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Inventor(s)	SEO; Yeong Woo et al.

MOTOR

Abstract

The present disclosure relates to a motor including a stator, a coil wound around the stator, a housing member provided to surround a circumference of the stator and having a cooling medium injection portion through which a cooling medium is injected, a guide flow path defined between the housing member and the stator and configured to communicate with the cooling medium injection portion and guide the cooling medium, and a guide member provided at an end of the housing member and configured to guide the cooling medium, which is discharged from the guide flow path, toward an end-turn portion of the coil exposed to an end of the stator, thereby obtaining an advantageous effect of improving cooling performance, stability, and reliability.

Inventors: **SEO; Yeong Woo (Yongin-si, KR), YIM; Jung Kyu (Yongin-si, KR), KIM; Sang Jin (Yongin-si, KR), LEE; Seung Ho (Yongin-si, KR), GAM; Myung Jun (Yongin-si, KR), PARK; Hee Seo (Yongin-si, KR)**

Applicant: **HYUNDAI MOBIS CO., LTD.** (Seoul, KR)

Family ID: **1000008449475**

Assignee: **HYUNDAI MOBIS CO., LTD. (Seoul, KR)**

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2024-0024466 filed in the Korean Intellectual Property Office on Feb. 20, 2024, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a motor, and more particularly, to a motor capable of improving cooling performance, safety, and reliability.

BACKGROUND ART

[0003] A hybrid vehicle or an electric vehicle, which is called an environmentally friendly vehicle, generates driving power using an electric motor (hereinafter, referred to as a ‘drive motor’) that obtains rotational force from electrical energy.

[0004] In general, the drive motor includes a stator coupled to a housing, and a rotor rotatably disposed in the stator with a predetermined air gap from the stator.

[0005] The stator includes a core made by stacking electric steel sheets and having a plurality of coil winding portions, and a stator coil wound around the core.

[0006] Meanwhile, high-temperature heat is generated in the motor because of eddy currents created in the stator. When the temperature of the motor is raised to a predetermined temperature, the efficiency and lifespan of the motor may deteriorate. Therefore, it is necessary to essentially cool the motor to prevent damage caused by heat and consistently enable stable operability.

[0007] However, in the related art, it is difficult to effectively cool an end-turn portion of the coil exposed (protruding) to an end of the stator. For this reason, it is difficult to ensure sufficient performance in cooling the motor.

[0008] Recently, various studies have been conducted to improve the performance in cooling the motor, but the study results are still insufficient. Accordingly, there is a need to develop a technology to improve the performance in cooling the motor.

SUMMARY

[0009] The present disclosure has been made in an effort to provide a motor for an electric vehicle, which is capable of improving cooling performance, stability, and reliability.

[0010] In particular, the present disclosure has been made in an effort to effectively ensure efficiency and performance in cooling an end-turn portion of a coil.

[0011] The present disclosure has also been made in an effort to simplify a structure and reduce costs.

[0012] The present disclosure has also been made in an effort to minimize power consumption and improve energy efficiency.

[0013] The objects to be achieved by the embodiments are not limited to the above-mentioned objects, but also include objects or effects that may be understood from the solutions or embodiments described below.

[0014] In order to achieve the above-mentioned objects, an exemplary embodiment of the present disclosure provides a motor including: a stator; a coil wound around the stator; a housing member provided to surround a circumference of the stator and having a cooling medium injection portion through which a cooling medium is injected; a guide flow path defined between the housing member and the stator and configured to communicate with the cooling medium injection portion and guide the cooling medium; and a guide member provided at an end of the housing member and configured to guide the cooling medium, which is discharged from the guide flow path, toward an

