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WO-A1-99/04479
US-A1- 2008 303 360
US-A1- 2010 148 602
US-A1- 2015 130 306

DESCRIPTION

(a) Technical Field of the Invention

[0001] The present invention relates to a motor with a heat dissipation 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.

[0003] 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.

[0004] 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

[0005] yet been solved completely. Prior art document WO 99/04479 A1 discloses an additional shroud positioned around the cooling fan impeller in order to improve cooling of the motor.

SUMMARY OF THE INVENTION

[0006] One object of the present invention is to provide a motor which can effectively dissipate heat therein. 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, which closes the front opening of the housing, is pressed to form a plurality of air guiding fins and a plurality of inlet holes corresponding to the air guiding fins. As such, a central portion of the air current generated by the cooling fan can be guided by the air guiding fins to pass through the inlet holes of the front cover, thus entering the housing, whereby the heat generated in the motor can be dissipated effectively.

[0007] According to one feature of the present invention, the surrounding wall of the housing defines at least one communication hole, through which the air within the housing can flow into ambient environment. In one embodiment, while the motor is running, the air current having entered the housing can flow out of the housing via the communication hole, so that the temperature within the motor's housing can be reduced effectively.

[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 working view of the motor, which demonstrates the air current being guided by the air guiding fins to enter the associated inlet holes of the front cover for dissipating the heat generated in the motor.

FIG 5 shows a plan view of the motor.

FIG 6 shows a sectional view of the motor, which demonstrates a first airflow path (A) and a second airflow path (B) for the air current for dissipating the heat generated in the motor.

FIG 7 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 operation of a motor has 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 mounting collar 5, 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 housing 1 is provided with a plurality of hooks 12 at its front edge which defines 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 defines a plurality of communication holes 13, through which the air within the housing 1 can flow into ambient environment. 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 6). 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 mounting collar 5 is provided with two opposite sheaths 51, 52 at one side and two mounting tubes 53, 54 at the other side or the opposite side, wherein the two sheaths 51, 52 allows two electrical terminal blades 81, 82 provided in the housing 1 to insert therethrough, while the two mounting tubes 53, 54 allows two fixing dowel rods 83, 84 provided in the housing 1 to insert therein, so that the front cover 6 can be coupled to the housing 1 and thus closes the front opening 10 of the housing 1.

[0014] The front cover 6, which is substantially disk-shaped, has a central hub 60 defining a central hole 61 and has a peripheral portion formed around the central hub 60. The front cover 6 is pressed to form a plurality of air guiding fins 63, which are bent from the peripheral portion of the front cover 6 such that a plurality of inlet holes 64 are defined next to the corresponding air guiding fins 63. The air guiding fins 63 extend generally towards the cooling fan 7, so that they are at a predetermined angle of ($\Theta 1$) to a reference plane (V), which is perpendicular to the rotating shaft 8 or with which the front cover 6 is coincident (see FIG 6), wherein the predetermined angle ($\Theta 1$) is greater than 90 degrees. Furthermore, the front cover 6 defines at its outer edge two opposite first cutouts 621 which are capable of engaging with the sheaths 51, 52 of the mounting collar 5, so as to fix the front cover 6 to the mounting collar 5 which is in turn fixed to the housing 1. Furthermore, the front cover 6 defines a plurality of second cutouts 622, which are smaller than the first cutouts 621, corresponding to the hooks 12 of the housing 1. As the front cover 6 is coupled to the housing 1 by the mounting collar 5, the hooks 12 of the housing are fitted into the second cutouts 622 of the front cover 6 to snap the front cover 6, thereby facilitating the front cover 6 being coupled to the housing 1. Still 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 fixed more firmly. While the front cover 6 is being coupled to the housing 1 by the mounting collar 5, the second end 89 of the rotating shaft 8 can be inserted through the central hole 61 of the central hub 60 of the front cover 6, wherein a bearing (not shown) may be provided in the central hub 60 of the front cover 6 and fitted with the second end 89 of the rotating shaft 8.

[0015] 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.

