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Jang et al.

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(45) Date of Patent: Aug. 19, 2025

(54) **ELECTRIC MOTOR, CLEANER HAVING SAME AND ELECTRIC MOTOR MANUFACTURING METHOD**

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(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

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H02K 1/14 (2006.01)
H02K 7/14 (2006.01)
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CPC ***H02K 1/148*** (2013.01); ***H02K 7/145*** (2013.01); ***H02K 15/022*** (2013.01); ***H02K 15/10*** (2013.01)

(58) **Field of Classification Search**
CPC H02K 1/148; H02K 1/14; H02K 3/522; H02K 1/146
See application file for complete search history.

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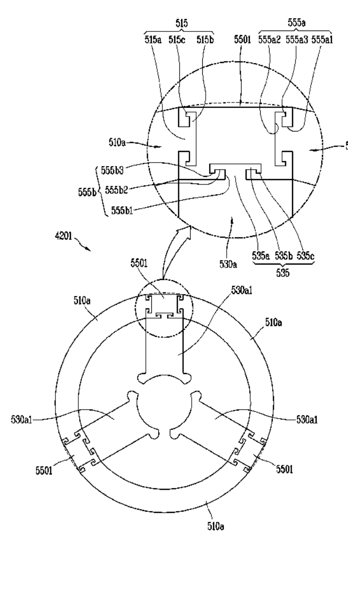
Primary Examiner — Oluseye Iwarere
Assistant Examiner — Masoud Vaziri
(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(57) **ABSTRACT**

An electric motor includes a stator and a rotor which is rotatable with respect to the stator. The stator has: a stator core; and a stator coil which is wound around the stator core. The stator core has: a yoke which is segmented in the circumferential direction of the stator; an assembly connector which is coupled between two yokes which are continuously disposed along the circumferential direction of the stator; and teeth which protrude along the radial direction of the stator from the inner surface of the assembly connector.

13 Claims, 19 Drawing Sheets



(51) **Int. Cl.**

H02K 15/022	(2025.01)
H02K 15/10	(2006.01)

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FIG. 1

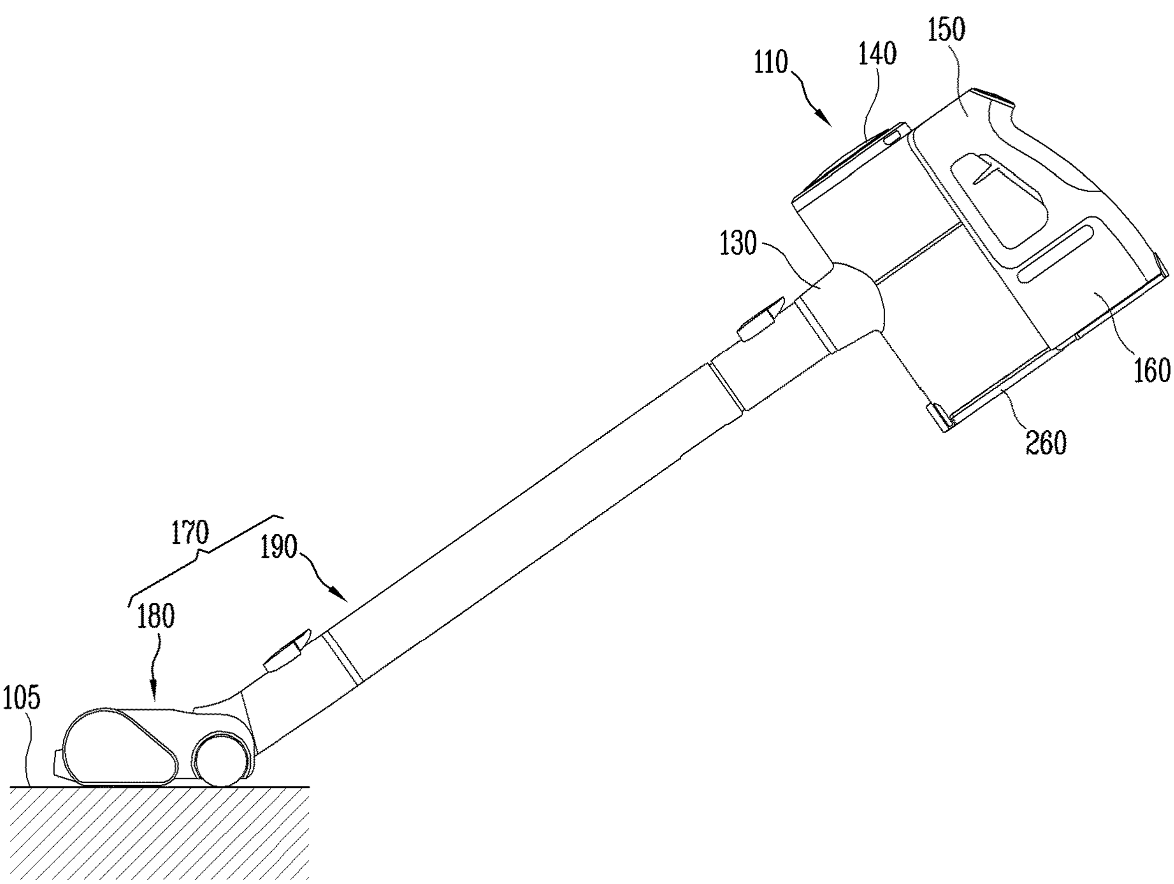
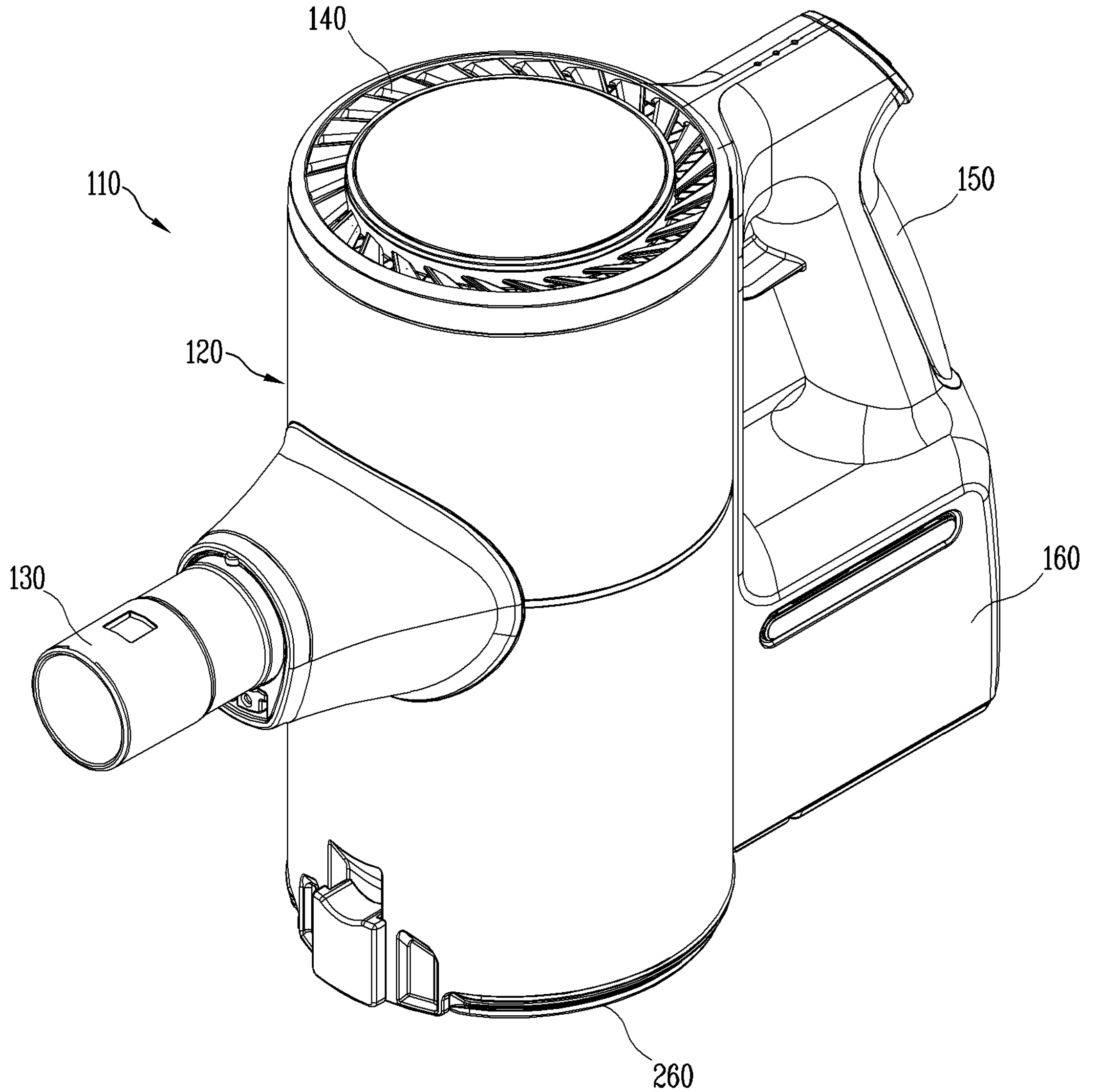


FIG. 2



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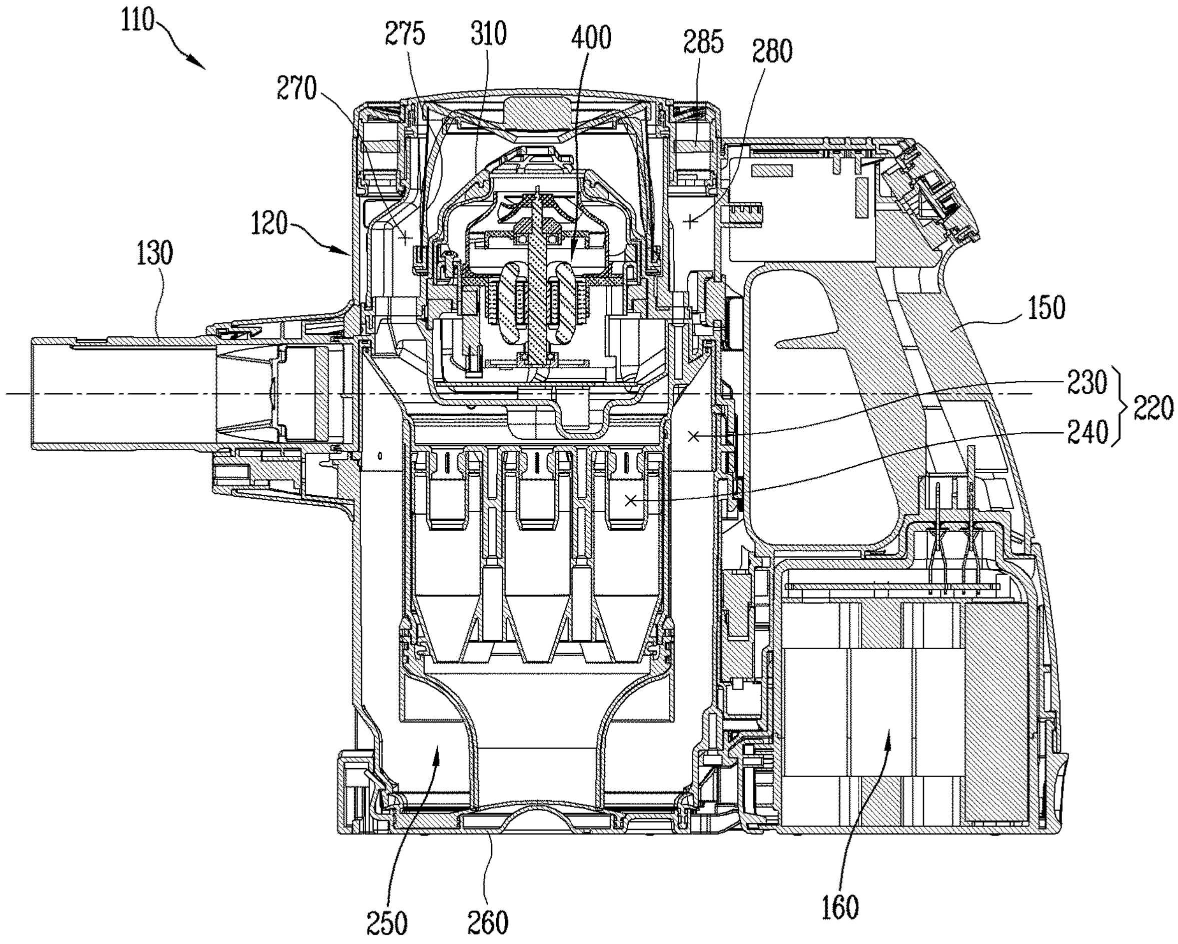

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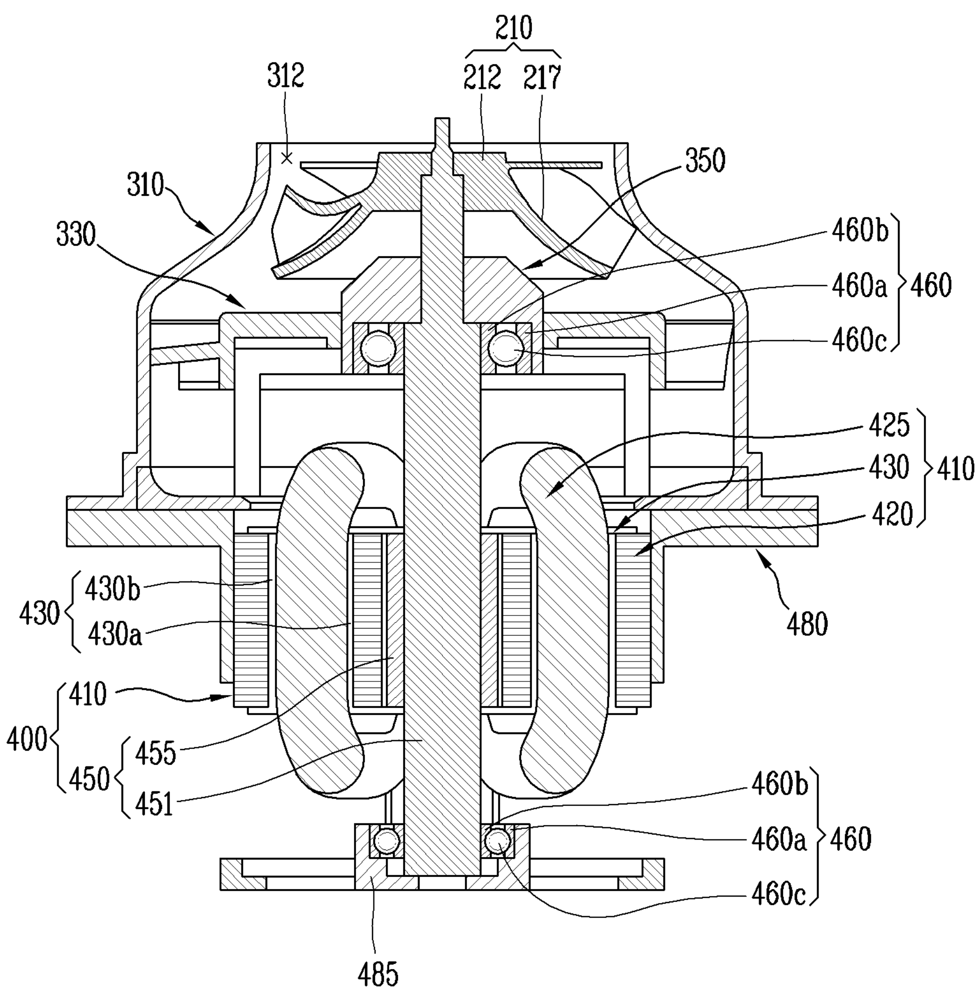
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460b
460a
460c
460
485