end-turn portion of the coil exposed to an end of the stator.
[0015] This is to improve the performance in cooling the motor and improve the stability and reliability.
[0016] That is, high-temperature heat is generated in the motor because of eddy currents created in the stator. When the temperature of the motor is raised to a predetermined temperature, the efficiency and lifespan of the motor may deteriorate. Therefore, it is necessary to essentially cool the motor to prevent damage caused by heat and consistently enable stable operability.
[0017] However, in the related art, it is difficult to effectively cool an end-turn portion of the coil exposed (protruding) to an end of the stator. For this reason, it is difficult to ensure sufficient performance in cooling the motor.
[0018] In contrast, in the embodiment of the present disclosure, the cooling medium discharged along the guide flow path is guided to the end-turn portion of the coil by means of the guide member. Therefore, it is possible to obtain an advantageous effect of improving the stability, reliability, and performance in cooling the motor.
[0019] Among other things, in the embodiment of the present disclosure, the cooling medium injected into the cooling medium injection portion not only cools the core portion of the coil (or the stator) while moving along the guide flow paths, but also is concentratedly sprayed, by means of the guide member, to the end-turn portions of the coil that generate a relatively large amount of heat. Therefore, it is possible to obtain an advantageous effect of minimizing a temperature deviation (cooling performance deviation) between the core portion of the coil and the end-turn portion and more effectively eliminating heat generated by the stator and the coil.
[0020] The guide member may have various structures capable of guiding the cooling medium, which is discharged from the guide flow path, to the end-turn portion of the coil.
[0021] According to the exemplary embodiment of the present disclosure, the guide member may include: a connection portion connected to the end of the housing member; and a guide portion provided at an end of the connection portion and configured to guide the cooling medium, which is discharged from the guide flow path, toward the end-turn portion.
[0022] According to the exemplary embodiment of the present disclosure, the guide portion may be provided to be inclined with respect to the connection portion and directed toward the end-turn portion.
[0023] As described above, in the embodiment of the present disclosure, the guide portion is provided to be inclined with respect to the connection portion. Therefore, it is possible to obtain an advantageous effect of minimizing a situation in which the cooling medium discharged from the guide flow path scatters backward in random directions when the cooling medium comes into contact with the guide portion. Further, it is possible to obtain an advantageous effect of more accurately controlling a spray direction of the cooling medium to the direction toward the end-turn portion of the coil.
[0024] According to the exemplary embodiment of the present disclosure, the motor may include: an inclined guiding portion provided integrally with the end of the housing member and configured to guide the cooling medium, which is discharged from the guide flow path, toward the end-turn portion.
[0025] As described above, in the embodiment of the present disclosure, the inclined guiding portion is provided at the end of the housing member. Therefore, it is possible to obtain an advantageous effect of more accurately controlling the spray direction of the cooling medium, which is discharged from the guide flow path, to the direction toward the end-turn portion of the coil.
[0026] According to the exemplary embodiment of the present disclosure, the motor may include: a guide baffle provided on an inner circumferential surface of the guide portion and protruding in a longitudinal direction of the housing member.
[0027] As described above, in the embodiment of the present disclosure, the guide baffles are

provided on the inner circumferential surface of the guide portion, such that the cooling medium discharged from the guide flow path may be guided to the end-turn portion of the coil without stagnating on the inner circumferential surface of the guide portion or flowing downward to a lower end of the guide portion in a circumferential direction of the guide portion. Therefore, it is possible to obtain an advantageous effect of more accurately controlling the supply direction of the cooling medium to the direction toward the end-turn portion of the coil.

[0028] According to the exemplary embodiment of the present disclosure, the motor may include: a guide groove provided in an outer surface of the stator in a longitudinal direction of the stator, in which the guide flow path is defined along the guide groove.

[0029] According to the exemplary embodiment of the present disclosure, the motor may include: a guide protrusion provided at an end of the guide groove and configured to define an outlet flow path having a smaller cross-sectional area than the guide flow path.

[0030] As described above, in the embodiment of the present disclosure, the outlet flow path, through which the cooling medium supplied along the guide flow path is finally discharged, has a smaller cross-sectional area than the guide flow path, such that a discharge speed of the cooling medium to be discharged along the outlet flow path may be increased on the basis of the Bernoulli's principle, and the cooling medium may be sprayed to the end-turn portions of the coil. Therefore, it is possible to obtain an advantageous effect of further improving the efficiency and performance in cooling the end-turn portions of the coil.

[0031] According to the exemplary embodiment of the present disclosure, the motor may include: a guide clip provided at an end of the guide groove and configured to guide the cooling medium toward the end-turn portion.

[0032] The guide clip may have various structures capable of guiding the cooling medium, which is discharged from the guide flow path, to the end-turn portion of the coil.

[0033] According to the exemplary embodiment of the present disclosure, the guide clip may include: a head portion provided at the end of the guide groove; a first leg portion connected to one end of the head portion and supported on a first inner wall surface of the guide groove; a second leg portion connected to the other end of the head portion and supported on a second inner wall surface of the guide groove that faces the first inner wall surface; a discharge flow path defined between the first leg portion and the second leg portion and configured to guide the cooling medium, which moves along the guide flow path, to an inner surface of the head portion; and an inclined portion provided on the inner surface of the head portion and configured to guide the cooling medium toward the end-turn portion.

[0034] The discharge flow path may have various structures capable of guiding the cooling medium, which moves along the guide flow path, to the inner surface of the head portion.

