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GB-A- 1 356 463
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US-A1- 2009 015 082

DESCRIPTION

(a) Technical Field of the Invention

[0001] The present invention relates to an improved motor structure and, more particularly, to a motor which can effectively dissipate the heat generated in its housing through multiple paths, so that heat is not easy to accumulate in the motor's housing, and thus the performance and service life of the motor can be increased.

(b) Description of the Prior Art

[0002] In today's industry, motors are one of commonly used devices for providing mechanical power. However, while a motor is running, heat is easy to accumulate in the motor's housing. If the heat is not timely dissipated, the magnetic field provided by the magnets in the motor's housing will decrease, so that the performance of the motor can be gradually reduced. Besides, when the temperature in the motor rises to a certain level, the coils or enamel wires in the motor can be damaged, and this may cause a short circuit, and thus the motor may burn out. For preventing such a problem, a motor is usually provided with a cooling fan. However, the air current generated by the cooling fan of the motor can merely flow along the outer surface of the motor's housing, but cannot flow into the interior of the motor, and thus the capacity of dissipating the heat generated in the motor is limited. The problem of heat accumulation in the motor's housing has not yet been solved completely.

[0003] JP H05 122885A discloses a motor with an external cooling fan, where the air flow generated by the cooling fan is guided inside and outside the motor housing.

[0004] GB 1356463 and US 2009/0015082 A1 disclose inlet and outlet vent holes at the bearing plates where air intercepting fins are used to guide the cooling air.

SUMMARY OF THE INVENTION

[0005] One object of the present invention is to provide a motor, which can effectively dissipate the heat generated in its housing through multiple paths. The problem is solved by the motor according to the invention as defined by claim 1.

[0006] According to one feature of the present invention, the motor generally includes a housing, a front cover, a rotating shaft, and a cooling fan. The housing defines therein an inner space with a front opening. The front cover closes the front opening of the housing and defines a central hole. The surrounding wall of the housing is pressed to form a plurality of air intercepting fins, which are bent outwardly such that a plurality of first inlet holes are defined

next to the corresponding air intercepting fins, whereby an outer portion of a whirling, ongoing air current generated by the cooling fan can be guided by the air intercepting fins to pass through the first inlet holes and thus to enter the housing for dissipating heat therein.

[0007] According to another feature of the present invention, an air passage is formed on the housing, between two adjacent intercepting fins to allow some of the outer portion of the air current to flow along an outer surface of the housing to cool down the temperature of the housing.

[0008] According to one advantage of the present invention, the motor can be used in a high-temperature environment without being damaged. In a test, the motor was continuously operated in a closed space of 70 degrees C for a long time without burning out.

[0009] Other objects, advantages, and novel features of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 shows an exploded view of a motor according to one embodiment of the present invention.

FIG. 2 shows a 3-dimensional view of the motor.

FIG. 3 shows another 3-dimensional view of the motor, which is viewed from a different angle than FIG. 2.

FIG. 4 shows a 3-dimensional view of a front cover used in the motor.

FIG. 5 shows a plan view of the motor.

FIG. 6 shows a sectional view of the motor taken along line E-E in FIG. 5, which demonstrates one portion of the air current being guided by the air intercepting fins to enter the inner space of the motor's housing for dissipating the heat generated in the motor.

FIG. 7 shows a sectional view of the motor taken along line F-F in FIG. 5, which demonstrates one portion of the air current being guided by the air intercepting fins to enter the inner space of the motor's housing for dissipating the heat generated in the motor.

FIG. 8 shows a working view of the motor, which demonstrates that the air current can flow out of the motor's housing via the outlet holes thereof to take away the heat generated in the motor.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Since the structure and operational principles of a motor have been known widely, a detailed description for the constituent parts thereof is not provided in the following paragraphs.

