

STATOR CORE, STATOR AND MOTOR

TECHNICAL FIELD

The present application relates to the technical field of motors, and more particularly, relates to a stator core, a stator including the stator core and a motor including the stator.

BACKGROUND

An air conditioning fan motor commonly used in prior art has following structures: a stator core is punched by just one type of a punching plate and a stator winding is arranged around a stator yoke. The air conditioning fan motor has following disadvantages in application: the winding path of the stator winding around the stator yoke is substantially rectangular and therefore relatively long, such that the amount of enameled wire used is relatively large and the loss of the stator winding is also relatively large, the efficiency of the motor is then hardly to be improved.

TECHNICAL PROBLEM

A purpose of an embodiment of the present application is to provide a stator core, a stator and a motor, aiming at solving the problem that the winding path of the stator winding around the stator yoke is relatively long, such that the amount of enameled wire used is relatively large and the loss of the stator winding is also relatively large, the efficiency of the motor is then hardly to be improved.

BRIEF SUMMARY

To achieve the above purpose, the technical solution adopted by the present

application is as follows: a stator core, comprising a stator yoke and a plurality of stator teeth arranged on the stator yoke, a wire settling slot is formed between any adjacent two stator teeth, the stator yoke has two oppositely provided axial ends, wherein a wire passing slot numerically equal to the wire settling slot is concavely provided at at least one axial end, and the wire passing slots is disposed oppositely to the wire settling slot from each other, the stator yoke has a radial divider provided between the wire passing slot and the opposite-disposed wire settling slot and a circumferential divider provided between two adjacent wire passing slot.

Preferably, the above-mentioned stator core includes two core halves connected end-to-end, the core half is axially laminated by at least two types of punching plates.

Preferably, the core half is laminated by a plurality of first punching plates and a plurality of second punching plates, the first punching plates are laminated successively to form the laminate body, the second punching plates are laminated on the same side of the laminate body, or the second punching plates are laminated on two sides of the laminate body, respectively.

Preferably, a plurality of first open slots being spaced are provided at one side of the first punching plate, a plurality of second open slots and a plurality of third open slots being spaced are provided at two sides of the second punching plate, respectively, the second open slot and the third open slot are both numerically equal to the first open slot, and the second open slots are opposite to the third open slot from each other, respectively, the first open slots and the second open slots are

axially laminated to form the wire settling slot, the third open slots are axially laminated to form the wire passing slot.

Preferably, the first punching plate includes a first yoke plate and a plurality of first tooth plates concavely provided at one side of the first yoke plate, a first open slot is formed between any two adjacent first tooth plates, the second punching plate includes a second yoke plate and a plurality of second tooth plate concavely provided at one side of the second yoke plate, the second yoke plate includes a half-circular yoke plate and a projecting yoke plate numerically equal to the second tooth plate, the second tooth plate and the projecting yoke plate are oppositely provided from each other and concavely provided at two sides of the half-circular yoke plate, the second open slot is formed between any two adjacent second tooth plate, the third open slot is formed between any two adjacent projecting yoke plates.

Preferably, the stator teeth are enclosed in peripheral direction to form a hollow inner hole through which the stator can pass, the wire settling slot includes a slot opening close to the hollow inner hole, a slot body away from the hollow inner hole and a slot shoulder located between the slot opening and the slot body, the slot opening is extended obliquely towards the side of the slot shoulder along the hollow inner hole with the width gradually increasing, the slot shoulder is extended obliquely towards the side of the slot body along the slot opening with the width gradually increasing.

Preferably, the number of the wire settling slot is 16, and the inner diameter of

the hollow inner hole is $\Phi 47\text{ mm} - \Phi 49\text{mm}$, the outer diameter of the stator yoke is $\Phi 74\text{ mm} - \Phi 84\text{mm}$.

Preferably, the stator tooth includes a wide tooth and a narrow tooth of which the circumferential width is less than the wide tooth, the wider teeth and the narrow teeth are alternatively distributed at the inner side of the stator yoke in the circumference direction, and the width of the wide tooth is 4.0mm-4.5mm, the width of the narrow tooth is 3.0mm-3.5mm, the width of one end of the slot opening close to the hollow inner hole is 1.7mm-1.9mm, the width of one end of the slot opening close to the slot shoulder is 1.8mm-2.0mm, the radially extended height of the slot opening is 0.5mm-0.8mm, the radially extended height of the slot shoulder is 0.45mm-0.65mm, the radially extended height of the radial divider is 1.0mm-6.0mm.

