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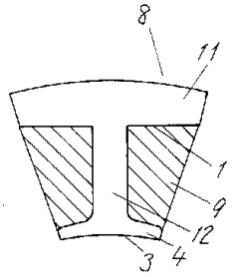
(54)Title of the Invention: STATOR OF MOTOR AND METHOD OF MANUFACTURING THE SAME

(57) [Abstract]

[Object] To provide a stator of a motor that requires no accuracy of coupling between yoke portions and tooth portions and can achieve a small cross-sectional area so that motor efficiency is not degraded.

[Solving means] Coil conductors 9 are wound on tooth portions 12 of unit core members 8 each including a yoke portion 11 having an arch-shaped outer circumference surface and an inner circumference formed as a flat surface portion 1 and a tooth portion 12 having a pole shoe portion 4 formed as a rotor facing surface 3 on an inner circumference end and provided to the flat surface portion 1 of the yoke portion 11. Then, the unit core members 8 are annularly arranged with both end surfaces of the yoke portions 11 in close contact with each other. Thus, a stator of a motor requiring no accuracy of coupling between the yoke portions and the tooth portions and causing no degradation in motor efficiency can be obtained.



1 flat surface portion
3 rotor facing surface
4 pole shoe portion
8 unit core member
9 coil conductor
11 yoke portion
12 tooth portion

[Claims]

[Claim 1] A stator of a motor, the stator comprising: unit core members each formed with unit cores each including a yoke portion core having an outer circumference surface forming a cylindrical shape and an inner circumference formed as a flat surface portion and a tooth portion core having a pole shoe portion formed as a rotor facing surface on an inner circumference end and provided to the flat surface portion of the yoke portion core; and coil conductors each wound on corresponding one of tooth portions of the unit core members, wherein the unit core members are annularly arranged with both end surfaces of the yoke portions of the unit core members in close contact with each other in a circumference direction.

[Claim 2] The stator of a motor according to claim 1, wherein the coil conductors are each wound on the corresponding one of the tooth portions of the unit core members in a trapezoidal stacked layer arrangement form in such a manner that a cross-sectional area gradually increases toward an inner circumference surface of the yoke portion.

[Claim 3] A method of manufacturing a stator of a motor, the method comprising: punching unit cores in alternate directions with a direction changing for every unit of n arrays (n being an integer equal to or larger than 2) of unit cores, the unit cores each including a yoke portion core having an outer circumference surface forming a cylindrical shape and an inner circumference formed as a flat surface portion and a tooth portion core having a pole shoe portion formed as a rotor facing surface on an inner circumference end and provided to the flat surface portion of the yoke portion core.

[Claim 4] The method of manufacturing the stator of a motor according to claim 3, wherein the unit cores are punched in a unit of unit cores, with a cross-sectional area of a wound portion of a coil conductor increased or reduced with the inner circumference flat surface portion of the yoke portion shifted toward an outer circumference side or an inner circumference side.

[Claim 5] A method of manufacturing a stator of a motor, the method comprising forming a unit core member with unit cores stacked by pressing, pressure welding, or with an adhesive using pressing force of manufacturing equipment in a punching step for the unit cores.

[Claim 6] A method of manufacturing a stator of a motor, the method comprising forming a unit core member by punching and stacking unit cores with a mold and a jig or a material heated in a punching step for the unit cores.

[Claim 7] A stator of a motor, the stator comprising: unit core members each formed with unit cores each including a yoke portion core having an arch-shaped surface formed as an arch-shaped outer circumference surface provided with a coupling recess and an inner circumference formed as a flat surface portion and a tooth portion core having a pole shoe portion formed as a rotor facing surface on an inner circumference end and provided to the flat surface portion of the yoke portion core; coil conductors each wound on corresponding one of tooth portions of the unit core members; and a flat plate member provided with coupling protrusions coupled with the coupling recesses formed on the arch-shaped surfaces of the unit core members, wherein with the flat plate member, the unit core members are annularly arranged with both end surfaces of the yoke portions of the unit core members in close contact with each other in a circumference direction.

[Claim 8] The stator of a motor according to claim 1 or 7, wherein the unit core members are each formed with the unit cores after the punching stacked by resin insert in a resin insert member including a resin mold and a jig.

[Claim 9] The stator of a motor according to claim 1 or 3, wherein a resin film is formed on the pole shoe portion in such a manner that an angle Q, between both end surfaces of the yoke portion, on which the resin film is not formed so that the unit core members formed by resin insert stacking are able to be joined to each other while being in close contact with each other, is substantially same as an angle between both end surfaces of the pole shoe portion on the inner surface end.

[Claim 10] The stator of a motor according to claim 7, wherein the flat plate member is made of a metal material, a non-metal material, a resin material, a leather material, or other like material and has a strip form and is provided with coupling protrusions coupled with the coupling recesses formed on the unit core members formed by resin insert stacking, coupling portions of the unit core members are fixed with an adhesive, by welding,

to the flat plate member.

[Claim 11] The stator of a motor according to claim 7, wherein a distance L between the coupling protrusions formed on the flat plate member is formed with the coupling protrusions arranged in such a manner that the distance corresponds to an angle Q between both end surfaces of each of the yoke portions of the unit core members.