[0035] According to the exemplary embodiment of the present disclosure, the discharge flow path may be defined to have a cross-sectional area that gradually decreases from an inlet, which is adjacent to a central portion of the stator, toward an outlet.

[0036] As described above, in the embodiment of the present disclosure, the discharge flow path has a cross-sectional area that gradually decreases from the inlet toward the outlet, such that a discharge speed of the cooling medium to be discharged through the outlet of the outlet flow path may be increased on the basis of the Bernoulli's principle, and the cooling medium may be sprayed to the inner surface (inclined portion) of the head portion. Therefore, it is possible to obtain an advantageous effect of further improving the efficiency and performance in cooling the end-turn portion of the coil.

[0037] According to the embodiment of the present disclosure described above, it is possible to obtain an advantageous effect of improving the cooling performance, stability, and reliability.

[0038] In particular, according to the embodiment of the present disclosure, it is possible to obtain an advantageous effect of effectively ensuring the efficiency and performance in cooling the end-turn portion of the coil.

[0039] In addition, according to the embodiment of the present disclosure, it is possible to obtain an advantageous effect of simplifying the structure and reducing the costs.
[0040] In addition, according to the embodiment of the present disclosure, it is possible to obtain an advantageous effect of minimizing electric power consumption and improving energy efficiency.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0041] FIG. **1** is a view for explaining a motor according to an embodiment of the present disclosure.
[0042] FIG. **2** is a view for explaining a guide member of the motor according to the embodiment of the present disclosure.
[0043] FIG. **3** is a view for explaining guide protrusions of the motor according to the embodiment of the present disclosure.
[0044] FIGS. **4** and **5** are views for explaining a modified example of the guide member of the motor according to the embodiment of the present disclosure.
[0045] FIGS. **6** to **8** are views for explaining a guide clip of the motor according to the embodiment of the present disclosure.
DETAILED DESCRIPTION
[0046] Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.
[0047] However, the technical spirit of the present disclosure is not limited to some embodiments described herein but may be implemented in various different forms. One or more of the constituent elements in the embodiments may be selectively combined and substituted for use within the scope of the technical spirit of the present disclosure.
[0048] In addition, unless otherwise specifically and explicitly defined and stated, the terms (including technical and scientific terms) used in the embodiments of the present disclosure may be construed as the meaning which may be commonly understood by the person with ordinary skill in the art to which the present disclosure pertains. The meanings of the commonly used terms such as the terms defined in dictionaries may be interpreted in consideration of the contextual meanings of the related technology.
[0049] In addition, the terms used in the embodiments of the present disclosure are for explaining the embodiments, not for limiting the present disclosure.
[0050] In the present specification, unless particularly stated otherwise, a singular form may also include a plural form. The expression “at least one (or one or more) of A, B, and C” may include one or more of all combinations that can be made by combining A, B, and C.
[0051] In addition, the terms such as first, second, A, B, (a), and (b) may be used to describe constituent elements of the embodiments of the present disclosure.
[0052] These terms are used only for the purpose of discriminating one constituent element from another constituent element, and the nature, the sequences, or the orders of the constituent elements are not limited by the terms.
[0053] Further, when one constituent element is described as being ‘connected,’ ‘coupled,’ or ‘attached’ to another constituent element, one constituent element may be connected, coupled, or attached directly to another constituent element or connected, coupled, or attached to another constituent element through still another constituent element interposed therebetween.
[0054] In addition, the expression “one constituent element is provided or disposed above (on) or below (under) another constituent element” includes not only a case in which the two constituent elements are in direct contact with each other, but also a case in which one or more other constituent elements are provided or disposed between the two constituent elements. The

expression "above (on) or below (under)" may mean a downward direction as well as an upward direction based on one constituent element.

[0055] With reference to FIGS. **1** to **8**, a motor **10** according to an embodiment of the present disclosure includes a stator **110**, a coil **130** wound around the stator **110**, a housing member **120** configured to surround a circumference of the stator **110** and having a cooling medium injection portion **122** through which a cooling medium is injected, guide flow paths **140** defined between the housing member **120** and the stator **110** configured to communicate with the cooling medium injection portion **122** and guide the cooling medium, and a guide member **150** provided at an end of the housing member **120** and configured to guide the cooling medium, which is discharged from the guide flow path **140**, toward end-turn portions **132** of the coil **130** exposed to an end of the stator **110**.

[0056] For reference, the motor **10** according to the embodiment of the present disclosure may be applied to various objects in accordance with required conditions and design specifications. The present disclosure is not restricted or limited by the type and properties of the object to which the motor **10** is applied.