FIG. 5

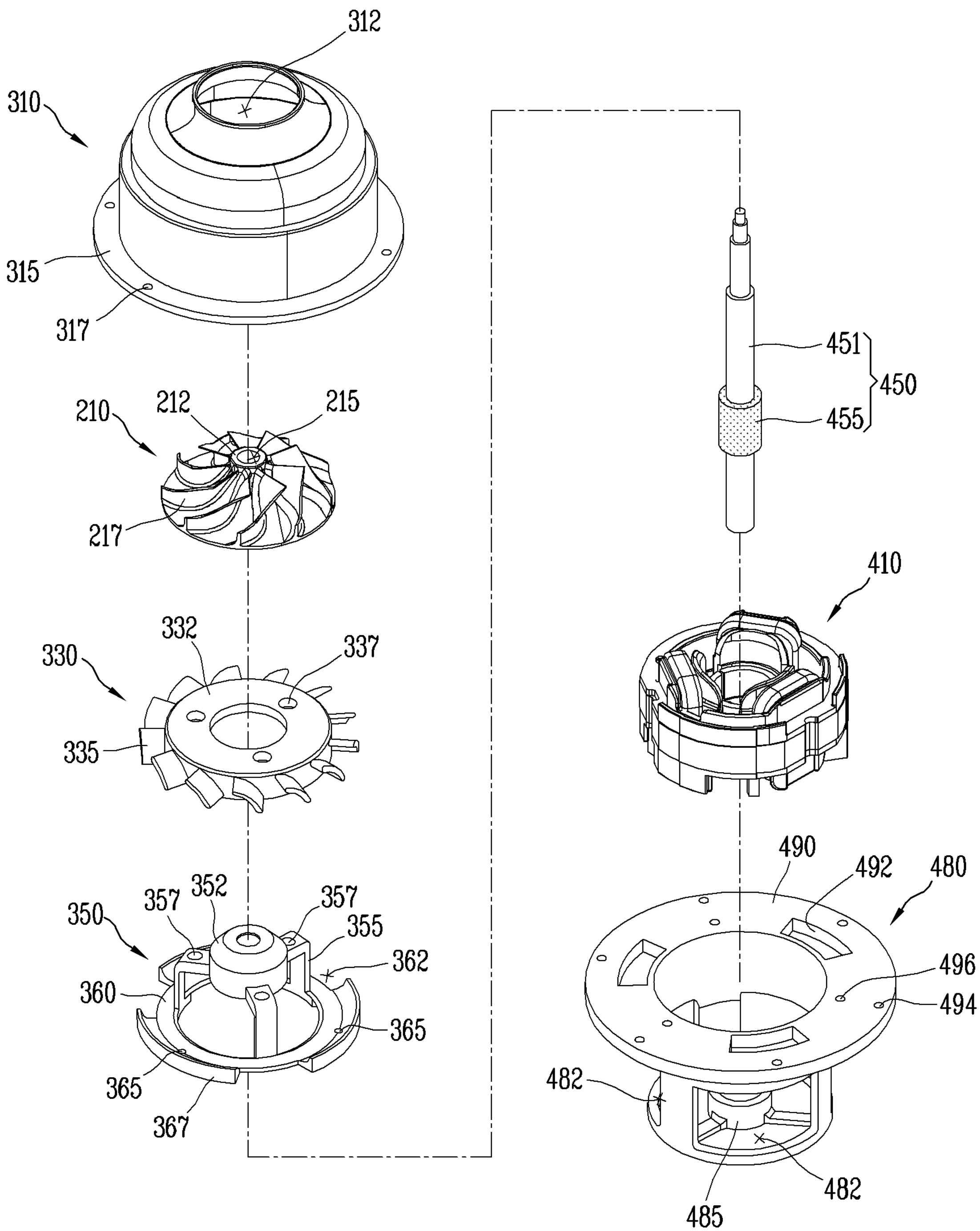
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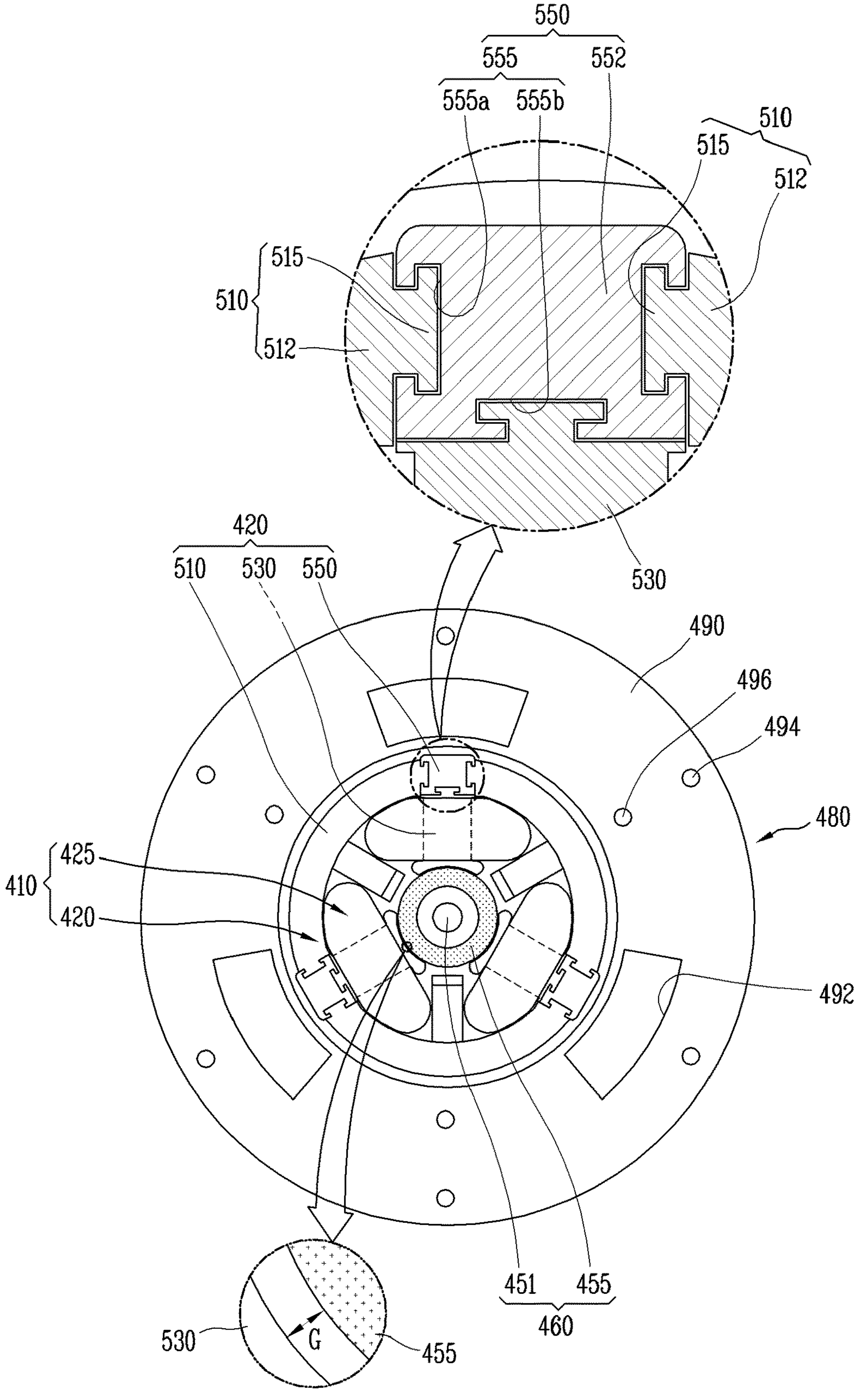
FIG. 6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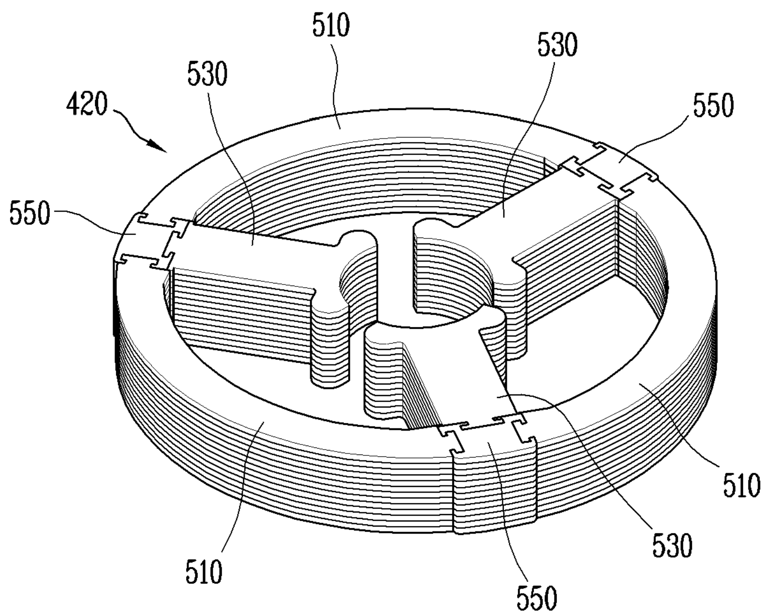
G
455

FIG. 7



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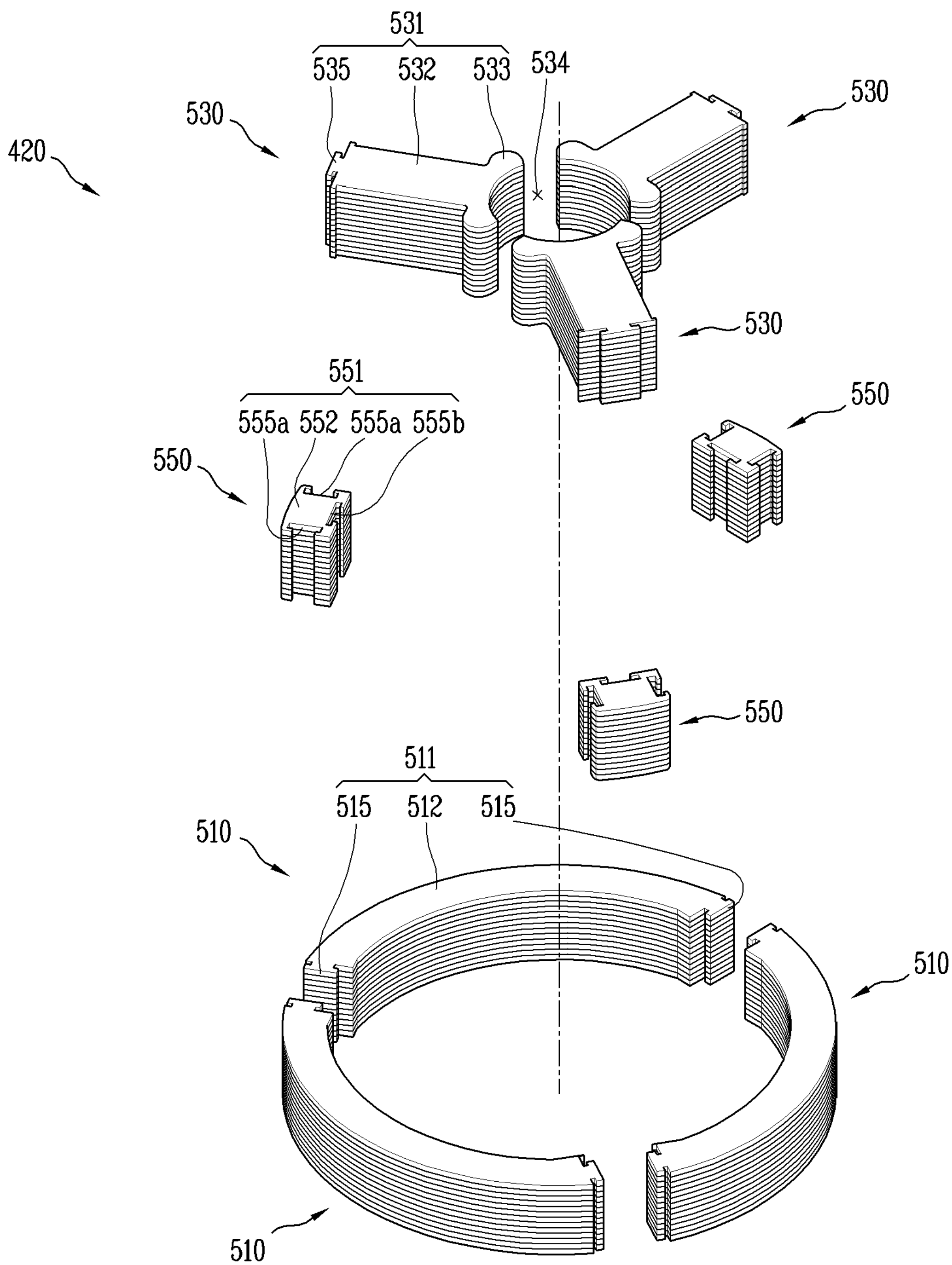

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FIG. 9

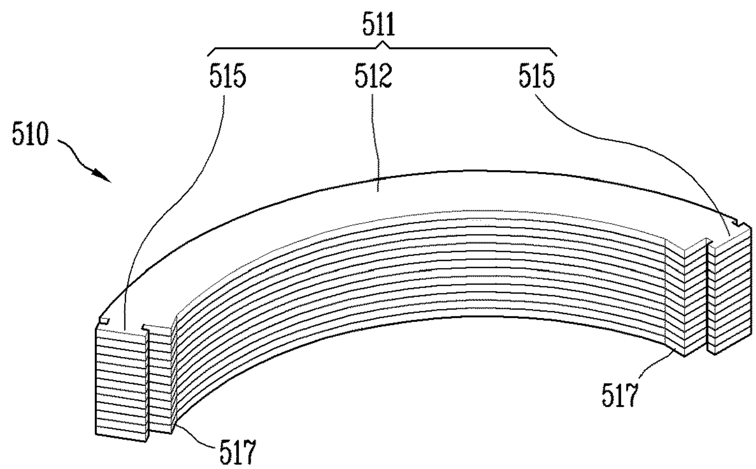
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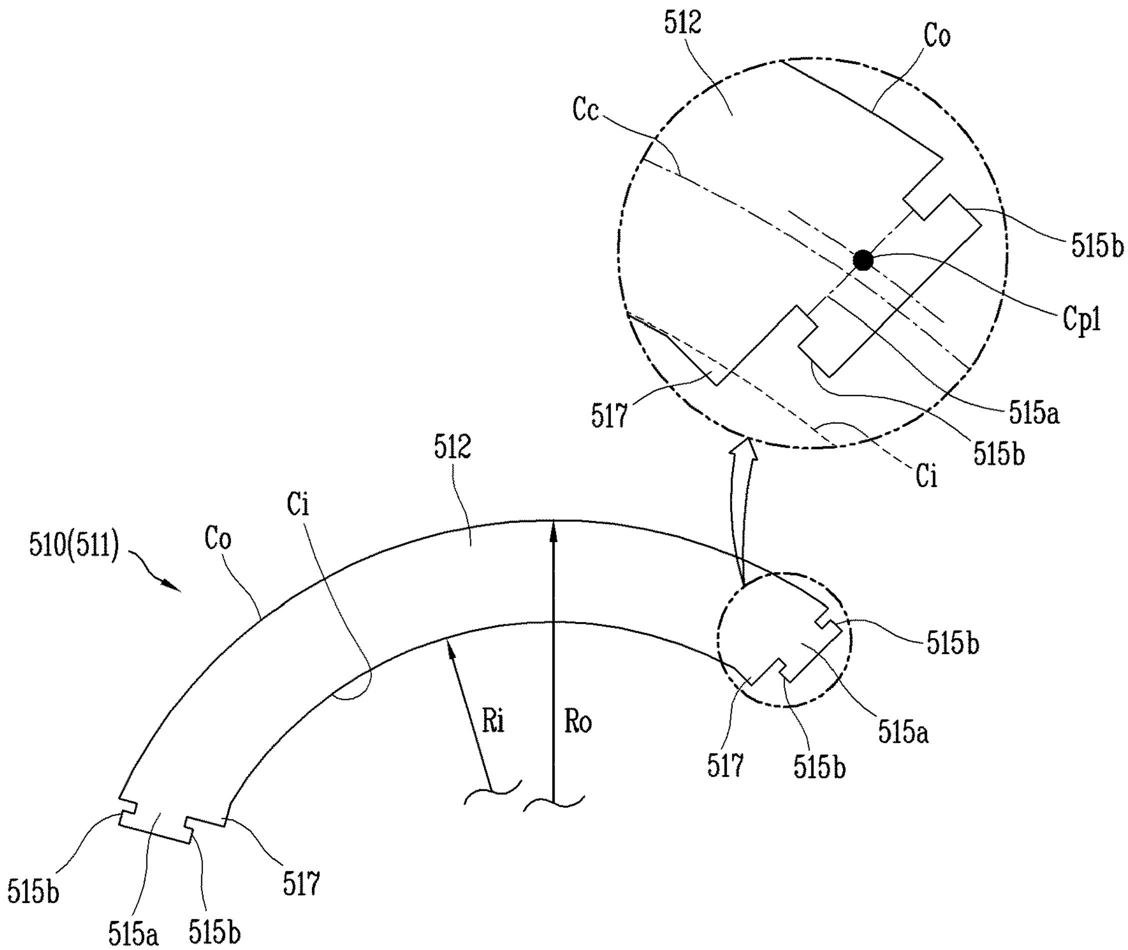
FIG. 10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515b
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FIG. 11

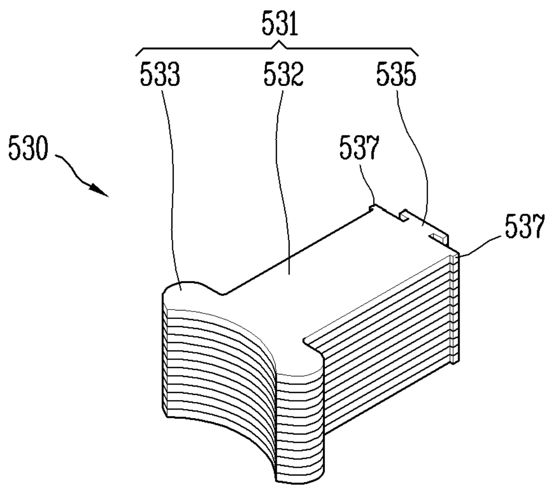
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FIG. 12

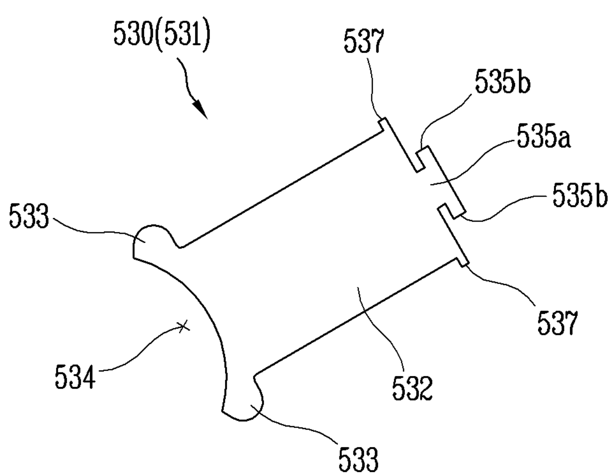
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FIG. 13

