



- (51) International Patent Classification:
B60B 7/00 (2006.01) *B60Q 1/32* (2006.01)
- (21) International Application Number:
PCT/CN2013/080391
- (22) International Filing Date:
30 July 2013 (30.07.2013)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
201210265841.6 30 July 2012 (30.07.2012) CN
- (71) Applicants: SHENZHEN BYD AUTO R&D COMPANY LIMITED [CN/CN]; Part B, 1/F, Bldg#B2, Yucan Industrial Area, Lanzhu Road, Shenzhen Export Processing Zone, Shenzhen Grand Industrial Zone, Shenzhen, Guangdong 518118 (CN). BYD COMPANY LIMITED [CN/CN]; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN).
- (72) Inventors: DENG, Xiaohong; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). WANG, Meng; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN).

dong 518118 (CN). **ZHONG, Yilin**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **BAI, Junming**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **DAI, Jun**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **SU, Fengwu**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **LIANG, Zhuhuan**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN).

(74) Agent: TSINGYIHUA INTELLECTUAL PROPERTY LLC; Room 301, Trade Building, Zhaolanyuan, Tsinghua University, Qinghuayuan, Haidian District, Beijing 100084 (CN).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC,

[Continued on next page]

(54) Title: LUMINOUS WHEEL HUB, WHEEL AND VEHICLE COMPRISING THE SAME

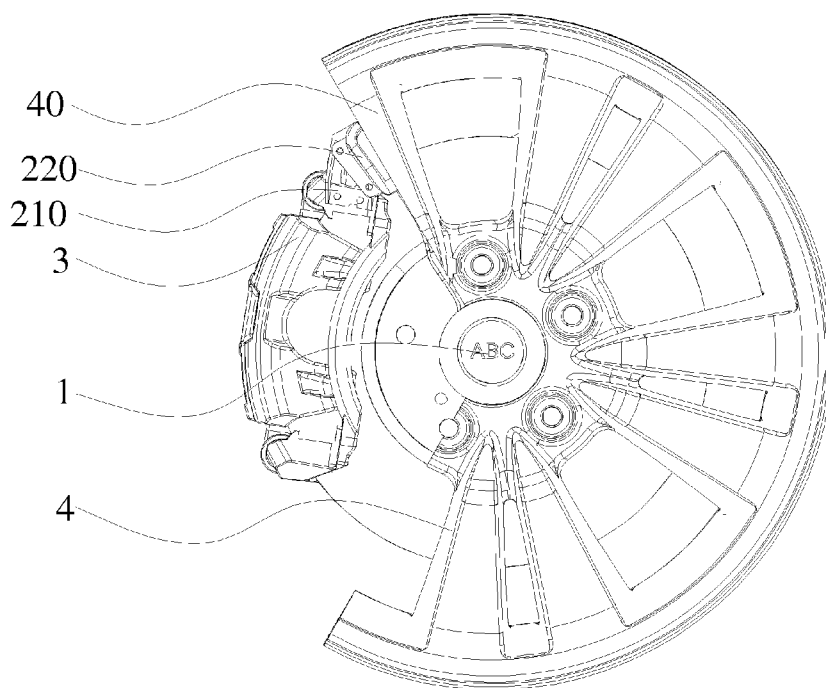


Fig. 1

(57) Abstract: A luminous wheel hub comprises: a wheel hub body (40), a luminous device (1) disposed on the wheel hub body (40), and an energy transformation device (2) adapted to connect with a power supply. The energy transformation device (2) comprises a first coil (21) adapted to be fixed on a caliper bracket (3) and a second coil (22) configured to rotate with the wheel hub body (40). The energy transformation device (2) is configured to output a current to the luminous device (1) only when the first coil (21) overlaps the second coil (22). A wheel and a vehicle comprising the luminous wheel hub are also provided.



SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (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).

Published:

— *with international search report (Art. 21(3))*

LUMINOUS WHEEL HUB, WHEEL AND VEHICLE COMPRISING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to, and benefits of Chinese Patent Application Serial No. 201210265841.6, filed with the State Intellectual Property Office of P. R. C. on July 30, 2012; the entire contents of which are incorporated herein by reference.

FIELD

The present disclosure relates to the vehicle field, and more particularly to a luminous wheel hub, a wheel and a vehicle comprising the same.