[0012] Referring first to FIGS. 1 through 3, a motor according to one embodiment of the present invention is shown, which generally includes a housing 1, a front cover 6, a rotating shaft 8, and a cooling fan 7. The housing 1 defines therein an inner space 15 with a front opening 10 and has a rear closure wall 11 opposite to the front opening 10. The rear closure wall 11 defines a central hole, in which a bearing may be mounted, and a plurality of outlet holes 14 around the central hole. The surrounding wall of the housing 1 is pressed to form a plurality of air intercepting fins 12, which are bent outwardly such that a plurality of inlet holes 13 are defined next to the corresponding air intercepting fins 12. The air intercepting fins 12 extend generally towards the front opening 10 of the housing 1 or the cooling fan 7, at a predetermined angle of ($\Theta 2$) to a cross-sectional plane (C) of the housing 1 which is perpendicular to the rotating shaft 8 (see FIG. 5), wherein the predetermined angle ($\Theta 2$) is greater than 90 degrees. Since there is no obstruction between two adjacent intercepting fins 12, a plurality of air passages 16 are formed between the intercepting fins 12. Furthermore, a rotor 2, coils 3 and magnets 4, which are necessary elements for a motor, are provided in the inner space 15 of the housing 1 (see FIG. 7). The rotating shaft 8 is mounted across the inner space 15 of the housing 1, wherein the rotating shaft 8 has a first end 80 which is inserted through the central hole of the rear closure wall 11 for connecting with a transmission mechanism (not shown) for providing necessary mechanical power. The rotating shaft 8 has a second end 89 which is inserted out of the front opening 10 of the housing 1 to be fitted with the cooling fan 7, as will be further illustrated below. A magnetically permeable sleeve 9, which can be made of metal, is closely fitted around the outer surface of the housing 1, to increase the performance of the motor.

[0013] The front cover 6 defines a central hole 61 and a plurality of inlet holes 64 around the central hole 61. Furthermore, the front cover 6 defines two through holes 66, 67, and is provided with two mounting tubes 68, 69 (see FIG. 4) at its inner surface. When the front cover 6 is installed to the housing 1, two electrical terminal blades 81, 82 provided in the housing 1 can be inserted through the two through holes 66, 67 of the front cover 6, while two fixing dowel rods 83, 84 provided in the housing 1 can be inserted into the mounting tubes 68, 69 of the front cover 6, so that the front cover 6 closes the front opening 10 of the housing 1, and electrical connection for the motor is facilitated. Furthermore, the front cover 6 defines a plurality of fixing holes 65, through which a plurality of screws can be engaged with other portions of the housing 1 (not shown), so that the front cover 6 can be installed to the housing 1 more firmly. While the front cover 6 is being installed to the housing 1, the second end 89 of the rotating shaft 8 can be inserted through the central hole 61 of the front cover 6, wherein a bearing (not shown) may be provided in the front cover 6 and fitted with the second end 89 of

the rotating shaft 8.

[0014] The cooling fan 7 defines a central hole 70, into which the second end 89 of the rotating shaft 8 extending out of the central hole 61 of the front cover 6 can be fitted, so that the cooling fan 7 is attached to and rotated together with the rotating shaft 8.

[0015] FIGS. 2 and 3 show one embodiment of the motor being assembled from the housing 1, the front cover 6, and the cooling fan 7. When the motor is started, the cooling fan 7 can be rotated together with the rotating shaft 8 to generate a whirling, ongoing air current towards the front cover 6, so that the air at the right side of the cooling fan 7 can be forced to flow into the left side of the cooling fan 7 (see FIG. 5). In particular, the air current can enter the inner space 15 of the housing 1 easily, and the heat generated in the housing 1 can be dissipated effectively through multiple paths (see FIGS. 5, 6 and 7). In addition to a central portion of the air current generated by the cooling fan 7 flowing into the housing 1 via the inlet holes 64 of the front cover 6, an outer portion of the air current, which is outside the area of the front cover 6 and constitutes a large portion of the air current, may enter the inner space 15 of the housing 1 via the inlet holes 13 of the housing 1. Specifically, the most part of the outer portion of the air current can be guided or intercepted by the intercepting fins 12 to pass through the corresponding inlet holes 13 and thus to enter the inner space 15 of the housing 1, as indicated by the airflow path (B) shown in FIG. 7, so that the temperatures of the rotor 2, the coils 3, and the magnets 4 in the housing 1 can be restrained effectively. On the other hand, the rest of the outer portion of the air current may flow along the outer surface of the housing 1 or the sleeve 9 via the air passages 16 between the intercepting fins 12 of the housing 1, as indicated by the airflow path (D) shown in FIG. 5, so that the housing 1 can be effectively cooled down to facilitate dissipation of the heat generated in the housing 1. In this embodiment, the air current which has entered the inner space 15 of the housing 1 can flow out of the housing 1 via the outlet holes 14 (see FIGS. 7 and 8).

