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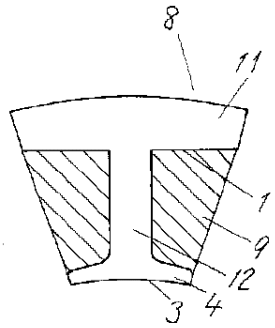
(54) [Title of Invention] STATOR FOR ELECTRIC MOTOR AND METHOD OF MANUFACTURING SAME

(57) [Abstract]

[Object] To provide a stator for an electric motor that does not require high precision in joining teeth to a yoke, minimizing the cutting area to ensure that motor efficiency does not decrease.

[Solution] By the winding of winding conductor 9 around tooth portions 12 of unit iron core body 8 provided with yoke portions 11 formed with an arcuate outer periphery and a planar portion 1 on an inner periphery thereof, the tooth portions 12 provided on the planar portion and having a pole shoe 4 defining a rotor opposing surface 3 on the inner peripheral edge thereof; and by annularly arranging so that the side end surfaces of the yoke portions 11 closely contact one another, a stator for an electric motor can be obtained wherein high precision in joining the tooth to the yoke is not required, and decreased motor efficiency can be prevented.



1 planar portion
3 rotor opposing surface
4 pole shoe
8 unit iron core body
9 winding conductor
11 yoke portion
12tooth portion

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[Claims]

[Claim 1] A stator for an electric motor comprising yoke portion iron cores with an arcuate outer circumferential surface and a planar inner circumference, unit iron core bodies formed by laminating unit iron cores provided with a tooth portion iron core having a rotation opposing surface formed on a pole shoe portion at an inner circumferential end provided on a planar portion of the yoke portion iron core, and a winding conductor wound around the tooth portion of the unit iron core body; wherein the unit iron core bodies are arranged in a ring shape so that both end faces of the yoke portion of the unit iron core body come into close contact with each other in a circumferential direction.

[Claim 2] The stator for an electric motor according to claim 1, wherein the winding conductor is wound around the tooth portion of the unit iron core bodies in a trapezoidal lamination alignment by progressively increasing a cross-sectional area of the winding toward the inner peripheral surface of the yoke portion.

[Claim 3] A manufacturing method for a stator wherein a unit iron core, provided with a tooth portion iron core having a pole shoe portion defining a rotor opposing surface on an inner peripheral end provided on the planar portion of a yoke portion iron core within an arcuate outer circumferential surface and a planar portion inner circumference, is manufactured by punching out in a state in which directions are alternately changed in n rows (n is an integer of 2 or more columns) as one unit..

[Claim 4] The method for manufacturing the stator for an electric motor according to claim 3, wherein in a manufacturing method involving punching out unit iron cores as one unit, by changing the inner circumferential surface portion of the yoke portion to the outer circumferential side or the inner circumferential side, a unit iron core is manufactured by enlarging or reducing the cross-sectional area of the winding portion of the winding conductor.

[Claim 5] A method for manufacturing a stator for an electric motor, wherein in the punching step for the unit iron core the pressure force of the manufacturing equipment is used to manufacture the unit iron core body by press-contacting, crimping, or laminating with an adhesive.

[Claim 6] In the punching step of the unit iron core, a method for manufacturing a stator for an electric motor, wherein the die, the jig or the material are heated and punched/laminated to manufacture the unit iron core body.

[Claim 7] A stator for an electric motor, comprising the following: a yoke portion iron core provided with a concave portion for connecting on the arcuate outer circumferential surface and the inner circumference is formed by a planar portion, unit iron core bodies formed by laminating unit iron cores provided with a tooth portion iron core having a rotor facing surface formed on a pole shoe portion at an inner circumferential end provided at a planar portion of the yoke portion iron core, a winding conductor wound around the tooth portion of the unit iron core body, and a flat plate member provided with a convex portion for connecting connected to a concave portion for connecting provided on an arcuate surface of the unit iron core body; wherein both end surfaces of the yoke portion are brought into close contact in the circumferential direction by the flat plate member and the unit iron core bodies are arranged in a ring shape.