BACKGROUND

With the development of the science and technology, the requirements for vehicle becomes higher and higher. Currently, most vehicles have a logo disposed on the center of the wheel. However, the logo can't be identified when the vehicle is running at night.

SUMMARY

Embodiments of the present disclosure seek to solve at least one of the problems existing in the prior art at least to some extent.

According to a first aspect of the present disclosure, a luminous wheel hub is provided. The luminous wheel hub comprises: a wheel hub body, a luminous device disposed on the wheel hub body, an energy transformation device adapted to connect with a power supply. The energy transformation device comprises a first coil adapted to be fixed on a caliper bracket and a second coil configured to rotate with the wheel hub body. The energy transformation device is configured to output a current to the luminous device only when the first coil overlaps the second coil.

According to a second aspect of the present disclosure, a wheel comprising the luminous wheel hub is provided.

According to a third aspect of the present disclosure, a vehicle comprising the wheel as described above is provided.

According to an embodiment of the present disclosure, the caliper bracket is fixed on the chassis of the vehicle, and the wheel hub body can rotate relative to the caliper bracket. With the

luminous wheel hub according to embodiments of the present disclosure, when the second coil arranged on the wheel hub body rotates with the caliper bracket until the first coil overlaps the second coil, the position of the luminous device is unchanged relative to the second coil and the first coil, particularly a logo pattern on the luminous device may keep unchanged relative to the second coil and the first coil. In this condition, the energy transformation device may output a current to the luminous device, and LEDs in the logo pattern may be powered on, thus the logo pattern can be clearly identified with the fast rotation of the wheel hub. In an embodiment, the energy transformation device outputs a current to the luminous device only when the second coil overlaps the first coil, and stop outputting the current when the first coil and the second coil are not overlapped.

The above summary of the present disclosure is not intended to describe each disclosed embodiment or every implementation of the present disclosure. The Figures and the detailed description which follow more particularly exemplify illustrative embodiments.

Additional aspects and advantages of the embodiments of present disclosure will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects and advantages of embodiments of the present disclosure will become apparent and more readily appreciated from the following descriptions made with reference to the accompanying drawings, in which:

Fig. 1 is a schematic view of a luminous wheel hub according to an embodiment of the present disclosure;

Fig. 2 is an exploded view of a luminous device of a luminous wheel hub according to an embodiment of the present disclosure;

Fig. 3 is a sectional view of a first box of a luminous wheel hub according to an embodiment of the present disclosure; and

Fig. 4 is a circuit diagram of an energy transformation device of a luminous wheel hub according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

Reference will be made in detail to embodiments of the present disclosure. The embodiments described herein with reference to drawings are explanatory, illustrative, and used to generally understand the present disclosure. The embodiments shall not be construed to limit the present disclosure. The same or similar elements and the elements having same or similar functions are denoted by like reference numerals throughout the descriptions.

In the specification, relative terms such as “central”, “longitudinal”, “lateral”, “front”, “rear”, “right”, “left”, “lower”, “upper”, “horizontal”, “vertical”, “above”, “below”, “up”, “top”, “bottom” as well as derivative thereof (e.g., “horizontally”, “downwardly”, “upwardly”, etc.) should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience of description and do not require that the present disclosure be constructed or operated in a particular orientation.

A luminous wheel hub according to embodiments of the present disclosure will be described below with reference to Figs. 1 to 4.

As shown in Figs. 1 to 2, according to an embodiment of the present disclosure, the luminous wheel hub comprises: a wheel hub body 40, a luminous device 1 disposed on the wheel hub body 40, an energy transformation device 2 adapted to connect with a power supply. The energy transformation device 2 comprises a first coil 21 adapted to be fixed on a caliper bracket 3 and a second coil 22 configured to rotate with the wheel hub body 40. The energy transformation device 2 is configured to output a current to the luminous device 1 only when the first coil 21 overlaps the second coil 22. In an embodiment, the luminous device 1 rotates with the wheel hub 4.

In some embodiments, the luminous device 1 comprises: a front cover 11 having a transparent pattern 110; a back cover 17 connected with the front cover 11 so as to define an enclosed space; a light guide plate 13 disposed in the enclosed space; a circuit board 16 disposed in the enclosed space; a reflecting plate 14 disposed in the enclosed space and between the light guide plate 13 and the circuit board 16, and an LED 15 disposed on the circuit board 16 and extending through the reflecting plate 14 so as to be embedded in the light guide plate 13. In one embodiment, the reflecting plate 14 is coated with at least one layer of film, so that reflecting effects thereof may be improved. In a further embodiment, the front cover 11 is properly configured so as to serve as a cover for the center of the wheel.