[0016] As a summary, the intercepting fins 12 and the associated inlet holes 13 of the housing 1 allow the motor of the present invention to provide an airflow path (B) via which the most part of the outer portion of the air current generated by the cooling fan 7 enters the inner space 15 of the housing 1 to dissipate the heat generated in the housing 1. In addition, the air passages 16 between the intercepting fins 12 of the housing 1 allow the motor of the present invention to provide another airflow path (D) via which the rest of the outer portion of the air current flows along the outer surface of the housing 1 to lower the temperature of the housing 1 and thus to increase the capacity of dissipating the heat generated in the housing 1. Through multiple paths for heat dissipation, heat is not easy to accumulate in the housing 1 of the motor; therefore, maximum power output of the motor can be achieved, and thus the performance and service life of the motor can be increased. Even though the motor is operated in a high-temperature environment, it will not burn out.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JPH05122885A [0003]
- GB1356463A [0004]
- US20090015082A1 [0004]

Patentkrav

1. Motor omfattende et hus (1), et forreste dæksel (6), en roterende aksel (8) og en køleblæser (7), hvorved huset (1) afgrænser et indre rum (15) med en
5 forreste åbning (10) og har en bageste lukkevæg (11) modsat den forreste åbning (10), hvilken bageste lukkevæg (11) afgrænser et centralt hul og et antal udgangshuller (14), hvilket forreste dæksel (6) aflukker husets (1) forreste åbning (10) og afgrænser et centralt hul (61), hvilken roterende aksel (8) er monteret på tværs af husets (1) indre rum (15), idet den roterende aksel (8) har en første ende
10 (80), som er indført igennem det centrale hul i den bageste lukkevæg (11) og har en anden ende (89), som er indført igennem det forreste dæksels (6) centrale hul (61), hvilken køleblæser (7) er fastgjort til den roterende aksels (8) anden ende (89), således at køleblæseren (7) drejes rundt sammen med den roterende aksel (8), hvorved huset (1) presses til at danne et antal luftopfangningsfinner (12),
15 **kendetegnet ved**, at luftopfangningsfinnerne (12) bukket således udad, at der afgrænses et antal første indgangshuller (13) i tilstødning til de tilsvarende luftopfangningsfinner (12), hvorved en ydre del af en hvirvlende vedvarende luftstrøm, som genereres ved hjælp af køleblæseren (7), kan ved hjælp af luftopfangningsfinnerne (12) føres på en sådan måde, at den passerer igennem de første ind-
20 gangshuller (13) og dermed trænger ind i huset (1) med henblik på at sprede varme deri.
2. Motor ifølge krav 1, hvorved luftopfangningsfinnerne (12) strækker sig i hovedsagen imod køleblæseren (7) ved en forudbestemt vinkel (θ_2) i forhold til et
25 tværsnitsplan (C) i huset (1), som er vinkelret på den roterende aksel (7), hvilken forudbestemte vinkel (θ_2) er større end 90 grader.
3. Motor ifølge krav 1, hvorved der på huset (1) er tildannet en luftpassage (16) imellem to nærliggende opfangningsfinner (12) med henblik på at tillade noget af
30 den ydre del af luftstrømmen at strømme langs en ydre overflade på huset (1).

4. Motor ifølge krav 1, hvorved det forreste dæksel (6) afgrænser et antal sekundære indgangshuller (64) omkring sit centrale hul (61) med henblik på at tillade en central del af luftstrømmen at trænge ind i husets (1) indre rum (15) med henblik på at sænke husets (1) temperatur.

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5. Motor ifølge krav 1, hvorved det forreste dæksel (6) afgrænser to gennemgående huller (66, 67), som tillader to elektriske polblade (81, 82), som er tilvejebragt i huset (1), at blive indført herigennem for at lette den elektriske forbindelse og monteringen af det forreste dæksel (6) på huset (1).

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6. Motor ifølge krav 5, hvorved det forreste dæksel (6) er på sin indre overflade forsynet med et antal monteringsrør (68, 69), som tillader fastgørelse af dyveltappe (83, 84), som er tilvejebragt i huset (1), at blive indført heri med henblik på at montere det forreste dæksel (6) på huset (1) og derved aflukke husets (1) forreste åbning (10).