[0057] For example, the motor **10** according to the embodiment of the present disclosure may be used as a drive motor for a hybrid vehicle or an electric vehicle.

[0058] With reference to FIGS. **1** to **3**, the stator **110** is configured to induce an electrical interaction collectively with a rotor (not illustrated).

[0059] More specifically, the stator **110** may be accommodated in the housing member **120**, and the coil **130** may be wound around the stator **110** and configured to induce an electrical interaction between the stator and the rotor.

[0060] More specifically, the stator **110** may include a stator core (not illustrated) provided to have a hollow cylindrical shape.

[0061] The stator core may have various structures in which a plurality of teeth (not illustrated) is provided along an inner circumferential surface thereof and spaced apart from one another, and slots (not illustrated) are defined between the teeth. The present disclosure is not restricted or limited by the structure and size (standard) of the stator core.

[0062] For example, the stator core may be made by stacking a plurality of electric steel sheets in an axial direction of the stator **110**. According to another embodiment of the present disclosure, the stator core may be made by using a plurality of split cores that collectively defines a ring shape.

[0063] The coil **130** may be made of a typical metallic material (e.g., copper) capable of defining a magnetic path. The present disclosure is not restricted or limited by the material and shape of the coil **130**.

[0064] For example, an annular coil **130** having a circular cross-section may be used as the coil **130**. According to another embodiment of the present disclosure, a flat coil (also referred to as an angular copper wire or a hairpin) having an angular cross-section (e.g., a quadrangular cross-section) may be used as the coil.

[0065] In the state in which the coil **130** is disposed (wound) in the stator **110**, the end-turn portions **132** of the coil **130**, which are exposed to the outside of the stator **110** (left and right ends of the stator based on an axial direction based on FIG. **1**), may be twisted in a predetermined posture and then welded. For example, end turn portions **132** of the coil **130**, which are exposed to the outside of the stator **110**, may be disposed to define an approximately ring shape.

[0066] The rotor is rotated by an electrical interaction between the rotor and the stator **110** and configured to provide driving power to the object.

[0067] The rotor may have various structures capable of being rotated by the electrical interaction between the rotor and the stator **110**. The present disclosure is not restricted or limited by the type and structure of the rotor.

[0068] For example, the rotor may include a rotor core (not illustrated) and magnets (not illustrated). The rotor core may have a structure made by stacking a plurality of circular plates each

provided in the form of a thin steel sheet or be provided in the form of a bin.
[0069] A shaft hole (not illustrated) may be provided at a center of the rotor, and a shaft may be coupled to the shaft hole.
[0070] Protrusions (not illustrated) may protrude from an outer circumferential surface of the rotor core and guide the magnets. The magnets may be attached to the outer circumferential surface of the rotor core and spaced apart from one another at predetermined intervals in a circumferential direction of the rotor core.
[0071] In addition, the rotor may include a can member (not illustrated) configured to surround the magnets and inhibit the separation of the magnets.
[0072] The housing member **120** is provided to surround the circumference of the stator **110**. The cooling medium injection portion **122**, through which the cooling medium is injected, is provided in the housing member **120**.
[0073] The housing member **120** may have various structures capable of surrounding the circumference of the stator **110**. The present disclosure is not restricted or limited by the structure and shape of the housing member **120**.
[0074] In particular, the housing member **120** may be provided in an approximately circular cylindrical shape that continuously surrounds a circumference of the coil **130**.
[0075] For reference, in the embodiment of the present disclosure illustrated and described above, the example has been described in which the housing member **120** is provided in a cylindrical shape that continuously surrounds the circumference of the stator **110**. However, according to another embodiment of the present disclosure, the housing member may be configured to partially surround a part of the circumference of the stator (e.g., have a circular arc shape).
[0076] With reference to FIGS. **1** and **2**, the cooling medium injection portion **122** is formed through a wall surface of the housing member **120** so that the cooling medium is injected into the housing member **120**.
[0077] For reference, in the embodiment of the present disclosure, the cooling medium may be defined as a refrigerant (cooling medium) for cooling the coil **130** (or the stator). The present disclosure is not restricted or limited by the type and properties of the cooling medium. Hereinafter, an example will be described in which oil having a lower temperature than the coil **130** is used as the cooling medium.
[0078] The cooling medium injection portion **122** may have various structures capable of injecting the cooling medium. The present disclosure is not restricted or limited by the structure and shape of the cooling medium injection portion **122**.
[0079] For example, the cooling medium injection portion **122** may have an approximately circular hole shape and be formed through the wall surface of the housing member **120**.
[0080] In particular, the cooling medium injection portion **122** may be provided in an approximately central portion of the housing member **120** based on a longitudinal direction of the housing member **120** (the axial direction of the stator).
[0081] As described above, because the cooling medium injection portion **122** is provided in an approximately central portion of the housing member **120** based on the axial direction of the stator **110**, it is possible to obtain an advantageous effect of supplying the cooling medium, which is injected through the cooling medium injection portion **122**, to the end-turn portions **132** at two opposite sides of the coil **130** under a uniform condition (e.g., at a uniform temperature and a uniform flow rate).
[0082] With reference to FIGS. **2** to **3**, the guide flow paths **140** are defined between the housing member **120** and the stator **110** and configured to communicate with the cooling medium injection portion **122** and guide the cooling medium, which is injected through the cooling medium injection portion **122**, to the end of the stator **110** (the end-turn portions of the coil).
[0083] In the embodiment of the present disclosure, the configuration in which the guide flow paths **140** are defined between the housing member **120** and the stator **110** is defined as including

