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(54) Title: LAMP

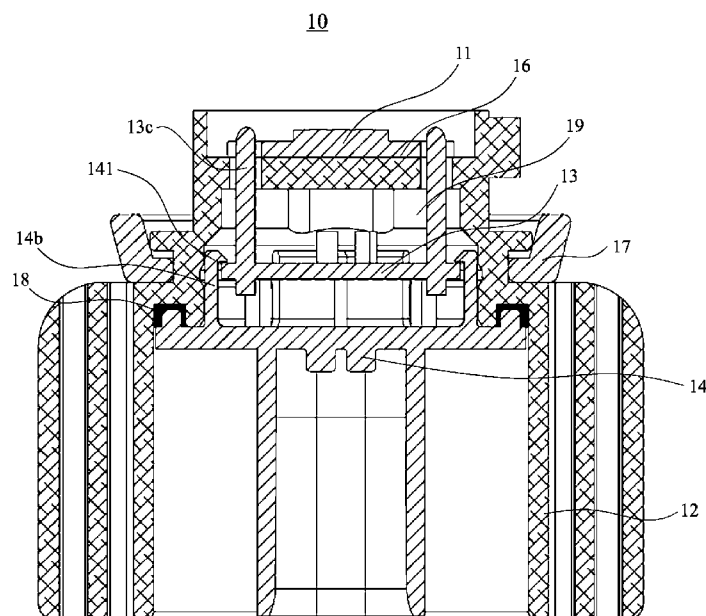


Figure 3

(57) Abstract: Provided is a lamp (10) including a light source (11), a driver (13), a connector (14) and a heat sink (12). The light source (11) includes a light source circuit board on which a light emitting element (11b) is arranged. The driver (13) drives the light source (11) and includes a driving circuit board (13a) on which a driving electronic element (13b) is arranged. The connector (14) is connected to a power source and to the driver (13) spatially separated from the light source (11). The light source (11) and connector (14) are fixedly attached inside the heat sink (12) so that the light source (11) and driver (13) are radially surrounded by the heat sink (12). The connector (14) includes a supporting column (14a) for supporting the driving circuit board (13a) and a retainer (14b) for holding the driving circuit board (13a). The lamp according to this disclosure can not only improve the heat dissipation so as to meet power demand, but also has a compact structure to reduce space of installation.

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- 1 -

LAMP

FIELD

5 [0001] The present disclosure relates to a lamp and, in particular, to a lamp for a vehicle, for example, a headlight or a taillight.

BACKGROUND

[0002] This section provides background information related to the present disclosure, which may not necessarily constitute the prior art.

10 [0003] A lamp is known, including a light-emitting diode (LED) serving as a light source and a driver for driving the light source. The LED and driver are arranged on a printed circuit board (PCB). The lamp usually has a small size. Luminous efficiency of the LED decreases with increase of temperature, so heat dissipation is a key technical difficulty of the lamp. To this end, the lamp further includes a heat sink for dissipating heat generated from the LED
15 and/or the driver.

[0004] In some LED lamps, the LED and the driver are arranged on the same printed circuit board and are attached to the heat sink. For these LED lamps, the driver is close to the LED, that is, heat is concentrated. Therefore, power and luminous flux of these lamps are limited due to poor heat dissipation.

20 [0005] There are known lamps disclosed in the following references: US 10,563,833 B2, US 2010/0073884 A1, US D690,053 S, etc.

SUMMARY

25 [0006] In view of the problems existing in the existing lamps, the present disclosure aims to provide a lamp having good heat dissipation to increase power and luminous flux and having a compact structure to reduce space of installation.

[0007] According to an aspect of the present disclosure. There is provided a lamp including a light source, a driver, a connector and a heat sink. The light source includes a light source circuit board and a light emitting element arranged on the light source circuit board. The

driver is configured to drive the light source and includes a driving circuit board and a driving electronic element arranged on the driving circuit board. The connector is adapted to be connected to a power source, and the driver is connected to the connector such as to be spatially separated from the light source. The light source and the connector are fixedly
5 attached inside the heat sink, so that the light source and the driver are radially surrounded by the heat sink. The connector includes a supporting column for supporting the driving circuit board, and a retainer for holding the driving circuit board. The lamp according to the present disclosure can not only improve the heat dissipation so as to meet power demand, but also has a compact structure to reduce space of installation.

10 **[0008]** The lamp according to the present disclosure has two circuit boards dedicated to the light source and the driver and spatially separated from each other, and both the light source and the driver are attached inside the heat sink, such that heat generated from the light source and heat generated from the driver are separated from each other rather than concentrated, thereby facilitating heat dissipation. Since the heat management of the lamp is optimized, that
15 is, the heat is easily dissipated, the power and luminous flux of the lamp can be increased. In addition, the lamp according to the present disclosure has the light source, the driver and the connector that are integrated inside the heat sink, and therefore has a compact structure, requiring only a small space for installation. In this way, it is possible to have additional space for arranging components such as a fan, thereby further improving the heat dissipation and
20 increasing the power and the luminous flux.

[0009] In some examples, an internal driver and a heat sink with a special structure are adopted to achieve better heat dissipation, thereby having better photoelectric performance.

[0010] In some examples, the driver is located between the connector and the light source.

[0011] In some examples, the heat sink includes a base and a heat dissipation structure
25 extending from the base in an axial direction. The base includes a supporter to which the light source is attached. The light source and the driver are arranged on opposite sides of the supporter in the axial direction. The heat sink with such a structure facilitates conduction and dissipation of heat.

[0012] In some examples, the supporter is provided with at least one through hole via which
30 the driver is electrically connected to the light source. Such a structure facilitates assembling.

[0013] In some examples, the light source is attached to the supporter by thermally conductive glue. The supporter is provided with an aperture via which thermally conductive glue is filled between the supporter and the connector. The thermally conductive glue promotes heat generated by the light source and heat generated by the driver to be conducted to the heat sink, thereby improving heat dissipation.