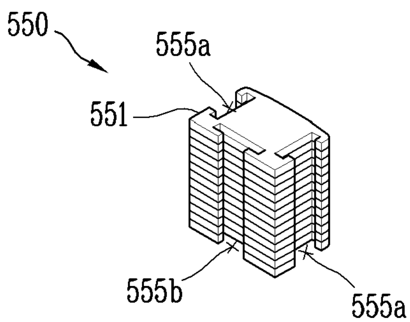
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FIG. 14

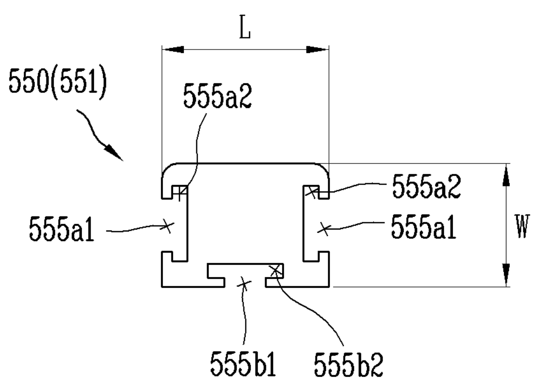
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FIG. 15

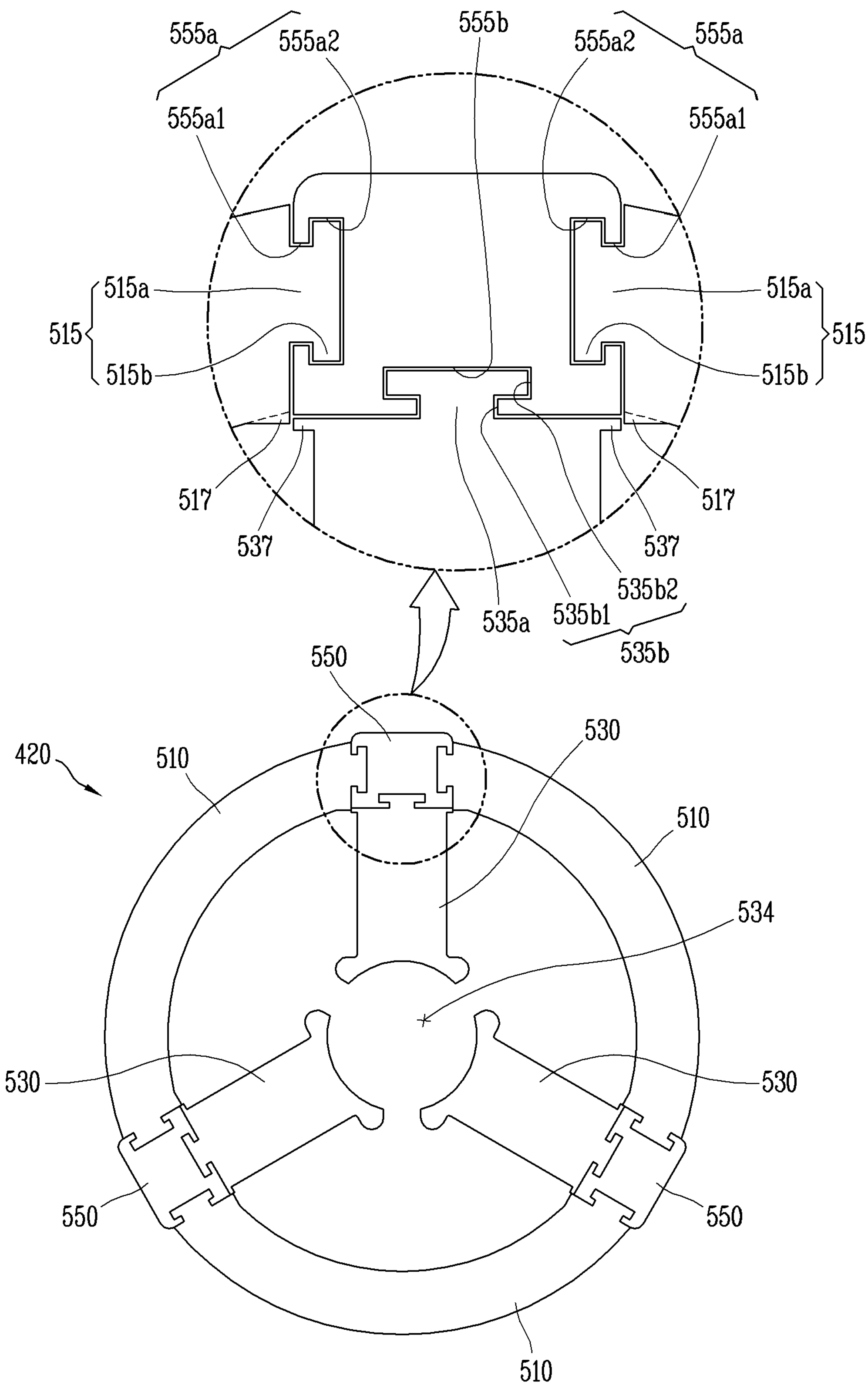

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FIG. 16

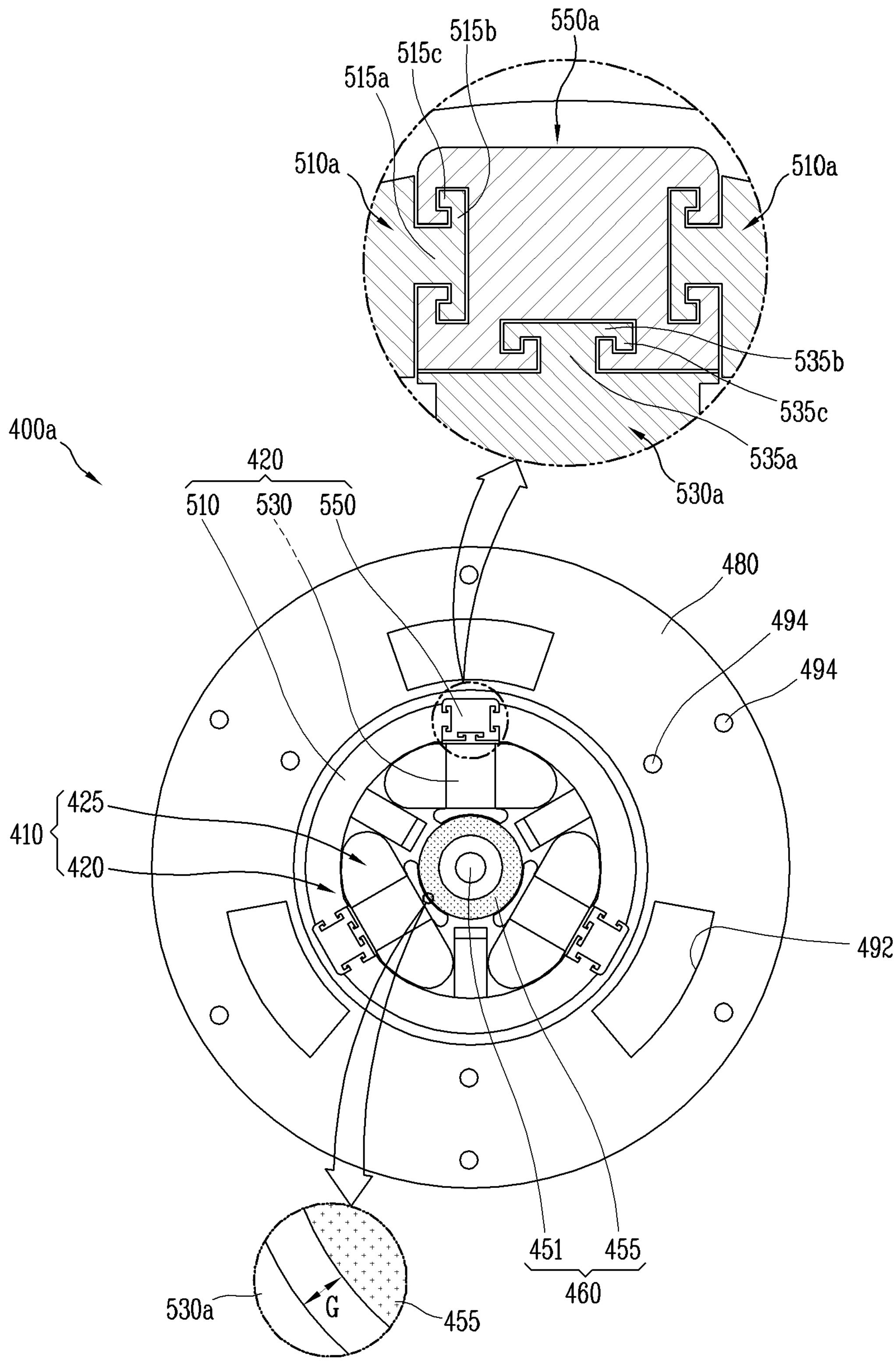
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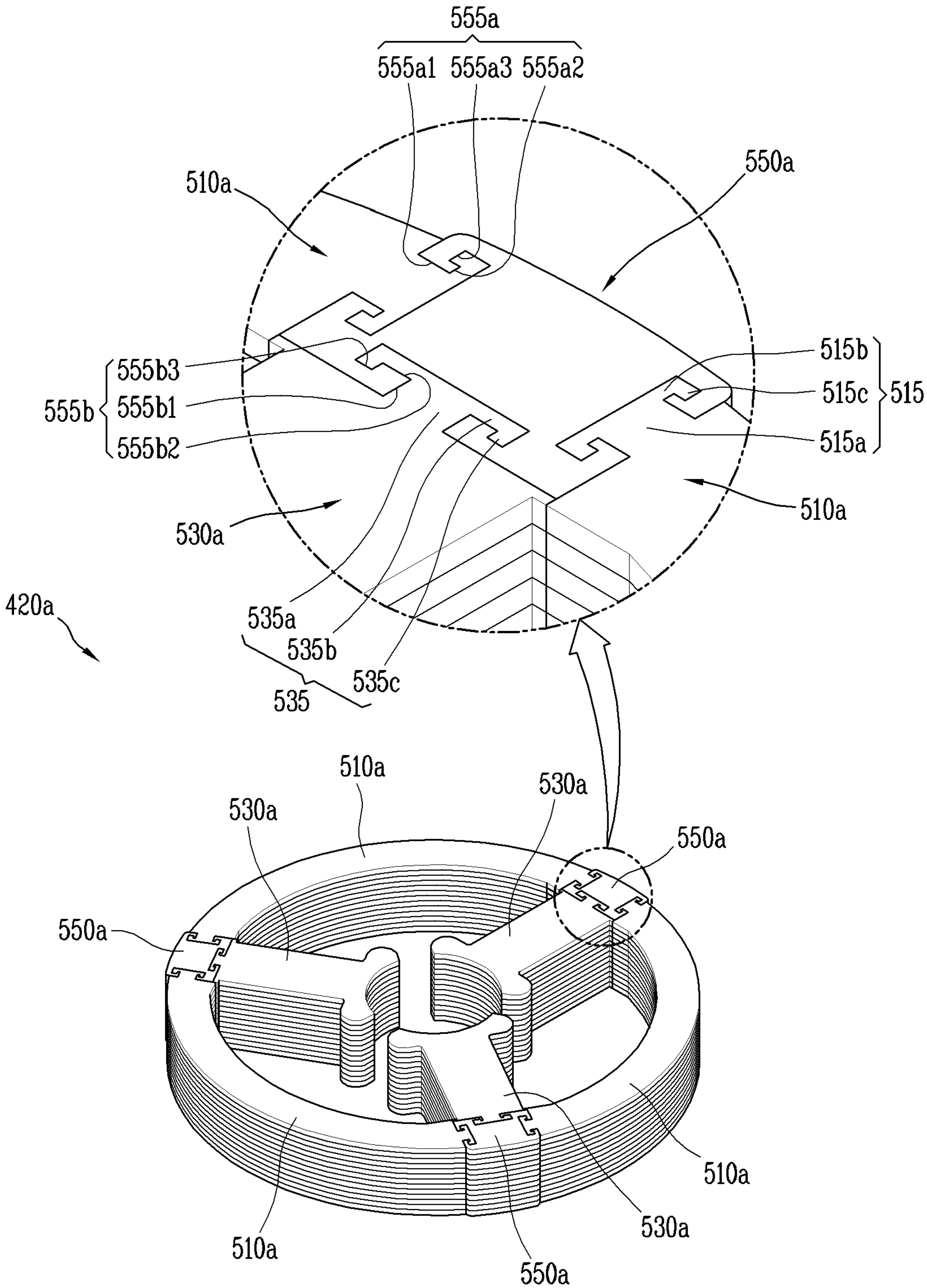
FIG. 17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510a
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510a
550a

FIG. 18

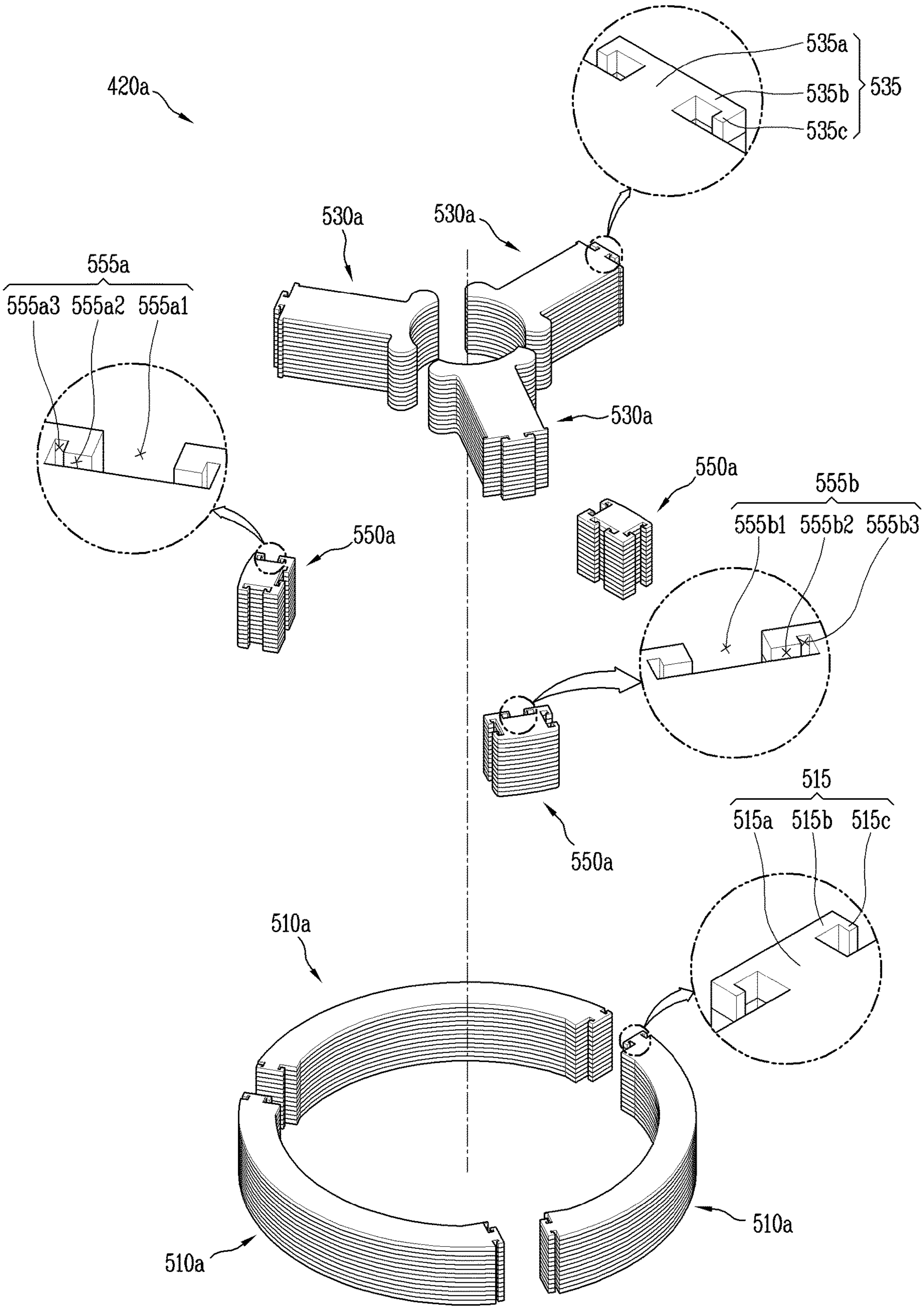
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FIG. 19