[Claim 12] The stator of a motor according to claim 1, wherein the unit cores each include: a yoke portion core having an arch-shaped surface formed as an arch-shaped outer circumference surface provided with a coupling protrusion and an inner circumference formed as the flat surface; and the tooth portion core having the pole shoe portion formed as the rotor facing surface on the inner circumference end and provided to the flat surface portion of the yoke portion core.

[Claim 13] A method of manufacturing a stator of a motor, the method comprising: forming a unit core member by stacking unit cores each having an arch-shaped outer circumference surface provided with a coupling protrusion through the punching step in the method according to claim 5.

[Claim 14] A method of manufacturing a stator of a motor, the method comprising: forming a unit core member by stacking unit cores each having an arch-shaped outer circumference surface provided with a coupling protrusion through the punching step in the method according to claim 6.

[Claim 15] The stator of the motor according to claim 8, wherein the unit core members are each formed by stacking unit cores each having an arch-shaped outer circumference surface provided with a coupling protrusion by resin insert.

[Claim 16] The stator of the motor according to claim 9, wherein the unit core members are each formed by stacking unit cores each having an arch-shaped outer circumference surface provided with a coupling protrusion by resin insert.

[Claim 17] A stator of a motor, wherein unit core members, each being formed by stacking unit core each having an arc-shaped outer circumference surface provided with a coupling protrusion, are formed, a flat plate member that is made of a metal material, a non-metal material, a resin material, a leather material, or other like

protrusions formed on unit core members, coupling portions of the unit core members are fixed with an adhesive, by welding, or by other like method, coil conductors are wound on the unit core members, and the unit cores are annularly arranged.

[Claim 18] The stator of a motor according to claim 17, wherein the notches are alternately formed on upper and lower sides of the flat plate member to form a zigzag form.

[Claim 19] The stator of a motor according to claim 17, wherein the notches are formed on lower sides of the flat plate member.

[Claim 20] The stator of a motor according to claim 7, wherein resin insert molding is performed for unit cores, each having an arch-shaped outer circumference surface provided with a coupling recess, to integrally form insulators for the unit core members and the flat plate member, with which the unit core members are coupled to each other, with resin.

[Claim 21] The stator of a motor according to claim 17, wherein resin insert is performed for unit cores, each having an arch-shaped outer circumference surface provided with a coupling protrusion, to integrally form insulators for the unit core members and the flat plate member, with which the unit core members are coupled to each other, with resin.

[Claim 22] The stator of a motor according to claim 1, wherein the coil conductors are wound on the unit core members formed by insert molding in such a manner that each unit of n pair of unit cores are coupled to each other with a ring, and the unit core members are annularly arranged with one unit having a position shifted from another unit.

[Claim 23] The stator of a motor according to claim 22, wherein a ring with which the unit core members are coupled is provided with fitting holes in which ribs provided to the unit core members coupled with positions shifted are inserted.

[Claim 24] A method for manufacturing a stator of a motor, the method comprising winding a coil conductor on a unit core member in a state of being coupled to a flat plate member.

[Claim 25] A method of manufacturing a stator of a motor, the method comprising: inserting a unit of n unit cores, insert molded to be coupled to

with a jig B; and sequentially winding the coil conductors on the unit core members by spindle winding.

[Claim 26] The stator of a motor according to claim 1, wherein n unit core members on which the coil conductors are wound are provided to a flat plate member, and the flat plate member are formed into a round shape and have end portions coupled to each other in such a manner that both end surfaces of the yoke portions of the unit core members come into close contact with each other.

[Claim 27] The stator of a motor according to claim 26, wherein the flat plate member is coupled by welding, pressure welding, or with an adhesive.

[Claim 28] The stator of a motor according to claim 26, wherein the flat plate member is coupled by caulking.

[Claim 29] The stator of a motor according to claim 26, wherein the flat plate member has end portions provided with coupling portions protruding outward, and the coupling portions are aligned with each other and are coupled to each other with a screw or a rivet.

[Claim 30] The stator of a motor according to claim 26, wherein the flat plate member has both end portions that are formed as coupling portions having fitting holes in a form in which a coupling pin is inserted and are coupled to each other.

[Claim 31] The stator of a motor according to claim 1, wherein the unit core members annularly arranged are coupled to each other with a ring formed of a shrinkable material.

[Claim 32] The stator of a motor according to claim 1, wherein the unit core members are annularly arranged with both end surfaces of the tooth portions, each having the pole shoe portion with the rotor facing surface, in close contact with each other.

[Detailed Description of the Invention]

[0001]

[Technical field to which the invention pertains] The present invention relates to a stator of a motor formed by winding coil conductors on unit cores, each provided with a yoke portion core and a tooth portion, and then annularly arranging the unit cores, and a method of forming the stator.

[0002]

[Conventional technique] One motor stator that has recently been popular is formed by separately preparing a yoke portion on an outer diameter side and a plurality of tooth portions for forming slots, winding coil conductors on the tooth portions, and then coupling the tooth portions to the yoke portion, so that the winding operation can be easily performed. In this context, a demand for a configuration using a unit member in which the yoke portion and the tooth portion are integrally formed and thus no coupling accuracy between the yoke portion and the tooth portion is required have been increasing.

