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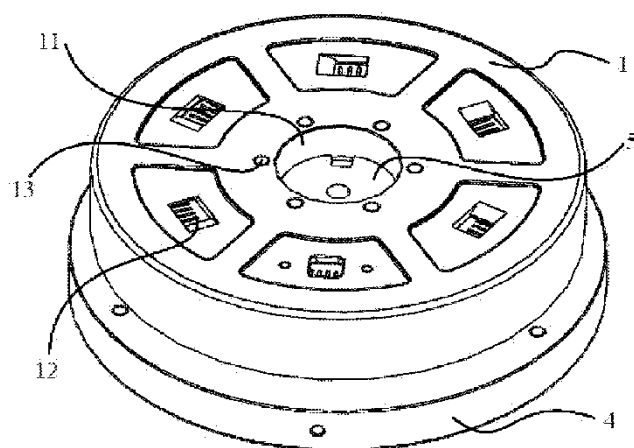


Fig. 1

(57) Abstract: A rotating structure for a laser radar. The structure comprises a stator (4), a motor winding (2), a rotor pressing cover (6), a rotor (1), and a bearing (3). The stator (4) drives the rotor (1) to rotate after being energized, thereby driving a laser radar assembly mounted at an upper portion of the rotor (1) to rotate. The rotating structure for a laser radar employs a design based on a hollow shaft having a large diameter, and portions of the stator (4) and the rotor (1) form the hollow shaft, thus leaving enough space in the middle to accommodate a signal transmission structure and an electrical energy transmission structure. In this way, the present invention ensures stability of the rotating shaft, improves shock resistance of the rotating structure, and prevents mutual interference of signal transmission systems.

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(84) Designated countries (each of which is required to provide regional protection unless otherwise specified): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Asia (AM, AZ, BY, KG, KZ, RU, TJ, TM), Europe (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Statement according to Rule 4.17:

- About the applicant's right to apply for and be granted a patent (Rule 4.17(ii))
- About the applicant's right to claim priority rights for a prior application (Rule 4.17(iii))
- Inventor qualifications (Rule 4.17(iv))

This international publication:

- Includes international search report (Article 21(3) of Treaty)

(57) Abstract: A rotating structure for a laser radar comprises a stator (4), a motor winding (2), a rotor pressing cover (6), a rotor (1), and bearings (3). Herein, the stator (4) drives the rotor (1) to rotate after being energized, thereby driving a laser radar assembly mounted at an upper portion of the rotor (1) to rotate. The rotating structure for a laser radar employs a design based on a hollow shaft having a large diameter, and portions of the stator (4) and the rotor (1) form a shaft system, thus leaving enough space in the middle to accommodate a signal transmission structure and an electrical power transmission structure. In this way, the present invention ensures stability of the rotating shaft, improves shock resistance of the rotating structure, and prevents mutual interference of signal transmission systems.

Rotating Structure for Laser Radar

Technical Field

The present utility model relates to the field of rotating structures and particularly to a rotating structure for use on a laser radar.

Background Art

With the rapid development of the field of intelligent radar technology, the field of application of radar has gradually widened, and rotary radar has become increasingly valued by various industries due to its convenience. Rotating radar structures come in many styles, but there are still many problems.

At present, laser rangefinder radars are mostly divided into two upper and lower parts, with the lower part being the rotary base and the upper part being the laser transceiver assembly that is driven to rotate. The rotating base of the laser rangefinder radar is typically a single solid shaft structure with smaller diameter due to the limitations in signal transmission and power supply. However, since the upper part of the laser transceiver assembly weighs at least 600 g, this small-diameter uniaxial design is easily damaged by external force vibration with the high-speed rotation of the radar, thereby affecting the normal use of the laser rangefinder radar.

Summary of the Utility Model

In order to solve the above problems, a rotating structure for a laser radar employs a design based on a hollow shaft having a large diameter, and portions of the rotary system's stator and rotor form a shaft system, thus leaving enough space in the middle to accommodate a signal transmission structure and an electrical power transmission structure. This ensures stability of the rotating shaft, improves shock resistance of the rotating structure, and prevents mutual interference of signal transmission systems.