[0016] FIGS. 2 and 3 show one embodiment of the motor being assembled from the housing 1, the mounting collar 5, 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 5, 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 more easily, and the heat generated in the housing 1 can be dissipated effectively through multiple paths (see FIGS. 4 and 6). A central portion of the air current generated by the cooling fan 7 can be guided by the air guiding fins 63 of the front cover 6 to pass through the associated inlet holes 64 and thus to enter the inner space 15 of the housing 1. While the motor is running, the central portion of the air current may follow a first airflow path (A) to dissipate the heat generated in the housing 1 (see FIGS. 4 and 6). In this embodiment, the air current which has entered the housing 1 can flow out of the housing 1 via the outlet holes 14 and the communication holes 13 (see FIGS. 6 and 7). An outer portion of the air current generated by the cooling fan 7, which is outside the area surrounded by the air guiding fins 63 of the front cover 6, can flow along the outer surface of the housing 1 or the sleeve 9; namely, the outer portion of the air current may follow a second airflow path (B) to cool down the temperature of the housing 1 (see FIG 6) and thus to facilitate dissipation of the heat generated in the housing 1. The two airflow paths (A), (B) allow the heat generated in the housing 1 to dissipate more effectively, so that the motor can be prevented from burning out.

[0017] As a summary, the air guiding fins 63 and the associated inlet holes 64 of the front cover 6 allow the motor of the present invention to provide an airflow path (A) via which a central portion of the air current generated by the cooling fan 7 enters the housing 1 to dissipate the heat generated in the housing 1. In addition, the motor of the present invention provides another airflow path (B) via which an 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 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. These features render the motor of the present invention useful and inventive.

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

- WO9904479A1 [0005]

Patentkrav

1. Motor, som har et hus (1), et forreste dæksel (6), en drejelig aksel (8) og en kølende ventilator (7), og hvor huset (1) har et indre rum (15) med en forreste
5 åbning (10) og en bageste lukkevæg (11), som er anbragt modsat den forreste åbning (10), og hvor den bageste lukkevæg (11) fastlægger et centralt hul og et antal udløbshuller (14); og hvor det forreste dæksel (6), som er i hovedsagen diskformet, aflukker den forreste åbning (10) i huset (1) og har et centralt nav (60), som fastlægger et centralt hul (61) og har en periferisk del tildannet omkring
10 det centrale nav (60), hvilken drejelige aksel (8) er monteret ind gennem det indre rum (15) i huset (1), hvilken drejelige aksel (8) har en første ende (80), som er indskudt i det centrale hul i den bageste lukkevæg (11) og har en anden ende (89), som er indskudt gennem det centrale hul (61) i navet (60) i det forreste dæksel (6); hvilken kølende ventilator (7) er fastgjort til den anden ende (89) af
15 den drejelige aksel (8), så at den kølende ventilator (7) kan rotere sammen med den drejelige aksel (8), **kendetegnet ved**, at det forreste dæksel (6) er således oppresset, at der er dannet et antal luft-ledefinner (63), som er bukket bort fra den perifere del af det forreste dæksel (6), således at et antal indløbshuller (64) er fastlagt ved siden af de tilsvarende luft-ledefinner (63); og at huset (1) fastlægger
20 mindst et kommunikationshul (13) ved husets omgivende væg; hvorved en del af en hvirvlende luftstrøm skabt af den kølende ventilator (7) kan blive ledt af luft-ledefinnerne (63), så at en luftstrøm kan passere gennem indløbshuller (64) i det forreste dæksel (6), så at luftstrømmen kan passere ind i det indre rum (15) i huset (1) og endeligt strømme ud af huset (1) via kommunikationshullerne (13)
25 og udløbshullerne (14) med henblik på at bortlede den varme, som er genereret i huset (1).

2. Motor ifølge krav 1, hvor luft-ledefinnerne (63) strækker sig i hovedsagen hen mod den kølende ventilator (7), idet de danner en i forvejen bestemt vinkel
30 (θ_1) med et referenceplan (V), med hvilket det forreste dæksel (6) er sammenfaldende, og hvor den i forvejen bestemte vinkel (θ_1) er større end 90 grader.