[0014] In some examples, the connector is fixedly attached to the heat sink by a sealant.

[0015] In some examples, the retainer is provided with a hook for retaining the driving circuit board. The retainer has a simple structure and low manufacturing cost.

[0016] In some examples, the connector includes a positioning member having a protrusion.

The heat sink is provided with a recess for receiving the protrusion. The positioning member facilitates assembling and positioning of the connector.

[0017] In some examples, the heat dissipation structure includes: a cylindrical portion extending from the base in the axial direction, and multiple fins extending in the axial direction on an outer circumferential surface of the cylindrical portion and evenly distributed in a circumferential direction of the cylindrical portion.

[0018] In some examples, the cylindrical portion of the heat sink is provided with an opening. A fin at each side of the opening has an "F"-shaped cross-section. The other fins than the fin at each side of the opening each have a cross-section with a shape in which two "F"s are connected back to back to each other. The heat sink with such a structure has a large area of heat fins and has opening that facilitates flow of surrounding air, so that the heat dissipation can be significantly improved.

[0019] In some examples, the base and the heat dissipation structure of the heat sink are formed into one piece. This structure facilitates heat conduction.

[0020] In some examples, the lamp is a headlight or a taillight for a vehicle. The lamp according to the present disclosure has a compact structure, and therefore is particularly suitable for an apparatus having a small space of installation, for example, the vehicle. In addition, as described above, due to the increased power and luminous flux, the lamp according to the present disclosure may have multiple LEDs so as to realize multiple functions.

[0021] From the detailed descriptions below, other application fields of the present disclosure will become more apparent. It should be understood that, although showing preferred embodiments of the present disclosure, these detailed descriptions and specific examples are intended for the purpose of illustrative description only and are not intended to
5 limit the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Features and advantages of one or more embodiments of the present disclosure will become easier to be understood through the following description with reference to the
10 drawings in which:

[0023] Figures 1 and 2 are schematic perspective views of a lamp according to an embodiment of the present disclosure viewed from different directions;

[0024] Figures 3 and 4 are schematic sectional views of the lamp of Figure 1 taken along different planes;

15 [0025] Figure 5 is an exploded view of the lamp shown in Figure 2;

[0026] Figures 6 and 7 are schematic perspective views of a heat sink according to an embodiment of the present disclosure viewed from different directions;

[0027] Figure 8 is a top plan view of the heat sink shown in Figure 6; and

[0028] Figure 9 is a schematic perspective view of a variant of the heat sink shown in
20 Figures 6 to 8.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0029] Now, exemplary embodiments will be described more fully with reference to the drawings.

25 [0030] Exemplary embodiments are provided so that the present disclosure can be exhaustive and can more fully convey the scope to those skilled in the art. Specific details such as examples of specific components, devices, and methods are described to provide a thorough understanding of various embodiments of the present disclosure. It will be clear to those skilled in the art that the exemplary embodiments can be implemented in various forms

without specific details, and should not be construed as limiting the scope of the present disclosure. In some exemplary embodiments, well-known processes, device structures, and technologies are not described in detail.

[0031] The lamp according to the present disclosure is applicable to various occasions. In particular, the lamp according to the present disclosure is applicable to a vehicle, for example, serving as a headlight, a taillight, a fog light, a position light, a brake light, a turn signal light for a vehicle, or a suitable combination thereof. It should be understood that the lamp according to the present disclosure is not limited to the applications described herein, and may be adapted to any other suitable apparatus.

[0032] A lamp 10 according to an embodiment of the present disclosure will be described below with reference to Figures 1 to 5.

[0033] As shown in Figures 1 to 5, the lamp 10 includes a light source 11, a driver 13, a connector 14 and a heat sink 12. The light source 11 and the connector 14 are attached inside the heat sink 12. The driver 13 is connected to the connector 14 and is spatially separated from the light source 11. The driver 13 is electrically connected to the light source 11 and is configured to drive the light source 11 to emit a light beam. The connector 14 is electrically connected to the driver 13 and is configured to connect the driver 13 to a power source. The heat sink 12 is configured to transfer or dissipate heat generated from the light source 11 and the driver 13.

[0034] The light source 11 is configured to emit a light beam for illumination or signal. The light source 11 includes a light source circuit board 11a and a light emitting element 11b arranged on the light source circuit board 11a. According to required functions, the light source 11 may include various light emitting elements 11b, for example, LEDs that can emit light beams with different wavelengths or brightness. A type, the number, and arrangement of the light emitting element 11b may vary with actual needs. The light source circuit board 11a is attached to the heat sink 12 by thermally conductive glue 16 so as to transfer the heat generated by the light source 11 to the heat sink 12 via the thermally conductive glue 16. The light source circuit board 11a may be, for example, a printed circuit board (PCB). It should be understood that a structure or arrangement of the light source circuit board 11a may vary with actual needs.

[0035] The driver 13 is configured to drive the light source 11 so that the light emitting element 11b gives out light. The driver 13 includes a driving circuit board 13a and a driving electronic element 13b arranged on the driving circuit board 13a. A pin 13c is arranged on the driving circuit board 13a. The pin 13c is electrically connected to the light source 11. For example, the pin 13c is soldered to the light source circuit board 11a. The driving circuit board 13a may be, for example, a printed circuit board (PCB). It should be understood that structures or arrangement of the driving circuit board 13a and the driving electronic element 13b may vary with actual needs.

[0036] The connector 14 is connected to an external power source for power supply. A pin 14c is arranged on the connector 14. The pin 14c is electrically connected to the driver 13. For example, the pin 14c is soldered to the driving circuit board 13a. The driver 13 is connected to or arranged on the connector 14. As shown in Figures 3 and 5, the connector 14 includes a supporting column 14a and a retainer 14b. The supporting column 14a is configured to support the driving circuit board 13a so that the driving circuit board 13a is spatially separated from the connector 14 by a certain distance. The retainer 14b is configured to hold the driving circuit board 13a on the supporting column 14a. In the example shown, the retainer 14b is provided with a hook 141, so that the driving circuit board 13a is sandwiched between the hook 141 and the supporting column 14a.

