic circuit described below. These features allow to calibrate the detection range of the neutral position sensor by electronic hardware and by the dimension and design of the reflector. The edges of the reflector can be formed sharp-edged to reduce a possible light scattering problem.

[0012] One embodiment features a control lever with a shaft which is arranged to rotate about said rotation axis. The reflector in this embodiment is fixed to the shaft with a radial offset to the rotation axis. Preferably the reflector may be fixed to one end of the shaft in a first plane which is perpendicular to the rotation axis. The light emitter and the light detector can be positioned in another plane which is parallel to the first plane with a little distance between the first and second plane. This distance can be called the working distance or the working gap of the optical sensor consisting of the light emitter, the reflector and the light detector.

[0013] In one embodiment the light emitter and the light detector are both mounted on a printed circuit board,

known as PCB. This PCB can be positioned in said second plane which is arranged perpendicular to the rotation axis of the control lever. Thereby the neutral position sensor or parts of it can be integrated in the signal processing unit as discrete components being soldered onto the PCB in a very compact design. The rotation sensor or parts of it can as well be integrated in the signal processing unit and being soldered onto the PCB.

[0014] According to a further embodiment, the light emitter is arranged to emit a frequency signal and the light detector is arranged to detect such a frequency signal. The optical sensor can be driven by a photodiode emitting a frequency signal. The acquisition of the signal is also based on reading the frequency and not an on/off level of the signal. The use of frequency signal instead of on/off signal guarantees the detection of malfunction on the sensor or in the microcontroller. Reliability is further improved by this feature.

[0015] The invention and further benefits will be further described, by way of example only, and with reference to the accompanying drawings, in which:

Fig. 1 shows a schematic of a control lever assembly according to the invention;

Fig. 2 shows a section of the control lever assembly of Fig. 1 in a top view;

Fig. 3 shows a detail of Fig. 2 in an enlarged view and

Fig. 4 shows a diagram with the relation between mechanical angle of the control lever and the response signal of the neutral position sensor.

[0016] The control lever assembly 1 shown in Fig. 1 and Fig. 2 comprises a stationary base 3, a control lever 2 which is mounted rotatable about a rotation axis 4 on the stationary base 3. A PCB 10 is part of the stationary base 3.

[0017] The control lever assembly 1 further comprises a rotation sensor 5 which is configured to determine a rotational position of the control lever 2. This rotation sensor 5 of this embodiment is a hall effect rotary sensor which it is positioned at the rotation axis 4. A neutral position sensor 6 is arranged at the control lever assembly 1 to determine a neutral position of the control lever 2. The neutral position sensor 6 is positioned with a radial offset to the rotation axis 4. Hence, the neutral position sensor 6 and the rotation sensor 5 are positioned with a distance between each other in radial direction.

[0018] As can be seen in Fig. 3 the neutral position sensor 6 comprises a light emitter 7 a reflector 9 and a light detector 8. The light emitter 7 and the light detector 8 are both mounted on the PCB 10 and hence are stationary with regard to the base 3. Whereas the reflector 9 is fastened to the shaft 11 and rotates with the control lever 2 about rotation axis 4. With regard to a horizontally oriented rotation axis 4 the PCB 10 with the light emitter

7 and the light detector 8 is put in a vertical plane in a way, that there is only a small gap between the light emitter 7 and reflector 9. Said small gap is the working distance of the optical neutral position sensor 6 and can be in a range of about 1 mm. This allows a very compact arrangement of the sensors. The whole control lever assembly 1 can be of a simple and compact design.

[0019] The rotation sensor 5 comprises a magnet 12 as a moving element of the rotation sensor 5. The magnet 12 is fixed to the shaft 11 and rotating with the control lever 2 about the rotation axis 4, while a stationary part of the rotation sensor 5 is fixed onto the PCB 10.