3. Motor ifølge krav 1, hvor det forreste dæksel (6) er koblet til huset (1) ved hjælp af en monteringskrave (5), som er forsynet med to modsat beliggende kapper (51, 52) ved den ene side og to monteringsrør (53, 54) ved en modsat side, og hvor de to kapper (51, 52) gør det muligt, at to elektriske terminalblade (81, 82), som er tilvejebragt i huset (1), kan indskydes herimellem, medens de to monteringsrør (53, 54) tillader fastgørelse af to dyvel-stænger (83, 84), som er tilvejebragt i huset (1), kan indskydes herimellem, medens de to monteringsrør (53, 54) tillader fastgørelse af to dyvel-stænger (83, 84), som er tilvejebragt i huset (1), idet de er indskudt heri, således at det forreste dæksel (6) kan fastgøres på sin plads og aflukke den forreste åbning (10) i huset (1).

4. Motor ifølge krav 3, hvor det forreste dæksel (6) ved sin ydre kant fastlægger to modsat beliggende udskæringer (62), som kan gå i indgreb med kapperne (51, 52) i monteringskraven (5), således at det forreste dæksel (6) kan fastgøres på sin plads.

5. Motor ifølge krav 4, hvor huset (1) ved sin forkant er forsynet med et antal kroge (12) og fastlægger den forreste åbning (10), og hvor det forreste dæksel (6) fastlægger et antal sekundære udskæringer (622), hvor krogene (12) kan stikkes ind gennem nævnte sekundære udskæringer (622), så at de snapper det forreste dæksel (6).

6. Motor ifølge krav 5, hvor det forreste dæksel (6) fastlægger et antal fastgørelsesshuller (65), hvorigennem et antal skruer er bragt i indgreb med andre dele af huset (1), så at det forreste dæksel (6) kan fastgøres mere solidt.