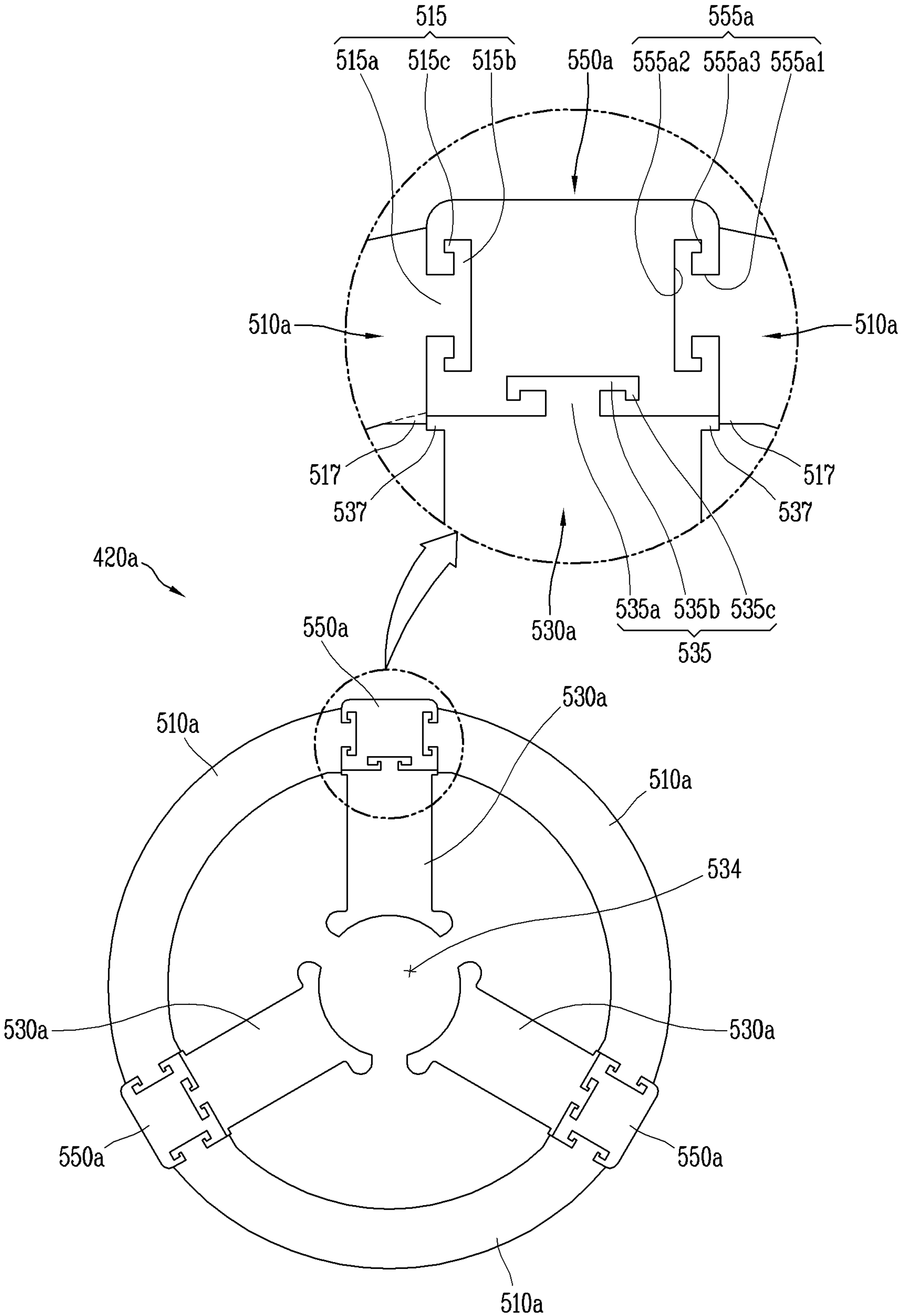
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FIG. 20

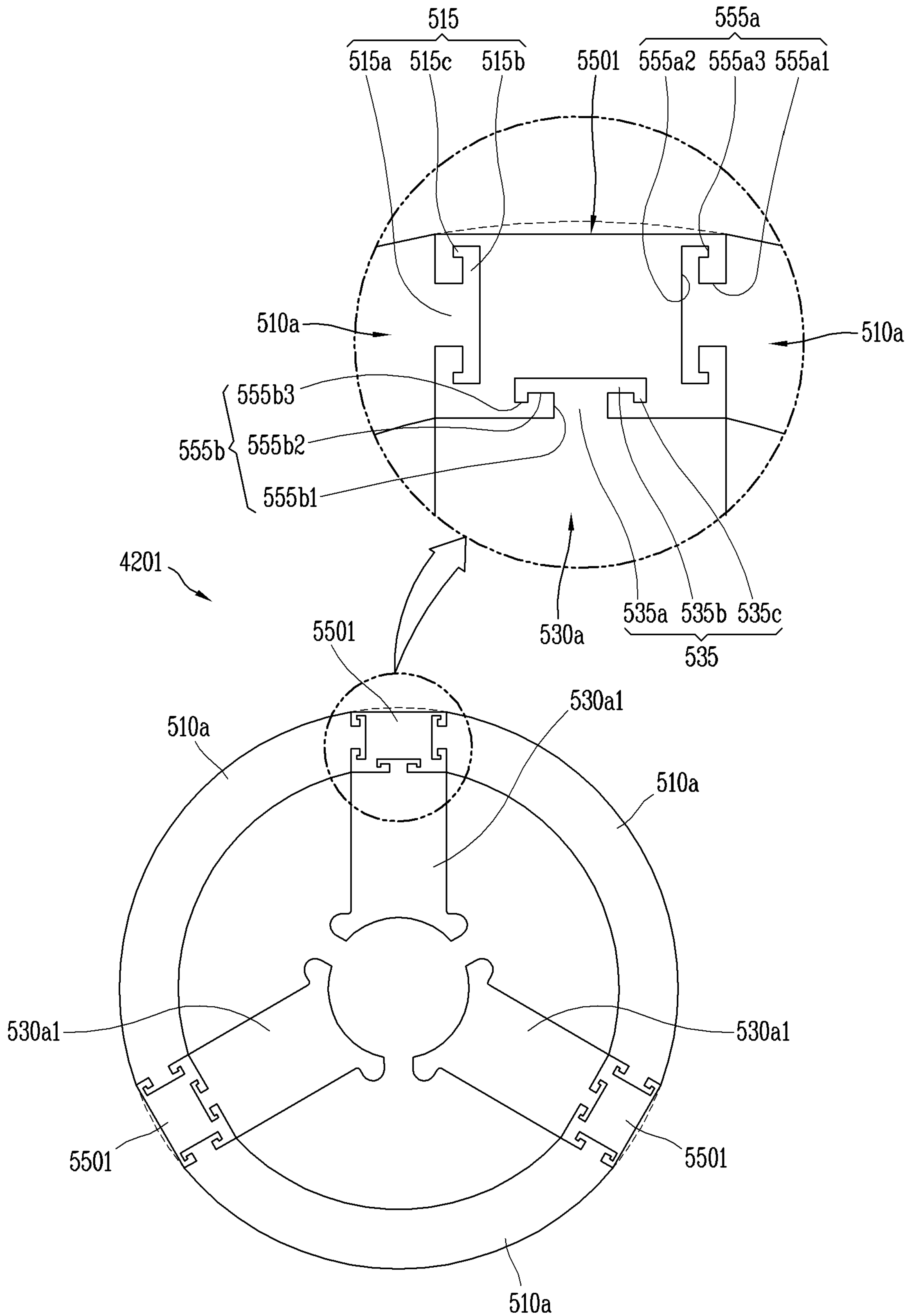
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FIG. 21

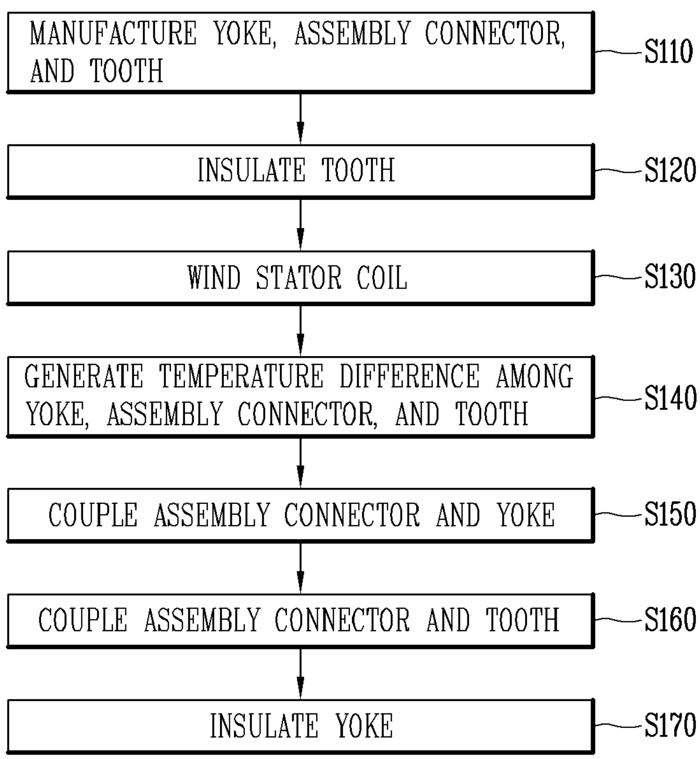
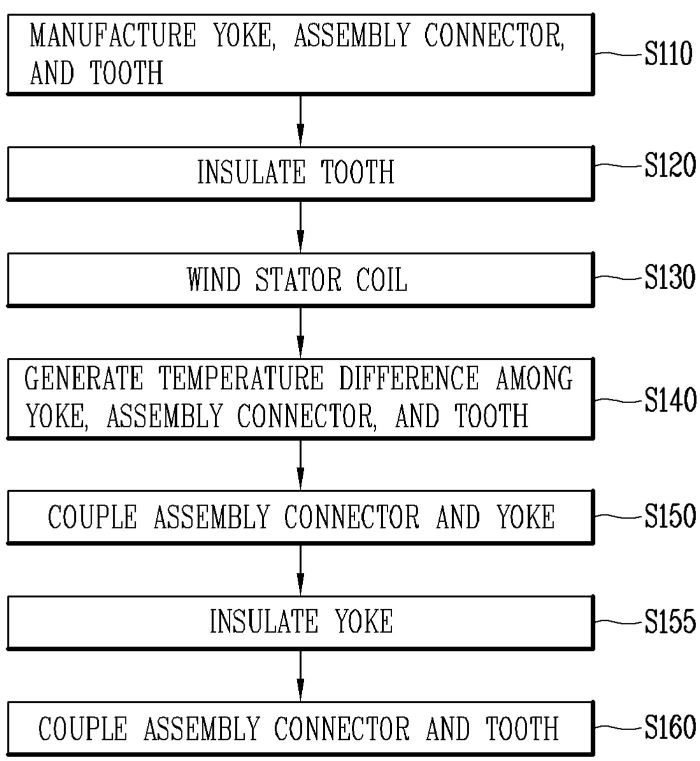

MANUFACTURE YOKE, ASSEMBLY CONNECTOR, AND TOOTH
S110
INSULATE TOOTH
S120
WIND STATOR COIL
S130
GENERATE TEMPERATURE DIFFERENCE AMONG YOKE, ASSEMBLY CONNECTOR, AND TOOTH
S140
COUPLE ASSEMBLY CONNECTOR AND YOKE
S150
COUPLE ASSEMBLY CONNECTOR AND TOOTH
S160
INSULATE YOKE
S170

FIG. 22


MANUFACTURE YOKE, ASSEMBLY CONNECTOR, AND TOOTH
S110
INSULATE TOOTH
S120
WIND STATOR COIL
S130
GENERATE TEMPERATURE DIFFERENCE AMONG YOKE, ASSEMBLY CONNECTOR, AND TOOTH
S140
COUPLE ASSEMBLY CONNECTOR AND YOKE
S150
INSULATE YOKE
S155
COUPLE ASSEMBLY CONNECTOR AND TOOTH
S160

ELECTRIC MOTOR, CLEANER HAVING SAME AND ELECTRIC MOTOR MANUFACTURING METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a National Stage application under 35 U.S.C. § 371 of International Application No. PCT/KR2021/001055, filed on Jan. 27, 2021, which claims the benefit of earlier filing date of and rights of priority to Korean Application 10-2020-0061167, filed on May 21, 2020. The disclosures of the prior applications are incorporated by reference in their entirety.

TECHNICAL FIELD

The present disclosure relates to an electric motor, a cleaner having the same, and a method of manufacturing the electric motor.

BACKGROUND ART

As is well known, an electric motor is a device that converts electrical energy into mechanical energy. Such electric motor typically includes a stator and a rotor disposed to be rotatable relative to the stator. The electric motor is manufactured in various sizes and weights depending on usage.

Among other electric motors, in an electric motor applied to a so-called handheld device that is used while being held in hand, a reduction of size and weight is a key point.

The electric motor that is applied to the handheld device, for example, a hair dryer or a cleaner is typically configured to rotate an impeller that generate suction force.

In the electric motor of the handheld device, upon manufacturing a stator, a segmented-core (or split core) that a stator core is segmented into plural parts in a circumferential direction is used in consideration of a reduction of scrap that is generated in the stator core and/or winding workability of the stator core.

However, in the related art electric motor of the handheld device, when yokes that are manufactured as a plurality of parts split in the circumferential direction of the stator core are assembled, there is a problem that coupling force is insufficient because a size of each coupling portion is relatively small.

Since the relatively small size of the coupling portion causes a coupling region of the yoke and/or tooth of the stator core to be insufficient in size, a deformation of the yoke and/or tooth may easily occur when external force is applied.

Due to this, it may be difficult to maintain concentricity of the segmented-core, which may make an air gap between the stator and the rotor non-uniform.

The non-uniform gap between the stator and the rotor causes an increase in vibration and noise.

In the related art electric motor of the handheld device, when the segmented-core is coupled, it is loosely fitted to be prevented from being deformed and an adhesive is applied to the coupling portion. This causes a limitation in preventing the decrease in concentricity due to loose-fit tolerance (assembly tolerance) of the segmented-core.

Due to this, the gap between the stator and the rotor becomes non-uniform, which causes an output of the electric motor to be lowered.

PRIOR ART LITERATURE

Patent Literature

(Patent Literature 1) KR100517922 B1
(Patent Literature 2) KR101348833 B1

DISCLOSURE OF INVENTION

Technical Problem

Therefore, one aspect of the present disclosure is to provide an electric motor capable of suppressing deformation of a yoke and tooth, a cleaner having the same, and a method of manufacturing the electric motor.

Another aspect of the present disclosure is to provide an electric motor capable of maintaining a uniform gap between a stator and a rotor, a cleaner having the same, and a method of manufacturing the electric motor.

Still another aspect of the present disclosure is to provide an electric motor capable of suppressing a decrease in concentricity due to an assembly tolerance, a cleaner having the same, and a method of manufacturing the electric motor.

Still another aspect of the present disclosure is to provide an electric motor capable of suppressing an increase in magnetic reluctance due to assembling, a cleaner having the same, and a method of manufacturing the electric motor.

Still another aspect of the present disclosure is to provide an electric motor capable of improving coupling strength of a stator core, a cleaner having the same, and a method of manufacturing the electric motor.

Solution to Problem

In order to achieve those aspects and other advantages of the present disclosure, there is provided an electric motor including a stator core that may be configured by coupling assembly connectors between adjacent yokes which are split in a circumferential direction, and teeth are radially coupled to inner surfaces of the respective assembly connectors.

Specifically, the stator core may include yokes split in a circumferential direction of the stator, assembly connectors each coupled between two adjacent yokes along the circumferential direction of the stator, and teeth each protruding from an inner surface of the assembly connector along a radial direction of the stator. When coupling the yoke, the assembly connector, and the tooth, rigidity of the assembly connector to be assembled with the yoke and the tooth can be adjusted to be lower than those of the yoke and the tooth, thereby suppressing deformation of the yoke and tooth.

Here, when the assembly connector is coupled to the yoke and the tooth, the assembly connector can be coupled to the yoke and the tooth in a state of having a higher temperature by a preset difference than temperatures of the yoke and the tooth.

This can suppress the deformation of the yoke and the tooth each having a relative low temperature.

An electric motor according to an embodiment of the present disclosure may include a stator, and a rotor disposed to be rotatable with respect to the stator. The stator may include a stator core and a stator coil wound around the stator core. The stator core may include yokes split in a circumferential direction of the stator, assembly connectors each coupled between two adjacent yokes along the circumferential direction of the stator, and teeth each protruding from an inner surface of the assembly connector along a radial direction of the stator.

Here, the yoke and the tooth may be fitted to the assembly connector, respectively, with a preset interference.

This can suppress an occurrence of a decrease in concentricity of the yoke and the tooth due to tolerance at the time of loose interference-fit.

This can also increase coupling force between the yoke and the assembling connector and coupling force between the assembling connector and the tooth.

In one embodiment disclosed herein, the assembly connector may be formed of a magnetic substance.

This can prevent an increase in magnetic reluctance due to the assembly connector.

In one embodiment disclosed herein, the assembly connector may be formed by stacking a plurality of magnetic steel sheets in an insulating manner.

This can prevent an occurrence of increase in iron loss (loss of eddy current) due to the assembly connector.

In one embodiment disclosed herein, the assembly connector may have a higher temperature than the yoke and the tooth to have a preset temperature difference from the yoke and the tooth when coupling with the yoke and the tooth.

With the configuration, rigidities of the yoke and the tooth, which have relatively low temperatures, can more increase than rigidity of the assembly connector having a relatively high temperature, such that the deformation of the yoke and the tooth due to a contact with the assembly connector can be suppressed.

In one embodiment disclosed herein, the stator may include an insulator insulating the stator core and the stator coil.

Accordingly, an occurrence of a short-circuit between the stator core and the stator coil can be suppressed.