[0020] Eventually Fig. 4 shows a diagram with the electric signaling of the rotation sensor 5 and the neutral position sensor 6 depending on the rotational position of the control lever 2. The position of the control lever 2 is plotted against the horizontal axis. A **neutral position is defined as a small range from N' to N around the exact middle position at 0°**. The electric signals of the sensors 5 and 6 in the connected electronic circuit are plotted against the vertical axis.

[0021] A dashed line indicates the response to the signal of the rotation sensor 5. The control logic of the rotation sensor 5 in this embodiment covers a rotation range of the control lever between - 70° and + 70° with regard to an exact middle position at 0°, wherein -70° corresponds to full astern command and +70° corresponds to a full ahead command of the user.

[0022] A bold continuous line indicates the response of the optical state logic based on the signal of the neutral position sensor 6 that can be adjusted by calibration of the electronic circuit and by the dimension of the mechanical reflector 8. In this embodiment, the neutral detection by the neutral position sensor 6 is calibrated to overlap the band of the defined neutral position between N' and N by a certain margin.

Referrals

[0023]

1	control lever assembly
2	control lever
3	base
4	rotation axis
5	rotation sensor
6	neutral position sensor
7	light emitter
8	light detector
9	reflector
10	PCB, printed circuit board
11	shaft
12	magnet

Claims

1. Control lever assembly (1) for a marine vessel com-

- prising a stationary base (3), a control lever (2) which is mounted rotatable about a rotation axis (4) on the stationary base (3), a rotation sensor (5) which is configured to determine a rotational position of the control lever (2), **characterized by** a neutral position sensor (6) arranged at the control lever assembly (1) for determining a neutral position of the control lever (2).
2. Control lever assembly (1) according to claim 1, wherein the rotation sensor (5) is located at the rotation axis (4) and wherein the neutral position sensor (6) is positioned with a radial offset to the rotation axis (4).
 3. Control lever assembly (1) according to claim 1 or 2, wherein the neutral position sensor (6) comprises a light emitter (7) a reflector (9) and a light detector (8).
 4. Control lever assembly (1) according to claim 3, wherein the light emitter (7) and the light detector (8) are both positioned stationary with regard to the base (3) and wherein the reflector (9) is mounted to rotate with the control lever (2).
 5. Control lever assembly (1) according to claim 4, wherein the control lever (2) comprises a shaft (11) which is arranged to rotate about the rotation axis (4), and wherein the reflector (9) is fixed to the shaft (11) with a radial offset to the rotation axis (4).
 6. Control lever assembly (1) according to one of claims 3 to 5, wherein the light emitter (7) and light detector (8) are both mounted on a printed circuit board (10).
 7. Control lever assembly (1) according to one of claims 3 to 6, wherein the light emitter (7) is arranged to emit a frequency signal and wherein the light detector (8) is arranged to detect a frequency signal.
2. Control lever assembly (1) according to claim 1, wherein the rotation sensor (5) is located at the rotation axis (4) and wherein the neutral position sensor (6) is positioned with a radial offset to the rotation axis (4).
 3. Control lever assembly (1) according to claim 1 or 2, wherein the light emitter (7) and the light detector (8) are both positioned stationary with regard to the base (3) and wherein the reflector (9) is mounted to rotate with the control lever (2).
 4. Control lever assembly (1) according to claim 3, wherein the control lever (2) comprises a shaft (11) which is arranged to rotate about the rotation axis (4), and wherein the reflector (9) is fixed to the shaft (11) with a radial offset to the rotation axis (4).
 5. Control lever assembly (1) according to one of claims 1 to 4, wherein the light emitter (7) and light detector (8) are both mounted on a printed circuit board (10).
 6. Control lever assembly (1) according to one of claims 1 to 5, wherein the light emitter (7) is arranged to emit a frequency signal and wherein the light detector (8) is arranged to detect a frequency signal.

Amended claims in accordance with Rule 137(2) EPC.