DRAWINGS

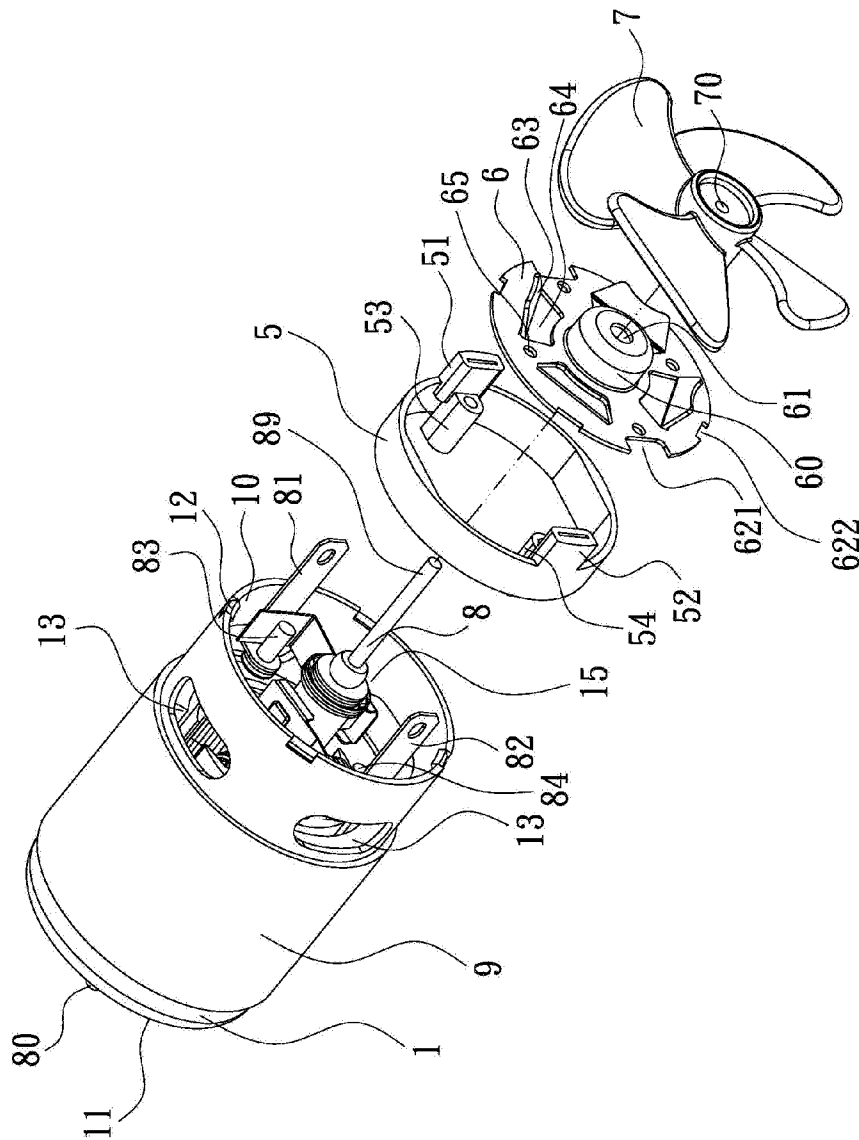


FIG. 1

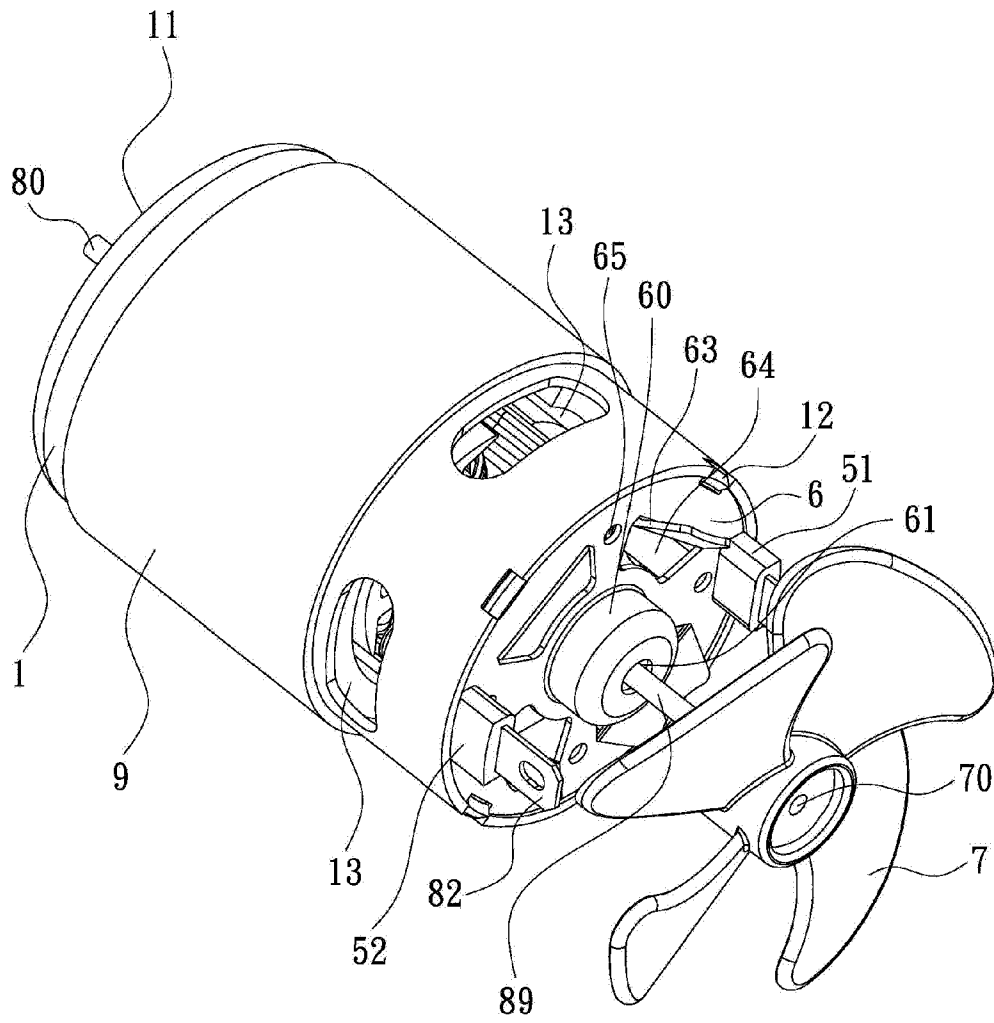