In particular, the present utility model provides a rotating structure of a laser radar, which is characterized in that it comprises a stator. The stator comprises a stator base and a stator body, with stator body being ring-shaped and configured at the center of the stator body [sic: base]. There is a motor coil, and the motor coil is configured on the outer side of the stator body. There is a rotor gland, and the rotor gland is ring-shaped. The rotor gland is firmly mounted on the inner side of the rotor body. There is a rotor, and the rotor has a cylindrical shape. The center of the end surface of the rotor is configured with a rotor mounting module. The rotor mounting module is firmly connected to the rotor gland so that the rotor is firmly connected to the stator. There are also bearings, and the bearings are mounted between the rotor [sic: stator] and the rotor mounting module, supporting the rotation of the rotor. After electrical power is applied to the stator, the stator drives the rotor to rotate, thereby driving the rotation of the laser radar assembly mounted on the upper part of the rotor.

Preferably, the rotating structure further comprises a first bearing and a second bearing. The inner side of stator body is configured with an annular bulge facing a central shaft. The first bearing is configured on the upper portion of the annular bulge, and second bearing is configured on the lower portion of the annular bulge and the upper portion of the rotor gland.

Preferably, the rotating structure further comprises an electrical power transmission unit configured on the inner side of the stator body used for supplying electrical power to the rotating structure as well as a signal transmission unit used for enabling the conversion of signals.

Preferably, the electrical power transmission unit comprises a first coupling coil and a second coupling coil, wherein the first coupling coil is cylindrical and is configured on the inner side of the stator body, while second coupling coil is configured on the stator base.

Preferably, the first coupling coil is configured with a through hole in the center, and the signal transmission unit is configured inside the through hole.

Preferably, at least one hollowed-out heat dissipation hole is configured on the end face of the rotor.

Preferably, mounting holes are also configured on the end face of the rotor, used for mounting the laser radar assembly.

Preferably, a stator [sic: rotor] mounting module is a hollow cylindrical structure having a diameter greater than or equal to the diameter of first coupling coil and less than or equal to the diameter of bearing. The first coupling coil is located on the inner side of the rotor mounting module after installation.

Preferably, the rotor mounting module is configured with external threads. Correspondingly, the inner side of the rotor gland is configured with internal threads. During installation, the rotor mounting module is screwed into the rotor gland and firmly connected with it.

Preferably, a heat dissipation module is configured on the end face of the rotor, and the heat dissipation module is a fan structure formed through the thinning of the end face of the rotor.

Compared with the prior art, the technical advantages of the present utility model are as follows:

- 1) In the present utility model, the stator, rotor, and bearing parts of the rotary system are integrated into a shaft system, which prevents the interference of magnetic force between the rotor and stator during installation, simplifies the installation step, and improves the accuracy of installation.
- 2) The present utility model installs the signal transmission structure and the electrical power transmission structure on the inner side of the shaft system integrated with stator, rotor, and bearing parts to prevent interference with the power transmission. When the radar is operated at high speed, it can ensure the smoothness of the rotating shaft while having high impact resistance.
- 3) The present utility model configures the rotor as an outer casing structure, which encases the stator and bearing and their internal signal transmission and electrical power transmission structures and increases the electromagnetic immunity of the rotating structure.

Explanations of Attached Drawings

Fig. 1 is a structural diagram of a laser radar rotating structure consistent with a preferred example of the present utility model.

Fig. 2 is a longitudinal cross-sectional view of the rotating structure of Fig. 1.

Fig. 3 is a structural diagram of the rotating structure of Fig. 1 without a rotor installed.

Fig. 4 is a structural diagram of the bearings and rotor gland of the rotating structure of Fig. 1.

Fig. 5 is a structural diagram of a rotor in the rotating structure of Fig. 1.

Drawing reference numbers:

- 1- rotor, 11-rotor mounting module, 12-heat dissipation hole, 13-mounting hole
- 2- motor coil
- 3- bearing
- 4- stator, 41-stator body, 42-stator base
- 5- first coupling coil, 51-through hole
- 6- rotor gland

Description of Embodiments

The advantages of the present utility model are described in detail below making use of the attached drawings and specific examples.