[0037] The connector 14 is fixedly attached to the heat sink 12. In the illustrated example, the connector 14 is fixedly attached to the heat sink 12 by a sealant 18. When the connector 14 and the light source 11 are attached to the heat sink 12, the light source 11 is spatially separated from the driver 12. Therefore, heat generated from the light source 11 is apart from heat generated from the driver 12, so that heat is not concentrated. Thermally conductive glue 19 may be filled around the driver 12 so that the heat generated by the driver 12 can be transferred to the heat sink 12 via the thermally conductive glue 19. As shown in Figures 4 and 5, the connector 14 may further include a positioning member 14d. The positioning member 14d extends in a circumferential direction and has a protrusion 145 on its outer circumferential surface. Accordingly, the heat sink 12 has a recess 125 for receiving the protrusion 145. After the connector 14 is assembled in position, the protrusion 145 is received in the recess 125, thereby positioning the connector 14.

[0038] It should be understood that a structure or a connection of the connector is not limited to the specific example shown, and instead may vary with actual needs.

[0039] Hereinafter, the heat sink 100 according to an embodiment of the present disclosure will be described in detail with reference to Figures 6 to 8. As shown in Figures 6 to 8, the heat sink 100 is generally cylindrical with an internal space. The light source 11, the driver 13 and the connector 14 are located inside the internal space of the heat sink 100 such that the light source 11 and the driver 13 are radially surrounded by the heat sink 100. Such a structure is conducive to heat dissipation.

[0040] The heat sink 12 includes a base 12a and a heat dissipation structure 12b. The heat dissipation structure 12b extends from the base 12a in an axial direction. The heat dissipation structure 12b may also extend in a radial direction relative to the base 12a. That is, the heat dissipation structure 12b has a larger inner diameter than the base 12a, so as to increase an area for heat dissipation and facilitate accommodation of the connector 14. The base 12a is configured to mount the lamp 10 to a vehicle or any other suitable apparatus via a mounting feature 102. A sealing ring 17 is radially around the base 12a for sealing. The heat dissipation structure 12b is configured for heat dissipation. The base 12a and the heat dissipation structure 12b may be formed into one piece, as shown in the example. The heat sink 12 may be made of a metal material such as aluminum alloy or copper, or may be made of any other suitable material having high conductivity.

[0041] The base 12a is generally cylindrical. A supporter 12c is arranged inside the cylindrical base 12a. The supporter 12c divides a space inside the cylindrical base 12a into an upper space for accommodating the light source 11 and a lower space for accommodating the driver 13. That is, the light source 11 and the driver 13 are arranged on opposite sides of the supporter 12c in the axial direction. The light source 11 is attached to the supporter 12c. For example, the light source 11 is attached to the supporter 12c by the thermally conductive glue 16 as described above. The connector 14 is attached to an end of the base 12a so that the driver 13 is located between the connector 14 and the light source 11 and is spatially separated from the supporter 12c by a certain distance.

[0042] The supporter 12c is provided with at least one through hole 128. The pin 13c of the driver 13 passes through the through hole 128 and is electrically connected to the light source 11. The supporter 12c is further provided with an aperture 129 via which thermally

conductive glue 19 is filled between the supporter 12c and the connector 14. It should be understood that the present disclosure is not limited to the specific examples shown herein. The through hole 128 may be communicated with the aperture 129, or shapes or numbers of the through hole 128 and the aperture 129 may vary based on actual needs.

5 **[0043]** The heat dissipation structure 12b is generally cylindrical. The heat dissipation structure 12b includes a cylindrical portion 121 and multiple fins 122. The cylindrical portion 121 extends from the base 12a in the axial direction. The multiple fins 122 each extend in the axial direction and the radial direction on an outer circumferential surface of the cylindrical portion 121. Preferably, the multiple fins 122 are evenly distributed in a circumferential
10 direction of the cylindrical portion 121.

[0044] In the illustrated example, the cylindrical portion 121 does not extend 360 degrees in the circumferential direction, that is, the cylindrical portion 121 is provided with an opening 126. The opening 126 can promote air flow to improve efficiency of heat dissipation. In addition, the opening 126 may also provide space for other components. It should be
15 understood that a size, a shape or the like of the opening 126 may vary with actual needs.

[0045] Each of the multiple fins 122 includes a radially extending portion and a laterally extending portion extending laterally from the radially extending portion. In the illustrated example, the fin 122 has a cross-section with a shape in which two "F"s are connected back to back to each other. In the case of the opening 126, a fin 123 at each side of the opening has an
20 "F"-shaped cross-section.

[0046] It should be understood that a size, a shape, an inclination angle of each part of the fin 122, the number of the fins 122, and the like may vary with actual needs, and should not be limited to the specific example shown.

[0047] Figure 9 is schematic perspective view of a variant of the heat sink shown in Figures
25 6 to 8. As shown in Figure 9, a difference between a heat sink 200 and the heat sink 100 is that a heat dissipation structure 22b of the heat sink 200 further includes a slit 227. The slit 227 can promote air flow to improve the efficiency of heat dissipation. Structures of a fin 222, a fin 223 and an opening 226 of the heat dissipation structure 22b are the same as the structures of the fin 122, the fin 123 and the opening 126 of the heat dissipation structure 12b.
30 In the example shown in Figure 9, a cylindrical portion 221 has a slit 227 between adjacent

fins 222. It should be understood that a size, a shape, the number and the like of the slit 227 may vary with actual needs, and should not be limited to the specific examples shown.

[0048] Although the present disclosure has been described with reference to the exemplary embodiments, it should be understood that the present disclosure is not limited to the specific
5 embodiments described and illustrated herein. Those skilled in the art can make various changes to the exemplary embodiments without departing from the scope defined by the claims. It should further be understood that, provided that the technical solutions are not contradictory, the features of the various embodiments may be combined with each other or may be omitted.