[Claim 8] The stator for an electric motor according to claim 1 or 7, wherein the punched unit iron core is resin-insert laminated by a resin insert tool comprising a resin molding die and a jig to form a unit iron core body.

[Claim 9] The stator for an electric motor according to claim 1 or 3, wherein, so that the resin-insert laminated unit iron core bodies are tightly connected, a resin film is formed of the pole shoe so that the angle Q of both end surfaces of the yoke portion where no resin film is formed and the angle of both end surfaces of the pole shoe portion at the inner surface end are substantially the same angle

[Claim 10] The stator for an electric motor according to claim 7, wherein a convex portion for connecting, to which a concave portion for connecting is connected, provided in a resin-insert laminated unit iron core body, is provided on a belt-shaped flat plate member such as a metal, nonmetal, resin or leather, the connecting portion of the unit core body is fixated by an adhesive or welding or the like, and in a state of being fixated to the flat plate member, a winding conductor is wound around the unit iron core body.

[Claim 11] The stator for an electric motor according to claim 7, wherein an interval L between the convex portions for connecting formed on the flat plate member is formed by arranging the convex portions for connecting as intervals matching the angle Q of both end surfaces of the yoke portion of the unit iron core body.

[Claim 12] The stator for an electric motor according to claim 1, wherein a convex portion for connecting is provided on an arcuate surface, having an arcuate outer peripheral surface, provided with a yoke portion iron core having an inner periphery formed of a planar portion, and a tooth portion iron core having a pole shoe portion defining a rotor opposing surface on an inner peripheral end provided on the planar portion of this yoke portion iron core, forming the unit iron core.

[Claim 13] A method for manufacturing a stator of an electric motor wherein a unit iron core provided with a convex portion for connecting on the arcuate outer peripheral surface is laminated in the punching step by the method according to claim 5 to manufacture the unit iron core body.

[Claim 14] A method for manufacturing a stator of an electric motor, wherein the unit iron core provided with a convex portion for connecting on an arcuate outer circumferential surface is laminated in a punching process by the method according to claim 6 to manufacture a unit iron core body.

[Claim 15] The stator for an electric motor according to claim 8, wherein the unit iron core provided with a convex portion for connecting on an arcuate outer peripheral surface is resin-insert laminated to form a unit iron core body.

[Claim 16] The stator for an electric motor according to claim 9, wherein the unit iron core provided with a convex portion for connecting on an arcuate outer peripheral surface is resin-insert laminated to form a unit iron core body.

[Claim 17] A stator for an electric motor, wherein a notch portion for connecting connected with a convex portion for connecting provided on a unit iron core body formed by resin-insert laminating a unit iron core provided with a convex portion for connecting on an arcuate outer peripheral surface is provided on a belt-shaped flat plate member such as metal, nonmetal, resin or leather and the like, the connecting portion of the unit iron core body is fixated by an adhesive or welding or the like, a winding conductor is wound around the unit iron core body, and the unit cores are arranged annularly.

[Claim 18] The stator for an electric motor according to claim 17, wherein the notch portions formed in the flat plate member are disposed in alternating upper and lower staggered fashion.

[Claim 19] The stator for an electric motor according to claim 17, wherein the notch portions formed in the flat plate member are provided on a lower surface side.

[Claim 20] The stator for an electric motor according to claim 7, wherein in a resin insert molding of a unit iron core provided with a concave portion for connecting on an arcuate outer peripheral surface, an insulator for the unit iron core bodies and a flat plate member connecting the unit iron core bodies are integrally formed by resin.

[Claim 21] The stator for an electric motor according to claim 17, wherein in resin-insert molding of a unit iron core provided with a convex portion for connecting on an arcuate outer peripheral surface, an insulator for the unit iron core bodies and a flat plate member connecting the unit iron core bodies are integrally formed by resin.

[Claim 22] The stator for an electric motor according to claim 1, wherein a winding conductor is wound around an insert molded unit iron core body so as to be connected by a ring with the n units of unit iron core pairs as one unit, and the unit iron core bodies are arrayed

annularly with the position shifted by one unit.