Furthermore, the embodiment of the present application also provides a stator, comprising the above-mentioned stator core and a stator winding wound around the stator yoke.

Furthermore, the embodiment of the present application also provides a motor, comprising the above-mentioned stator and a rotor cooperated with the stator.

BENEFICIAL EFFECTS

In the stator core, the stator and the motor provided by the present application, the wire passing slot opposite to the wire settling slot is concavely provided at at least one axial end of the stator yoke, such that the stator winding will be wound through the wire passing slot when wound around the stator yoke. Because the stator winding is wound through the wire passing slot in a form of an oblique line

segment, therefore, compared to the prior art, a particular part of the winding path of the prior stator wind is changed to a segment path from a L-shaped bending path, in this way, according to the theory that a line segment is shortest between two points, the winding path of the stator wind around the stator yoke can be effectively shortened in the present application, the amount of enameled wire used and the loss of the stator winding can be therefore reduced, thus providing a new solution to improve the efficiency of the motor,.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic planar structural view of a stator core provided by an embodiment of the present application;

FIG. 2 is a schematic perspective structural view of a core half provided by an embodiment of the present application;

FIG. 3 is a schematic planar structural view of a core half provided by an embodiment of the present application;

FIG. 4 is a schematic planar structural view of a first punching plate provided by an embodiment of the present application;

FIG. 5 is a schematic planar structural view of a second punching plate provided by an embodiment of the present application;

FIG. 6 is schematic cutaway structural view of a motor by an embodiment of the present application.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In order to make the purpose, the technical features and the advantages of the present application clearer, the present application will be described in detail with reference to accompanying drawings and embodiments. It should be understood

that the specific embodiments described herein are used for interpretation of present application merely, rather than the limitation to the present application.

It should be noted that an element can be provided on another element directly or an intermediate element may exist at the same time when the element is described as being fixed or provided on the another element, and an element can be connected with another element directly or an intermediate element may exist at the same time when the element is described as being connected with the another element.

As shown in Fig. 1 and Fig. 2, a stator core 1 provided by an embodiment of the present application includes a stator yoke 11 and a plurality of stator teeth 12 arranged on the stator yoke 11, a wire settling slot 13 is formed between any two adjacent stator teeth 12, the stator yoke 11 has two opposite-disposed axial ends (axially extended ends), at least one axial end is concavely provided thereon with wire passing slots 14 numerically equal to wire settling slots 13, and the wire passing slots 14 are disposed oppositely to the wire settling slots 13, respectively. The stator yoke 11 has a radial divider 111 provided between the wire passing slot 14 and the opposite-disposed wire settling slot 13 and a circumferential divider 112 provided between two adjacent wire passing slot 14. The wire passing slot 14 and the opposite-disposed wire settling slot 13 are provided at two sides of the radial divider 111, respectively. The wire passing slot 14 and the wire settling slot 13 are both openly shaped, and openings of the wire passing slot and the wire settling slot 13 face away from the radial divider 111, that is, the direction of the opening of the wire passing slot 14 is opposite to the one of the wire settling slot 13. In the embodiment of the present application, according to the theory that a line segment is shortest between two points, the wire passing slot 14 opposite-disposed to each wire settling slot 13 is provided at at least one axial end of the stator yoke 11, in this way, a particular part of the winding path of the prior stator wind is changed to

a segment path from a L-shape bending path, such that the winding path of the stator winding 2 around the stator yoke 11 can be effectively shortened, the amount of enameled wire used and the loss of the stator winding 2 can be therefore reduced, thus providing a new solution to improve the efficiency of the motor, the rising temperature can be decreased during the operation of the motor and the service life of the motor can be extended.