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7. Motor ifølge krav 6, hvorved det forreste dæksel (6) afgrænser et antal fastgørelshuller (65), hvorigennem et antal skruer føres i indgreb med andre dele af huset (1), således at det forreste dæksel (6) kan monteres mere fast på huset (1).

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DRAWINGS

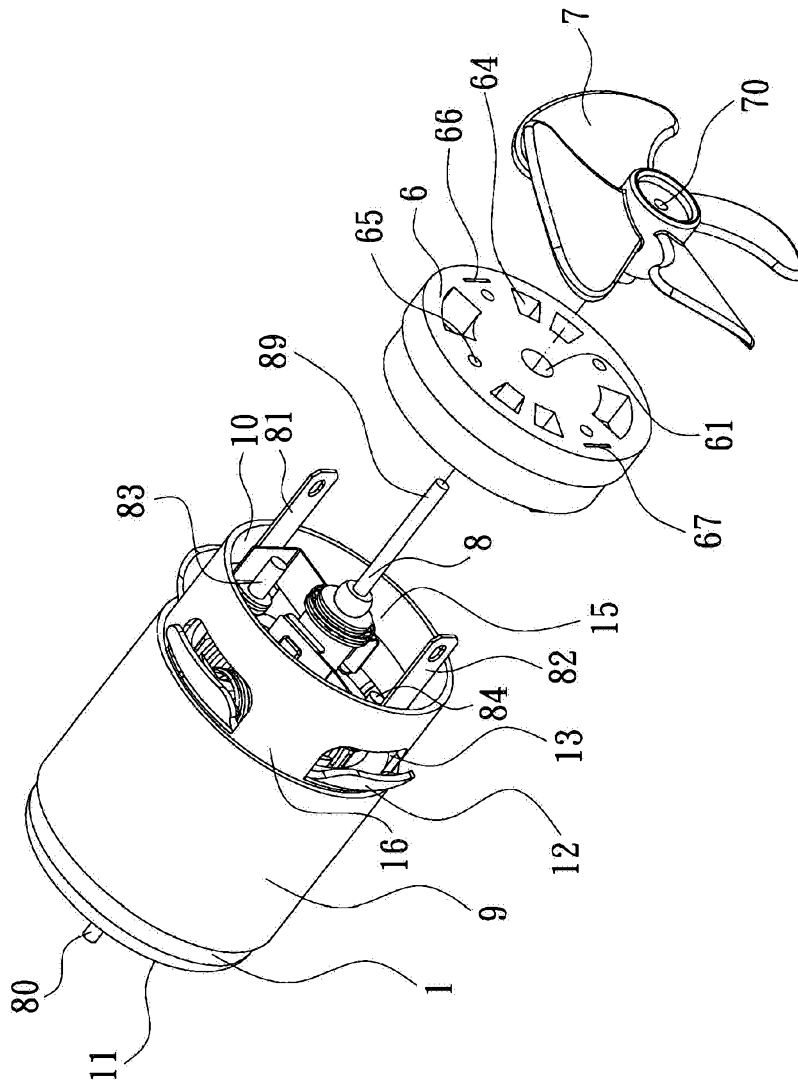


FIG. 1

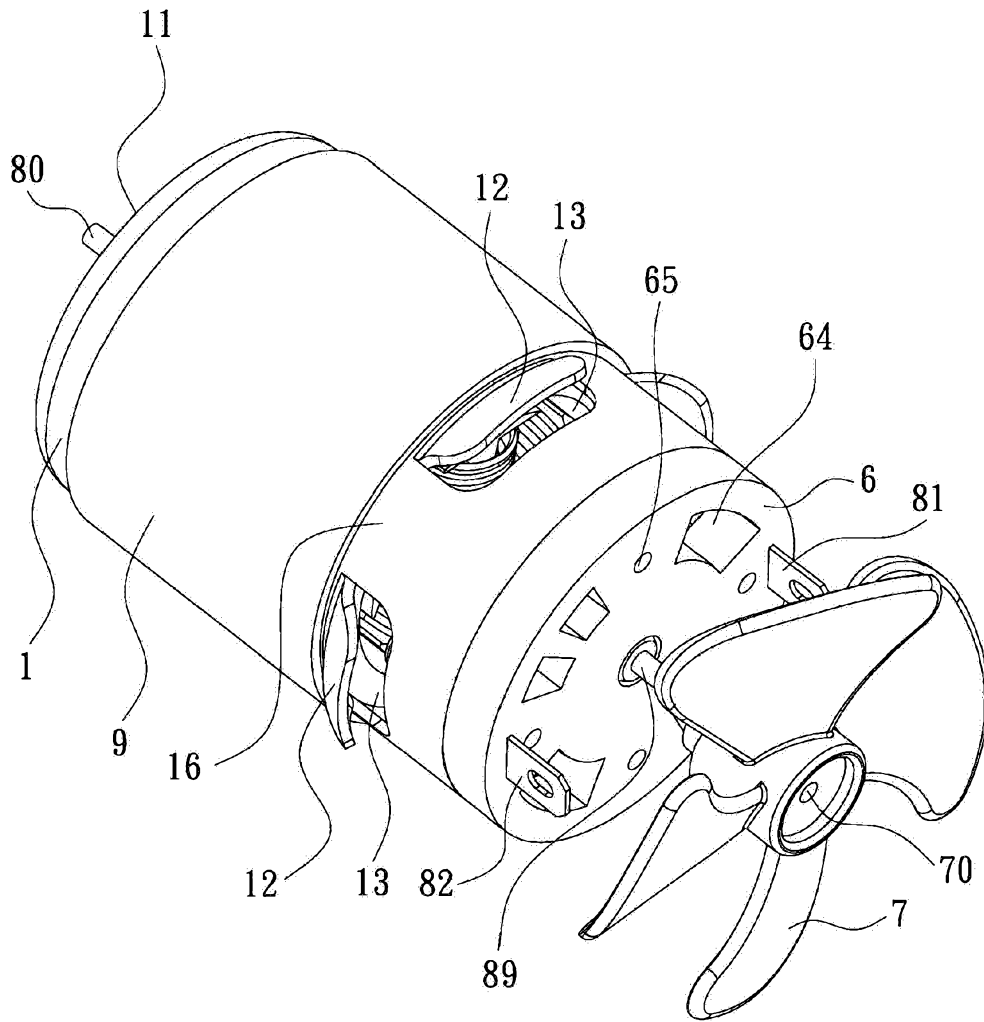


FIG. 2