In one embodiment disclosed herein, the yoke may be provided with a protruding portion and the assembly connector may be provided with a protrusion accommodating portion in which the protruding portion is accommodated.

Accordingly, when the yoke and the assembly connector are coupled, the protrusion accommodating portion can be further expanded, compared to the protruding portion, which can facilitate the coupling between the protruding portion and the protrusion accommodating portion.

This can suppress deformation of the protruding portion and the protrusion accommodating portion.

In one embodiment disclosed herein, the protruding portion may include a first protrusion protruding in the circumferential direction of the stator core, and second protrusions protruding from the first protrusion in a radial direction of the stator core.

The protrusion accommodating portion may include a first protrusion accommodating space in which the first protrusion is accommodated, and second protrusion accommodating spaces in which the second protrusions are accommodated.

Accordingly, when the yoke and the assembly connector are coupled, a generation of a gap in the circumferential direction of the stator core and a gap in the radial direction of the stator core can be suppressed.

In one embodiment disclosed herein, a center of the first protrusion in the radial direction of the stator core may be disposed more outward than a center of an end portion of the yoke.

With this configuration, a distance (thickness) from the first protrusion accommodating space in which the first protrusion is accommodated to an inner surface of the assembly connector can increase, so that supporting strength of the assembly connector can increase.

This can result in increasing coupling force between the yoke and the assembly connector.

In one embodiment disclosed herein, an outer surface of the assembly connector may protrude more outward than an outer surface of the yoke in the radial direction of the stator core.

With this configuration, a distance (thickness) from the first protrusion accommodating space in which the first protrusion is accommodated to an outer surface of the assembly connector can increase, so that supporting strength of the assembly connector can increase.

This can result in increasing coupling force between the yoke and the assembly connector.

In one embodiment disclosed herein, an extension portion may be disposed at an inner side of an end portion of the yoke to protrude more inward than an inner surface of the assembly connector.

The extension portion of the yoke may protrude more inward than an inner diameter of the yoke.

This can increase a width of the end portion of the yoke that comes in contact with the assembly connector, thereby increasing coupling force between the assembly connector and the yoke.

In one embodiment disclosed herein, the protrusion accommodating portion may include a first protrusion accommodating space in which the first protrusion is accommodated, and second protrusion accommodating spaces in which the second protrusions are accommodated, respectively.

A distance between the second protrusion accommodating space and an outer surface of the assembly connector may be larger than a protrusion length of the second protrusion.

With this configuration, when external force is applied in the radial direction of the yoke, supporting rigidities of the first protrusion accommodating space and the second protrusion accommodating spaces can increase, thereby suppressing deformation of the first protrusion accommodating space and the second protrusion receiving spaces.

In one embodiment disclosed herein, the protruding portion may further include third protrusions protruding respectively from the second protrusions in the circumferential direction of the stator core.

Accordingly, when external force is applied in the radial direction of the stator core, the first protrusion accommodating space of the assembly connector can be restricted in the radial direction, thereby suppressing the deformation of the first protrusion accommodating space.

This can further reinforce the coupling between the yoke and the assembly connector.

In addition, the deformation of the first protrusion accommodating space in the radial direction of the stator core can be suppressed, thereby reducing wall thicknesses of the first protrusion accommodating space and the second protrusion accommodating spaces.

Accordingly, a width (radial length) of the assembly connector in the radial direction of the stator core can be reduced.

In one embodiment disclosed herein, the assembly connector may have a width that is expanded compared to a width of the tooth in the circumferential direction of the stator core.

With this configuration, when the tooth and the assembly connector are coupled, supporting force of the tooth by the assembly connector can further increase.

In addition, a length of the yoke along the circumferential direction of the stator core can be shortened by that much, so that an occurrence of transverse deformation of the yoke can be further suppressed.

Here, the tooth may be provided with extension portions respectively extending to both sides along the circumferential direction of the stator core so as to be in contact with the assembly connector.

This can increase a contact area between the assembly connector and the tooth, thereby further increasing the coupling force between the assembly connector and the tooth.

On the other hand, according to another aspect of the present disclosure, there is provided a cleaner that may include a cleaner main body having an air passage defined therein and provided with a handle on one side, an impeller disposed inside the cleaner main body, and the electric motor disposed inside the cleaner main body and rotating the impeller.

In the electric motor, since deformation of a yoke and a tooth can be suppressed, a uniform air gap between a stator and a rotor can be maintained.

Here, a suction part may be provided on one side of the air passage and a discharge part may be provided on another side of the air passage.

Accordingly, when the impeller is driven by the electric motor, external air is suctioned through the suction part, flows along the air passage, and is discharged to outside through the discharge part.

In addition, a foreign material separation part may be disposed in the cleaner main body to separate foreign materials in air that flows along the air passage from the air.

Accordingly, foreign materials that are separated by the foreign material separation part from the air suctioned through the suction part can be discharged to the outside of the cleaner main body through the discharge part.

In one embodiment disclosed herein, the cleaner main body is further provided with a battery for supplying power to the electric motor.

Accordingly, since the cleaner main body is driven by receiving power from the battery, cleaning can be performed without being connected to commercial power.

The electric motor can rotate at a high speed and size and weight of the electric motor can be reduced, so that the cleaner main body can be easily handled.

According to still another aspect of the present disclosure, there is provided a method for manufacturing an electric motor that includes a stator, a rotor disposed to be rotatable with respect to the stator, wherein the stator comprises a stator core including yokes split in a circumferential direction of the stator, assembly connectors each coupled between two continuous yokes along the circumferential direction of the stator, and teeth each protruding from an inner surface of the assembly connector along a radial direction of the stator, and a stator coil wound on the stator core. The method may include forming the yoke, the assembly connector, and the tooth, respectively, winding the stator coil on the tooth, coupling the yoke to the assembly connector, and coupling the tooth to the assembly connector.

Here, in the steps of coupling the yoke to the assembly connector and coupling the tooth to the assembling connector, interference-fit with a preset interference may be made between the yoke and the assembly connector and between the tooth and the assembly connector.

In one embodiment disclosed herein, the method may further include, before winding the stator coil on the tooth, insulating the tooth and the stator coil.

In one embodiment disclosed herein, the method may further include, before the step of insulating the tooth and the stator coil, providing an insulator between the teeth and the stator coil.

In one embodiment disclosed herein, the method may further include, before the steps of coupling the yoke to the assembly connector and coupling the tooth to the assembly connector, adjusting temperatures of the yoke, the tooth, and the assembly connector such that the assembly connector has a preset temperature difference from the yoke and the tooth.

Here, in the step of adjusting the temperatures of the yoke, the tooth, and the assembly connector, the assembly connector may be heated to a preset temperature.

Advantageous Effects of Invention

As described above, according to one embodiment of the present disclosure, the stator core may include the yokes split along the circumferential direction, the assembly connectors each coupled between two adjacent yokes, and the teeth each coupled to the inner side of the assembly connector, thereby suppressing deformation of the yokes and the teeth.

This can maintain a uniform air gap between the stator and the rotor, and suppress a decrease in output of the electric motor due to a non-uniform air gap.

As the circumferential length of the yoke is shortened by the length of the assembly connector along the circumferential direction of the stator core, an occurrence of radial (transverse) deformation of the yoke can be suppressed.

By fitting the yoke and/or the tooth to the assembling connector with a preset interference, a decrease in concentricity of the yoke and the tooth due to an assembly tolerance can be suppressed.

By suppressing a generation of a gap in a coupling region of the yoke, the assembly connector, and the tooth, an increase in magnetic reluctance can be suppressed.

Since the assembly connector is formed by stacking magnetic steel sheets in an insulating manner, an increase in magnetic reluctance can be suppressed.

In addition, when the assembly connector is coupled with the yoke and/or the tooth, the assembly connector is controlled to have a higher temperature by a preset temperature difference than the yoke and the tooth, thereby effectively suppressing the deformation of the yoke and the tooth during coupling.

In addition, the yoke has the protruding portion and the assembly connector has the protrusion accommodating portion in which the protruding portion is accommodated. Accordingly, when the yoke and the assembly connector are coupled, deformation of the yoke can be effectively suppressed.

In addition, since the center of the first protrusion along the radial direction of the stator core is located more outward than the center of the yoke, a thickness of an outer wall (inner outer wall) of the first protrusion accommodating space for accommodating the first protrusion can increase. This can result in reinforcing coupling force between the yoke and the assembly connector.

In addition, since the outer surface of the assembly connector along the radial direction of the stator core protrudes more outward than the outer surface of the yoke, the thickness of an outer wall (outer wall of an outer side) of the first protrusion accommodating space for accommodating the first protrusion can increase. This can further reinforce the coupling force between the yoke and the assembly connector.

In addition, since the protruding portion is provided with the third protrusions protruding from the second protrusions along the circumferential direction of the stator core, the coupling force between the yoke and the assembly connector can be further reinforced.

Since the assembly connector has the width that is expanded more than the width of the tooth in the circumferential direction of the stator core, the coupling force among the yoke, the assembly connector, and the tooth can be reinforced.

In addition, since the tooth is provided with the extension portions respectively extending to both sides along the circumferential direction of the stator core to be in contact with the assembly connector, the coupling force between the tooth and the assembly connector can be reinforced.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view illustrating a cleaner having an electric motor in accordance with one embodiment.

FIG. **2** is a perspective view illustrating a cleaner main body of FIG. **1**.

FIG. **3** is a sectional view of FIG. **2**.

FIG. **4** is an enlarged view illustrating an electric motor of FIG. **3**.

FIG. **5** is an exploded perspective view of the electric motor of FIG. **4**.

FIG. **6** is a planar view of the electric motor of FIG. **5**.

FIG. **7** is a perspective view illustrating a stator core of FIG. **6**.

FIG. **8** is an exploded perspective view of the stator core of FIG. **7**.

FIG. **9** is a perspective view illustrating a yoke of FIG. **8**.

FIG. **10** is a planar view of the yoke of FIG. **9**.

FIG. **11** is a perspective view illustrating a tooth of FIG. **8**.

FIG. **12** is a planar view of the tooth of FIG. **11**.

FIG. **13** is a perspective view illustrating an assembly connector of FIG. **8**.

FIG. **14** is a planar view of the assembly connector FIG. **13**.

FIG. **15** is a planar view illustrating a coupled state of the stator core of FIG. **8**.

FIG. **16** is a planar view corresponding to FIG. **6** of an electric motor in accordance with another embodiment.

FIG. **17** is a perspective view illustrating a stator core of FIG. **16**.

FIG. **18** is an exploded perspective view of the stator core of FIG. **17**.

FIG. **19** is a planar view illustrating a coupled state of the stator core of FIG. **17**.

FIG. **20** is a view corresponding to FIG. **19** of a stator core of an electric motor in accordance with still another embodiment.

FIG. **21** is a view illustrating a method for manufacturing an electric motor in accordance with one embodiment.

FIG. **22** is a view illustrating a method for manufacturing an electric motor in accordance with another embodiment.

MODE FOR THE INVENTION

Hereinafter, implementations of the present disclosure will be described in detail with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components will be provided with the same reference numerals, and description thereof will not be repeated. A singular representation used herein may include a plural representation unless it represents a definitely different meaning from the context. In describing the present disclosure, if a detailed explanation for a related known function or construction is considered to unnecessarily divert the gist of the present disclosure, such explanation has been omitted but would be understood by those skilled in the art. The accompanying drawings are used to help easily understand the technical idea of the present disclosure and it should be understood that the idea of the present disclosure is not limited by the accompanying drawings.

FIG. **1** is a perspective view illustrating a cleaner having an electric motor in accordance with one embodiment, FIG. **2** is a perspective view illustrating a cleaner main body of FIG. **1**, and FIG. **3** is a sectional view of FIG. **2**. As illustrated in FIGS. **1** and **2**, a cleaner according to an embodiment of the present disclosure includes a cleaner main body **110**.

The cleaner main body **110** includes a body **120** having a substantially cylindrical shape. A cylindrical accommodation space may be defined inside the body **120**.

A suction part **130** through which external air is suctioned into the cleaner main body **110** (or body **120**) is disposed on one side of the cleaner main body **110**. The suction part **130** is located, for example, at a front region of the cleaner main body **110**.

A discharge part **140** through which internal air is discharged is disposed on another side of the cleaner main body **110**. The discharge part **140** is located, for example, at an upper end of the cleaner main body **110**.

An air movement path (air passage) through which air suctioned through the suction part **130** moves to the discharge part **140** is defined in the cleaner main body **110**.

The suction part **130** is provided with a suction unit **170** for suctioning foreign materials together with air. The suction unit **170**, for example, may be detachably coupled to the suction part **130**.

The suction unit **170** includes, for example, a suction head **180** brought into contact with a target surface to be cleaned (e.g., bottom surface or floor) **105**, and a connection pipe **190** having one side connected to the suction head **180** and another side connected to the suction part **130**. Although not illustrated, the suction unit **170** may include a suction nozzle detachably coupled to the suction part **130**.

A movement passage through which air and foreign materials can move is defined inside the connection pipe **190**. The connection pipe **190** is detachably coupled to the suction part **130**. The suction head **180** is detachably coupled to the connection pipe **190**. A suction port (not illustrated) through which air and foreign materials can be suctioned is disposed in a lower portion of the suction head **180**.

The cleaner main body **110** is provided with a handle **150** to be gripped. The handle **150** may be provided, for example, on a rear region of the cleaner main body **110** (the body **120**). The cleaner main body **110** is provided with a battery **160** for supplying power. The battery **160** is, for example, provided at one side (lower side in the drawing) of the handle **150**. The battery **160** may be disposed in a rear lower region of the cleaner main body **110**, for example.

As illustrated in FIG. **3**, an impeller **210** for generating suction force is provided inside the cleaner main body **110** (the body **120**). An electric motor **400** for rotating the impeller **210** is provided at one side (a lower side in the drawing) of the impeller **210**.

A suction passage **270** is defined outside the impeller **210**. A discharge passage **280** is defined at one side outside the electric motor **400**. A filter **275** for collecting foreign materials in the air may be disposed, for example, in the suction passage **270**. A filter (e.g., a high efficiency particulate air (HEPA) filter) **285** for collecting fine dust in the air is provided in the discharge passage **280**.

A foreign material separation part **220** is disposed inside the cleaner main body **110** to separate foreign materials moving together with air from the air.

The foreign material separation part **220** may be defined below the electric motor **400**.

The foreign material separation part **220**, for example, may include a first cyclone unit **230** that is capable of separating foreign materials by a cyclonic flow. The first cyclone unit **230** communicates with the suction part **130**. Air and foreign materials suctioned through the suction part **130** are separated from each other while making a so-called cyclonic flow spirally along an inner circumferential surface of the first cyclone unit **230**.

The foreign material separation part **220** may further include, for example, a second cyclone unit **240** that separates air and foreign materials by a cyclonic flow. The second cyclone unit **240** may, for example, be implemented have a smaller size than the first cyclone unit **230**. The first cyclone unit **230** may be disposed at an inner side of the first cyclone unit **230**. The second cyclone unit **240** may be provided in plurality that are disposed in parallel inside the body **120**. The second cyclone unit **240** may be, for example, disposed at the inner side of the first cyclone unit **230** in the circumferential direction.

A foreign material collecting unit **250** is disposed in a lower portion of the cleaner main body **110**. Foreign materials that are separated from air by the first cyclone unit **230** and the second cyclone unit **240** are collected in the foreign material collecting unit **250**.

A discharge cover **260** through which foreign materials collected can be thrown away is disposed on the lower portion of the cleaner main body **110**. The discharge cover **260** is configured to open and close a lower opening of the cleaner main body **110**. The discharge cover **260** may, for example, be open and closed by rotating in a vertical direction centering on one side of the lower portion of the cleaner main body **110** (the body **120**).

With this configuration, when the impeller **210** is driven, air is introduced into the cleaner main body **110** through the suction part **130**. The air introduced into the cleaner main body **110** makes a cyclonic flow that the air flows spirally along the inner circumferential surface of the body **120** in the first cyclone unit **230**, such that foreign materials in the air are primarily separated from the air. The separated foreign materials are collected in a lower side of the first cyclone unit **230**.

The air that has passed through the first cyclone unit **230** makes the cyclonic flow in the second cyclone unit **240**, so that foreign materials are secondarily separated from the air. The secondarily-separated foreign materials are collected in a lower side of the second cyclone unit **240**. The secondarily-separated foreign materials are collected in an inner space of the foreign materials which have been collected in an annular shape in the lower side of the first cyclone unit **230**.

The air that has passed through the second cyclone unit **240** moves to the suction passage **270**. The air passes through the filter **275** of the suction passage **270** and moves to the electric motor **400** through the impeller **210**. The air that has passed through the electric motor **400** moves to the discharge passage **280**. The air that has passed through the HEPA filter **285** of the discharge passage **280** is discharged to an upper side of the cleaner main body **110** through the discharge part **140**.

FIG. **4** is an enlarged view illustrating an electric motor of FIG. **3**, and FIG. **5** is an exploded perspective view of the electric motor of FIG. **4**. As illustrated in FIGS. **4** and **5**, the electric motor **400** includes an impeller **210**, a stator **410**, and a rotor **450**.

The impeller **210** includes a hub **212** and a plurality of blades **217** disposed along a circumference of the hub **212**. A rotating shaft coupling portion **215** to which one end portion (upper end portion in the drawing) of a rotating shaft **451** of the electric motor **400** is to be coupled is formed on the hub **212**.