FIG. 2

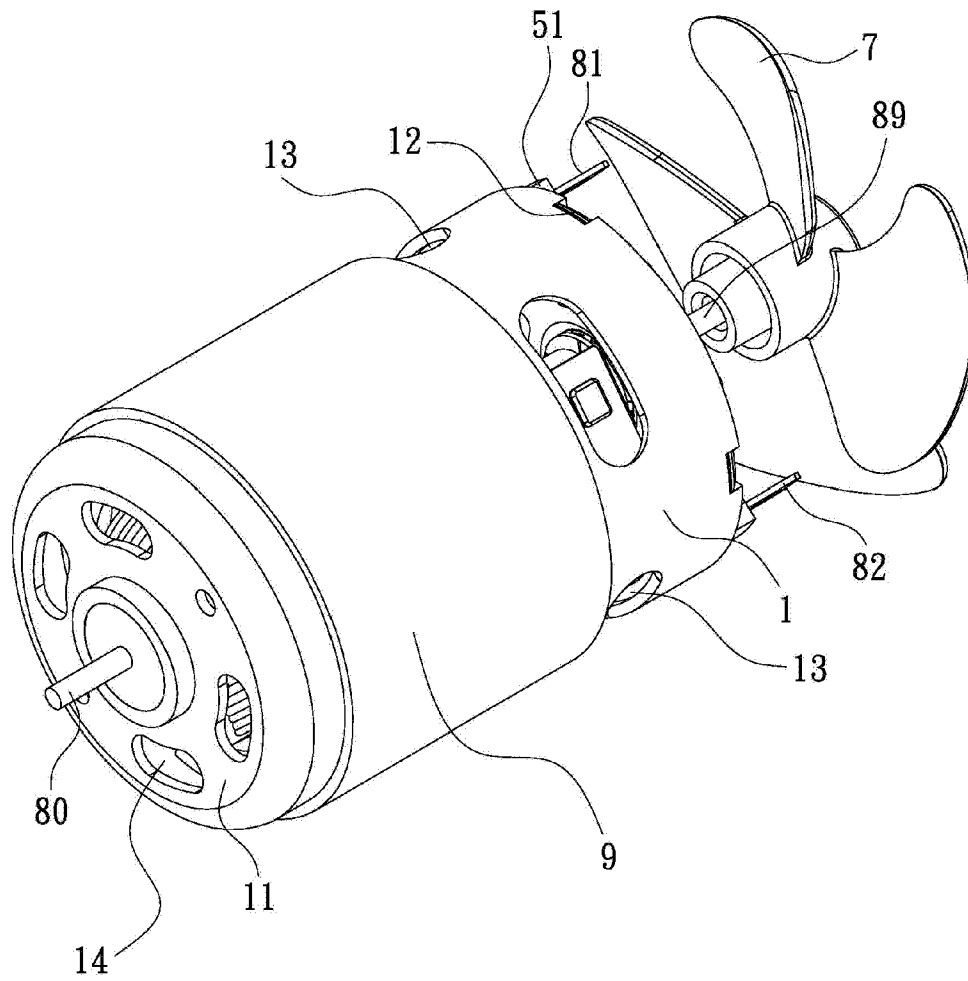


FIG. 3