both a configuration in which the guide flow paths **140** are formed in an inner surface of the housing member **120** or an outer surface of the stator **110** and a configuration in which the guide flow paths **140** are respectively formed in the inner surface of the housing member **120** and the outer surface of the stator **110**.

[0084] For example, the motor **10** may include guide grooves **112** provided in the outer surface of the stator **110** in a longitudinal direction of the stator **110**, and the guide flow paths **140** may be defined along the guide grooves **112**.

[0085] In particular, the guide flow path **140** may have a shape straight in the longitudinal direction of the stator **110**. According to another embodiment of the present disclosure, the guide flow path may be formed to be inclined with respect to the longitudinal direction of the stator, or the guide flow path may be formed in a curved shape.

[0086] With the above-mentioned structure, the cooling medium injected through the cooling medium injection portion **122** may move along the guide flow paths **140** to the end-turn portions **132** of the coil **130** exposed to the end of the stator **110**. As the cooling medium moves along the guide flow paths **140**, all a core portion of the coil **130** (or the stator) and the end-turn portions **132** of the coil **130** may be cooled.

[0087] With reference to FIG. **3**, according to the exemplary embodiment of the present disclosure, the motor **10** may include guide protrusions **114** provided at ends of the guide grooves **112** and configured to define outlet flow paths **114***a* each having a smaller cross-sectional area than the guide flow path **140**.

[0088] For example, the guide protrusions **114** may be respectively provided on two opposite inner wall surfaces (a first inner wall surface and a second inner wall surface) of the end of the guide groove **112**. The outlet flow path **114***a*, which has a smaller cross-sectional area than the guide flow path **140**, may be defined between the guide protrusions **114** that face each other. According to another embodiment of the present disclosure, the guide protrusion may be provided only on any one of the two opposite inner wall surfaces of the end of the guide groove.

[0089] As described above, in the embodiment of the present disclosure, the outlet flow path **114***a*, through which the cooling medium supplied along the guide flow path **140** is finally discharged, has a smaller cross-sectional area than the guide flow path **140**, such that a discharge speed of the cooling medium to be discharged along the outlet flow path **114***a* may be increased on the basis of the Bernoulli's principle, and the cooling medium may be sprayed to the end-turn portions **132** of the coil **130**. Therefore, it is possible to obtain an advantageous effect of further improving the efficiency and performance in cooling the end-turn portions **132** of the coil **130**.

[0090] With reference to FIGS. **1** and **2**, the guide member **150** is provided to allow the cooling medium discharged from the guide flow path **140** to have directionality so that the cooling medium is directed toward the end-turn portion **132** of the coil **130**. In other words, the guide member **150** is provided to allow the cooling medium discharged from the guide flow path **140** to be concentratedly supplied to the end-turn portion **132** of the coil **130**.

[0091] The guide member **150** may have various structures capable of guiding the cooling medium, which is discharged from the guide flow path **140**, to the end-turn portion **132** of the coil **130**. The present disclosure is not restricted or limited by the structure of the guide member **150**.

[0092] According to the exemplary embodiment of the present disclosure, the guide member **150** may include a connection portion **152** connected to the end of the housing member **120**, and a guide portion **154** provided at an end of the connection portion **152** and configured to guide the cooling medium, which is discharged from the guide flow path **140**, toward the end-turn portion **132**.

[0093] For example, the connection portion **152** may have an approximately hollow ring shape and be connected to the end of the housing member **120** (e.g., fastened by a fastening bolt). The guide portion **154** may be bent and integrated with the end of the connection portion **152** while facing the outlet of the guide flow path **140**.