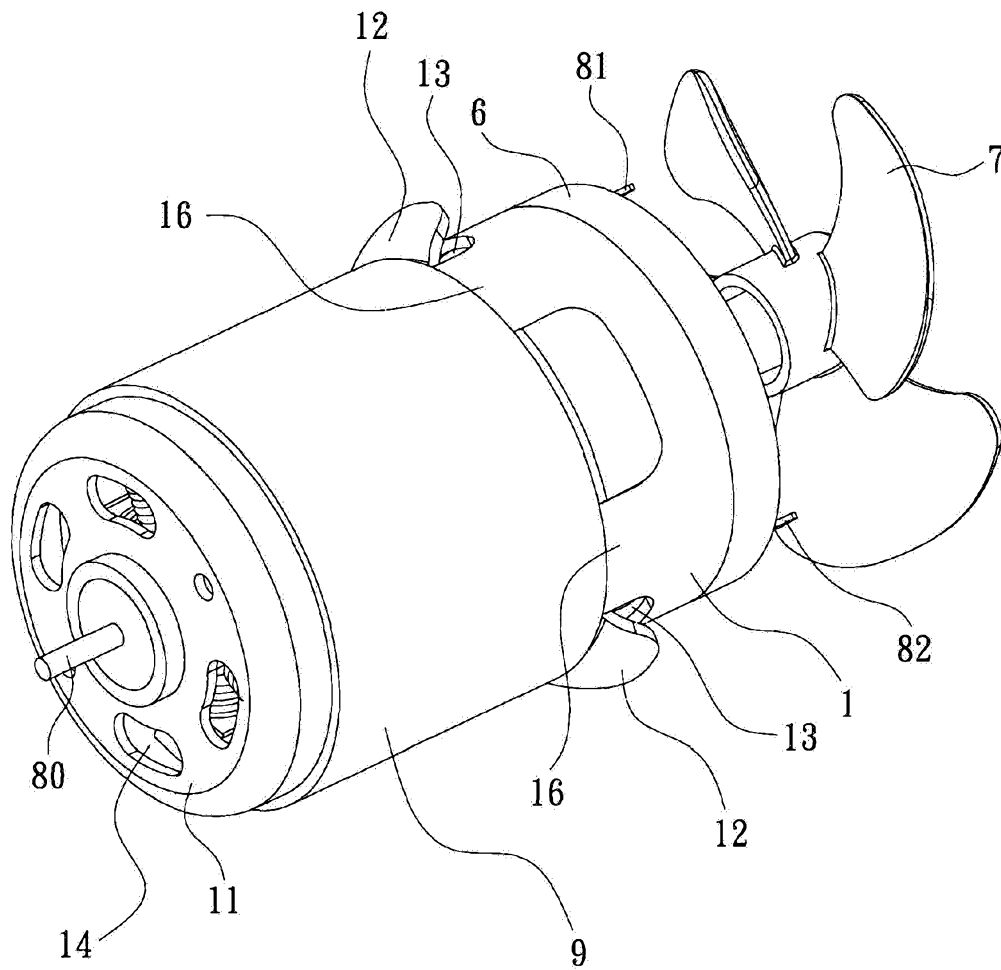


FIG. 3

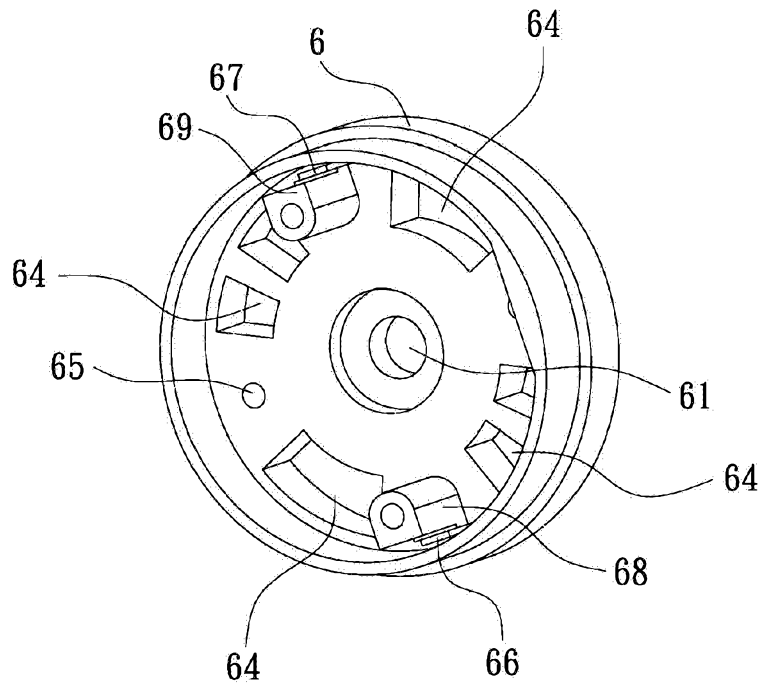


FIG. 4

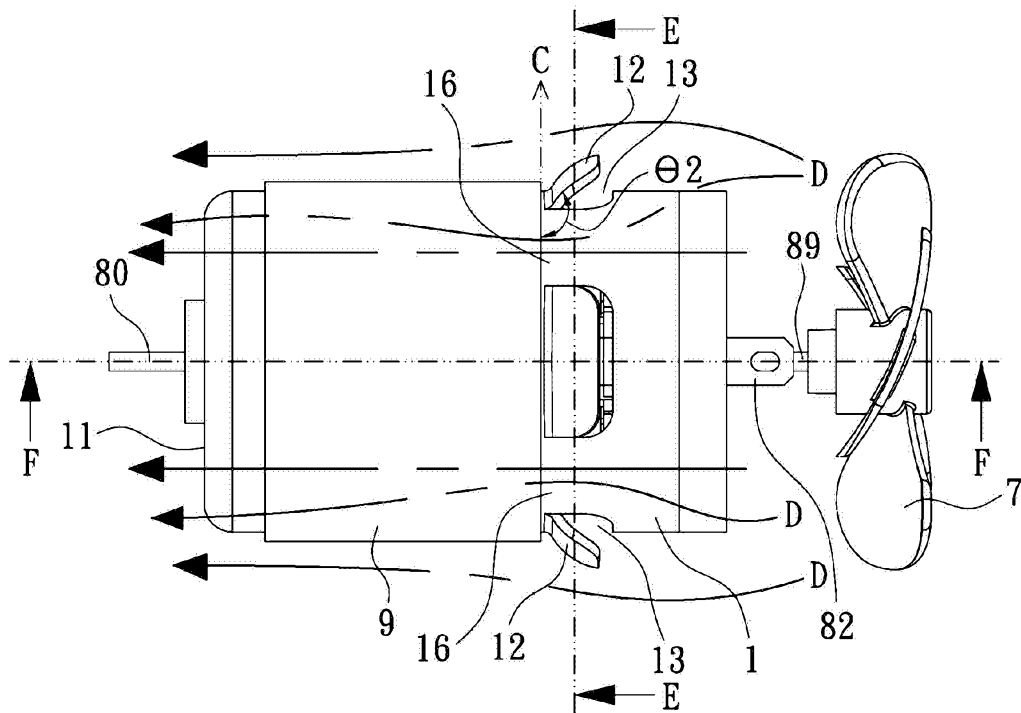


FIG. 5