[Claim 23] The stator for an electric motor according to claim 22, providing a fitting hole into which a rib provided on a unit iron core body connected to the ring linking the unit iron core bodies is fitted while being shifted in position.

[Claim 24] A method for manufacturing a stator of an electric motor wherein a winding conductor is wound around the unit iron core body in a state wherein the unit iron core bodies are connected to the flat plate member

[Claim 25] A method for manufacturing a stator of an electric motor wherein a molding unit insert-molded so that the unit iron core body is connected with a ring with n units as one unit is fitted in the jig A, fixated with jig B, and the winding conductor is spindle-wound on the unit iron core bodies and sequentially wound.

[Claim 26] The stator for an electric motor according to claim 1, wherein n pieces of unit iron core bodies wound with a winding conductor are provided on the flat plate member, and the flat plate members are rounded so that both end surfaces of the yoke portion of the unit iron core body come into close contact with each other.

[Claim 27] The stator for an electric motor according to claim 26, wherein the flat plate member is connected by welding, deposition or an adhesive.

[Claim 28] The stator for an electric motor according to claim 26, wherein the flat plate members are connected by crimping.

[Claim 29] The stator for an electric motor according to claim 26, wherein a connecting portion protruding outward is provided at the end portion of the flat plate member, and the connecting portion is joined with a matching screw or a rivet.

[Claim 30] The stator for an electric motor according to claim 26, wherein a connecting portion formed with fitting holes of a shape in which the connecting pins are fitted is provided at both end portions of the flat plate member and is connected.

[Claim 31] The stator for an electric motor according to claim 1, wherein the unit iron core bodies are connected in an annular fashion by a ring formed of a shrinkable material.

[Claim 32] The stator for an electric motor according to claim 1, wherein when the unit iron core bodies are arranged in an annular fashion, both side surfaces of the tooth portion closely contact each other forming the rotor opposing surface on the pole shoe portion.

[Detailed Description of the Invention]

[0001]

[The Technological Field the Invention Relates to] The present invention relates to a manufacturing method for a stator for an electric motor formed by winding a winding conductor around a unit iron core provided with a yoke portion iron core and a tooth, and then arranging the unit iron cores in an annular fashion.

[0002]

[Prior Art] In recent years, to the end of facilitating the winding work for a stator of an electric motor, it has become common practice to make a division into a yoke portion constituting an outer periphery, and a plurality of tooth portions defining slots; and after winding a winding conductor around the tooth portions, the tooth portions are connected to the yoke portion. However, there is increasing demand for using a unit portion in which the yoke portion and tooth portions are integrally formed, to eliminate the need for a high precision in connecting the tooth portions to the yoke portion.

[0003] Conventionally, the stators shown in Figures 35 to 37 have been invented as this kind of stator of an electric motor. This configuration is described in the following with reference to Figures 35 to 37.

[0004] As shown in the figure, to constitute the stator of the electric motor, the outer circumference is cylindrical and the inner circumference is formed into a polygonal surface by a plurality of planar portions 101; at the same time as punch-forming from the iron core plate the yoke portion iron core 104 provided with the concave portion 103 for connecting having the concave side cut portion 102 for preventing removal in the planar portion 101, having at one end a convex portion 105 for connecting to connect the concave portion 103 provided on the yoke portion iron core 104 on the side within the yoke portion iron core 104 as well as a convex notch portion 106 for preventing removal; and at the other end forming rotor facing surface 107 by the pole shoe portion 108, tooth iron core 109 is shifted in position in the radial direction concentrically; a plurality thereof are arranged in the radial direction, punched in a state of being separated from the yoke portion iron core 104; the tooth portion core 109 is laminated to a predetermined size; a winding frame 111 for winding the winding conductor 110 on the tooth portion 109A is provided; winding conductor 110 is wound; and so that the tooth portion 109A provided with the winding conductor 110 is connected to the yoke portion 104A, the convex portion 105 of the tooth portion 109A is connected to the concave portion 103 of the yoke portion 104A.