Preferably, as shown in Fig. 1 and Fig. 2, the above-mentioned stator core 1 includes two core halves 10 connected end-to-end, that is, the stator core 1 is jointed by two core halves 10, and the core half 10 is axially laminated by at least two types of punching plates. During production, punching plates are laminated to form the two core halves 10, the stator winding 2 is then winded around the stator yoke 11 of the two core halves 10 separately, the two core halves 10 are finally welded together to form the entirety stator core 1. In the embodiment, the stator core 1 is divided into two core halves 10 which are produced separately and winded respectively, such that the stator winding 2 is easy to be winded around the stator yoke 11, the winding smoothness of the stator winding 2 around the stator yoke 11 can be ensured and the winding efficiency of the stator winding 2 can be improved. The core half 10 is axially laminated by at least two types of punching plates, such that the wire passing slot 14 can be ensured to be formed at at least one end of the laminated stator core 1, the winding path of the stator winding 12 around the stator yoke 11 can be ensured to be effectively shortened. Meanwhile, the core half 10 is laminated by the punching plate, such that the producing process of the stator core 1 can be simplified and the producing cost of the stator core 1 can be lowered. Preferably, in the embodiment, the two core halves 10 jointed to form the stator core 1 have the same structures, that is, the two core halves 10 is equivalent to be formed by dividing the stator core 1 in half along a symmetry axis, such that the amount of elements can be reduced and the interchangeability of elements can be

improved.

Preferably, as shown in Figs. 2, 4 and 5, the core half 10 is laminated by a plurality of first punching plate 101 and a plurality of second punching plate 102, the first punching plate 101 is laminated successively to form the laminate body, that is, the first punching plate 101 is laminated together successively and the second punching plate 102 is laminated on the same side of the laminate body, such that the wire passing slot 14 is only formed at one end of the finally formed stator core 1. Alternatively, the second punching plate 102 is laminated on two sides of the laminate body, respectively, such that the wire passing slot 14 can be formed at two axial ends of the stator core 1. In the embodiment, the core half 10 is laminated only by two types of punching plates, i.e., the first punching plate 101 and the second punching plate 102, and the first punching plates 101 are laminated together, the second punching plate 102 can be laminated at one side of the first punching plate 101 or at two sides of the second punching plate 102, such that the effect that the wire passing slot 14 can be formed at only one axial end of the stator yoke 11 or the wire passing slot 14 can be formed at two end of the stator yoke 11 at the same time can be realized, respectively.

Specifically, as shown in Figs. 2, 4 and 5, a plurality of first open slots 1011 being spaced are provided at one side of the first punching plate 101, a plurality of second open slots 1021 and a plurality of third open slots 1022 being spaced are provided at two sides of the second punching plate 102, respectively. The second open slot 1021 and the third open slot 1022 are both numerically equal to the first open slot 1011, and the second open slots 1021 are opposite to the third open slot 1022 from each other, respectively. The first open slots 1011 and the second open slots 1021 are axially laminated to form the wire settling slots 13, the third open slots 1022 are axially laminated to form the wire passing slots 14. The first open slot 1011 has the same shape with the second open slot 1021 and has the same

sectional shape with the wire settling slot 13. The third open slot 1022 has the same sectional shape with the wire passing slot 14. In this way, the first punching plate 101 and the second punching plate 102 are provided in such structure and shape that the shape of the finally formed stator core 1 can meet the design requirement.

Specifically, as shown in Figs. 2, 4 and 5, the first punching plate 101 includes a first yoke plate 1012 and a plurality of first tooth plates 1013 concavely provided at one side of the first yoke plate 1012. A first open slot 1011 is formed between any two adjacent first tooth plates 1013. The second punching plate 102 includes a second yoke plate 1023 and a plurality of second tooth plate 1024 concavely provided at one side of the second yoke plate 1023. The second yoke plate 1023 includes a half-circular yoke plate 10231 and a projecting yoke plate 10232 numerically equal to the second tooth plate 1024, the second tooth plate 1024 and the projecting yoke plate 10232 are oppositely provided from each other and concavely provided at two sides of the half-circular yoke plate 10231, the circumferential wide of the projecting yoke plate 10232 is equal to the one of the tooth root of the oppositely-provided second tooth plate 1024, the second open slot 1021 is formed between any two adjacent second tooth plates 1024, the third open slot 1022 is formed between any two adjacent projecting yoke plates 10232. The first tooth plate 1013 and the second tooth plate 1024 are laminated to form the stator tooth 12, the first yoke plate 1012 and the second yoke plate 1023 are laminated to form the stator yoke 11, the semi-circular yoke plates 10231 are laminated to form the radial divider 111, the projecting yoke plates 10232 are laminated to form the circumferential divider 112.