1. Control lever assembly (1) for the control of a propulsion system in a marine vessel comprising a stationary base (3), a control lever (2) which is mounted rotatable about a rotation axis (4) on the stationary base (3), a rotation sensor (5) which is configured to determine a rotational position of the control lever (2), wherein a neutral position sensor (6) is arranged at the control lever assembly (1) for determining a neutral position of the control lever (2), **characterized in that** the neutral position sensor (6) comprises a light emitter (7) a reflector (9) and a light detector (8).

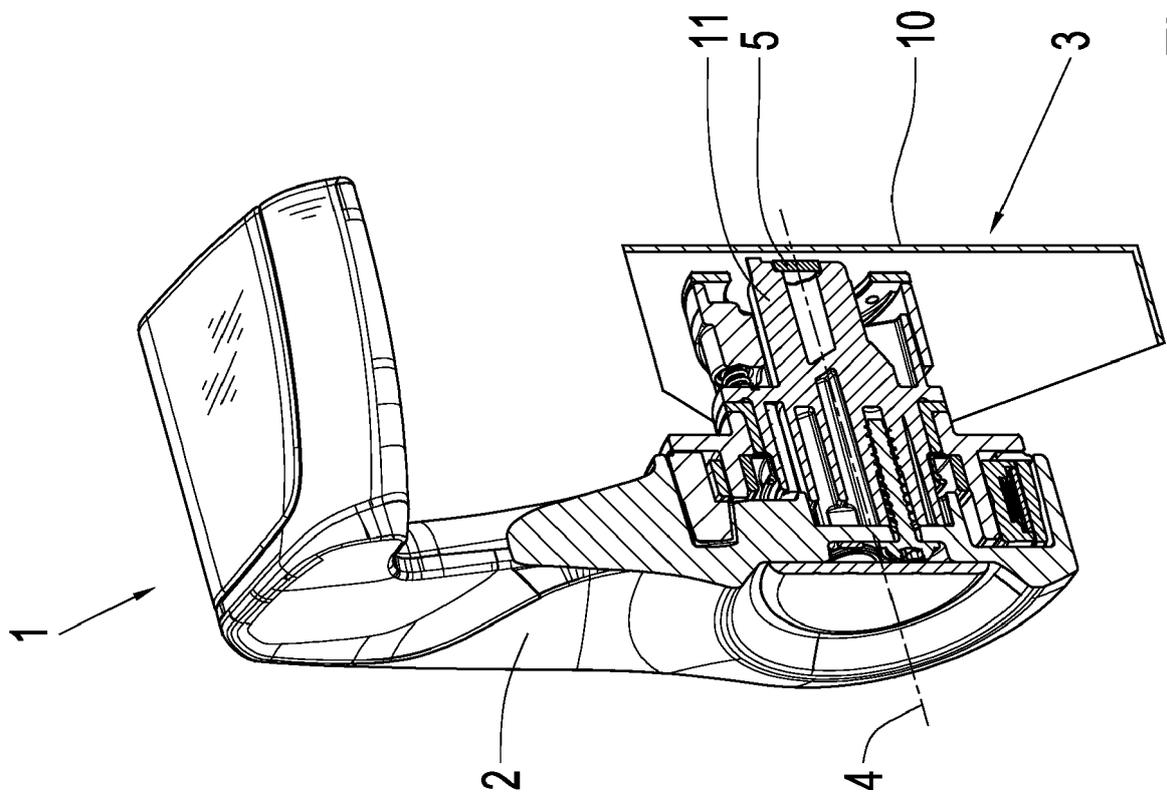


Fig. 1

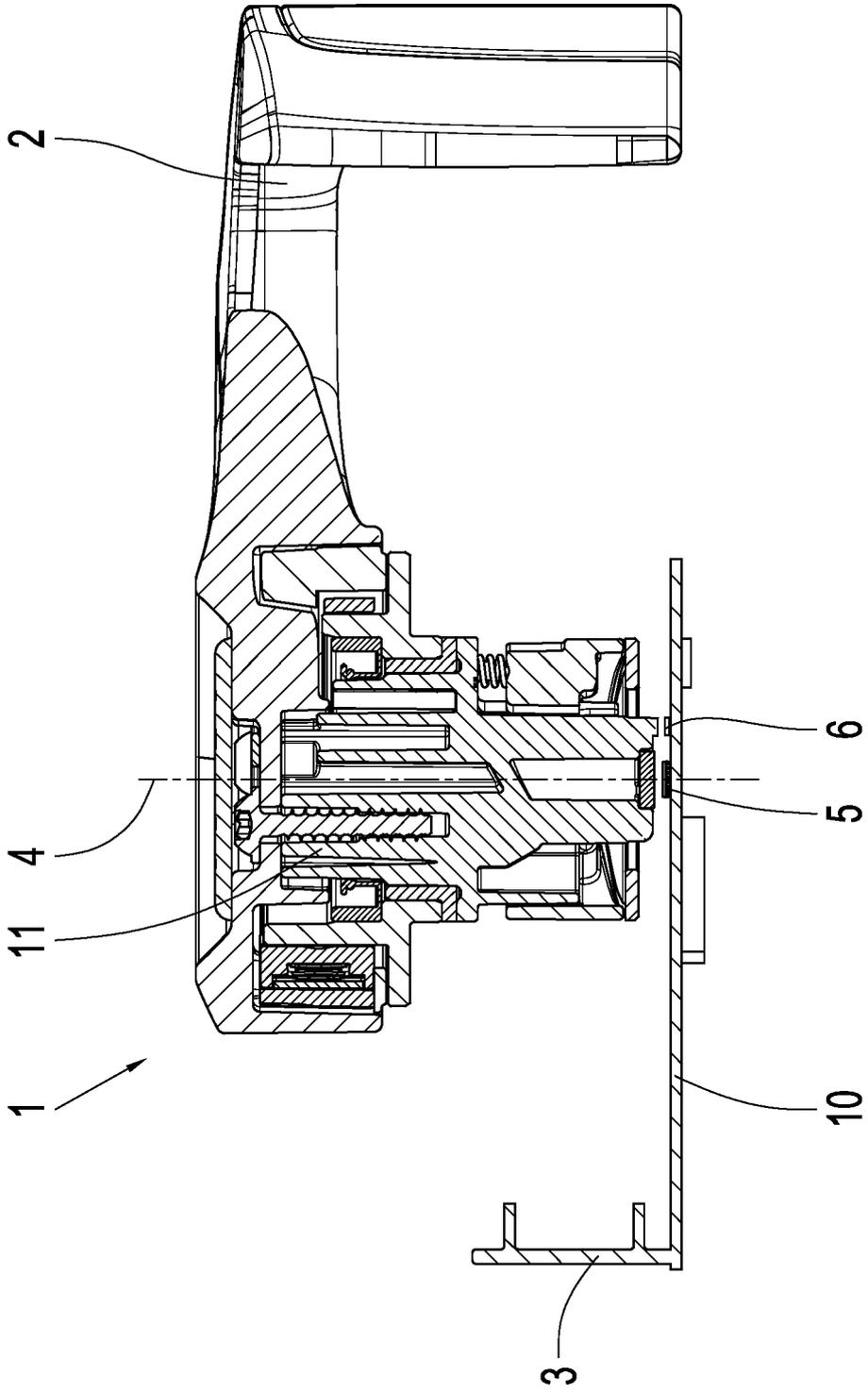


Fig. 2

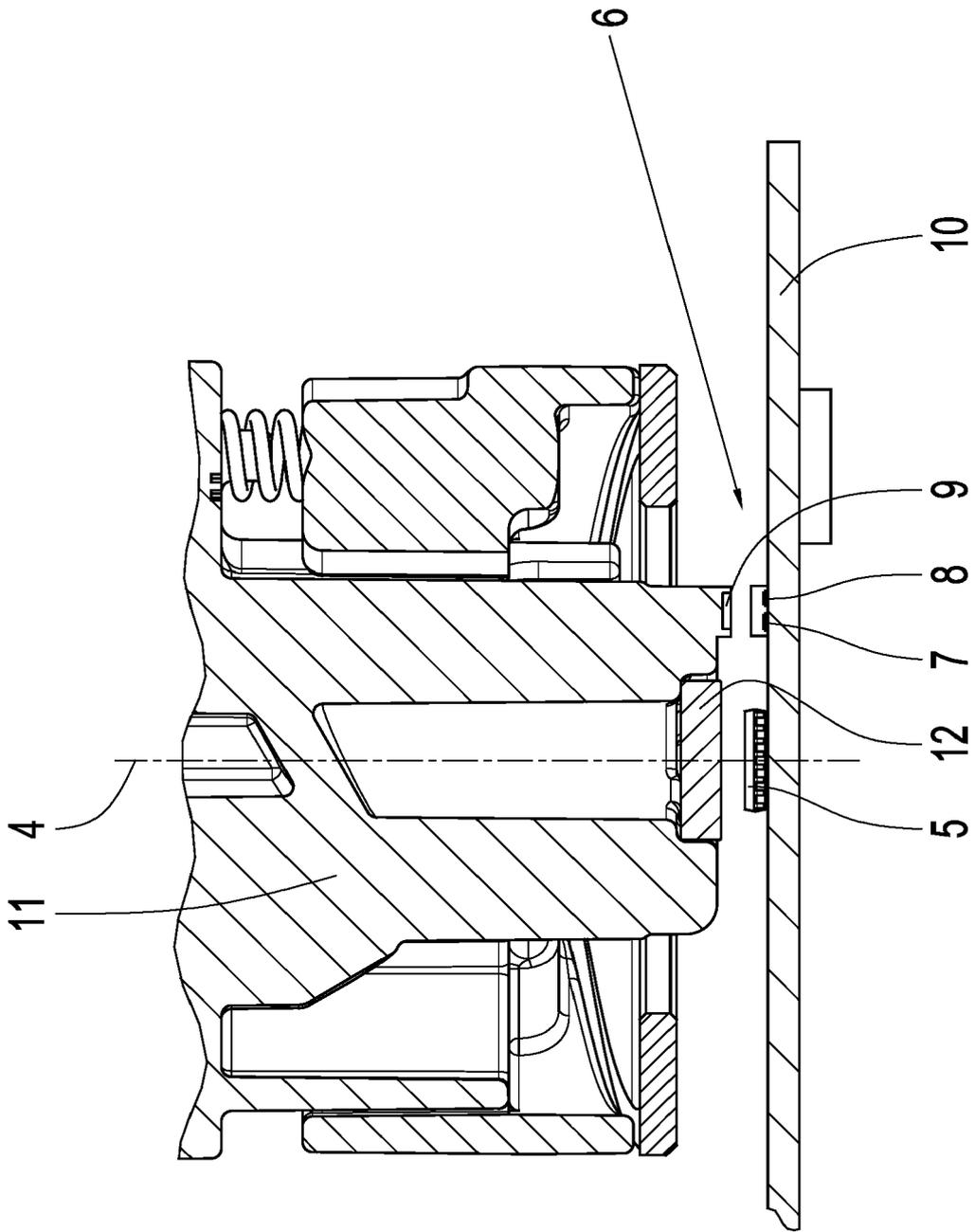


Fig. 3

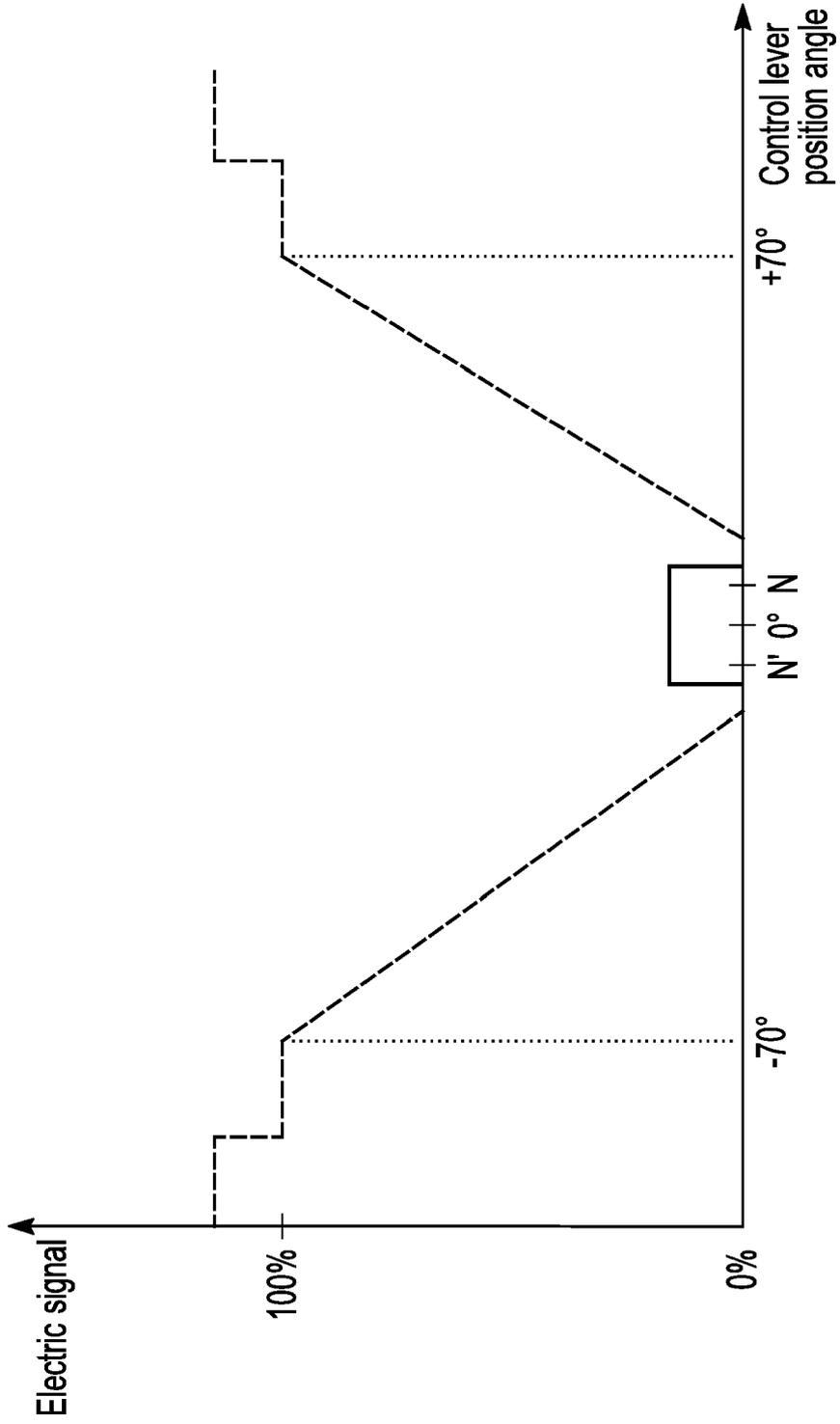


Fig. 4



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Application Number

EP 22 17 2004

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A	* figures 1a, 1b, 1c, 7a * * paragraphs [0034], [0043], [0051], [0069], [0070] *	2	
X	US 2012/077394 A1 (BANKS DAVID [US] ET AL) 29 March 2012 (2012-03-29) * figures 1, 8, 11 * * paragraphs [0002], [0119], [0121] *	1-7	
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Y	* figures 7, 8 *	3-7	
A	* column 6, line 31 - line 38 *	2	
Y	US 2008/283732 A1 (ROSENKRANZ HANS-GUNTHER [AU] ET AL) 20 November 2008 (2008-11-20)	3-7	TECHNICAL FIELDS SEARCHED (IPC) G05G B63H
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 November 2022	Examiner Rossatto, Cédric
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ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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