Referring to Figs. 1 and 2, Fig. 1 shows a structural diagram of a rotating structure consistent with a preferred example of the present utility model and a longitudinal view thereof. It can be seen from Figs. 1 and 2 that the rotating structure provided in this example mainly includes the stator (4), the motor coil (2), the rotor gland (6), and the bearings (3). The specific locations and interconnections are as follows:

- Stator (4)

The stator comprises a stator base (42) and a stator body (41). The stator base (42) is cylindrical, and stator body (41) is ring-shaped. The stator body (41) is configured at the center of stator base (42) and maintains a concentric coaxial configuration with the stator base (42).

- Motor coil (2)

The motor coil (2) is configured on the outer side of stator body (41) and is also arranged concentrically and coaxially with the stator body and the stator base.

- Rotor gland (6)

The rotor gland (6) is also ring-shaped, and rotor gland (6) can be firmly mounted on the inner side of the stator body (41) using the method of flanged edges, etc., with the outer diameter of the rotor gland (6) equal to or slightly smaller than the inner diameter of the stator body (41).

- Rotor (1)

The rotor (1) is in the shape of a cylinder. The central position of the end face of rotor (1) is configured with a rotor mounting module (11), which is firmly connected with rotor gland (6), so that rotor (1) is firmly connected with the stator (4). In this example, after rotor (1) is installed on the stator (4), the stator (4) encloses the motor coil (2) and the stator body (41) inside, thereby achieving the effect of electromagnetic shielding.

- Bearings (3)

The bearings (3) are mounted between the rotor (1) and the rotor mounting module (11) for supporting the rotation of the rotor (1).

In the rotating structure of the present utility model, when the stator (4) is connected to electrical power, the stator (4) first drives the rotor (1) to rotate, thereby using the rotor (1) to drive a laser radar assembly mounted on the upper part of the rotor (1) to rotate.

In view of the aforementioned configuration, the stator, rotor, and bearing parts of the rotary system are integrated into a shaft system in this example, which prevents the interference of magnetic force between the rotor and the stator during installation, simplifies the installation step, and improves the installation accuracy. At the same time, the cylindrical rotor structure is used in this example to encase the stator body, motor coil, bearings, and other structures inside, and the outer cover formed by the rotor increases the electromagnetic immunity of the rotating structure.

Further referring to Fig. 2, in this example, preferably the rotating structure comprises two bearings, a first bearing and a second bearing (not marked), while the inner side of stator body is configured with an annular bulge facing the central shaft such that first bearing is configured on the upper portion of the annular bulge, and second bearing is configured on the lower portion of the annular bulge and the upper portion of the rotor gland.

Referring further to Fig. 3, which is a structural diagram of the rotating structure of Fig. 1 when the rotor is not installed, it can be seen from the diagram that in this example, the rotating structure further includes an electrical power transmission unit (not marked) configured on the inner side of stator body (41) as well as a signal transmission unit (not marked). The electrical power transmission unit may provide electrical power to the rotating structure to initiate the rotating structure's operation, while the signal transmission unit may enable signal conversion, such as converting the signal received by the radar into an optical signal and passing it to the main board in the chassis. In view of the aforementioned configuration, compared with the external configuration in the prior art, this example effectively prevents the mutual interference of electrical power transmission and signal transmission in the system.

In particular, referring to Figs. 2 and 3, it can be seen that electrical power transmission unit includes a first coupling coil (5) and a second coupling coil (not marked), wherein first coupling coil (5) is cylindrical and is configured on the inner side of the stator body (41) and coaxial with the stator body (41), while second coupling coil is configured on the stator base (42). After the installation of the rotating structure is complete, a gap is maintained between the first and second coupling coils, thereby enabling the provision of electrical power to the rotating structure through the base to drive the rotating structure to operate in the situation of being cable-free. The above design uses the built-in coupling coil configuration instead of the external wire configuration. On the one hand, it avoids the safety hazards caused by various complex wires intersecting each other, and on the other hand, simplifies the installation process.

Furthermore, referring to Fig. 4, which is a structural diagram of the bearings and rotor gland of the rotating structure in Fig. 1, it can be seen from the diagram that in this example, a through hole (51) is configured in the center of first coupling coil (5), and signal transmission unit is configured in through hole, which further saves the space of the external signal transmission unit while preventing interference between various transmission units or cables.

In addition, referring to Fig. 1, preferably, where at least one hollowed-out heat dissipation hole (12) is configured on the end face of the rotor (1), the heat generated during the operation of the rotating structure inside it can be released in time, increasing the operating life of the rotating structure.