An inlet body **310** (impeller housing) is disposed at an outside of the impeller **210**. A suction port **312** is disposed on one end (upper end in the drawing) of the inlet body **310**. A flange **315** extends in a radial direction from another end (lower end of the drawing) of the inlet body **310**. A plurality of fastening member coupling portions **317** to which fastening members are to be coupled are formed in the flange **315** of the inlet body **310**.

A diffuser **330** is disposed at one side (lower side in the drawing) of the impeller **210** in an axial direction. The impeller **330** includes a body **332**, and a plurality of vanes **335** disposed on a circumference of the body **332**. The body **332** has a cylindrical shape. A through portion is formed through a center of the body **332**. A bearing housing **352** to be described later is accommodated in the center of the body **332**. A plurality of fastening member coupling portions **337** to which a plurality of fastening members are to be coupled are disposed in the body **332** of the diffuser **330**.

A bearing support unit **350** is disposed at one side (lower side in the drawing) of the diffuser **330** in the axial direction. The bearing support unit **350** includes a bearing housing **352** to which a bearing **460** is received, a plurality of support rods **355** each having one end coupled to an outer surface of the bearing housing **352**, and a support plate **360** in a ring shape to which another end of each of the plurality of support rods **355** is coupled. The support plate **360** has a circular ring shape. The support plate **360** is provided with a plurality of through portions **362** formed therethrough such that air passed through the diffuser **330** can move.

The support plate **360** is provided with side support portions **367** bent in the axial direction between the adjacent through portions **362** along the circumferential direction. A fastening member insertion portion **365** may be formed through the support plate **360** such that the support plate **360** can be coupled to a housing **480** to be explained later by a fastening member. The plurality of support rods **355** may be, for example, three in number. Each of the plurality of support rods **355** includes a horizontal section extending radially from the bearing housing **352**, and a vertical section bent from the horizontal section to be arranged in the axial direction so as to be connected to the support plate **360**. A fastening member coupling portion **357** is disposed in the horizontal section of the support rod **355** so that the body **332** of the diffuser **330** can be fastened thereto by a fastening member.

The electric motor **400** includes, for example, a stator **410** and a rotor **450** disposed to be rotatable relative to the stator **410**. The electric motor **400** of this embodiment is configured to be rotatable at a high speed. The electric motor **400** of this embodiment is configured to be rotatable at 160 to 200 krpm, for example.

The rotor **450** includes, for example, a rotating shaft **451** and a permanent magnet **455** rotating centering on the rotating shaft **451**. The permanent magnet **455** is implemented in a cylindrical shape having a rotating shaft hole formed through its center such that the rotating shaft **451** is inserted therethrough. The permanent magnet **455** has alternately different magnetic poles (N pole and S pole) along the circumferential direction. The permanent magnet **455** may be configured to protrude (overhang), for example, to both sides of the stator core **420** by preset lengths in the axial direction. In this embodiment, the permanent magnet **455** of the rotor **450** may protrude from both ends of the stator core **420** in the axial direction, respectively, by the preset lengths, for example, 0.60 mm.

The rotating shaft **451** extends, for example, to both sides of the rotor **450**.

One end portion (an upper end portion in the drawing) of the rotating shaft **451** is coupled to the impeller **210**.

The rotating shaft **451** may be rotatably supported, for example, by bearings **460** that are disposed on both sides (upper and lower sides in the drawing) of the rotor **450**. Each of the bearings **460** may include, for example, an outer ring **460***a*, an inner ring **460***b* concentrically disposed at an inner side of the outer ring **301**, and a plurality of balls **460***c* disposed between the outer ring **460***a* and the inner ring **460***b*. The embodiment illustrates that the bearing **460** is implemented as a ball bearing. However, this is merely illustrative and the present disclosure is not limited thereto. The bearing **460** may alternatively be implemented as a gas bearing, for example.

The stator **410**, for example, includes a stator core **420**, a stator coil **425** wound around the stator core **420**, and an insulator **430** disposed to insulate between the stator core **420** and the stator coil **425**. The insulator **430** may be disposed between the stator core **420** and the stator coil **425**, for example. The insulator **430** includes, for example, a tooth insulating portion **430***a* that insulates between a tooth **530** and the stator coil **425**. The tooth insulating portion **430***a* is configured to surround a peripheral surface (an upper surface, a lower surface, and both side surfaces in the drawing) of the tooth **530**. The stator coil **425** is wound along the periphery of the tooth insulating portion **430***a*. The insulator **430** includes, for example, a yoke insulating portion **430***b* that insulates between a yoke **510** and the stator coil **425**. The yoke insulating portion **430***b* may, for example, be configured to surround an upper surface, a lower surface and an inner surface of the yoke **510** of the stator core **420**.

The electric motor **400** includes, for example, a housing **480** in which the stator **410** and the rotor **450** are accommodated.

The housing **480** defines, for example, an accommodation space in which the stator **140** is accommodated. A plurality of communication portions **482** are formed through a side surface of the housing **480** such that inside and outside communicate with each other. The housing **480** is provided with a bearing accommodating portion **485** to which the bearing **460** provided on the lower side of the rotor **450** is coupled. A flange **490** extends outwardly from an upper end of the housing **480** in the radial direction.

The inlet body **310** is fastened to the flange **490** of the housing **480**.

The bearing support unit **350** that supports the bearing **460** disposed on the upper side of the rotor **450** is fastened to the flange **490** of the housing **480**.

More specifically, the flange **315** of the inlet body **310** is coupled in contact with an outer side of the flange **490** of the housing **480** in the radial direction. The support plate **360** of the bearing support unit **350** is coupled to the inside of the inlet body **310** along the radial direction of the flange **490** of the housing **480**.

The flange **490** of the housing **480** is provided with first fastening member coupling portions **494** to which the fastening members coupled to the inlet body **310** are fastened.

The flange **490** of the housing **480** is provided with second fastening member coupling portions **496** to which fastening members coupled to the bearing support unit **350** are fastened.

The second fastening member coupling portions **496** may be respectively disposed on a circumference having a diameter smaller than a diameter of a circumference on which the first coupling member coupling portions **494** are disposed.

A plurality of through portions **492** are formed through a planar surface of the flange **490** of the housing **480**. The plurality of through portions **492** of the housing **480** are spaced apart along the circumferential direction. The plurality of through portions **492** of the housing **480** may be located between the adjacent second fastening member coupling portions **496**. The plurality of through portions **492** of the housing **480** may be located between the adjacent second fastening member coupling portions **494**.

FIG. **6** is a planar view of FIG. **5**. As illustrated in FIG. **6**, the electric motor **400** includes a stator **410** and a rotor **450**. The stator **410** includes the stator core **420** and the stator coil **425** wound around the stator core **420**.

The stator core **420** includes yokes **510** split along the circumferential direction, assembly connectors **550** each coupled between the two adjacent yokes **510**, and teeth **530** each coupled to an inner side of the assembly connectors **550**.

According to this configuration, a length of each yoke **510** can be shortened by a length of each assembly connector **550** along the circumferential direction of the stator core **420**. This can suppress deformation of the yoke **510**.

Also, a length of each tooth **530** can be shortened by a width of each assembly connector **550** along the radial direction of the stator core **420**. This can suppress deformation of the tooth **530**.

This embodiment illustrates an example in which the yoke **510**, the assembly connector **550**, and the tooth **530** are provided respectively by three in number. However, this is merely illustrative but the present disclosure is not limited to this.

The stator coil **425** may be configured as, for example, a so-called centralized winding that is intensively wound around the tooth **530**.

The stator **410** further includes an insulator **430** interposed between the stator core **420** and the stator coil **425** for insulation between the stator core **420** and the stator coil **425**.

In this embodiment, the stator coil **425** may be configured by including a plurality of coil portions each wound around a periphery of the tooth **530**. In this embodiment, the plurality of coil portions are provided by three in number to correspond to the number of the teeth **530**.

FIG. **7** is a perspective view illustrating a stator core of FIG. **6** and FIG. **8** is an exploded perspective view of the stator core of FIG. **7**. As illustrated in FIGS. **7** and **8**, the stator core **429** may be made of a magnetic substance. The stator core **420** may be configured by stacking in an insulating manner a plurality of electronic or electrical steel sheets (hereinafter, referred to as "electrical steel sheets".

The stator core **420** is provided with a rotor accommodating hole **534** in which the rotor **450** is rotatably disposed with a preset air gap G.

The yoke **510**, the assembly connector **550**, and the tooth **530** are, for example, configured to have the same thickness.

The yoke **510**, the assembly connector **550**, and the tooth **530** have bottom surfaces disposed on the same plane in the drawing, and upper surfaces disposed on the same plane in the drawing.

Each of the yokes **510** has, for example, an arcuate shape.

More specifically, the yoke **510** may be formed by, for example, stacking a plurality of electrical steel sheets **511** each having an arcuate shape.

Each of the plurality of electrical steel sheets **511** of the yoke **510** includes a yoke body **512** having the arcuate shape, and protruding portions **515** formed on both end portions of the yoke body **512**, respectively.

Each of the teeth **530** has a shape like an alphabet "T".

Specifically, the tooth **530** may be formed by, for example, stacking a plurality of electrical steel sheets **531** having the "T" shape.

Each of the plurality of electrical steel sheets **531** of the tooth **530** includes a tooth body **532** having a substantially rectangular shape and a protruding portion **535** formed on an end portion of the tooth body **532**.

Each of the assembly connectors **550** has a substantially rectangular parallelepiped shape.

Specifically, the assembly connector **550** may be formed by, for example, stacking a plurality of electrical steel sheets **551** each having a rectangular shape.

Each of the plurality of electrical steel sheets **551** of the assembly connector **550** includes an assembly connector body **552** having a substantially rectangular shape and a protrusion accommodating portion **555** formed in the assembly connector body **552**.

FIG. **9** is a perspective view illustrating a yoke of FIG. **8** and FIG. **10** is a planar view of the yoke of FIG. **9**. As illustrated in FIGS. **9** and **10**, the yoke **510** includes, for example, an outer diameter surface Co and an inner diameter surface Ci that are arranged concentrically with each other. The protruding portions **515** protrude from the both end portions of the yoke **510**, respectively, in the circumferential direction of the stator core **420**.

The protruding portions **515** include, for example, first protrusions **515***a* protruding from the both end portions of the yoke **510** (yoke body **512**) in the circumferential direction, respectively, and second protrusions **515***b* protruding from the first protrusions **515***a*, respectively.

The second protrusions **515***b* may protrude to inner and outer sides of each of the first protrusions **515***a*.

The second protrusions **515***b* may be, for example, disposed in the radial direction of the stator core **420**.

This embodiment illustrates an example in which the second protrusions **515***b* protrude to the outer and inner sides of the first protrusion **515***a*. However, this is merely illustrative and the second protrusion **515***b* may alternatively protrude to any one of the outer and inner sides of the first protrusion **515***a*.

The first protrusion **515***a* of the yoke **510** may be configured such that a center Cp**1** (central line) thereof in the radial direction of the stator core **420** is located more outward than a center Cc (central line) of the yoke **510**.

This can increase a length between an inner surface of the first protrusion **515***a* of the yoke **510** and an extension line of the inner diameter surface Ci of the yoke **510**.

Accordingly, a thickness of a protrusion accommodating space of the assembly connector **550** for accommodating the first protrusion **515***a* of the yoke **510** can increase, thereby increasing coupling force between the yoke **510** and the assembly connector **550**.

Conversely, a length between an outer surface of the first protrusion **515***a* and an extension line of the outer diameter surface Co of the yoke **510** can be shortened.

Accordingly, when a width of the assembly connector **550** (a radial width of the stator core **420**) is large so that the outer surface of the assembly connector **550** protrudes more than the outer diameter of the yoke **510**, the coupling force between the yoke **510** and the assembly connector **550** can increase.

On the other hand, extension portions **517** extend from both end regions of the yoke **510** to protrude more inwardly than the inner diameter surface of the yoke **519** along the radial direction of the stator core **420**.

The extension portions **517** may be formed, for example, in a linear shape such that an inner diameter (inner width) thereof is gradually reduced.

Each of the extension portions **517** may be formed, for example, in a linear shape disposed at a right angle with respect to the extension direction (radial direction) of the tooth **530**.

Each of the extension portions **517** of the yoke **510** may be disposed, for example, to be parallel with an inner surface of the assembly connector **550**.

With this configuration, when the yoke **510** and the assembly connector **550** are coupled to each other, a contact surface of the yoke **510** that is brought into contact with a side portion of the assembly connector **550** can increase.

Accordingly, when the yoke **510** and the assembly connector **550** are coupled to each other, deformation of an end region of the yoke **510** can be suppressed.

FIG. **11** is a perspective view illustrating a tooth of FIG. **8** and FIG. **12** is a planar view of the tooth of FIG. **11**. As illustrated in FIGS. **11** and **12**, the tooth **530** includes a tooth body **532** and a protruding portion **535** protruding from the tooth body **532** in a longitudinal direction.

The tooth body **532** is implemented, for example, in a rectangular shape having the same width. Shoes **533** extend respectively from both sides of one end portion (an inner end portion) of the tooth body **532** in the circumferential direction. An inner surface of each shoe **533** is formed in an arcuate shape. As the inner surface of each shoe **533** of the tooth **530** is disposed on the same circumference, a rotor accommodating hole **534** is defined at an inner side of the shoe **533** with a preset air gap from the rotor **450**.

The protruding portion **535** coupled to the assembly connector **550** is located at another end portion (an outer end portion) of the rotor **450**. The protruding portion **535** of the tooth **530** includes a first protrusion **535***a* protruding along the radial direction of the stator core **420**, and second protrusions **535***b* protruding from the first protrusion **535***a*. The second protrusions **535***b* of the tooth **530**, for example, protrude from the first protrusion **535***a* along the circumferential direction of the stator core **420**. The second protrusions **535***b* of the tooth **530** protrude to both sides from an end portion of the first protrusion **535***a*, respectively.

The first protrusion **535***a* is formed so that a center line along the radial direction of the stator core **420** coincides with a center line (a center line along the radial direction) of the tooth body **532**.

A width (a circumferential width) of the tooth **530** may be smaller than a width (a circumferential length) of the assembly connector **550**.

The tooth **530** includes the extension portions **537** that can be in contact with the inner surface of the assembling connector **550** when assembling with the assembly connector **550**.

The extension portions **537** of the tooth **530** are formed on both sides of the outer end portion of the tooth body **532**.

The extension portions **537** of the tooth **530** may be formed, for example, symmetrically with respect to the center line of the tooth body **532** and the first protrusion **535***a*.

Accordingly, when the tooth **530** and the assembly connector **550** are coupled to each other, a contact area between the tooth **530** and the assembly connector **550** can increase.

With the configuration, when the tooth **530** and the assembly connector **550** are coupled to each other, coupling force between the tooth **530** and the assembly connector **550** can increase.

FIG. **13** is a perspective view illustrating an assembly connector of FIG. **8** and FIG. **14** is a planar view of the assembly connector FIG. **13**. As illustrated in FIGS. **13** and **14**, the assembly connector **550** includes an assembly connector body **552** and a protrusion accommodating portion **555** formed in the assembly connector body **552**. The assembly connector body **552** has a substantially rectangular parallelepiped shape. The assembly connector **550** has preset length L and width W. The assembly connector **550** is disposed to have a long length L along the circumferential direction of the stator core **420**. Specifically, the yokes **510** are coupled to both end portions along the longitudinal direction of the assembly connector **550**, respectively. The tooth **530** is coupled to the inner surface of the assembly connector **550**.

The assembly connector **550** is configured such that the length L is larger than the width (the circumferential width) of the tooth **530**.

Accordingly, when the tooth **530** and the assembly connector **550** are coupled, the coupling force can increase to firmly support the tooth **530**.

In addition, when the tooth **530** and the assembly connector **550** are coupled to each other, the deformation of the assembly connector **550** can be suppressed.

The assembly connector **550** is configured so that the width W is larger than a thickness (a circumferential width) of the yoke **510**.

Accordingly, when the yoke **510** and the assembly connector **550** are coupled to each other, the coupling force can increase to firmly support the yoke **510**.

In addition, when the yoke **510** and the assembly connector **550** are coupled to each other, the deformation of the assembly connector **550** can be suppressed.

The assembly connector **550** may be coupled to the yoke **510** so that an inner surface thereof corresponds to the inner diameter surface of the yoke **510**.

The outer surface of the assembly connector **550** protrudes outward compared to the outer diameter surface of the yoke **510**.

A protrusion accommodating portion **555**, in which the protruding portions of the yoke **510** can be accommodated from both side surfaces of the assembly connector **550**, is formed in the assembly connector **550**.

The protrusion accommodating portion **555** includes side protrusion accommodating spaces **555***a* respectively formed in both side surfaces of the assembly connector **550** along the circumferential direction of the stator core **420**.

Each of the side protrusion accommodating spaces **555***a* includes a first protrusion accommodating spaces **555***a***1** in which the first protrusion **535***a* of the yoke **510** is accommodated.

The side protrusion accommodating spaces **555***a* are open to both sides (left and right sides in the drawing) of the assembly connector **550**, respectively.

Each of the side protrusion accommodating spaces **555***a* includes, for example, second protrusion accommodating spaces **555***a***2** that communicate with the first protrusion accommodating space **555***a***1** and extend in the radial direction of the stator core **420**, respectively.

Here, a distance from the second protrusion accommodating space **555***a***2** of the side protrusion accommodating space **555***a* to the inner surface of the assembly connector **550** is larger than a protrusion length of the second protrusion **515***b* of the yoke **510**.