[0005]

[Problems to be Solved by the Invention] In this conventional stator for an electric motor, as the tooth 109A and the yoke 104A are integrally formed by connecting the convex portions 105 of tooth portions 109A with the concave portions 103 of the yoke portions 104A, a high degree of precision is required in forming the convex portions 105 of tooth portions 109A and the concave portions 103 of yoke portions 104A, and the cutting area is increased due to punching, so that the motor efficiency is impaired, which is problematic.

[0006] Further, because the annular yoke portion iron core 104 and the tooth portions 109A are punched out, the material yield is poor, the die is complicated, and an extra connecting step is required for connecting the tooth portions 109A to the yoke portion 104A.

[0007] The present invention has been made to solve the above-stated problems; the object thereof is to provide a stator for an electric motor which does not require a high precision in connecting the tooth portions to the yoke portion, and minimizes the cutting area to ensure that motor efficiency is not degraded.

[0008] Another object of the present invention is to provide a method for manufacturing a stator of an electric motor that has a good material yield, simplifies the die, and eliminates the need for the connecting step for connecting the tooth portions to the yoke portion.

[0009]

[Means for Solving the Problems] To achieve such objects, the stator of an electric motor of the present invention provides a winding conductor wound around a tooth portion of a unit core body formed by laminating unit iron cores provided with yoke portion iron cores formed with an arcuate outer periphery and a flat portion on an inner periphery thereof, and a tooth portion iron core provided on the flat portion of the yoke portion iron core and having a pole shoe defining a rotor opposing surface on an inner periphery thereof; wherein the unit iron cores are arranged in an annular fashion so that side end surfaces of the yokes closely contact each other.

[0010] According to the present invention, it is possible to obtain a stator for an electric motor which does not require a high precision in connecting the tooth portions to the yoke portion, and minimizes the cutting area to ensure that motor efficiency is not degraded.

[0011] To achieve the above objects, the method of manufacturing a

stator of an electric motor is a manufacturing method wherein unit iron cores, formed with an arcuate outer periphery and a flat portion on an inner periphery thereof, provided with a tooth portion iron core provided on the flat portion of the yoke portion iron core and having a pole shoe defining a rotor opposing surface on an inner peripheral end thereof, are punched out in a state in which the direction is changed alternately in n columns (n is an integer of 2 or more columns) as one unit.

[0012] According to the present invention, it is possible to obtain a method for manufacturing a stator of an electric motor that yields good material yield, simplifies the die, and eliminates the need for the step of connecting the tooth portions to the yoke portion.

[0013]

[Preferred Embodiment(s)] The present invention comprises the following: a yoke portion iron core having an arcuate outer peripheral surface and a planar portion, and a winding conductor wound around a tooth portion of a unit iron core body formed by laminating a unit iron core provided with a tooth portion iron core having a pole shoe portion defining a rotor opposing surface on an inner peripheral end; and has actions wherein the unit iron core members are annularly arranged so that both end surfaces of the yoke portion come into close contact with each other in the circumferential direction, and the yoke portion and the tooth portion are integrally formed so that it is not necessary to enhance the connecting precision with the tooth portion of the yoke portion, and the cutting area is reduced as compared with the case where the yoke portion and the tooth portion are separately formed so that a reduction of the efficiency of the motor is suppressed.

[0014] Further, [the present invention] is a manufacturing method wherein a unit iron core, provided with a tooth iron core having a pole shoe portion defining a rotor opposing surface on an inner peripheral end provided on the planar portion of a yoke portion iron core formed by an arcuate outer peripheral surface and a planar inner periphery; and it has actions wherein it is manufactured by punching in a state in which the direction is alternately changed in n rows (n is an integer of 2 or more rows) as one unit, there is no need to punch out the annular yoke portion iron core, only one type of unit iron core can be punched with good yield, the die is also simplified, and the yield of the material is improved.

[0015] Embodiments of the present invention are described in the following with reference to Figures 1 to 34.