In some embodiments, the light guide plate 13 comprises a plurality of light guide

microstructures 130 which form a luminous region corresponding to the transparent pattern 110. In some embodiments, the transparent pattern 110 may be configured as a logo of the vehicle.

In an embodiment, the LED 15 is connected with energy transformation device 2 by a wire (not shown). When the energy transformation device 2 outputs a current the luminous device 1, the current may power on the LED 15 so that the LED is luminous and emits lights. The light may be reflected and refracted in the guide light plate 13, and a part of the light may finally be transmitted to the transparent pattern 110 via the light guide microstructures 130. In that way, the transparent pattern 110 is illuminated.

In some embodiments, the luminous device 1 further comprises a light shielding film 12 disposed between the LED 15 and the front cover 11. When the part of the light is transmitted towards the transparent pattern 110 via the light guide microstructures 130, the light shielding film 12 disposed between the LED 15 and the front cover 11 may prevent the transparent pattern 110 from being excessively illuminated (the transparent pattern 110 is extra luminous), thus the pattern, such as a logo, can be observed clearly without harming eyes of the observer. In an embodiment, a circuit connector 18 is disposed at the back cover 17 and configured to extract and fix the wire.

In some embodiments, the luminous wheel hub further comprises a first box 210 fixed onto a surface of the caliper bracket 3, and a second box 220 fixed onto a surface of the wheel hub body 4 opposing to the surface of the caliper bracket 3. The first coil 21 is disposed in the first box 210, and the second coil 22 is disposed in the second box 220. In an embodiment, the energy transformation device 2 is connected with a power supply having an output voltage of 12 Volts. In an embodiment, the second box 220 is arranged on a spoke 40 of the wheel hub body 4, and the first box 210 is arranged at the caliper bracket 3 and corresponding to the second box 220.

In some embodiments, the first box 210 comprises a first shell 2101 capable of dissipating heat and defining a first chamber 2103 to receive the first coil 21, and a radiator 2102 disposed at a bottom of the first shell 2101, as shown in Fig. 3. In one embodiment, the radiator 2102 comprises a plurality of heat-dissipating strips formed integrally with the first shell 2101. In one embodiment, the heat-dissipating strips and the first shell 2102 are made of aluminum. In that way, the overall heat dissipation area of the first shell 2102 is increased, therefore the heat dissipation effect can be improved. In an embodiment, the first coil 21 defines a first terminal connected with the power supply and a second terminal connected to ground, and the first coil 21 is connected in series with a switch module 23 disposed in the first chamber 2103.

In some embodiments, the second box 220 comprises a second plastic shell capable of dissipating heat and defining a second chamber to receive the second coil 22. The second coil 22 is connected in series with the luminous device 1, specifically, the second coil 22 is connected in series with the LED 15. During the process that the energy transformation device 2 is outputting the current to the luminous device 1, the first coil 21 and the second coil 22 may generate heat, which may damage the energy transformation device 2 or make the energy transformation device 2 out of function in the condition of overheating.

As described above, the energy transformation device 2 is configured to output the current to the luminous device 1 only when the first coil 21 overlaps the second coil 22, i.e., when the first coil 21 and the second coil 22 are not overlapped, the energy transformation device 2 stop outputting the current to the luminous device 1. When the wheel rotates for one circle, the second coil 22 may rotate with the wheel hub body 4 and overlap with the first coil 21 for one time. That is to say, during one rotation circle of the wheel, the second coil 22 may overlap with the first coil once. During a continuous rotation progress of the wheel, the position of the luminous device 1 is unchanged relative to the position of the second coil 22 and the first coil 21, specifically, the position of the transparent pattern 110 (for example, a logo of the vehicle) in the luminous device 1 is unchanged relative to the position of the second coil 22 and the first coil 21. When the first coil 21 overlaps the second coil 22 and the energy transformation device 2 outputs the current to the luminous device 1, the LED 15 in the luminous device 1 is powered on and the transparent pattern 110 is illuminated, so that the transparent pattern 110 can be clearly identified even at night. On the contrary, when second coil 22 rotates until the first coil 21 does not overlap the second coil 22, the energy transformation device 2 stops outputting the current to the luminous device 1. Then the transparent pattern 110 is not illuminated and may not be identified in a dark environment.