[0094] As described above, in the embodiment of the present disclosure, the cooling medium discharged from the guide flow path **140** comes into contact with the guide portion **154** and then is guided to the end-turn portions **132** of the coil **130**, such that the cooling medium may be concentratedly supplied to the end-turn portions **132** of the coil **130**. Therefore, it is possible to obtain an advantageous effect of further improving the efficiency in cooling the end-turn portions **132** of the coil **130**.

[0095] According to the exemplary embodiment of the present disclosure, the guide portion **154** may be provided to be inclined with respect to the connection portion **152** so that the guide portion **154** is directed toward the end-turn portion **132**.

[0096] In this case, the configuration in which the guide portion **154** is provided to be inclined with respect to the connection portion **152** may be understood as a configuration in which the guide portion **154** is disposed to be inclined at a predetermined angle with respect to a radial direction of the stator **110**.

[0097] An angle of the guide portion **154** with respect to the connection portion **152** may be variously changed in accordance with the structure and specifications of the end-turn portion **132** of the coil **130**. The present disclosure is not restricted or limited by the angle of the guide portion **154** with respect to the connection portion **152**.

[0098] As described above, in the embodiment of the present disclosure, the guide portion **154** is provided to be inclined with respect to the connection portion **152**. Therefore, it is possible to obtain an advantageous effect of minimizing a situation in which the cooling medium discharged from the guide flow path **140** scatters backward in random directions when the cooling medium comes into contact with the guide portion **154**. Further, it is possible to obtain an advantageous effect of more accurately controlling a spray direction of the cooling medium to the direction toward the end-turn portion **132** of the coil **130**.

[0099] In addition, with reference to FIG. **2**, according to the exemplary embodiment of the present disclosure, the motor **10** may include an inclined guiding portion **124** provided integrally with the end of the housing member **120** and configured to guide the cooling medium, which is discharged from the guide flow path **140**, toward the end-turn portions **132**.

[0100] For example, the above-mentioned guide member **150** may be provided at one end (the left end based on FIG. **6**) of the housing member **120**, and the inclined guiding portion **124** may be integrated with the other end (the right end based on FIG. **6**) of the housing member **120**.

[0101] For example, the inclined guiding portion **124** and the housing member **120** may be formed as a unitary one-piece structure by partially processing the end of the housing member **120**.

[0102] An angle of the inclined guiding portion **124** may be variously changed in accordance with the structure and specifications of the end-turn portion **132** of the coil **130**. The present disclosure is not restricted or limited by the angle of the inclined guiding portion **124**.

[0103] As described above, in the embodiment of the present disclosure, the inclined guiding portion **124** is provided at the end of the housing member **120**. Therefore, it is possible to obtain an advantageous effect of more accurately controlling the spray direction of the cooling medium, which is discharged from the guide flow path **140**, to the direction toward the end-turn portion **132** of the coil **130**.

[0104] In the embodiment of the present disclosure illustrated and described above, the example has been described in which the guide portion **154** is provided to be inclined with respect to the connection portion **152**. However, according to another embodiment of the present disclosure, the guide portion may extend in a radial direction of the connection portion.

[0105] That is, with reference to FIGS. **4** and **5**, the guide member **150** may include a connection portion **152′** connected to the end of the stator **110**, and a guide portion **154′** provided at an end of the connection portion **152′** and configured to guide the cooling medium, which is discharged from the guide flow path **140**, toward the end-turn portion **132**. The guide portion **154′** may extend in a radial direction of the connection portion **152′** (the radial direction of the stator) and be disposed to cover the outlet of the guide flow path **140**.

[0106] In addition, with reference to FIG. **4**, according to the exemplary embodiment of the present disclosure, the motor **10** may include guide baffles **156** provided on an inner circumferential surface of the guide portion **154′** and protruding in the longitudinal direction of the housing member **120**.

[0107] The guide baffle **156** may be provided to be inclined at a predetermined angle with respect to a radial direction of the guide member **150**. The present disclosure is not restricted or limited by the arrangement angle of the guide baffle **156**.

[0108] In particular, the guide baffles **156** may be provided as a plurality of guide baffles **156** provided to be spaced apart from one another in a circumferential direction of the guide member **150**.

[0109] As described above, in the embodiment of the present disclosure, the guide baffles **156** are provided on the inner circumferential surface of the guide portion **154′**, such that the cooling medium discharged from the guide flow path **140** may be guided to the end-turn portion **132** of the coil **130** without stagnating on the inner circumferential surface of the guide portion **154′** or flowing downward to a lower end (a lower end based on a gravitational direction) of the guide portion **154′** in a circumferential direction of the guide portion **154′**. Therefore, it is possible to obtain an advantageous effect of more accurately controlling the supply direction of the cooling medium to the direction toward the end-turn portion **132** of the coil **130**.