Preferably, as shown in Figs. 1, 2 and 3, each of the stator teeth 12 is enclosed in peripheral direction to form a hollow inner hole 15 through which the stator 3 can pass. The wire settling slot 13 includes a slot opening 131 close to the hollow inner hole 15, a slot body 132 away from the hollow inner hole 15 and a slot

shoulder 123 located between the slot opening 131 and the slot body 132. The slot opening 131 is extended obliquely towards the side of the slot shoulder 123 along the hollow inner hole 15 with the width L1 gradually increasing, the slot shoulder 123 is extended obliquely towards the side of the slot body 132 along the slot opening 131 with the width L1 gradually increasing. Specifically, the stator teeth 12 are circumferentially and concavely provided on the inner wall of the stator yoke 11, that is, the hollow inner hole 15 is formed in the inner side of the stator teeth 12. In the embodiment, the shape of the wire settling slot 13 is optimized such that on one hand, the stator winding 2 can easily pass through and be wound into the wire settling slot 13, on the other hand, the uniformity of the magnetic density distribution of the stator tooth 12 and the stator yoke 11 can be further improved, the material utilization of the stator and the efficiency of the motor can be thus improved.

Preferably, as shown in Figs. 1-5, the number of the wire settling slot 13 is 16, that is, each core half 10 has 8 wire settling slot 13, the inner diameter D1 of the hollow inner hole 15 is $\Phi 47\text{ mm} - \Phi 49\text{mm}$, the outer diameter D2 of the stator yoke 11 is $\Phi 74\text{ mm} - \Phi 84\text{mm}$. The stator tooth 12 includes a wide tooth 121 and a narrow tooth 122 of which the circumferential width (the projection width in the circumferential direction of the stator core 1) is less than the wide tooth 121, the wider teeth 121 and the narrow teeth 122 are alternatively distributed at the inner side of the stator yoke 11 along the circumference direction, and the width L1 (the projection width in the circumferential direction of the stator core 1) of the wide tooth is 4.0mm-4.5mm; the width L2 (the projection width in the circumferential direction of the stator core 1) of the narrow tooth is 3.0mm-3.5mm; the width L3 (the projection width in the circumferential direction of the stator core 1) of one end of the slot opening 131 close to the hollow inner hole 15 is 1.7mm-1.9mm; the width L4 (the projection width in the circumferential direction of the stator core 1)

of one end of the slot opening 131 close to the slot shoulder 123 is 1.8mm-2.0mm; the radically extended height H1 (the projection width in the radical direction of the stator core 1) of the slot opening 131 is 0.5mm-0.8mm, the radically extended height H2 (the projection width in the circumferential direction of the stator core 1) of the slot shoulder 123 is 0.45mm-0.65mm, the radically extended height H3 (the projection width in the circumferential direction of the stator core 1) of the radical divider 11 is 1.0mm-6.0mm. Specifically, the stator tooth 12 includes a tooth root 1201 concavely arranged on the inner wall of the stator yoke 11 and a tooth crown 1202 concavely arranged at one end of the tooth root 1201, the tooth roots 1201 are extended towards the tooth crown 1202 along the inner wall of the stator yoke 11 with the circumferential width L1 not changing, the circumferential width of each circumferential divider 112 is equal to the circumferential width of the oppositely provided tooth root 1201. In the embodiment of the present application, the referred width L1 of the wide tooth 121 specifically refers to the circumferential width of the tooth root 1201 of the wide tooth 121, the referred width L2 of the narrow tooth 122 specifically refers to the circumferential width of the tooth root 1201 of the narrow tooth 122, the circumferential width L1 of the tooth root 1201 of each wide tooth 121 is constant and 4.0mm-4.5mm, the circumferential width L2 of the tooth root 1201 of each narrow tooth 122 is constant and 3.0mm-3.5mm. In the embodiment, the parameter design of the stator core 1 is optimized such that the stator winding 2 can easily pass through and be winded into the wire settling slot 13, and the magnetic field of the stator tooth 12 and the stator yoke 11 can be relatively reasonably and uniformly distributed, therefore, on one hand, the rising temperature during the work process of the motor can be lowered, the working life of the motor can be extended and the efficiency of the motor can be improved, on the other hand, the material utilization of the punching plate can be improved and the material cost of the stator core 1 can be reduced.