[0016]

[Embodiments] (Embodiment 1) As shown in Figures 1 to 6, in punching step 7, the number of unit iron cores 6 to be punched as well as that have been punched to become the required height dimension, that use a die and a jig in which the direction has been alternately changed in n (n is an integer equal to or greater than 2) rows, with unit iron core 6 provided with tooth portion iron core 5 on planar surface portion 1 of yoke portion iron core 2 formed with an arcuate outer periphery and a flat portion on an inner periphery thereof, having a pole shoe 4 defining a rotor opposing surface 3 on an inner peripheral end thereof, and is pressure-welded, crimped or laminated with an adhesive using the pressurizing force of the manufacturing equipment to form unit iron core body 8.

[0017] When an insulator (not shown in the drawings) is provided on the unit iron core body 8, and a winding conductor 9 is wound around the unit iron core body 8 in the winding step 10, it is wound around the tooth portion 12 in a trapezoidal lamination arrangement so as to progressively enlarge toward the inner peripheral surface of the yoke portion 11 of the unit iron core body 8; and the unit iron core body 8 wound with the winding conductor 9 is arranged in arranging step 13 so that both end surfaces of the yoke portions 11 closely contact each other.

[0018] According to this configuration, because the unit iron core body 8 is formed so that the yoke portion 11 and the tooth portions 12 are integrally joined to each other, there is no need for a high precision that would be otherwise required for the convex and concave portions in connecting the tooth portions 12 to the yoke portion 11 in comparison with the case wherein the yoke portion and tooth portions are connected using convex and concave portions with the tooth portions 12 and yoke portion 11 separately formed, the cut area is reduced as compared with the case wherein the yoke portion and the tooth portions are separately formed as in the conventional case, it is possible to prevent motor efficiency degradation, and the need for the step of connecting the tooth portions to the yoke portion can be eliminated.

[0019] Further, as the winding conductor 9 wound around the tooth portions 12 is wound in a trapezoidal lamination arrangement so as to enlarge toward the inner peripheral surface 1 of the yoke portion 11, the winding conductor 9 may have a larger number of turns so that the performance of the electric motor can be improved.

[0020] Since the unit iron cores 6 formed integrally with the yoke portion iron core 2 and the tooth portion iron core 5 are punched and manufactured in n (integer equal to or greater than 2) rows, the material yield is improved as compared to the case where the yoke portion iron core 2 and the tooth portion iron core 5 are punched separately.

[0021] Further, when punching the unit iron core 6 as 1 unit, a cross-sectional area of the winding portion of the winding conductor 9 can be increased or reduced by forming the planar portion 1 on the inner periphery of the yoke portion iron core 2 so that its position shifts toward the outer peripheral side or inner peripheral side, so that the unit core 6 can be punched out and the cross-section area of the wound portion can be easily changed.

[0022] In the punching step 7 of the unit iron core 6, the unit iron core body 8 may be formed by pressure bonding, crimping or laminating by an adhesive layer using the pressure of the manufacturing equipment so that the manufacturing cost can be minimized.

[0023] In the punching step 7, either the die and the jig are heated and punched out or a heating means is provided before the iron core material is inserted into the punching die and the jig and the core material is heated, punched out and laminated, so that the peel strength of the unit core 6 can be improved.

[0024] (Second Embodiment) As shown in Figures 7 to 10, a unit iron core body 8A is formed in the following manner: a pair of concave portions 15 are provided for connecting at intervals to the arcuate surface 14 having an arcuate outer peripheral surface, and a unit iron core 6A provided with a tooth portion iron core 5 having a pole shoe portion 4 defining a rotor opposing surface 3 on an inner peripheral end thereof is insertion molded on the planar surface portion 1 of yoke portion iron core 2A forming the inner periphery by planar surface portion 1. At this time, the angle Q of both end faces of the yoke portion 11A and the resin film 17 of the pole shoe portion 4 of the inner peripheral end are formed, while resin film 17 to serve as an insulator is not formed on either end face of the yoke portion 11A of the unit core body 8A.

[0025] By flat plate member 19, wherein winding conductor 9 is wound around the unit iron core body 8A formed with the resin film 17, and convex portion 18, connected to concave portion 15 for connecting that is provided on annular surface 14, is provided unit iron core body 8A, both end surfaces of the yoke portions 11A hold unit iron core body 8A arranged in an annular shape so that both end surfaces come into close contact with each other in the circumferential direction to form the stator.

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