This can suppress an occurrence of an inner displacement of the yoke **510** due to an external force applied in an inward direction of the stator core **420**.

Also, a distance from the second protrusion accommodating space **555***a***2** of the side protrusion accommodating space **555***a* to the outer surface of the assembly connector **550** is larger than the protrusion length of the second protrusion **515***b* of the yoke **510**.

This can suppress an occurrence of an outer displacement of the yoke **510** due to an external force applied in an outward direction of the stator core **420**.

With this configuration, the occurrence of the inner and outer displacements of the yoke **510** when external force is applied in the radial direction of the stator core **420** can be suppressed, thereby firmly supporting the yoke **510**.

FIG. **15** is a planar view illustrating a coupled state of the stator core of FIG. **8**. As illustrated in FIG. **15**, the assembly connectors **550** are spaced apart from one another at preset distances along the circumferential direction of the stator core **420**. The yokes **510** are respectively coupled to both sides of each of the assembly connectors **550**. Each of the yokes **510** has an outer diameter and an inner diameter that are concentric with each other. The yokes **510** has the same thickness in the radial direction of the stator core **420**.

The yokes **510** may have a thickness of 3.10 mm, for example. More specifically, for example, the outer diameter of each yoke **510** may be implemented as 39.00 mm. The inner diameter of each yoke **510** may be implemented as 32.80 mm, for example. The protruding portions **515** are respectively provided on the both end portions of each of the yokes **510**. Each of the protruding portions **515** of the yoke **510** includes a first protrusion **515***a* protruding along the circumferential direction of the stator core **420**, and second protrusions **515***b* protruding from the first protrusion **515***a* along the radial direction of the stator core **420**.

Extension portions **517** are respectively disposed on both end portions of the yoke **510** so that the width of the yoke **510** gradually increases along the radial direction of the stator core **420**. The extension portions **517** of the yoke **510** may have a maximum width of 3.42 mm, for example. A length of each of the extension portions **517** may be implemented as 1.27 mm, for example. Each of the extension portions **517** may extend by the length of 1.27 mm from the end portion of the yoke **510**.

Since the yoke **510** has the outer diameter of 39.00 mm, the inner diameter of 32.80 mm, and the thickness of 3.10 mm, and each of the extension portions **517** has the maximum width of 3.42 mm, the extension portion **517** may protrude by up to 0.32 mm inward with respect to the inner diameter of the yoke **510**.

The tooth **530** may have, for example, a width of 5.00 mm along the radial direction of the stator core **420**. The protruding portion **535** is disposed on an end portion (an outer end portion) of the tooth **530**. The protruding portion **535** of the tooth **530** includes, for example, a first protrusion **535***a* protruding outward along the radial direction of the stator core **420**, and second protrusions **535***b* protruding from the first protrusion **535***a* along the circumferential direction of the stator core **420**.

Extension portions **537** extend from the outer end portion of the tooth **530** to correspond to the adjacent assembly connectors **550**. Each of the extension portions **537** may have, for example, a maximum width that corresponds to the length (the circumferential width) of the assembly connector **550**.

On the other hand, the assembly connector **550** is implemented, for example, in a rectangular parallelepiped shape. The assembly connector **550** may be implemented to have a rectangular cross-section, for example. The assembly connector **550** may be implemented to have a long length L along the circumferential direction of the stator core **420**.

Here, the length (the circumferential width) of the assembly connector **550** may be larger than the width of the tooth **530**. The width (the radial width) of the assembly connector **550** may be larger than the maximum width of the yoke **510**. When the inner surface of the assembly connector **550** is disposed to correspond to the inner surface (the extension portion) of the yoke **510**, the outer surface of the assembly connector **550** protrudes outward from the outer surface of the yoke **510**.

The length of the assembly connector **550** may be implemented as 5.60 mm, for example. The width of the assembly connector **550** may be implemented as 3.82 mm, for example. Here, since the width of the assembly connector **550** is larger than the width of the yoke **510**, when the inner surface of assembly connector **550** is disposed to correspond to the inner surface of the yoke **510** in the radial direction of the stator core **420**, the assembly connector **550** may protrude outward with respect to the outer surface of the yoke **510**. In this embodiment, the width of the assembly connector **550** is 3.82 mm. Therefore, when the assembly connector **550** is disposed to correspond to the extension portion of the yoke **510**, the outer surface of the assembly connector **550** may protrude by about 0.40 mm from the outer surface of the yoke **510**.

The first protrusion of the yoke **510** may have a width of, for example, 1.69 mm. The first protrusion accommodating space **555***a***1** of the side protrusion accommodating space **555***a* of the assembly connector **550** may be, for example, smaller than 1.69 mm so as to be fitted with a predetermined interference when the first protrusion **515***a* of the yoke **510** is coupled.

The second protrusions **515***b* of the yoke **510** may protrude from the first protrusion **515***a* by a protrusion length of 0.34 mm. A distance between end portions of the second protrusions **515***b* may be 2.37 mm. The second protrusion accommodating spaces **555***a***2** of the side protrusion accommodating space **555***a* of the assembly connector **550** may be smaller than 2.37 mm.

The first protrusion **535***a* of the tooth **530** may have a width of, for example, 1.75 mm. A first protrusion accommodating space **555***b***1** of an inner protrusion accommodating space **555***b* that configures the protrusion accommodating portion **555** of the assembly connector **550** may be smaller than 1.75 mm so as to be fitted with a predetermined interference when the first protrusion **535***a* of the tooth **530** is coupled. The second protrusions **535***b* of the tooth **530** may protrude from the first protrusion **535***a* of the tooth **530** by a protrusion length of 0.525 mm, respectively. Second protrusion accommodating spaces **555***b***2** of the inner protrusion accommodating space **555***b* of the assembly connector **550** may be smaller than 2.80 mm.

In this embodiment, in the configuration that the side protrusion accommodating spaces **555***a* of the assembly connector **550** are formed smaller than the protruding portions **515** of the yoke **510** and the inner protrusion accommodating space **555***b* of the assembly connector **550** is formed smaller than the protruding portion **535** of the tooth **530**, a degree that they are formed to be small means a degree that interference-fit is allowed.

With this configuration, the protruding portions **515** of the yokes **510** can be fitted to the side protrusion accommodating spaces **555***a* of the assembly connector **550**. The protruding portion **535** of the tooth **530** may be fitted to the inner protrusion accommodating space **555***b* of the assembly connector **550**.

Here, the assembly connector **550**, the yokes **510**, and the tooth **530** may be adjusted in temperature to have a preset temperature difference before coupling.

For example, the assembly connector **550** may be heated to have a relatively high temperature with a preset temperature difference from the yoke **510** and the tooth **530**.

Accordingly, the side protrusion accommodating spaces **555***a* and the inner protrusion accommodating space **555***b* of the assembly connector **550** may be expanded.

With this configuration, after the side protrusion accommodating spaces **555***a* and the inner protrusion accommodating space **555***b* of the assembly connector **550** are heated and expanded, the protruding portions **515** of the yoke **510** and the protruding portion **535** of the tooth **530** can be accommodated and coupled. This can facilitate smooth coupling between the assembly connector **550** and the yokes **510** and between the assembly connector **550** and the tooth **530**.

Since the protrusion accommodating portion **555** of the assembly connector **550** is in the expanded state due to the rise in temperature, compared to the protruding portions **515** of the yokes **510** and the protruding portion **535** of the tooth **530**, its rigidity (strength) is lowered and an elongation is increased compared to the protruding portions **515** of the yokes **510** and the protruding portion **535** of the tooth **530**. Accordingly, when they are coupled, the protruding portions **515** of the yokes **510** and the protruding portion **535** of the tooth **530** can be prevented from being deformed due to the contact with the protrusion accommodating portion **555** of the assembly connector **550**.

FIG. **16** is a planar view corresponding to FIG. **6** of an electric motor in accordance with another embodiment, FIG. **17** is a perspective view illustrating a stator core of FIG. **16**, FIG. **18** is an exploded perspective view of the stator core of FIG. **17**, and FIG. **19** is a planar view illustrating a coupled state of the stator core of FIG. **17**. As described above, the electric motor **400***a* of the embodiment includes the impeller **210**, a stator **410***a*, and the rotor **450**. The impeller **210** includes the hub **212** and the plurality of blades **217** disposed along the circumference of the hub **212**. The inlet body **310** is disposed outside the impeller **210**, and the housing **480** is disposed at one side of the inlet body **310**. The stator **410***a* is accommodated inside the housing **480**. The rotor **450** is rotatably disposed inside the stator **410***a* with a preset air gap G therebetween.

As illustrated in FIG. **16**, the rotor **450** includes the rotating shaft **451** and the permanent magnet **455** coupled to the rotating shaft **451** to rotate centering on the rotating shaft **451**.

The stator **410***a* includes a stator core **420***a* and the stator coil **425** wound around the stator core **420***a*. The stator coil **425** is implemented, for example, as a concentrated winding that the stator coil **425** is intensively wound around the tooth **530***a* of the stator core **420***a*. As described above, the electric motor **400***a* of this embodiment has a relatively small size (e.g., an outer diameter of a yoke **510***a* of the stator **410***a* is about 39.0 mm), and is allowed to rotate at a high speed (e.g., about 160 to 200 krpm). The stator **410***a* includes the insulator **430** interposed between the stator core **420***a* and the stator coil **425** (refer to FIG. **4**). Accordingly, an occurrence of a short-circuit between the stator core **420***a* and the stator coil **425** can be suppressed.

On the other hand, as illustrated in FIGS. **17** and **18**, the stator core **420***a* of the electric motor **400***a* of this embodiment includes yokes **510***a* split along the circumferential direction, assembly connectors **550***a* each coupled between the two adjacent yokes **510**, and teeth **530***a* each coupled to an inner side of the assembly connector **550**.

The yoke **510***a*, the assembly connector **550***a* and the tooth **530***a* may be provided by three in number, respectively.

This embodiment illustrates an example in which the yoke **510***a*, the assembly connector **550***a*, and the tooth **530***a* are provided respectively by three in number. However, this is merely illustrative but the present disclosure is not limited to this.

The stator core **420***a* may be formed of a magnetic substance.

Each of the yokes **510***a* has an arcuate shape.

Specifically, the yoke **510***a* may be formed by, for example, stacking a plurality of electrical steel sheets **511** each having an arcuate shape.

Each of the assembly connectors **550***a* has a rectangular parallelepiped shape.

Specifically, the assembly connector **550***a* may be formed by, for example, stacking a plurality of electrical steel sheets **551** each having a rectangular shape.

Each of the teeth **530***a* has a shape like an alphabet "T".

Specifically, the tooth **530***a* may be formed by, for example, stacking a plurality of electrical steel sheets **531** having the "T" shape.

Each of the yokes **510***a* includes a yoke body **512** having the arcuate shape, and protruding portions formed on both end portions of the yoke body **512**. The yoke body **512** includes extension portions **517** protruding inward from an inner diameter surface of the yoke body **512**.

In this embodiment, the assembly connector **550***a* has, for example, a length L larger than a width of the tooth **530***a*. The assembly connector **550***a* has a width W more expanded than a radial thickness of the yoke **510***a*.

Meanwhile, in this embodiment, the protruding portions **515** of the yoke **510***a* include first protrusions **515***a* protruding from both end portions of the yoke body **512**, respectively, second protrusions **515***b* protruding from each of the first protrusions **515***a*, and third protrusions **515***c* protruding from the second protrusions **515***b*, respectively.

Specifically, the first protrusions **515***a* of the yoke **510***a* may protrude respectively from the end portions of the yoke **420***a* along the circumferential direction, for example.

The second protrusions **515***b* of the yoke **510***a* may protrude, for example, from each of the first protrusions **515***a* in the radial direction of the stator core **420***a*.

The second protrusions **515***b* of the yoke **510***a* may protrude to inner and outer sides of the first protrusion **515***a* of the yoke **510***a*, for example.

The third protrusions **515***c* of the yoke **510***a* may protrude from the second protrusions **515***b*, respectively, along the circumferential direction of the stator core **420***a*.

The third protrusions **515***c* of the yoke **510***a* may protrude from the second protrusions **515***b* of the yoke **510***a*, respectively, toward the end portion of the yoke body **512**.

The tooth **530***a* includes a tooth body **532** and a protruding portion **535** protruding from an end portion of the tooth body **532**. Extension portions **537** may extend from the tooth body **532** to come in contact with an inner surface of the assembly connector **550***a*. The extension portions **537** of the tooth **530***a* are formed on both sides of the tooth body **532**.

In this embodiment, the protruding portion **535** of the tooth **530***a* includes a first protrusion **535***a* protruding from an end portion of the tooth body **532**, second protrusions **535***b* protruding from the first protrusion **535***a*, and third protrusions **535***c* protruding from the second protrusions **535***b*, respectively.

Specifically, the first protrusion **535***a* of the tooth **530***a* may protrude from an outer end portion of the tooth body **532** in the radial direction of the stator core **420***a*.

The second protrusions **535***b* of the tooth **530***a* may protrude from the first protrusion **535***a* of the tooth **530***a* in the circumferential direction of the stator core **420***a*.

The second protrusions **535***b* of the tooth **530***a* may protrude to both sides of the first protrusion **535***a* of the tooth **530***a*, for example.

The third protrusions **535***c* of the tooth **530***a* may protrude from the second protrusions **535***b* of the tooth **530***a*, respectively, in the radial direction of the stator core **420***a*.

The third protrusions **535***c* of the tooth **530***a* may protrude, for example, to inner sides of the second protrusions **535***b* of the tooth **530***a* (the end portion of the tooth body **532**), respectively.

On the other hand, the assembly connector **550***a* includes an assembly connector body **552** having a rectangular parallelepiped shape, and a protrusion accommodating portion **555** formed in the assembly connector body **552**.

The protrusion accommodating portion **555** of the assembly connector **550***a* includes side protrusion accommodating spaces **555***a* respectively formed in both side surfaces of the assembly connector body **552**, and an inner protrusion accommodating space **555***b* formed in an inner surface of the assembly connector body **552**.

In this embodiment, each of the side protrusion accommodating spaces **555***a* is configured by including a first protrusion accommodating space **555***a***1**, second protrusion accommodating spaces **555***a***2**, and third protrusion accommodating portions **555***a***3** in which the first protrusion **515***a*, the second protrusions **515***b*, and the third protrusions **515***c* of the yoke **510***a* are accommodated.

With this configuration, when the yoke **510***a* and the assembly connector **550***a* are coupled to each other, a relative movement of the first protrusion accommodating space **555***a***1** of the side protrusion accommodating space **555***a* of the assembly connector **550***a* and the first protrusion **515***a* of the yoke **510***a* in the radial direction of the stator core **420***a* can be suppressed.

This can remarkably improve coupling force between the first protrusion **515***a* of the yoke **510***a* and the first protrusion accommodating space **555***a***1** of the side protrusion accommodating space **555***a* of the assembly connector **550***a*.

In this embodiment, the inner protrusion accommodating space **555***b* is configured by including a first protrusion accommodating space **555*b*1**, second protrusion accommodating spaces **555*b*2**, and third protrusion accommodating spaces **555*b*3** in which the first protrusion **535*a***, the second protrusions **535*b***, and the third protrusions **535*c*** of the yoke **530*a*** are accommodated.

With this configuration, when the tooth **530*a*** and the assembly connector **550*a*** are coupled to each other, a relative movement of the first protrusion accommodating space **555*b*1** of the inner protrusion accommodating space **555*b*** of the assembly connector **550*a*** and the first protrusion **535*a*** of the tooth **530*a*** in the circumferential direction of the stator core **420*a*** can be suppressed.

This can remarkably improve coupling force between the first protrusion **535*a*** of the tooth **530*a*** and the first protrusion accommodating space **555*b*1** of the inner protrusion accommodating space **555*b*** of the assembly connector **550*a***.

Meanwhile, as illustrated in FIG. **19**, the assembly connectors **550*a*** may be spaced apart from one another at preset intervals along the circumferential direction. The yokes **510*a*** may be respectively coupled to both sides of the assembly connector **550*a***. The tooth **530*a*** may be coupled to the inner surface of each assembly connector **550*a***.

Here, when the yokes **510*a***, the assembly connector **550*a*** and the tooth **530*a*** are coupled, the assembly connector **550*a*** may be heated to a higher temperature so as to have a preset temperature difference from the yokes **510*a*** and the tooth **530*a***.

According to this configuration, in the state in which the side protrusion accommodating spaces **555*a*** and the inner protrusion accommodating space **555*b*** of the assembly connector **550*a*** have been expanded, respectively, the protruding portions **515** of the yokes **510*a*** and the protruding portion **535** of the tooth **530** can be inserted therein.

Due to the rise in temperature of the side protrusion accommodating spaces **555*a*** and the inner protrusion accommodating space **555*b*** of the assembly connector **550*a***, those accommodating spaces have relatively lower rigidity (strength) and higher elongation than the protruding portions **515** of the yokes **510*a*** and the protruding portion **535** of the tooth **530*a***. This can suppress an occurrence of deformation of the protruding portions **515** of the yokes **510*a*** and the protruding portion **535** of the tooth **530*a*** due to the contact with the side protrusion accommodating spaces **555*a*** and the inner protrusion accommodating space **555*b*** of the assembly connector **550*a*** during coupling.

In the electric motor **400*a*** of this embodiment, when the stator core **420*a*** is coupled, the occurrence of the deformation of the yokes **510*a*** and the teeth **530*a*** can be suppressed, so that the concentricity of the yokes **510*a*** and the teeth **530*a*** after coupling can be maintained in a preset state.