LIST OF REFERENCE SIGNS

	lamp	10
	heat sink	100
5	mounting feature	102
	light source	11
	light source circuit board	11a
	light emitting element	11b
	heat sink	12
10	base	12a
	heat dissipation structure	12b
	supporter	12c
	cylindrical portion	121
	fin	122
15	fin	123
	recess	125
	opening	126
	through hole	128
	aperture	129
20	driver	13
	driving circuit board	13a
	driving electronic element	13b
	pin	13c
	connector	14
25	supporting column	14a

	retainer	14b
	pin	14c
	positioning member	14d
	hook	141
5	protrusion	145
	thermally conductive glue	16
	sealing ring	17
	sealant	18
	thermally conductive glue	19
10	heat sink	200
	heat dissipation structure	22b
	cylindrical portion	221
	fin	222
	fin	223
15	opening	226
	slit	227

CLAIMS

1. A lamp, characterized by comprising:

5 a light source comprising a light source circuit board and a light emitting element arranged on the light source circuit board;

a driver configured to drive the light source and comprising a driving circuit board and a driving electronic element arranged on the driving circuit board;

a connector adapted to be connected to a power source, wherein the driver is connected to the connector such as to be spatially separated from the light source; and

10 a heat sink inside which the light source and the connector are fixedly attached in such a manner that the light source and the driver are radially surrounded by the heat sink,

wherein the connector comprises:

a supporting column for supporting the driving circuit board; and

a retainer for holding the driving circuit board.

15

2. The lamp according to claim 1, characterized in that the driver is located between the connector and the light source.

3. The lamp according to claim 2, characterized in that the heat sink comprises a base
20 and a heat dissipation structure extending from the base in an axial direction,

the base comprises a supporter to which the light source is attached; and

the light source and the driver are arranged on opposite sides of the supporter in the axial direction.

25 4. The lamp according to claim 3, characterized in that the supporter is provided with at least one through hole via which the driver is electrically connected to the light source.

5. The lamp according to claim 3, characterized in that
the light source is attached to the supporter by thermally conductive glue; and
the supporter is provided with an aperture via which thermally conductive glue is filled
between the supporter and the connector.

5

6. The lamp according to claim 2, characterized in that the connector is fixedly attached
to the heat sink by a sealant.

7. The lamp according to claim 1, characterized in that the retainer is provided with a
hook for retaining the driving circuit board.

10

8. The lamp according to claim 2, characterized in that the connector comprises a
positioning member having a protrusion; and
the heat sink is provided with a recess for receiving the protrusion.

15

9. The lamp according to claim 3, characterized in that the heat dissipation structure
comprises:

a cylindrical portion extending from the base in the axial direction; and

a plurality of fins extending in the axial direction on an outer circumferential surface of
the cylindrical portion and evenly distributed in a circumferential direction of the cylindrical
portion.

20

10. The lamp according to claim 9, characterized in that

the cylindrical portion of the heat sink is provided with an opening;

a fin at each side of the opening has "F"-shaped cross-section; and

25

the other fins than the fin at each side of the opening have a cross-section with a shape in
which two "F"s are connected back to back to each other.

11. The lamp according to claim 3, characterized in that the base and the heat dissipation structure of the heat sink are formed into one piece.

5 12. The lamp according to any one of claims 1 to 11, characterized in that the lamp is a headlight or a taillight for a vehicle.