In some embodiments, when the first coil 21 and the second coil 22 is completely overlapped, the luminous device 1 is in a positive position, that is to say, the transparent pattern 110 is in the positive position in which the transparent pattern 110 can be identified by an observer most conveniently, such as the position as shown in Fig. 1. As an overlapped area (even the largest overlapped area) of the first coil 21 and the second coil 22 is relatively small with respect to the area of the wheel hub, during overlapping process of the first coil 21 and the second coil 22, a current outputting time for the luminous device 1 is very short, that is to say, a luminous time of the transparent pattern 110 is very short, so that the transparent pattern 110 can be identified

clearly by an outside observer.

A detailed structure and work procedure of the energy transformation device 2 are provided below, with reference to Figs. 3-4.

As shown in Figs 3-4, the first coil 21 defines a first end (the upper end as shown in Fig. 4) connected with the power supply and a second end (the lower end as shown in Fig. 3) connected to ground, and the first coil 21 is connected in series with a switch module 23 disposed in the first chamber 2103. Specifically, the second end of the first coil 21 is connected to ground via the switch module 23. The switch module 23 is further connected with a controller 24, and the controller 24 is configured to control the switch module 23 to switch on or switch off.

The second coil 22 is connected in series with the luminous device 1 so as to output the current to the luminous device 1. In an embodiment, the on-off state of the switch module 23 may change magnetic flux of the first coil 21 and the second coil 22, so that the current may be generated in the second coil 22.

According to a specific embodiment of the present disclosure, as shown in Fig. 4, the first coil 21 is connected to the power supply having an output voltage of 12 Volts. After the controller 24 controls the switch module 23 to switch on or switch off, the current flowing through the first coil 21 changes abruptly and the magnetic flux of the first coil 21 changes instantaneously. Because the first coil 21 is coupled with the second coil 22, so the magnetic flux of the second coil 22 is changed immediately, thereby a current is generated in the second coil 22. The current generated by the second coil 22 is output to the luminous device 1. Therefore, with the rotation of the wheel, the controller 24 controls the switch module 23 to switch on or switch off, so that the energy transformation device 2 outputs the current to the luminous device 1 intermittently.

In some embodiments, the controller 24 is configured to adjust an on-off frequency of the switch module 23 according to a vehicle speed. In an embodiment, the on-off frequency is about 300 KHz when the vehicle speed is within a range of 0-180 km/h.

In some embodiments, the luminous wheel hub further comprises a light-sensitive sensor (not shown) connected with the energy transformation device 2 and configured to turn on or turn off the energy transformation device 2 according to ambient light. With the light-sensitive sensor, the energy transformation device 2 may not work when the ambient light is strong enough for the outside observer to identify the transparent pattern 110, for example, in broad daylight. In that way, it ensures that the energy transformation device 2 starts to work only under certain dark condition,

such as at night. In an embodiment, the light-sensitive sensor sends a signal to disconnect the energy transformation device 2 and the power supply for a long time at night when there are enough ambient light.

According to embodiments of a second aspect of the present disclosure, a wheel comprising
5 the luminous wheel hub as described above is provided.

According to embodiments of a third aspect of the present disclosure, a vehicle comprising the wheel is provided. The wheel comprising the luminous wheel hub as described above.

Reference throughout this specification to “an embodiment,” “some embodiments,” “one embodiment,” “another example,” “an example,” “a specific example,” or “some examples,”
10 means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the phrases such as “in some embodiments,” “in one embodiment,” “in an embodiment,” “in another example,” “in an example,” “in a specific example,” or “in some examples,” in various places throughout this specification are not
15 necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples.

Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that the above embodiments can not be construed to limit the present
20 disclosure, and changes, alternatives, and modifications can be made in the embodiments without departing from spirit, principles and scope of the present disclosure.

What is claimed is:

1. A luminous wheel hub, comprising:

a wheel hub body,

a luminous device disposed on the wheel hub body,

5 an energy transformation device adapted to connect with a power supply, and comprising a first coil adapted to be fixed on a caliper bracket and a second coil configured to rotate with the wheel hub body,

wherein the energy transformation device is configured to output a current to the luminous device only when the first coil overlaps the second coil.