Therefore, a uniform air gap can be maintained between the stator **410*a*** and the rotor **450**.

Also, since the coupling force among the yokes **510*a***, the assembly connectors **550*a*** and the teeth **530*a*** can be stably maintained, the uniform air gap G between the stator **410*a*** and the rotor **450** can be continuously maintained during operation.

This can suppress an occurrence of a decrease in output of the electric motor **400*a*** due to a non-uniform air gap between the stator **410*a*** and the rotor **450**.

FIG. **20** is a view corresponding to FIG. **19** of a stator core of an electric motor in accordance with still another embodiment. As illustrated in FIG. **20**, a stator core **4201** of an electric motor **400*a*** according to this embodiment includes yokes **510*a*** split along the circumferential direction, assembly connectors **5501** each coupled between the two adjacent yokes **510** continuously disposed in the circumferential direction, and teeth **530*a*** each coupled to an inner surface of the assembly connector **550**.

Each of the yokes **510*a*** includes protruding portions **515** formed on both end portions of the stator core **4201**. Each of the protruding portions **515** of the yoke **510*a*** includes a first protrusion **515*a*** protruding in the circumferential direction of the stator core **4201**, second protrusions **515*b*** protruding from the first protrusion **515*a***, and third protrusions **515*c*** protruding from the second protrusions **515*b***, respectively.

Each of the teeth **530*a*** includes a protruding portion **535** protruding in the radial direction of the stator core **4201**. The protruding portion **535** of the tooth **530*a*** includes a first protrusion **535*a*** protruding in the radial direction, second protrusions **535*b*** protruding from the first protrusion **535*a***, and third protrusions **535*c*** protruding from the second protrusions **535*b***, respectively.

Meanwhile, referring to FIG. **20**, the assembly connector **5501** may be configured not to protrude from both side surfaces of the tooth **530*a***. The assembly connector **5501** of this embodiment is configured to have the same length (circumferential length) as the width of the tooth **530*a***. The assembly connector **5501** of this embodiment may be configured such that both side surfaces are disposed on extension lines of both side surfaces of the tooth **530*a***.

The assembly connector **5501** includes side protrusion accommodating spaces **555*a*** to which the protruding portions **515** of the yokes **510*a*** are accommodated. Each of the side protrusion accommodating spaces **555*a*** includes a first protrusion accommodating space **555*a*1**, second protrusion accommodating spaces **555*a*2**, and third protrusion accommodating spaces **555*a*2** in which the first protrusion **515*a***, the second protrusions **515*b***, and the third protrusions **515*c*** of the yoke **510*a*** are accommodated.

The first protrusion accommodating space **555*a*1**, the second protrusion accommodating spaces **555*a*2** and the third protrusion accommodating spaces **555*a*2** of the side protrusion accommodating space **555*a*** of the assembly connector **550*a*** may be configured to be smaller than the first protrusion **515*a***, the second protrusions **515*b***, and the third protrusions **515*c*** of the yoke **510*a***, so as to be fitted to those protrusions with a preset interference when the protrusions are accommodated.

In this embodiment, the outer surface of the assembly connector **5501** may be configured not to protrude outward from the outer surface of the yoke **510*a***. The outer surface of the assembly connector **5501** of this embodiment may be disposed inside a circumference (shown by a dotted line) that extends from the outer surface of the yoke **510*a***.

According to this configuration, the maximum outer diameter of the stator core **4201** can be reduced, so that a compact configuration can be obtained.

The assembly connector **5501** includes an inner protrusion accommodating space **555*b*** to which the protruding portion **535** of the tooth **530*a*** is accommodated. The inner protrusion accommodating space **555*b*** includes a first protrusion accommodating space **555*b*1**, second protrusion accommodating spaces **555*b*2**, and third protrusion accommodating spaces **555*b*2** in which the first protrusion **535*a***, the second protrusions **535*b***, and the third protrusions **535*c*** of the yoke **530*a*** are accommodated.

The first protrusion accommodating space **555*b*1**, the second protrusion accommodating spaces **555*b*2** and the third protrusion accommodating spaces **555*b*2** of the inner protrusion accommodating space **555*b*** of the assembly connector **5501** may be configured to be smaller than the first protrusion **535*a***, the second protrusions **535*b***, and the third protrusions **535**c of the tooth **530**a, so as to be fitted to those protrusions with a preset interference when the protrusions are accommodated.

With this configuration, when the tooth **530**a and the assembly connector **5501** are coupled to each other, a relative movement of the first protrusion accommodating space **555**b**1** of the assembly connector **5501** and the first protrusion **535**a of the tooth **530**a in the circumferential direction of the stator core **4201** can be suppressed.

This can remarkably improve coupling force between the first protrusion **535**a of the tooth **530**a and the first protrusion accommodating space **555**b**1** of the inner protrusion accommodating space **555**b of the assembly connector **5501**.

With this configuration, the length of the assembly connector **5501** (the circumferential length of the stator core) can be reduced to be equal to the width of the tooth **530**a.

According to this embodiment, an occurrence of displacement and deformation of the yoke **510**a and the tooth **530**a can be suppressed, and the width (radial width) of the assembly connector **5501** can be reduced, thereby providing a compact structure of the stator core **4201**.

Hereinafter, a method of manufacturing an electric motor having the aforementioned structural features will be described with reference to the aforementioned drawings and FIG. **21**.

FIG. **21** is a view illustrating a method for manufacturing an electric motor in accordance with one embodiment, and FIG. **22** is a view illustrating a method for manufacturing an electric motor in accordance with another embodiment. As described above, an electric motor **400** according to this embodiment includes a stator **410** and a rotor **450** that is rotatably disposed inside the stator **410** with a preset gap G therebetween.

The stator **410** may include a stator core **420** and a stator coil **425** wound around the stator core **420**.

The stator **410** further includes an insulator **430** interposed between the stator core **420** and the stator coil **425** for electrical insulation between the stator core **420** and the stator coil **425**.

The stator core **420** includes yokes **510** split along the circumferential direction, assembly connectors **550** each coupled between the two adjacent yokes **510**, and teeth **530** each coupled to an inner surface of the assembly connector **550**.

Each of the yokes **510** includes a yoke body **512** having the arcuate shape, and protruding portions formed on both end portions of the yoke body **512**. Each of the protruding portions **515** of the yoke **510** includes a first protrusion **515**a protruding along the circumferential direction of the stator core **420**, and second protrusions **515**b protruding from the first protrusion **515**a along the radial direction of the stator core **420**.

The tooth **530** includes a tooth body **532** formed in a "T" shape and a protruding portion **535** protruding from the tooth body **532**. The protruding portion **535** of the tooth **530** includes, for example, a first protrusion **535**a protruding from the tooth body **532** along the radial direction of the stator core **420**, and second protrusions **535**b protruding from the first protrusion **535**a along the circumferential direction of the stator core **420**.

The assembly connector **550** includes an assembly connector body **552** having a rectangular parallelepiped shape, and a protrusion accommodating portion **555** formed in the assembly connector body **552**. The protrusion accommodating portion **555** includes side protrusion accommodating spaces **555**a respectively formed in both side surfaces of the assembly connector body **552**, and an inner protrusion accommodating space **555**b formed in an inner surface of the assembly connector body **552**.

As illustrated in FIG. **21**, a method of manufacturing the electric motor according to this embodiment includes forming the yoke **510**, the assembly connector **550** and the tooth **530**, respectively (S**110**), winding the stator coil **425** on the tooth **530** (S**130**), coupling the yoke **510** to the assembly connector **550** (S**150**), and coupling the tooth **530** to the assembly connector **550** (S**160**).

When each of the yoke **510**, the assembly connector **550**, and the tooth **530** is formed, the stator coil **425** is wound around the periphery of the tooth **530** before the assembly connector **550** and the tooth **530** are coupled (S**130**).

The method of manufacturing the electric motor according to this embodiment may further include, before the step S**130** of winding the stator coil **425** on the tooth **530**, insulating the tooth **530** and the stator coil **425** from each other (S**120**).

The insulator **430** may be coupled to the periphery of the tooth **530** before winding the stator coil **425**.

A tooth insulating portion **430**a may be coupled to the periphery of the tooth **530**. The tooth insulating portion **430**a is configured to surround a peripheral surface (an upper surface, a lower surface, and both side surfaces in the drawing) of the tooth **530**. Accordingly, the peripheral surface (upper surface, lower surface, both side surfaces) of the tooth **530** on which the stator coil **425** is wound can fully be insulated (blocked).

The stator coil **425**, for example, may be wound on the periphery of the tooth insulating portion **430**a to be spaced apart from the assembly connector **550** by a preset length (interval). After coupling of the yoke **510**, the assembly connector **550** and the tooth **530**, a gap of the preset length is generated between the yoke **510** and the stator coil **425** wound on the tooth **530**.

On the other hand, the manufacturing method of the electric motor of this embodiment may further include adjusting temperatures of the yoke **510**, the tooth **530**, and the assembly connector **550** to cause the assembly connector **550** to have a preset temperature difference from the yoke **510** and the tooth **530** (S**140**), before those steps of coupling the yoke **510** to the assembly connector **550** (S**150**), and coupling the tooth **530** to the assembly connector **550** (S**160**).

Here, the step (S**140**) of adjusting the temperatures of the yoke **510**, the tooth **530**, and the assembly connector **550** may be configured such that the assembly connector **550** has a higher temperature than the yoke **510** and the tooth **530**.

Specifically, the assembly connector **550** may be heated, for example, to have a temperature that is 80 degrees to 120 degrees higher than temperatures of the yoke **510** and the tooth **530**.

For example, when the yoke **510** and the tooth **530** have a temperature of 25° C., the assembly connector **550** may be heated to 105° C. to 145° C.

According to this configuration, in the state in which the side protrusion accommodating spaces **555**a and the inner protrusion accommodating space **555**b of the assembly connector **550** have been expanded, the protruding portion **515** of the yoke **510** and the protruding portion **535** of the tooth **530** can be inserted smoothly.

In addition, since the protrusion accommodating portion **555** of the assembly connector **550** has been heated so as to have lower rigidity (strength) than the protruding portion **515** of the yoke **510** and the protruding portion **535** of the tooth **530**, the deformation of the protruding portion **515** of the yoke **510** and the protruding portion **535** of the tooth **530** can be suppressed during coupling.

On the other hand, in the step S**140** of adjusting the temperatures of the yoke **510**, the tooth **530**, and the assembly connector **550**, the yoke **510** and the tooth **530** may be cooled to have temperatures lower than the temperature of the assembly connector **550**.

Specifically, the yoke **510** and the tooth **530** may be cooled to have a preset temperature difference (e.g., about 70° C.) compared to the assembly connector **550**.

For example, when the temperature of the assembly connector **550** is 25° C., the yoke **510** and the teeth **530** may be cooled down to −45° C.

According to this configuration, the protruding portion **515** of the yoke **510** and the protruding portion **535** of the tooth **530** can be cooled and contracted, so as to be smoothly inserted into the protruding accommodating portion **555** of the assembly connector **550**.

The method of manufacturing the electric motor of this embodiment may further include insulating the yoke **510** (S**170**).

The step S**170** of insulating the yoke **510** may be performed after the step S**160** of coupling the assembly connector **550** and the tooth **530**.

The insulator **430** may include, for example, a yoke insulating portion **430***b* coupled to the yoke **510** for insulation between the yoke **510** and the stator coil **425**. Specifically, the yoke insulating portion **430***b* of the insulator **430** may be coupled to the upper surface, the lower surface, and the inner surface of the yoke **510**.

Here, as illustrated in FIG. **21**, the step S**155** of insulating the yoke **510** may be performed before the step S**160** of coupling the assembly connector **550** and the tooth **530**.

So far, those specific embodiments of the present disclosure have been illustrated and described. However, since the present disclosure can be embodied in various forms without departing from the essential characteristics, the embodiments described above should not be limited by the specific contents for carrying out the invention.

In addition, even embodiments not listed in the foregoing detailed description should be broadly construed within the scope of the technical idea defined in the appended claims. And, all changes and modifications included within the technical range of the claims and their equivalents should be embraced by the appended claims.

The invention claimed is:

1. An electric motor comprising:

a stator, the stator comprising a stator core and a stator coil wound around the stator core; and

a rotor configured to rotate relative to the stator,

wherein the stator core comprises:

a plurality of yokes that are split in a circumferential direction of the stator core, each of the plurality of yokes comprising a protruding portion,

a plurality of assembly connectors that connect the plurality of yokes to one another, each of the plurality of assembly connectors comprising a protrusion accommodating portion that accommodates the protruding portion and couples two adjacent yokes among the plurality of yokes to each other along the circumferential direction, and

a plurality of teeth, each tooth protruding from an inner surface of one of the plurality of assembly connectors in a radial direction of the stator core,

wherein an outer surface defined by the plurality of assembly connectors protrudes radially outward relative to an outer surface defined by the plurality of yokes,

wherein each of the plurality of teeth comprises a tooth protruding portion,

wherein each of the plurality of assembly connectors further comprises a tooth protrusion accommodating portion that accommodates the tooth protruding portion, the tooth protrusion accommodating portion being an opening defined at the inner surface of each of the plurality of assembly connectors,

wherein a circumferential width of each of the plurality of assembly connectors is greater than a circumferential width of each of the plurality of teeth in the circumferential direction,

wherein each of the plurality of teeth comprises extension portions that are in contact with the inner surfaces of one of the plurality of assembly connectors, the extension portions extending from sides of an outer end portion of one of the plurality of teeth in the circumferential direction and being in contact with the inner surfaces of the one of the plurality of assembly connectors, and

wherein a maximum width of the extension portions corresponds to the circumferential width of each of the plurality of assembly connectors.

2. The electric motor of claim **1**, wherein each of the plurality of yokes and each of the plurality of teeth are fitted to one of the plurality of assembly connectors.

3. The electric motor of claim **1**, wherein the plurality of assembly connectors are made of a magnetic material.

4. The electric motor of claim **1**, wherein the plurality of assembly connectors comprise a plurality of electrical steel sheets that are stacked and insulated from one another.

5. The electric motor of claim **1**, wherein the plurality of assembly connectors are coupled to the plurality of yokes and the plurality of teeth based on (i) a first temperature of the plurality of assembly connectors being greater than a second temperature of the plurality of yokes and the plurality of teeth, and (ii) a difference between the first temperature and the second temperature being equal to a preset temperature difference.

6. The electric motor of claim **1**, wherein the stator further comprises an insulator that insulates the stator core from the stator coil.

7. The electric motor of claim **1**, wherein the protruding portion comprises:

a first protrusion that protrudes in the circumferential direction; and

second protrusions that protrude from the first protrusion in the radial direction.

8. The electric motor of claim **7**, wherein a first circumference of the stator core passing through a center of the first protrusion is disposed radially outward relative to a second circumference of the stator core passing through centers of the plurality of yokes.

9. The electric motor of claim **8**, wherein the protrusion accommodating portion comprises:

a first protrusion accommodating space that accommodates the first protrusion; and

second protrusion accommodating spaces that accommodate the second protrusions, respectively, and

wherein a distance between one of the second protrusion accommodating spaces and an outer surface of one of the plurality of assembly connectors is larger than a radial protrusion length of one of the second protrusions.

10. The electric motor of claim **7**, wherein the protruding portion further comprises third protrusions that protrude from the second protrusions, respectively, in the circumferential direction.

11. An electric motor comprising:

a stator, the stator comprising a stator core and a stator coil wound around the stator core; and

a rotor configured to rotate relative to the stator,

wherein the stator core comprises:

a plurality of yokes that are split in a circumferential direction of the stator core,

a plurality of assembly connectors that connect the plurality of yokes to one another, each of the plurality of assembly connectors coupling two adjacent yokes among the plurality of yokes to each other along the circumferential direction, and

a plurality of teeth, each tooth protruding from an inner surface of one of the plurality of assembly connectors in a radial direction of the stator core,

wherein each of the plurality of teeth comprises a tooth protruding portion toward one of the plurality of assembly connectors,

wherein each of the plurality of assembly connectors comprises a tooth protrusion accommodating portion that accommodates the tooth protruding portion, the tooth protrusion accommodating portion being an opening defined at the inner surface of each of the plurality of assembly connectors,

wherein a circumferential width of each of the plurality of assembly connectors is greater than a circumferential width of each of the plurality of teeth in the circumferential direction,

wherein each of the plurality of teeth comprises extension portions that are in contact with the inner surfaces of one of the plurality of assembly connectors, the extension portions extending from sides of an outer end portion of one of the plurality of teeth in the circumferential direction and being in contact with the inner surfaces of the one of the plurality of assembly connectors, and

wherein a maximum width of the extension portions corresponds to the circumferential width of each of the plurality of assembly connectors.

12. The electric motor of claim **1**, wherein the inner surfaces of the one of the plurality of assembly connectors are inner circumferential surfaces of the one of the plurality of assembly connectors, and

wherein the extension portions of each of the plurality of teeth are in contact with and coupled to the inner circumferential surfaces of the one of the plurality of assembly connectors in the radial direction.

13. The electric motor of claim **11**, wherein the inner surfaces of the one of the plurality of assembly connectors are inner circumferential surfaces of the one of the plurality of assembly connectors, and

wherein the extension portions of each of the plurality of teeth are in contact with and coupled to the inner circumferential surfaces of the one of the plurality of assembly connectors in the radial direction.

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