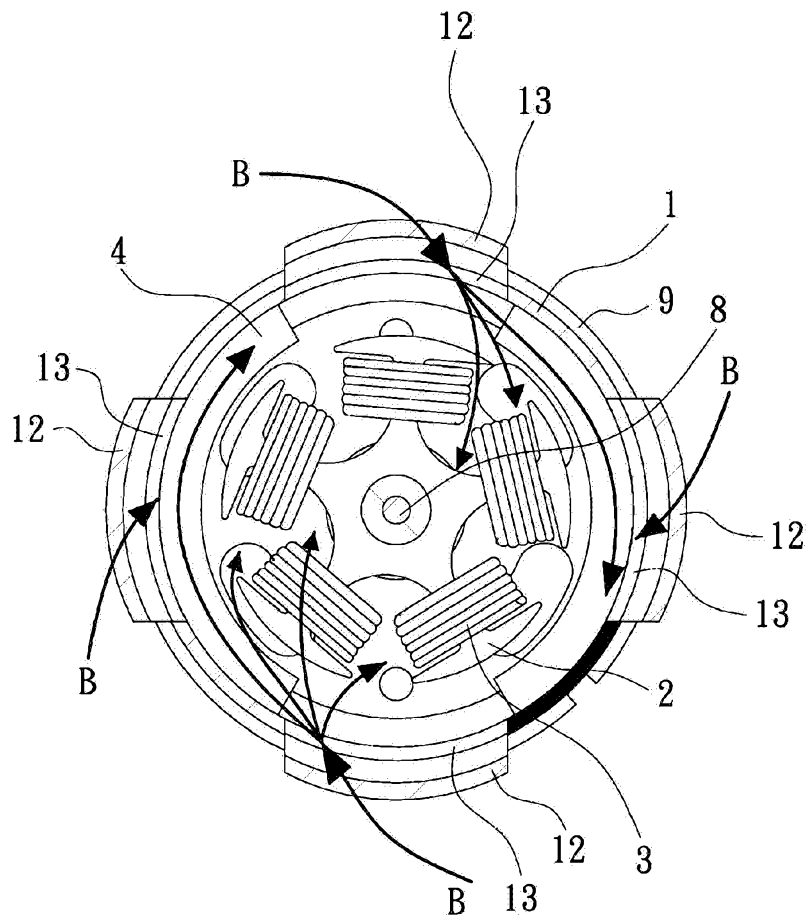


FIG. 6

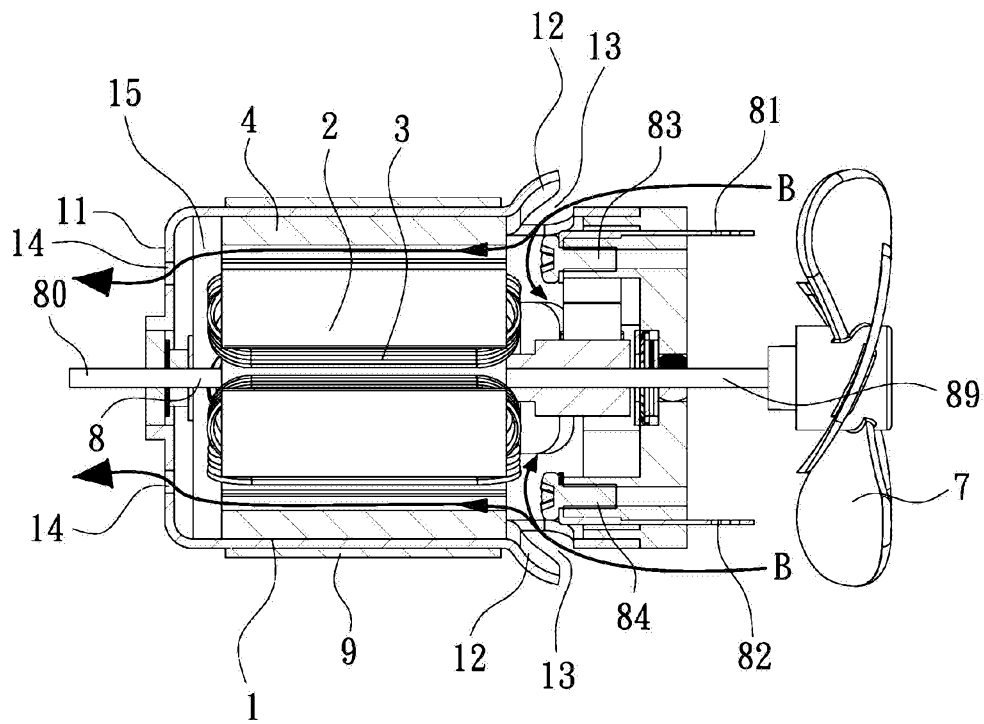


FIG. 7

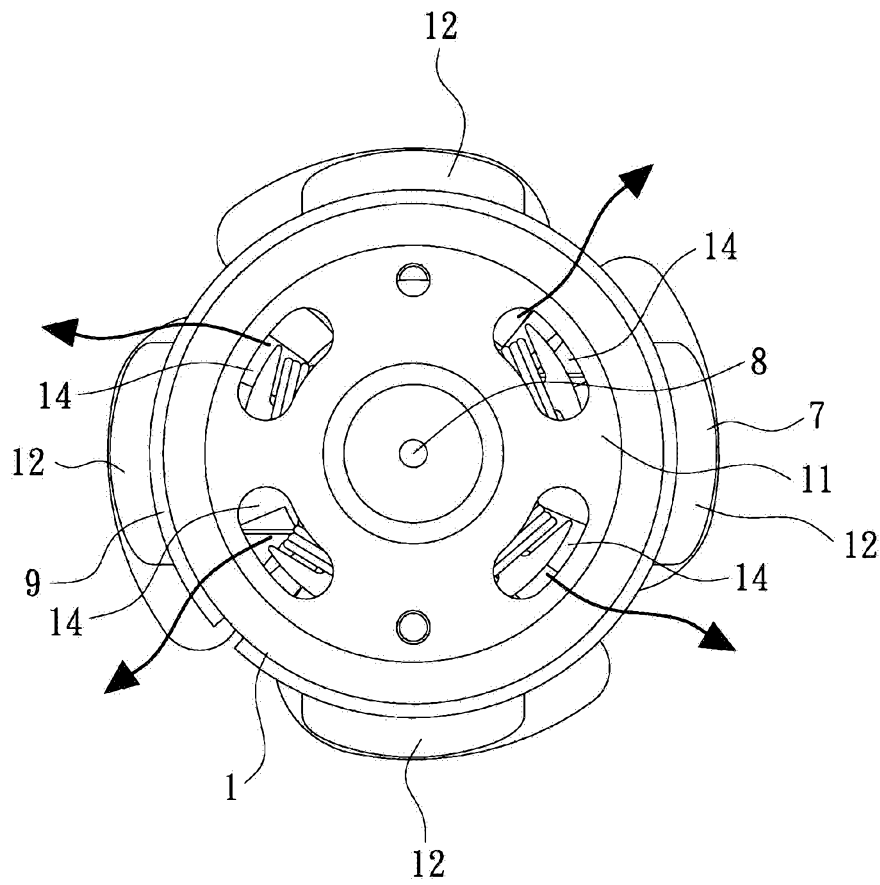


FIG. 8