[0110] With reference to FIGS. **6** to **8**, according to the exemplary embodiment of the present disclosure, the motor **10** may include guide clips **160** provided at the ends of the guide grooves **112** and configured to guide the cooling medium toward the end-turn portions **132**.

[0111] The guide clip **160** is provided to allow the cooling medium discharged from the guide flow path **140** to have directionality so that the cooling medium is directed toward the end-turn portions **132** of the coil **130**. In other words, the guide member **150** is provided to allow the cooling medium discharged from the guide flow path **140** to be concentratedly supplied to the end-turn portions **132** of the coil **130**.

[0112] Hereinafter, an example will be described in which the guide clips **160** are respectively provided at two opposite ends of the guide flow path **140**.

[0113] The guide clip **160** may have various structures capable of guiding the cooling medium, which is discharged from the guide flow path **140**, to the end-turn portion **132** of the coil **130**. The present disclosure is not restricted or limited by the structure of the guide clip **160**.

[0114] According to the exemplary embodiment of the present disclosure, the guide clip **160** may include a head portion **161** provided at an end of the guide groove **112**, a first leg portion **163** connected to one end of the head portion **161** and supported on the first inner wall surface of the guide groove **112**, a second leg portion **164** connected to the other end of the head portion **161** and supported on the second inner wall surface of the guide groove **112** that faces the first inner wall surface, a discharge flow path **165** defined between the first leg portion **163** and the second leg portion **164** and configured to guide the cooling medium, which moves along the guide flow path **140**, to an inner surface of the head portion **161**, and an inclined portion **162** provided on the inner surface of the head portion **161** and configured to guide the cooling medium toward the end-turn portion **132**.

[0115] For example, the head portion **161**, the first leg portion **163**, and the second leg portion **164** may be connected to collectively define an approximately “U” shape.

[0116] For example, the head portion **161**, the first leg portion **163**, and the second leg portion **164** may each be made of a typical plastic material. The first leg portion **163** and the second leg portion **164** may be supported by the head portion **161** and configured to be elastically movable in directions in which the first leg portion **163** and the second leg portion **164** move toward and away from each other relative to the head portion **161**.

[0117] The discharge flow path **165** may have various structures capable of guiding the cooling medium, which moves along the guide flow path **140**, to the inner surface of the head portion **161**. The present disclosure is not restricted or limited by the structure and shape of the discharge flow path **165**.

[0118] In particular, the discharge flow path **165** may be defined to have a cross-sectional area that gradually decreases in a direction from an inlet (a right side based on FIG. **7**), which is adjacent to a central portion of the stator **110**, toward an outlet (a left side based on FIG. **7**).

[0119] As described above, in the embodiment of the present disclosure, the discharge flow path **165** has a cross-sectional area that gradually decreases from the inlet toward the outlet, such that a discharge speed of the cooling medium to be discharged through the outlet of the outlet flow path **114***a* may be increased on the basis of the Bernoulli's principle, and the cooling medium may be sprayed to the inner surface (inclined portion) of the head portion **161**. Therefore, it is possible to obtain an advantageous effect of further improving the efficiency and performance in cooling the end-turn portion **132** of the coil **130**.

[0120] The inclined portion **162** is provided to guide the cooling medium, which has passed through the discharge flow path **165**, toward the end-turn portion **132** of the coil **130** (e.g., the inclined portion **162** is provided to guide the cooling medium in a direction inclined downward with respect to the outlet of the discharge flow path **165**.

[0121] An angle of the inclined portion **162** may be variously changed in accordance with the structure and specifications of the end-turn portion **132** of the coil **130**. The present disclosure is not restricted or limited by the angle of the inclined portion **162**.

[0122] For example, the inclined portion **162** may have a curved shape. Alternatively, the inclined portion may have a planar shape or other shapes.

[0123] As described above, in the embodiment of the present disclosure, the inclined portion **162** is provided on the inner surface of the head portion **161**. Therefore, it is possible to obtain an advantageous effect of more accurately controlling the spray direction of the cooling medium, which is discharged from the discharge flow path **165**, to the direction toward the end-turn portion **132** of the coil **130**.

[0124] According to the exemplary embodiment of the present disclosure, the motor **10** may include stopper protrusions **166** protruding from lateral surfaces of the head portion **161**.

[0125] The stopper protrusions **166** are provided to prevent the guide clip **160** from excessively entering the guide groove **112** when the guide clip **160** enters the guide groove **112**.