Specifically, as shown in Fig. 2-5, the first tooth 1013 includes a first wide tooth plate 10131 and a first narrow tooth plate 10132 alternatively arranged from each other. A first open slot 1011 is formed between the first wide tooth plate 10131 and the adjacent first narrow tooth plate 10132, the width of a tooth root of the first wide tooth plate 10131 is L_1 , the width of a tooth root of the first narrow tooth plate 10132 is L_2 . The second tooth 1024 includes a second wide tooth plate 10241 and a second narrow tooth plate 10242 alternatively arranged from each other. A second open slot 1021 is formed between the second wide tooth plate 10241 and the adjacent second narrow tooth plate 10242, the width of a tooth root of the second wide tooth plate 10241 is L_1 , the width of a tooth root of the second narrow tooth plate 10242 is L_2 . The first wide tooth plate 10131 and the second wide tooth plate 10241 are laminated to form the wide tooth 121, the first narrow tooth plate 10132 and the second narrow tooth plate 10242 are laminated to form the narrow tooth 122.

Preferably, as shown in Figs. 1, 2 and 3, an outer wall of the stator yoke 11 is provided thereon with a trimming structure 16, the trimming structure 16 is equivalent to a tangent plane formed on the out wall of the stator yoke 11 after a part of material of the stator yoke 11 is cut away by a surface. The trimming structure 16 is arranged such that on one hand, the magnetic distribution of the stator yoke 11 can be optimized, the magnetic distribution of the stator yoke 11 and the stator teeth 12 can be thus more uniform, on the other hand, the material cost of the stator core 1 can be reduced. Of course, in the actual application, the outer wall of the stator yoke 11 can also be not provided thereon with the trimming structure 16.

Furthermore, as shown in Fig. 6, a stator is also provided by the embodiment of the present application, the stator includes the above-mentioned stator core 1 and the stator winding 2 winded around the stator core1. In the stator provided by the

embodiment of the present application, the stator core 1 is adopted such that the winding path of the stator winding 2 around the stator yoke 11 can be effectively shortened, the amount of enameled wire used and the loss of the stator winding 2 can be reduced, thus providing a new solution to improve the efficiency of the motor. Meanwhile, the rising temperature can be decreased during the operation of the motor and thus the situation of over temperature of the motor can be avoided, which is beneficial to extend the service life of the motor and lower the cost of the motor.

Furthermore, as shown in Fig. 6, a motor is also provided by an embodiment of the present application, the motor includes the above-mentioned stator and a rotor 3 cooperated with the stator. In the motor provided by the embodiment of the present application, the above-mentioned stator is adopted such that the efficiency of the motor can be effectively improved on one hand, the situation of over temperature of the motor can be avoided on the other hand, which is beneficial to extend the service life of the motor and lower the cost of the motor.

Specifically, as shown in Fig. 6, the motor provided by the embodiment of the present application is actually a plastic package motor, which further includes a rotating shaft 5, a plastic housing 4, a first end cover 6, a second end cover 7, a first bearing 8 and a second bearing 9, wherein the rotor 3, the first bearing 8 and the second bearing 9 are both sheathed around the rotating shaft 5, and the first bearing 8 and the second bearing 9 are located at two sides of the rotor 3, respectively, the rotor 3 passes through the hollow inner hole 15 of the stator core 1, the first bearing 8 is installed in the first end cover 16, the second bearing 9 is installed in the second end cover 7, the plastic housing 4 is BMC plastic package material enclosing outside of the stator, the rotor 3 and the first end cover 6, the second end cover 7 is installed at one end of the plastic housing 4 facing away the first end cover 6. Specifically, the rotor 3 is installed in a way of an interference fit on the

rotating shaft 5, such that the rotating shaft 5 can be driven to rotate by the rotor 3 to achieve the purpose of exporting power outside.

The motor provided by the embodiment of the present application is preferably suitable for the motor of the air conditioning fan, compared to the motor of the prior air conditioning fan, the motor of the present application can obtain obvious effects that the winding path of the stator winding 2 around the stator yoke 11 can be shortened, the using amount of the enameled wire can be decreased and the efficiency of the motor can be improved. Of course, in the actual application, the motor provided by the embodiment of the present application is also suitable for other motors, such as those of the household appliance including a kitchen ventilator, a washing machine, a dry cleaning machine.