10 2. The luminous wheel hub according to claim 1, wherein the luminous device comprises:

a front cover having a transparent pattern;

a back cover connected with the front cover so as to define an enclosed space;

a light guide plate disposed in the enclosed space;

a circuit board disposed in the enclosed space;

15 a reflecting plate disposed in the enclosed space and between the light guide plate and the circuit board, and

an LED disposed on the circuit board and extending through the reflecting plate so as to be embedded in the light guide plate.

3. The luminous wheel hub according to claim 2, wherein the light guide plate comprises a plurality of light guide microstructures which form a luminous region corresponding to the transparent pattern.

4. The luminous wheel hub according to claim 2, wherein the luminous device further comprises a light shielding film disposed between the LED and the front cover.

5. The luminous wheel hub according to claim 1, further comprising:

25 a first box fixed onto a surface of the caliper bracket; and

a second box fixed onto a surface of the wheel hub body opposing to the surface of the caliper bracket,

wherein the first coil is disposed in the first box, and the second coil is disposed in the second box.

30 6. The luminous wheel hub according to claim 5, wherein the first box comprises:

a first shell capable of dissipating heat and defining a first chamber to receive the first coil;

and

a radiator disposed at a bottom of the first shell.

7. The luminous wheel hub according to claim 6, wherein the radiator comprises a plurality of heat-dissipating strips formed integrally with the first shell,

5 wherein the heat-dissipating strips and the first radiating shell are made of aluminum.

8. The luminous wheel hub according to claim 7, wherein the second box comprises a second plastic shell capable of dissipating heat and defining a second chamber to receive the second coil.

9. The luminous wheel hub according to claim 6, wherein the first coil defines a first end connected with the power supply and a second end connected to ground, and

10 wherein the first coil is connected in series with a switch module disposed in the first chamber.

10. The luminous wheel hub according to claim 9, further comprising:

a controller connected with the switch module and configured to control the switch module to switch on or switch off.

15 11. The luminous wheel hub according to claim 10, wherein the controller is configured to adjust an on-off frequency of the switch module according to a vehicle speed.

12. The luminous wheel hub according to claim 11, wherein the on-off frequency is about 300 KHz when the vehicle speed is in a range of 0-180 km/h.

20 13. The luminous wheel hub according to claim 1, wherein the second coil is connected in series with the luminous device so as to output the current to the luminous device.

14. The luminous wheel hub according to any of claims 1-13, further comprising:

a light-sensitive sensor connected with the energy transformation device and configured to turn on or turn off the energy transformation device according to ambient light.

15. A wheel comprising the luminous wheel hub according to any of claims 1-14.

25 16. A vehicle comprising the wheel according to claim 15.