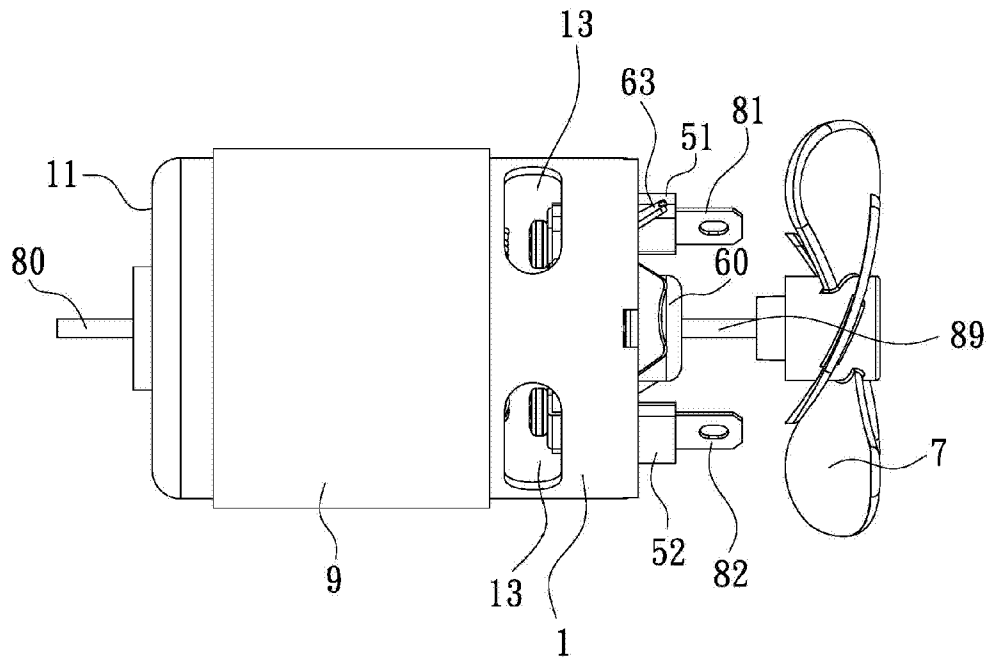


FIG. 5

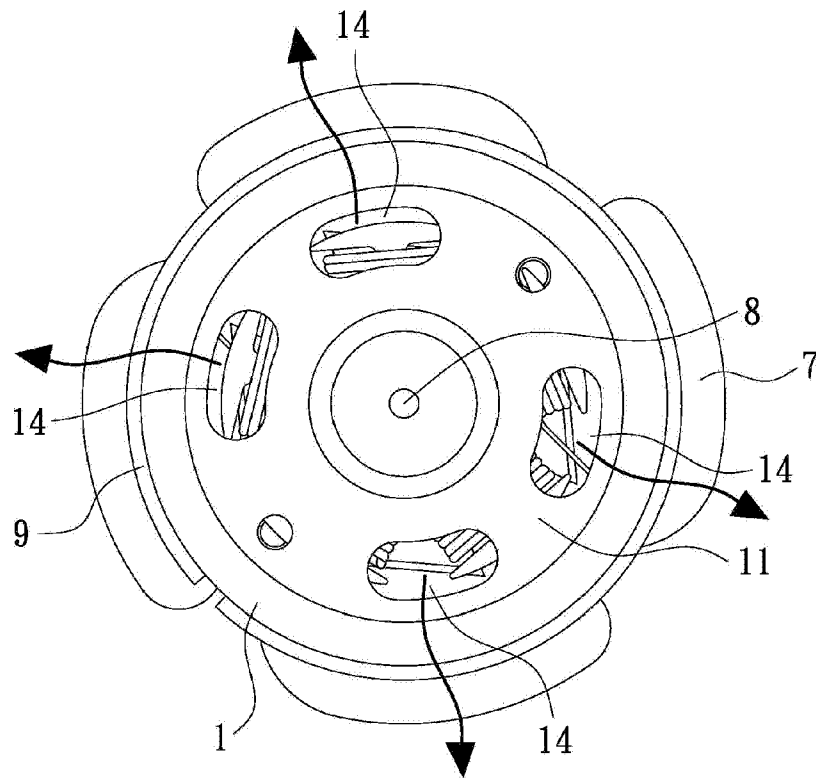


FIG. 7