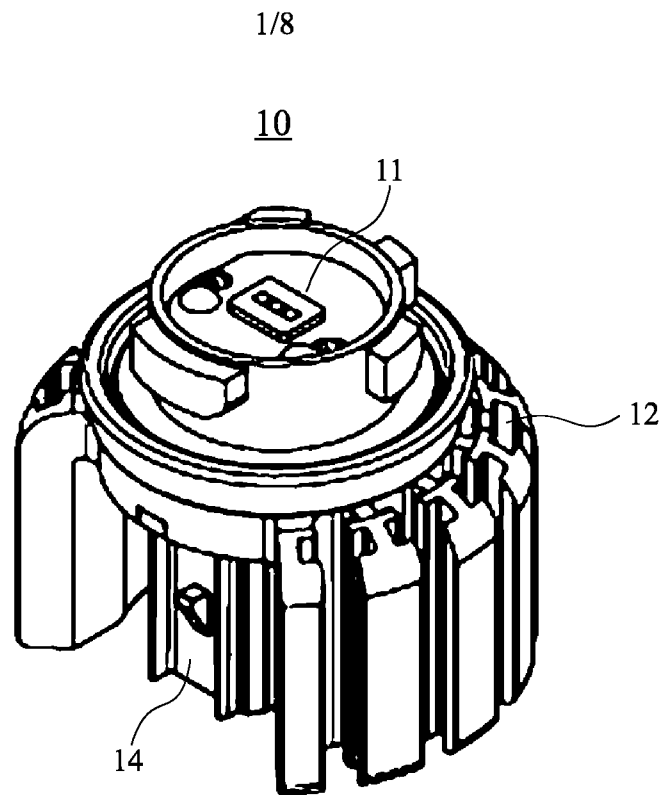


Figure 1

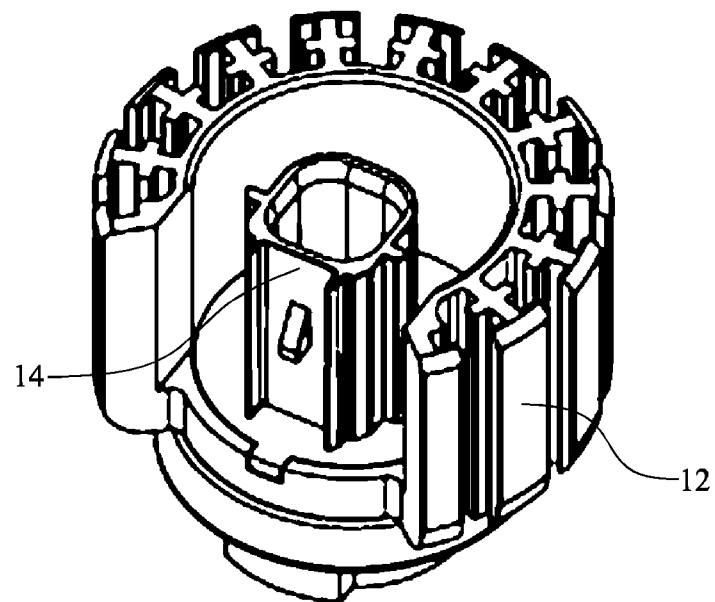


Figure 2

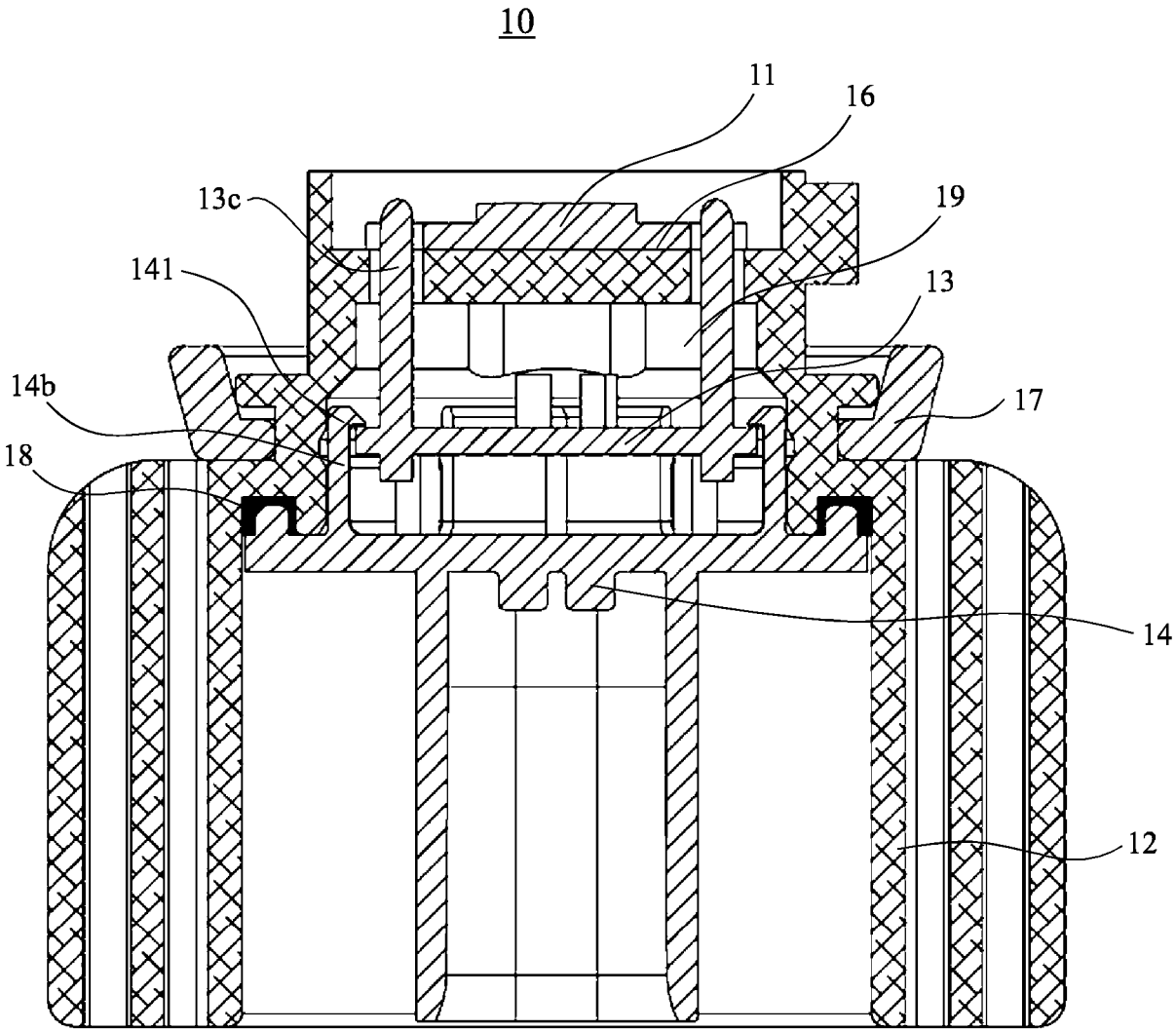


Figure 3

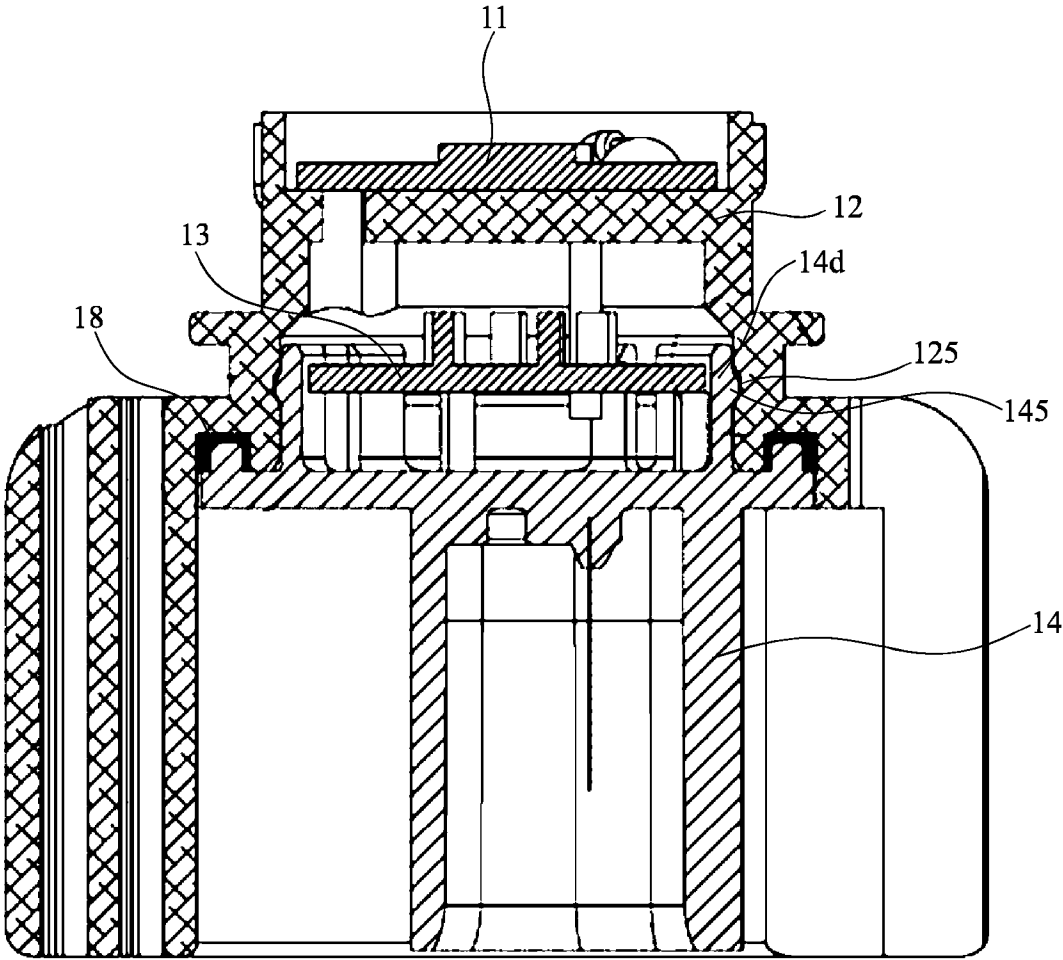


Figure 4

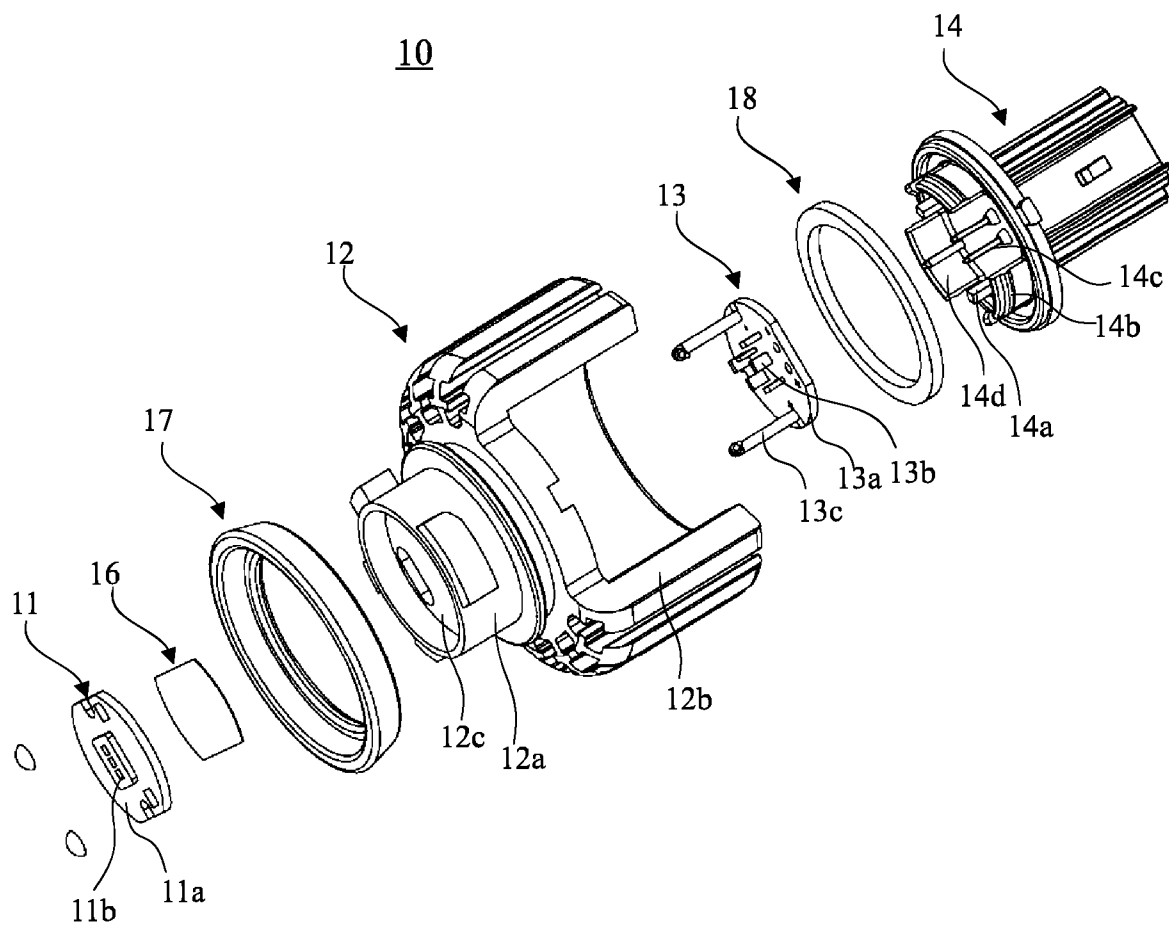


Figure 5

5/8

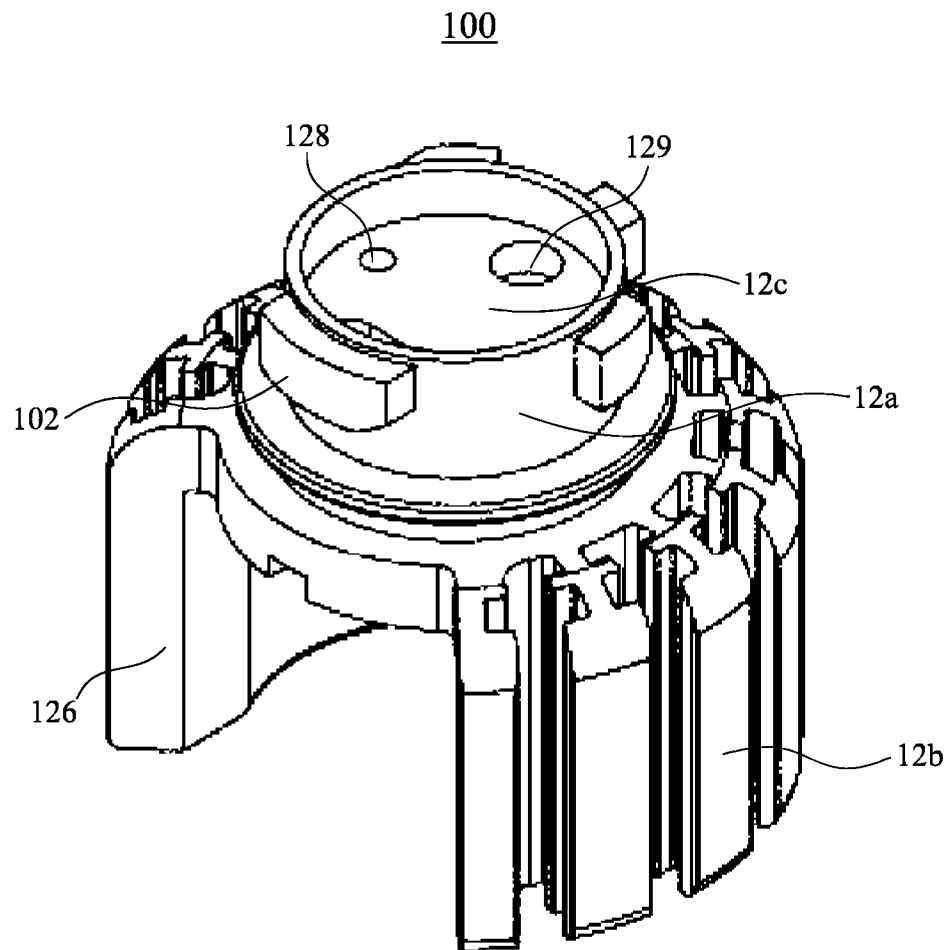


Figure 6

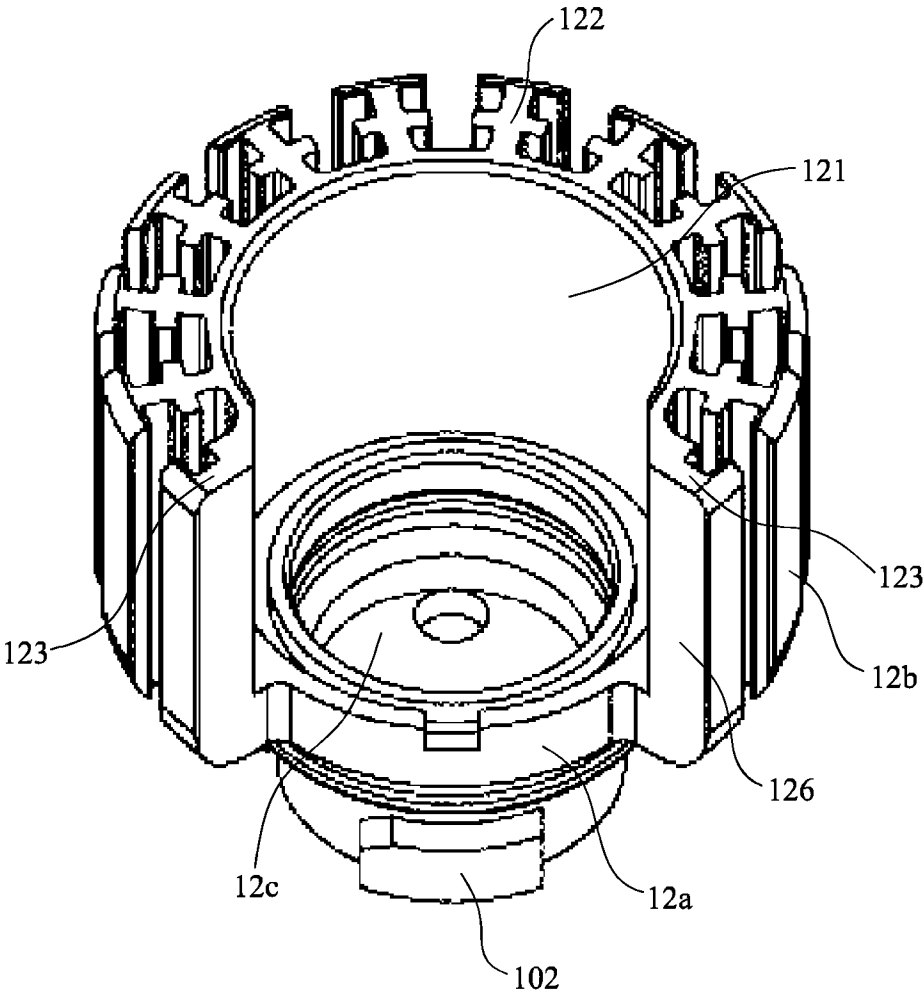


Figure 7

7/8

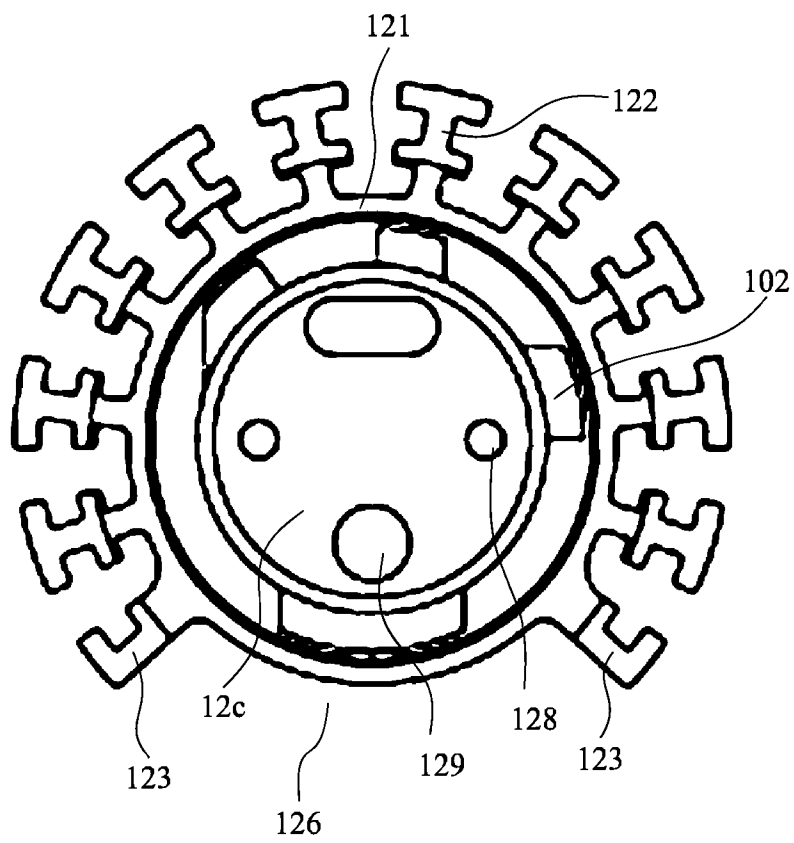


Figure 8

8/8

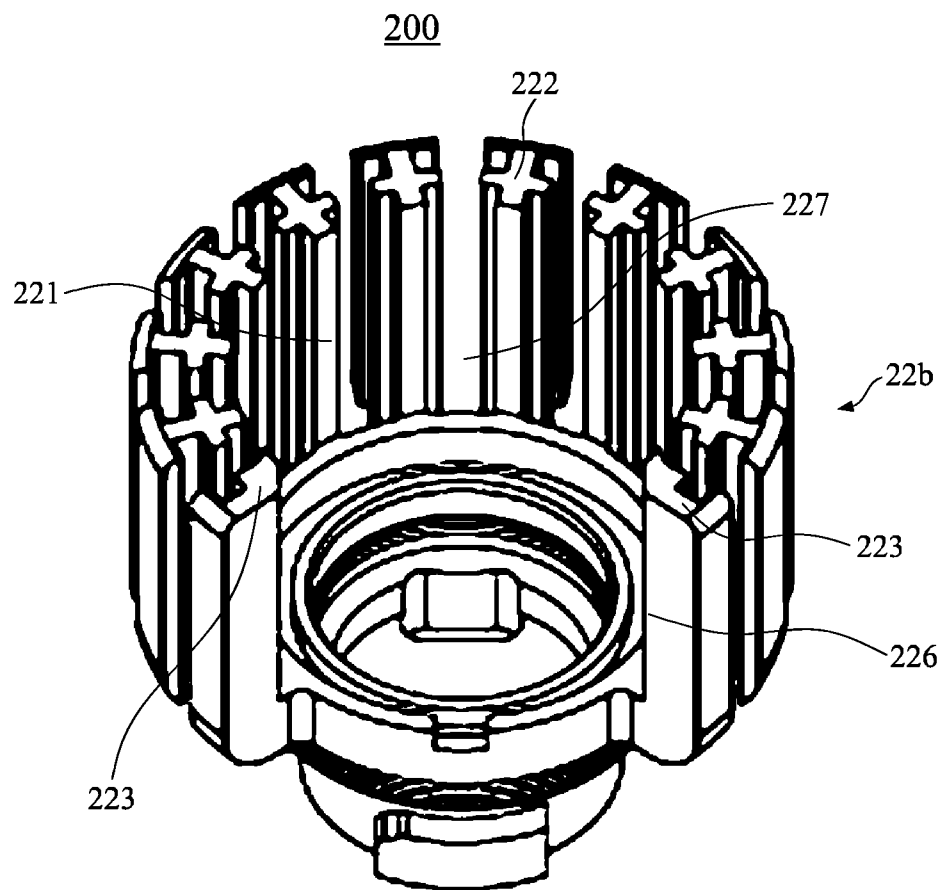


Figure 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/053390