Referring to Fig. 1, preferably, mounting holes (13) are also configured on the end face of the rotor (1) for mounting the laser radar assembly, so that when the rotor (1) is running, the laser radar assembly can be driven coaxially and at the same speed, and the stability of the laser radar assembly operation can be improved.

Referring to Fig. 5, preferably, Fig. 5 is a structural diagram of the rotor of the rotating structure in this example. It can be seen from the diagram that the mounting module (11) of the stator [sic: rotor] (1) is a hollow cylindrical structure with a diameter greater than or equal to the diameter of first coupling coil (5) and less than or equal to the diameter of bearing (3). In addition, it can also be seen from Fig. 4 that external threads are configured on the mounting module (11) of the stator [sic: rotor] (1), and correspondingly, internal threads are configured on rotor gland (6). During installation, rotor (1) is screwed into the rotor gland (6) and firmly connected with it. Thus, the tightness of the connection between the rotor and the stator is further guaranteed.

Referring to Fig. 1, a heat dissipation module is configured on the end face of the rotor (1), and the heat dissipation module is a fan structure (not marked) formed through the thinning of the end face of rotor. In view of the above configuration, the contact area of the rotor (1) with the upper rotating assembly may be reduced, thereby forming a heat dissipation passage and improving the heat dissipation efficiency of the internal rotating structure.

In summary, the present utility model adopts the design of a hollow shaft system with a large diameter at the bottom. The stator and rotor portion of the rotary system are made into a shaft system, and there is sufficient space in the middle to place the signal transmission structure and the electrical power transmission structure. In the situation of not interfering with each other, this can ensure the smoothness of the rotary shaft when the radar is rotating at a high speed during operation while also having high impact resistance.

It should be noted that the examples of the present utility model have better implementability and do not limit the present utility model in any form. Any person skilled in the art may change or modify the technical content disclosed above to equivalent effective examples, but any modification or equivalent change and modification made to the above examples according to the technical substance of the present utility model without departing from the content of the technical solution of the utility model, shall still fall within the scope of the technical solution of the present utility model.

Claims

1. A rotating structure for laser radar is characterized in that it comprises:

There is a stator. The stator comprises a stator base and a stator body, with stator body being ring-shaped and configured at the center of the stator body [sic: base].

There is a motor coil, and motor coil is configured on the outer side of stator body.

There is a rotor gland, and rotor gland is ring-shaped. The rotor gland is firmly mounted on the inner side of rotor body.

There is a rotor, and rotor has a cylindrical shape. The center of the end surface of rotor end face is configured with a rotor mounting module.

The rotor mounting module is firmly connected to rotor gland so that rotor is firmly connected to stator.

There are also bearings, and bearings are mounted between rotor and rotor mounting module, supporting the rotation of the rotor. After electrical power is applied to stator, stator drives rotor to rotate, thereby driving the rotation of the laser radar assembly mounted on the upper part of rotor.

2. The rotating structure of Claim 1 is characterized in that:

The rotating structure comprises a first bearing and a second bearing.

The inner side of stator body is configured with an annular bulge facing the central shaft

The first bearing is configured on the upper portion of annular bulge.

The second bearing is configured on the lower portion of annular bulge and the upper portion of rotor gland.

3. The rotating structure of Claim 1 is characterized in that:

It further comprises an electrical power transmission unit configured on the inner side of stator body used for supplying electrical power to the rotating structure as well as a signal transmission unit used for enabling the conversion of signals.

4. The rotating structure of Claim 2 is characterized in that:

The electrical power transmission unit comprises a first coupling coil and a second coupling coil, wherein the first coupling coil is cylindrical and is configured on the inner side of stator body, while second coupling coil is configured on the stator base.

5. The rotating structure of Claim 3 is characterized in that:

The first coupling coil is configured with a through hole in the center, and the signal transmission unit is configured inside the through hole.

6. The rotating structure of Claim 1 is characterized in that:

At least one hollowed-out heat dissipation hole is configured on the end face of rotor.

7. The rotating structure of Claim 1 is characterized in that:

Mounting holes are also configured on the end face of rotor, used for mounting the laser radar assembly.

8. The rotating structure of Claim 1 is characterized in that:

The mounting module of rotor is a hollow cylindrical structure having a diameter greater than or equal to the diameter of first coupling coil and less than or equal to the diameter of bearing.