Foregoing contents are some preferable embodiments of the present application merely, and are not regarded as being limitation to the present application, within the spirit and principle of the present application, those changes, equivalent replacement or modifications should all fall within the protection scope of the present application.

CLAIMS

1. A stator core, comprising a stator yoke and a plurality of stator teeth arranged on the stator yoke, a wire settling slot is formed between any adjacent two stator teeth, the stator yoke has two oppositely provided axial ends, wherein a wire passing slot numerically equal to the wire settling slot is concavely provided at at least one axial end, and the wire passing slots is disposed oppositely to the wire settling slot from each other, the stator yoke has a radial divider provided between the wire passing slot and the opposite-disposed wire settling slot and a circumferential divider provided between two adjacent wire passing slot.

2. The stator core according to claim 1, wherein the stator core included two core halves connected end-to-end, the core half is axially laminated by at least two types of punching plates.

3. The stator core according to claim 2, wherein the core half is laminated by a plurality of first punching plates and a plurality of second punching plates, the first punching plates are laminated successively to form the laminate body, the second punching plates are laminated on the same side of the laminate body, or the second punching plates are laminated on two sides of the laminate body, respectively.

4. The stator core according to claim 3, wherein a plurality of first open slots being spaced are provided at one side of the first punching plate, a plurality of second open slots and a plurality of third open slots being spaced are provided at two sides of the second punching plate, respectively, the second open slot and the third open slot are both numerically equal to the first open slot, and the second open

slots are opposite to the third open slot from each other, respectively, the first open slots and the second open slots are axially laminated to form the wire settling slot, the third open slots are axially laminated to form the wire passing slot.

5. The stator core according to claim 4, wherein the first punching plate includes a first yoke plate and a plurality of first tooth plates concavely provided at one side of the first yoke plate, a first open slot is formed between any two adjacent first tooth plates, the second punching plate includes a second yoke plate and a plurality of second tooth plate concavely provided at one side of the second yoke plate, the second yoke plate includes a half-circular yoke plate and a projecting yoke plate numerically equal to the second tooth plate, the second tooth plate and the projecting yoke plate are oppositely provided from each other and concavely provided at two sides of the half-circular yoke plate, the second open slot is formed between any two adjacent second tooth plate, the third open slot is formed between any two adjacent projecting yoke plates.

6. The stator core according to any one of claims 1-5, wherein the stator teeth are enclosed in peripheral direction to form a hollow inner hole through which the stator can pass, the wire settling slot includes a slot opening close to the hollow inner hole, a slot body away from the hollow inner hole and a slot shoulder located between the slot opening and the slot body, the slot opening is extended obliquely towards the side of the slot shoulder along the hollow inner hole with the width gradually increasing, the slot shoulder is extended obliquely towards the side of the slot body along the slot opening with the width gradually increasing.

7. The stator core according to claim 6, wherein the number of the wire settling slot is 16, and the inner diameter of the hollow inner hole is $\Phi 47\text{ mm} - \Phi 49\text{mm}$, the outer diameter of the stator yoke is $\Phi 74\text{ mm} - \Phi 84\text{mm}$.

8. The stator core according to claim 7, wherein The stator tooth includes a wide tooth and a narrow tooth of which the circumferential width is less than the wide tooth, the wide teeth and the narrow teeth are alternatively distributed at the inner side of the stator yoke in the circumference direction, and the width of the wide tooth is 4.0mm-4.5mm, the width of the narrow tooth is 3.0mm-3.5mm, the width of one end of the slot opening close to the hollow inner hole is 1.7mm-1.9mm, the width of one end of the slot opening close to the slot shoulder is 1.8mm-2.0mm, the radically extended height of the slot opening is 0.5mm-0.8mm, the radically extended height of the slot shoulder is 0.45mm-0.65mm, the radically extended height of the radical divider is 1.0mm-6.0mm.

9. A stator, comprising the stator core according to any one of claims 1-8 and a stator winding wound around the stator yoke.

10. A motor, comprising the stator according to claim 9 and a rotor cooperated with the stator.