A. CLASSIFICATION OF SUBJECT MATTER INV. F21V23/00 F21V29/10 F21V29/70 F21S41/19 F21S41/143 F21S45/48 F21S43/14 F21S43/19 F21V29/74 ADD. 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) F21V F21S 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) EPO-Internal, 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 2019/368676 A1 (LEE YEON-WOO [KR]) 5 December 2019 (2019-12-05)	1-8, 11, 12
Y	paragraphs [0021], [0022], [0026] - [0028], [0037], [0043] figures 2-6 -----	9, 10
X	US 2013/257278 A1 (DEVORE CHARLES N [US] ET AL) 3 October 2013 (2013-10-03) figures 4-7 -----	1, 2, 6-8, 12
Y	US 2009/071624 A1 (ZHANG WEN-XIANG [CN] ET AL) 19 March 2009 (2009-03-19) figures 1, 2 -----	9, 10
A	US 2014/334162 A1 (KWON MI SUK [KR] ET AL) 13 November 2014 (2014-11-13) paragraphs [0040], [0044] figures 1, 3-5 -----	1-12
-/-		
☒ 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 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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 "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
7 April 2022		20/04/2022
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Allen, Katie

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2022/053390

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 2016 0028081 A (LEDLITEK CO LTD [KR]) 11 March 2016 (2016-03-11) figure 1 -----	1-12
A	US 2014/369056 A1 (KWON MISUK [KR]) 18 December 2014 (2014-12-18) figures 3-7 -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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