The first coupling coil is located on the inner side of rotor mounting module after installation.

9. The rotating structure of Claim 1 is characterized in that:

The rotor mounting module is configured with external threads. Correspondingly, the inner side of the rotor gland is configured with internal threads. During installation, the rotor mounting module is screwed into the rotor gland and firmly connected with it.

10. The rotating structure of Claim 1 is characterized in that:

A heat dissipation module is configured on the end face of rotor, and heat dissipation module is a fan structure formed through the thinning of the end face of rotor.

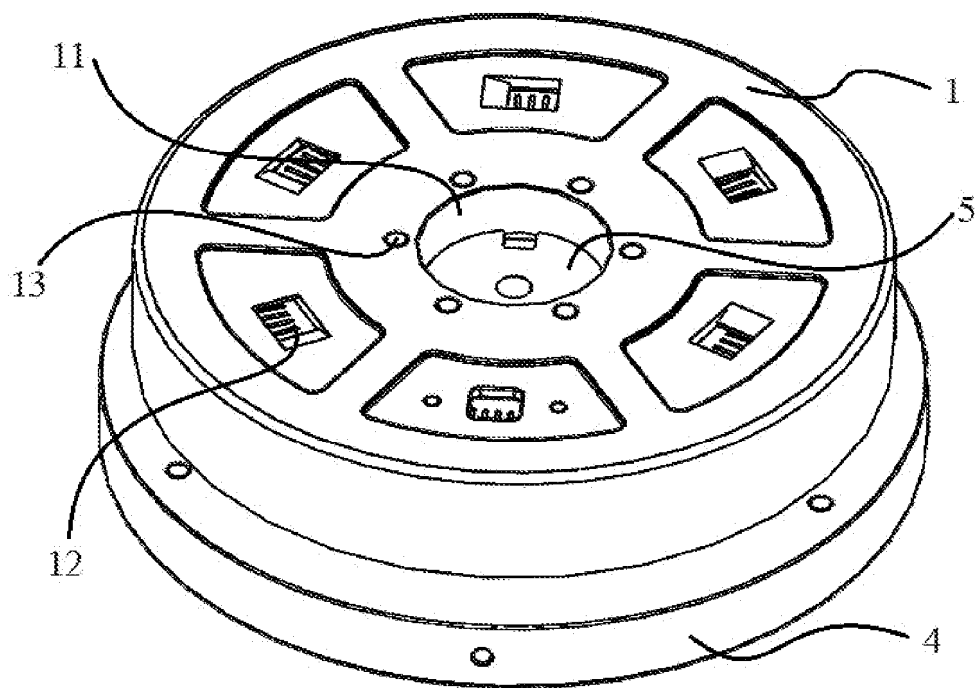


Figure 1

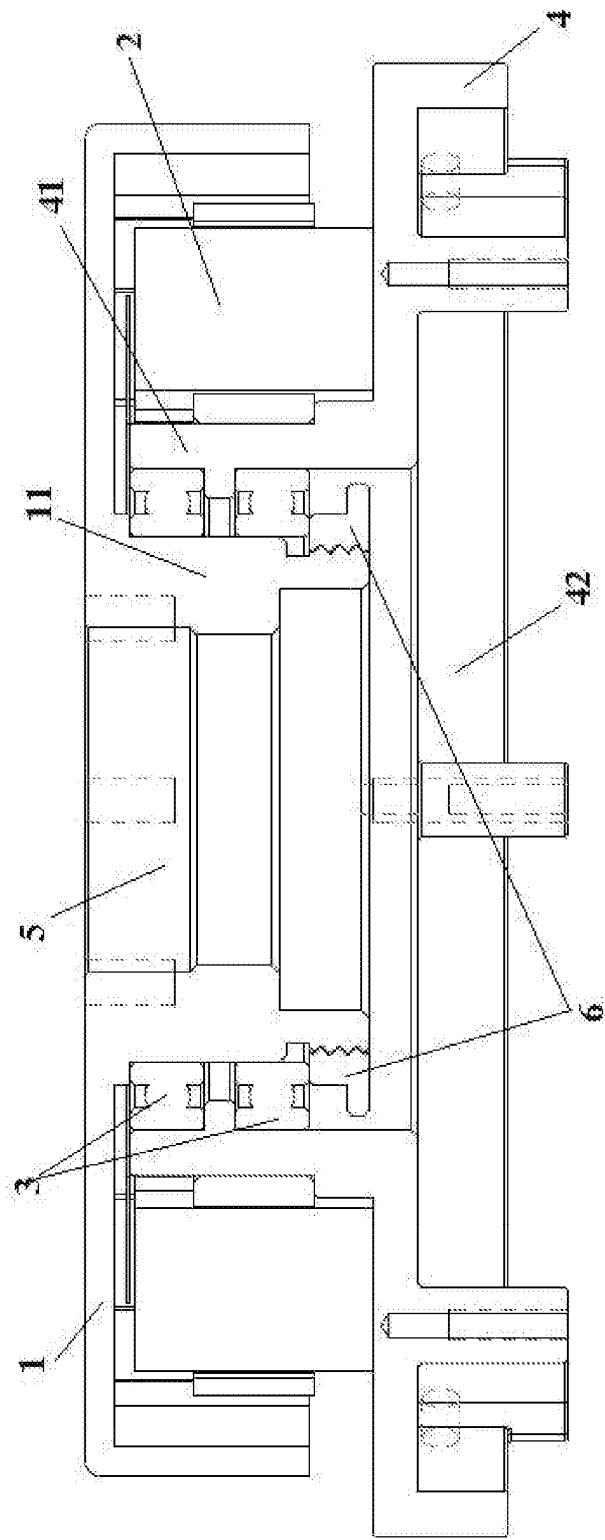


Figure 2