[0126] The stopper protrusion **166** may have various structures capable of being restrained by the end of the stator **110** in the longitudinal direction of the stator **110**. The present disclosure is not restricted or limited by the structure and shape of the stopper protrusion **166**.

[0127] For example, the stopper protrusions **166** may be symmetrically provided on two opposite surfaces of the head portion **161** and each have an approximately quadrangular protrusion shape.

[0128] In addition, according to the exemplary embodiment of the present disclosure, the motor **10** may include restraining grooves **116***a* provided in at least any one of the first inner wall surface and the second inner wall surface, and restraining protrusions **167** provided on at least any one of the first leg portion **163** and the second leg portion **164** and configured to be restrained by the restraining grooves **116***a*.

[0129] Hereinafter, an example will be described in which the restraining protrusions **167** are respectively provided on the first leg portion **163** and the second leg portion **164**, and the restraining grooves **116***a*, which accommodate the restraining protrusions **167**, are respectively provided in the first inner wall surface and the second inner wall surface.

[0130] The restraining grooves **116***a* and the restraining protrusions **167** are provided to suppress the separation of the guide clip **160** while securing the state in which the guide clip **160** is disposed in the guide groove **112**. The present disclosure is not restricted or limited by the structures and shapes of the restraining groove **116***a* and the restraining protrusion **167**.

[0131] For example, the restraining groove **116***a* may have an approximately quadrangular groove shape, and the restraining protrusion **167** may have an approximately triangular shape.

[0132] The restraining protrusions **167** may be moved along the first inner wall surface and the second inner wall surface and then restrained by the restraining grooves **116***a* in a snap-fit fastening manner by the elastic movements of the first and second leg portions **163** and **164** relative to the head portion **161**.

[0133] While the embodiments have been described above, the embodiments are just illustrative and not intended to limit the present disclosure. It can be appreciated by those skilled in the art that various modifications and applications, which are not described above, may be made to the present embodiment without departing from the intrinsic features of the present embodiment. For example, the respective constituent elements specifically described in the embodiments may be modified and then carried out. Further, it should be interpreted that the differences related to the modifications and applications are included in the scope of the present disclosure defined by the appended claims.

Claims

1. A motor comprising: a stator; a coil wound around the stator; a housing member provided to surround a circumference of the stator and including a cooling medium injection portion for injecting a cooling medium; a guide flow path defined between the housing member and the stator and configured to communicate with the cooling medium injection portion and guide the cooling medium; and a guide member provided at an end of the housing member and configured to direct the cooling medium, which is discharged from the guide flow path, toward an end-turn portion of the coil exposed to an end of the stator.

2. The motor of claim 1, wherein the guide member comprises: a connection portion connected to the end of the housing member; and a guide portion provided at an end of the connection portion and configured to direct the cooling medium, which is discharged from the guide flow path, toward the end-turn portion of the coil.

3. The motor of claim 2, wherein the guide portion is provided to be inclined with respect to the connection portion and directed toward the end-turn portion of the coil.

4. The motor of claim 2, comprising: a guide baffle provided on an inner circumferential surface of the guide portion and protruding in a longitudinal direction of the housing member.

5. The motor of claim 1, comprising: an inclined guiding portion provided integrally with the end of the housing member and configured to direct the cooling medium, which is discharged from the guide flow path, toward the end-turn portion of the coil.

6. The motor of claim 1, comprising: a guide groove provided in an outer surface of the stator in a longitudinal direction of the stator, wherein the guide flow path is defined along the guide groove.

7. The motor of claim 6, comprising: a guide protrusion provided at an end of the guide groove and configured to define an outlet flow path having a smaller cross-sectional area than the guide flow path.

8. The motor of claim 6, comprising: a guide clip provided at an end of the guide groove and configured to direct the cooling medium toward the end-turn portion of the coil.

9. The motor of claim 8, wherein the guide clip comprises: a head portion provided at the end of the guide groove; a first leg portion connected to one end of the head portion and supported on a first inner wall surface of the guide groove; a second leg portion connected to another end of the head portion and supported on a second inner wall surface of the guide groove that faces the first inner wall surface; a discharge flow path defined between the first leg portion and the second leg portion and configured to direct the cooling medium, which moves along the guide flow path, to an inner surface of the head portion; and an inclined portion provided on the inner surface of the head portion and configured to direct the cooling medium toward the end-turn portion of the coil.

10. The motor of claim 9, wherein the discharge flow path is defined to have a cross-sectional area that gradually decreases from an inlet toward an outlet.