[0003] Fig. 35 to Fig. 37 illustrate a conventional stator of a motor of this type that has been developed. Thus, a configuration thereof is described with reference to Fig. 35 to Fig. 37.

[0004] As illustrated in the figures, a yoke portion core 104, having an outer circumference forming a cylindrical form, and an inner circumference formed to be a polygonal shape with a plurality of flat surface portions 101 each provided with a coupling recess 103 including a recess side notch 102 for retaining, is formed by punching a core plate. A plurality of tooth portion cores 109, each having one end provided with a coupling protrusion 105 and a retaining protrusion side notches 106 to be coupled with a corresponding one of the recesses 103 formed on the yoke portion core 104 and having the other end provided with a pole shoe portion 108 having a rotor facing surface 107, are radially and concentrically arranged while being shifted to each other in a radial direction on the inner side of the yoke portion core 104, and are punched separately from the yoke portion core 104. After the tooth portion cores 109 are stacked to a predetermined height, the tooth portions 109A are provided with coil frames 111 on which coil conductors 110 are wound, and then the coil conductors 110 are wound. Then, the protrusions 105 of the tooth portions 109A are coupled to the recesses 103 of the yoke portion 104A so that the tooth portions 109A provided with the coil conductors 110 are coupled to the yoke portion 104A, whereby the stator of the motor is formed.

[0005]

[Problem to be solved by the invention] In such a conventional stator of the motor, the yoke portion 104A and the tooth portions 109A are integrated

109A coupled with the recesses 103 of the yoke portion 104A. Thus, the recesses 103 of the yoke portion 104A and the protrusions 105 of the tooth portions 109A need to be accurately formed. Furthermore, the punching results in a large cross-sectional area, leading to low motor efficiency.

[0006] The punching of the annular shaped yoke portion core 104 and the tooth portions 109A is plagued by low material yield and requires a complicated mold and the step of coupling the yoke portion 104A and the tooth portions 109A to each other.

[0007] The present invention is made in view of the problems described above, and an object of the present invention is to provide a stator of a motor that requires no accuracy for coupling a yoke portion and a tooth portion to each other and can achieve a small cross-sectional area so that motor efficiency is not degraded.

[0008] A further object of the present invention is to provide a method of manufacturing a stator of a motor, featuring high material yield, achievable with a simple mold, and requiring no step for coupling the yoke portion and the tooth portion to each other.

[0009]

[Means for solving the problem] A stator of a motor for achieving the object includes: unit core members each formed with unit cores each including a yoke portion core having an outer circumference surface forming a cylindrical shape and an inner circumference formed as a flat surface portion and a tooth portion core having a pole shoe portion formed as a rotor facing surface on an inner circumference end and provided to the flat surface portion of the yoke portion core; and coil conductors each wound on corresponding one of tooth portions of the unit core members by stacking the unit core members, wherein the unit core members are annularly arranged with both end surfaces of the yoke portions of the unit core members in close contact with each other in a circumference direction.

[0010] With the present invention, a stator of a motor that requires no accuracy of coupling between yoke portions and tooth portions and can achieve a small cross-sectional area so that motor efficiency is not degraded can be obtained.

[0011] A method of manufacturing a stator of a motor for achieving the object described above includes punching unit cores alternately with a direction changing for every unit of n arrays (n being an integer equal to or larger than 2) of unit cores, the unit cores each including a yoke portion core having an outer circumference surface forming a cylindrical shape and an inner circumference formed as a flat surface portion and a tooth portion core having a pole shoe portion formed as a rotor facing surface on an inner circumference end and provided to the flat surface portion of the yoke portion core.

[0012] With the present invention, a method of manufacturing a stator of a motor, featuring high material yield, achievable with a simple mold, and requiring no step for coupling the yoke portion and the tooth portion to each other can be obtained.

[0013]

[Modes for carrying out the invention] The present invention includes a stator of a motor including: unit core members each formed with unit cores each including a yoke portion core having an outer circumference surface forming a cylindrical shape and an inner circumference formed as a flat surface portion and a tooth portion core having a pole shoe portion formed as a rotor facing surface on an inner circumference end and provided to the flat surface portion of the yoke portion core; and coil conductors each wound on corresponding one of tooth portions of the unit core members by stacking the unit core members, wherein the unit core members are annularly arranged with both end surfaces of the yoke portions of the unit core members in close contact with each other in a circumference direction. With this configuration, the yoke portion and the tooth portion are integrally formed, and thus a stator of a motor that requires no accuracy of coupling between the yoke portions and the tooth portions and can achieve a small cross-sectional area so that motor efficiency is not degraded can be obtained.

[0014] The present invention further includes a method of manufacturing a stator of a motor including: punching unit cores in alternate directions with a direction changing for every unit of n arrays (n being an integer equal to or larger than 2) of unit cores, the unit cores each including a yoke portion core having an outer circumference surface forming a cylindrical shape and an inner circumference formed as a flat

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