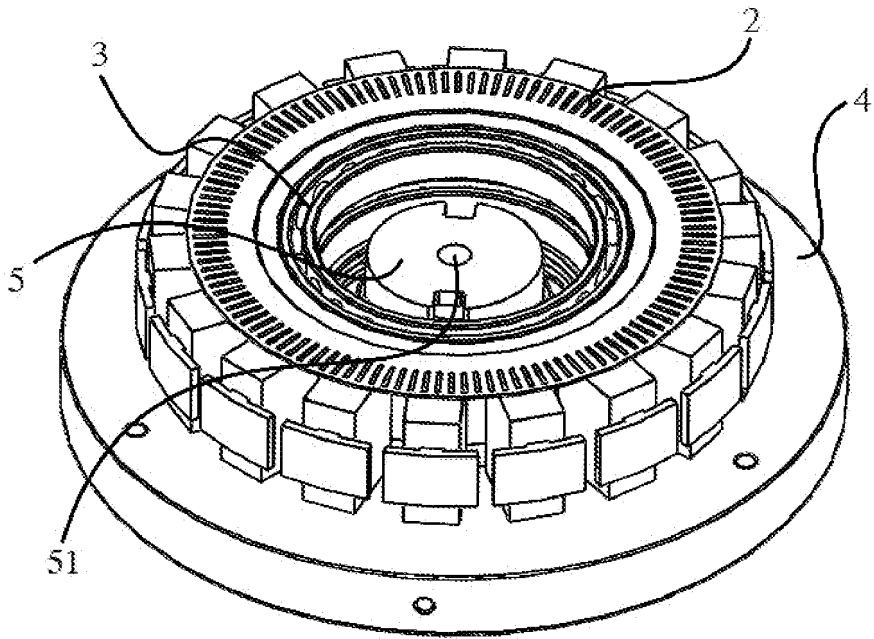


Figure 3

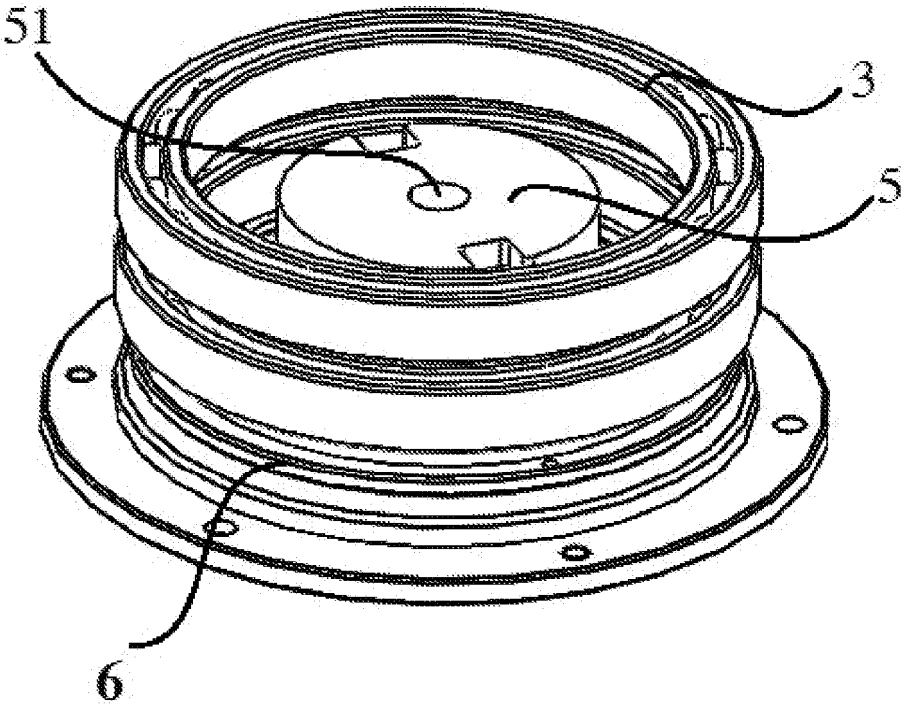


Figure 4

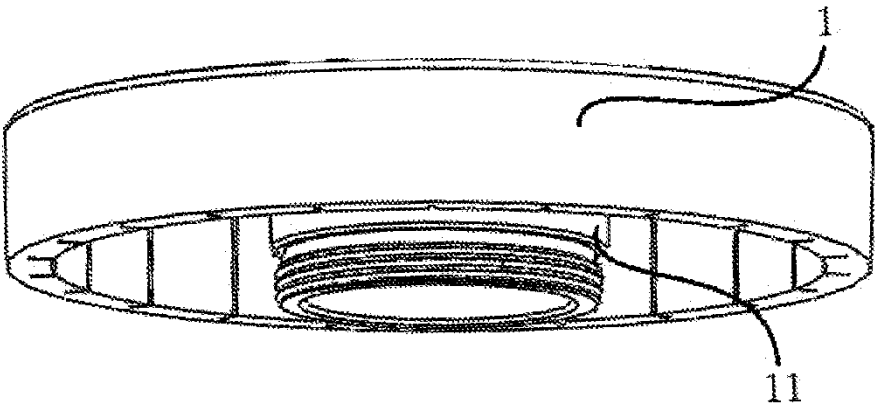


Figure 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/088546

A. CLASSIFICATION OF SUBJECT MATTER

G01S 17/08 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G01S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, WPI, EPODOC: Hangzhou Ole-Systems, Zhang Ou, laser ranging, stator, rotor, rotate, fixed, bearing, coil, thread, laser ranging, rotor, stator, rotat+, bearing, loop, screw thread

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 205681192 U (SICHUAN JINGMAN PHOTOELECTRIC TECHNOLOGY CO., LTD.), November 09, 2016 (11/09/2016), description, paragraphs [0018]–[0031], and Figures 2–3	1–10
A	CN 205643710 U (SHANGHAI SLAMTEC CO., LTD.), October 12, 2016 (10/12/2016), entire document	1–10
A	CN 205027903 U (HAN'S LASER TECHNOLOGY INDUSTRY GROUP CO., LTD. et al.), February 10, 2016 (02/10/2016), entire document	1–10
A	CN 104967248 A (GUANGDONG WELLING MOTOR MANUFACTURING CO., LTD. et al.), October 07, 2015 (10/07/2015), entire document	1–10
A	CN 205594163 U (SHANGHAI SLAMTEC CO., LTD.), September 21, 2016 (09/21/2016), entire document	1–10
A	US 2014198308 A1 (SAMSUNG TECHWIN CO., LTD.), July 17, 2014 (07/17/2014), entire document	1–10
A	JP 2001275331 A (MITSUBISHI MATERIALS CORP.), October 05, 2001 (10/05/2001), entire document	1–10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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“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