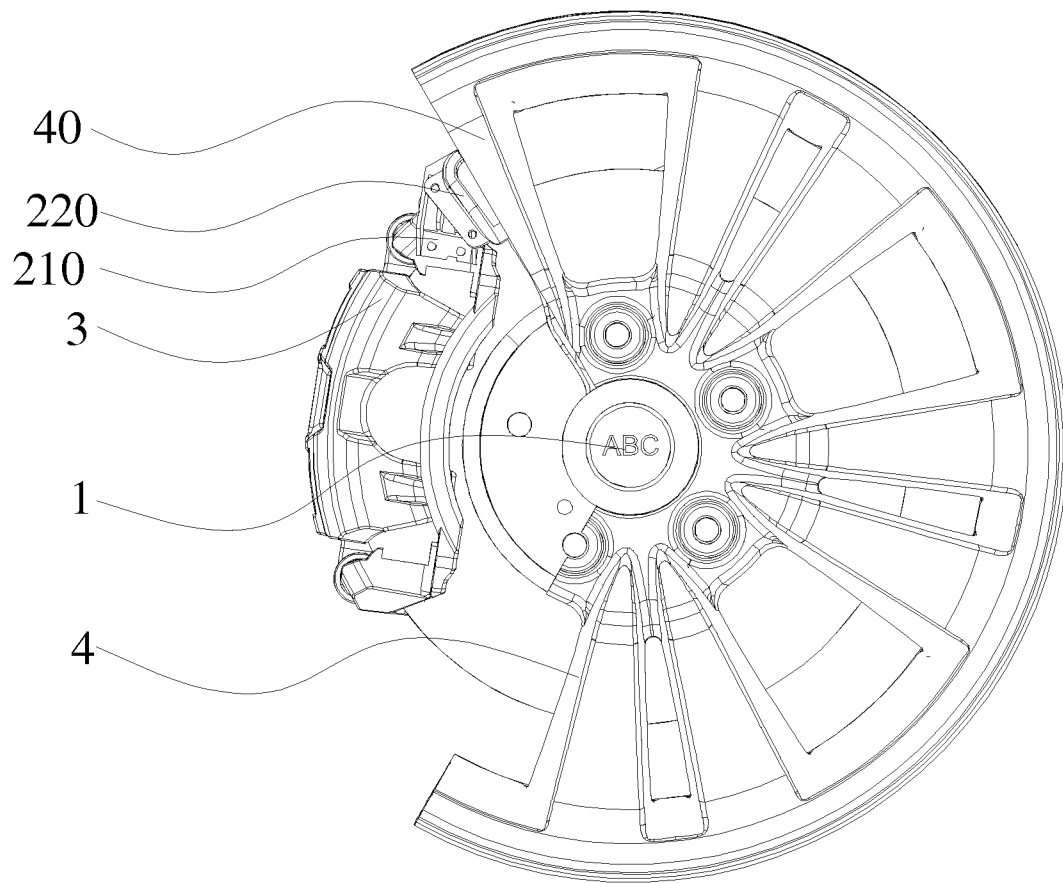


Fig. 1

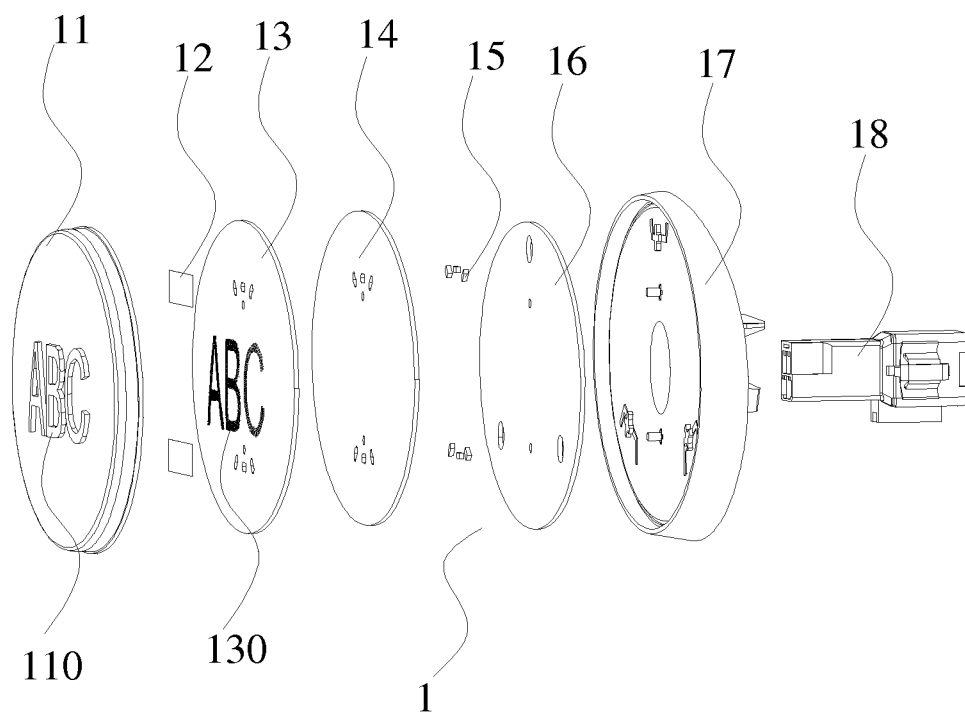


Fig. 2

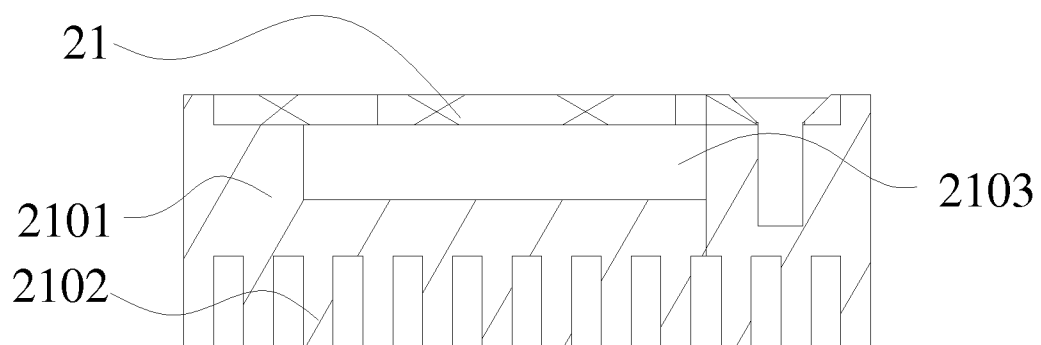


Fig. 3

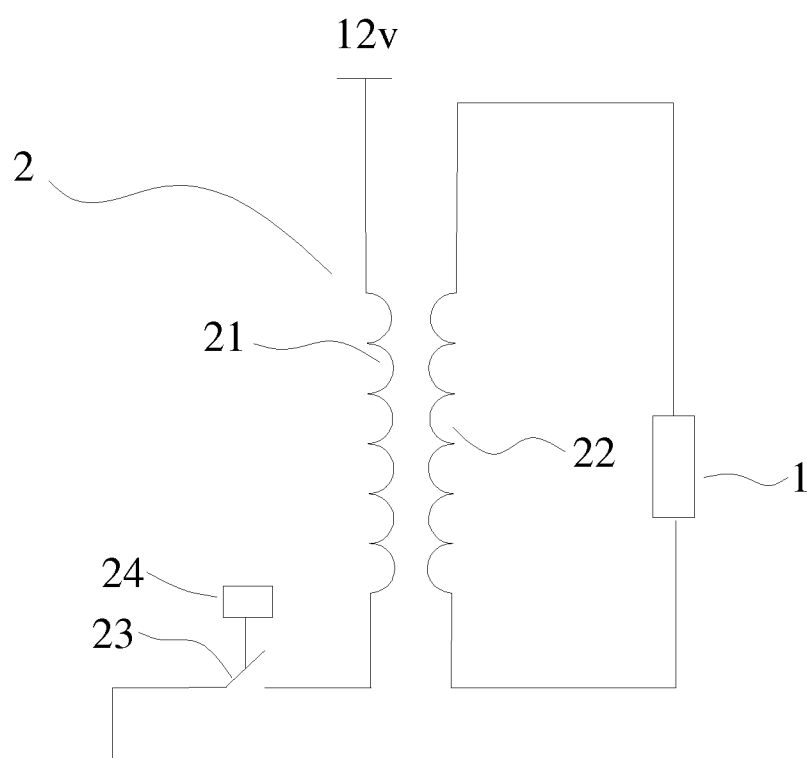


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2013/080391

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60B7/-, B60Q1/-

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)

WPI, EPODOC: luminous, illuminat???, blink???, light???, wheel?, hub?, coil?, magnet????, current, caliper?, circl???,
rotat???, bracket?, support???**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 2885624 Y (ZHOU, Wei) 04 April 2007 (04.04.2007) description, page 2, lines 6-17 and figures 1-2	1,5-16
A	WO 2009038391 A1 (PARK, Sung-Suk et al.) 26 March 2009 (26.03.2009) description, page 7, lines 27-30	1-16
A	CN 201841875 U (SHANGHAI EDIAUTOMOTIVE TECHNOLOGY CO., LTD.) 25 May 2011 (25.05.2011) the whole document	1-16
A	GB 2398041 A (LIU, Yao-Huang) 11 August 2004 (11.08.2004) the whole document	1-16
A	US 2011210600 A1 (LIN, Yung-Fa) 01 September 2011 (01.09.2011) the whole document	1-16
A	WO 2006137618 A1 (SUN, Mehao) 28 December 2006 (28.12.2006) the whole document	1-16

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“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
“A” document defining the general state of the art which is not considered to be of particular relevance	“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
“E” earlier application or patent but published on or after the international filing date	“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
“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)	“&” document member of the same patent family
“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	

Date of the actual completion of the international search 13 October 2013 (13.10.2013)	Date of mailing of the international search report 07 Nov. 2013 (07.11.2013)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer SHI, Guangyi Telephone No. (86-10) 62413109

International application No.
PCT/CN2013/080391

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2013/080391

A. CLASSIFICATION OF SUBJECT MATTER:

B60B 7/00 (2006.01)i

B60Q 1/32 (2006.01)i