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/088546

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 205681192 U	09 November 2016	None	
CN 205643710 U	12 October 2016	None	
CN 205027903 U	10 February 2016	None	
CN 104967248 A	07 October 2015	CN 104967248 B	04 July 2017
CN 205594163 U	21 September 2016	None	
US 2014198308 A1	17 July 2014	US 9389307 B2	12 July 2016
		KR 20140091342 A	21 July 2014
JP 2001275331 A	05 October 2001	None	

Form PCT/ISA/210 (patent family annex) (July 2009)

International search report

International application number
PCT/CN2017/088546

A. Classification of Subject Matter G01S 17/08(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																										
B. Fields Searched Minimum documentation searched (classification system followed by classification symbols) G01S Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNPAT, CNKI, WPI, EPODOC:Hangzhou Ole-Systems, Zhang Ou, laser ranging, stator, rotor, rotate, fixed, bearing, coil, thread, laser ranging, rotor, stator, rotat+, bearing, loop, screw thread																										
C. Documents Considered to Be Relevant <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>CN 205681192 U (Sichuan Jingman Photoelectric Technology Co., Ltd.) November 9, 2016 (11/09/2016) Paragraphs [0018]–[0031] of Specification and Attached Drawings 2–3</td> <td>1–10</td> </tr> <tr> <td>A</td> <td>CN 205643710 U (Shanghai Slamtec Co., Ltd.) October 12, 2016 (10/12/2016) Full text</td> <td>1–10</td> </tr> <tr> <td>A</td> <td>CN 205027903 U (Han's Laser Technology Industry Group Co., Ltd. etc.) February 10, 2016 (02/10/2016) Full text</td> <td>1–10</td> </tr> <tr> <td>A</td> <td>CN 104967248 A (Guangdong Welling Motor Manufacturing Co., Ltd. et al.) October 7, 2015 (10/07/2015) Full text</td> <td>1–10</td> </tr> <tr> <td>A</td> <td>CN 205594163 U (Shanghai Slamtec Co., Ltd.) September 21, 2016 (09/21/2016) Full text</td> <td>1–10</td> </tr> <tr> <td>A</td> <td>US 2014198308 A1 (Samsung Techwin Co., Ltd.) July 17, 2014 (07/17/2014) Full text</td> <td>1–10</td> </tr> <tr> <td>A</td> <td>JP 2001275331 A (Mitsubishi Materials Corp.) October 5, 2001 (10/05/2001) Full text</td> <td>1–10</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	CN 205681192 U (Sichuan Jingman Photoelectric Technology Co., Ltd.) November 9, 2016 (11/09/2016) Paragraphs [0018]–[0031] of Specification and Attached Drawings 2–3	1–10	A	CN 205643710 U (Shanghai Slamtec Co., Ltd.) October 12, 2016 (10/12/2016) Full text	1–10	A	CN 205027903 U (Han's Laser Technology Industry Group Co., Ltd. etc.) February 10, 2016 (02/10/2016) Full text	1–10	A	CN 104967248 A (Guangdong Welling Motor Manufacturing Co., Ltd. et al.) October 7, 2015 (10/07/2015) Full text	1–10	A	CN 205594163 U (Shanghai Slamtec Co., Ltd.) September 21, 2016 (09/21/2016) Full text	1–10	A	US 2014198308 A1 (Samsung Techwin Co., Ltd.) July 17, 2014 (07/17/2014) Full text	1–10	A	JP 2001275331 A (Mitsubishi Materials Corp.) October 5, 2001 (10/05/2001) Full text	1–10
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Date of the actual completion of the international search January 16, 2018		Date of mailing of the international search report February 1, 2018																								
Name and mailing address of the ISA/CN State Intellectual Property Office of the P. R. China (ISA/CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451		Authorized officer LIU Chang Telephone No. (86-10) 53962364																								

Table PCT/ISA/210 (Page 2) (July 2009)

International search report
Patent family annex

International application number
PCT/CN2017/088546

Patent documents cited in search report			Date of publication (MM/DD/YYYY)	Patent family members			Date of publication (MM/DD/YYYY)
CN	205681192	U	11/19/2016	None			
CN	205643710	U	10/12/2016	None			
CN	205027903	U	02/10/2016	None			
CN	104967248	A	10/07/2015	CN	104967248	B	07/04/2017
CN	205594163	U	09/21/2016	None			
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JP	2001275331	A	10/05/2001	None			

Table PCT/ISA/210 (Patent Family Annex) (July 2009)