

Description

This invention relates to electric motors and/or machine drives utilizing such motors and/or methods of making the same and has been devised particularly though not solely for use as a source of power and/or drive for a laundry machine.

It is an object of the present invention to provide an electric motor and/or a machine drive utilizing such a motor and/or a method of making the same which will at least provide the public with a useful choice.

Accordingly in one aspect the invention consists in a method of manufacturing a motor element of an electric motor said motor element being selected from a rotor having a ferromagnetic circuit spaced radially from a shaft carrier mounting means and a stator having a ferromagnetic circuit including a set of poles adapted to receive electrical windings thereon, said poles being spaced radially from a shaft carrier mounting means thereof said method comprising the steps of fixing the selected ferromagnetic circuit in a plastics injection moulding die, said die having walls defining a cavity to receive injection moulded plastics material, said walls including wall portions to define a part of the cavity into which plastics material is injected to form the appropriate selected shaft carrier mounting means and injecting a plastics material into said die; to provide a plastics moulding having embedded therein said ferromagnetic circuit; to form said shaft carrier mounting means and to form a web between said ferromagnetic circuit and said shaft carrier mounting means said die holding desired parts of said ferromagnetic circuit in a fixed radial disposition relative to said shaft carrier mounting means to maintain substantial concentricity between said desired parts of said ferromagnetic circuit and said shaft carrier mounting means.

In a further aspect the invention consists in a method of manufacturing an electric motor comprising the steps of taking a motor element comprising a stator made by a method according to the preceding paragraph, placing electrical windings on the poles thereof and taking a further motor element comprising a rotor made according to the preceding paragraph magnetizing part of said ferromagnetic circuit to a permanent magnet state, attaching said stator to a bearing housing containing a distal bearing separated from a proximal bearing the outer surface of said proximal bearing being mounted partly in said shaft carrier mounting, mounting a shaft in said bearings and mounting said rotor on said shaft so that on the windings on said stator being energized through an electronic commutation circuit occurs to cause said rotor to rotate.

In a further aspect the invention consists in a motor element of an electric motor said motor element being selected from a rotor having a ferromagnetic circuit spaced radially from a shaft carrier mounting means thereof and a stator having a ferromagnetic circuit including a set of poles adapted to receive electrical windings thereon said poles being spaced radially from a shaft carrier mounting means thereof said motor element comprising a plastics injection moulding having embedded therein parts of said ferromagnetic circuit and having a web connecting said ferromagnetic circuit to said shaft carrier mounting means with parts of said ferromagnetic circuit held in a fixed radial disposition relative to said shaft carrier mounting means to maintain substantial concentricity between said desired parts of said ferromagnetic circuit and said shaft carrier mounting means.

In a still further aspect the invention consists in an electric motor comprising a motor element comprising a stator according to the preceding paragraph, said stator having electrical windings on the poles thereof and further motor element comprising a rotor made according to the preceding paragraph said motor having some of said ferromagnetic circuit magnetized to a permanent magnet state, a bearing housing attached to said stator, said housing containing a distal bearing separated from a proximal bearing, the outer surface of said proximal bearing being mounted partly in said bearing housing and partly in said shaft carrier mounting, a shaft in said bearings and said rotor being mounted on said shaft so that on windings on the poles of said stator being energized through an electronic commutating circuit magnetic coupling occurs to cause said rotor to rotate.

In a still further aspect the invention consists in a laundry machine having an outer casing, a water container within said casing, a spin tub rotatable within said container, an agitator mounted for agitation within said spin tub, said agitator being operable to enable said agitator alone to be agitated backwards and forwards or said spin tub and said agitator to be rotated in a single direction and spinning speed, said agitator being driven by an electric motor according to the preceding paragraph, said shaft driving said agitator and said bearing housing being fixed to a lower part of said container.

To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

The invention consists in the foregoing and also envisages constructions of which the following gives examples only.

One preferred form of the invention will now be described with reference to the accompanying drawings in which;

Figure 1 is a diagrammatic cross section of a laundry machine constructed according to the invention,

Figure 2 is an enlarged diagram of the drive mechanism forming part of the laundry machine of Figure 1,

Figure 3 is a plan view of a stator forming part of an electric motor also shown in figures 1 and 2,

Figure 4 is a cross section of an assembled die containing cavities in which a stator according to the invention is moulded,

Figure 5 is a plan view of a part of the die shown in Figure 4 and

Figure 6 is a cross section of an assembled die containing cavities in which a rotor according to the invention is moulded.

Referring to the drawings a laundry machine 1 is provided having an outer casing 2 and a container 3 which in use contains water in which clothes are to be laundered. The container 3 is preferably an injection moulding of a plastics material having reinforcing ribs 4 and 5. The ribs 4a and 5 support a bearing tube 6 preferably having a metal e.g. an aluminium alloy extrusion liner 8 moulded in the tube 6 when the container 3 is being injection moulded. The liner 8 is preferably shaped in plan to provide four wings into which motor mounting screws 65 extend. Mounted within the container 3 is a spin tub 4 having balancing rings 9 and mounted within the spin tub is an agitator 7. The agitator is mounted on and driven by a shaft 10 the driving being effected by splines 11 engaging corresponding parts 12 of the agitator. The described laundry machine also includes a clutch arrangement operated by a float 15 which is shown in a lower engaging position on the left hand side of the drawing and an upper disengaged position as shown in the right hand side. The operation of this float in connecting and disconnecting the spin tub 4 from the agitator 7 is fully described in European Patent Specification EP-A3-0239 261 which specification is incorporated herein by reference.

The shaft 13 is mounted in an upper distal bearing 20 (Figure 2) and a lower proximal bearing 21. The upper bearing 20 is mounted within the bearing tube 6 and the two bearings are separated by spacers 19 and 22. A seal 23 of known form is provided to seal the shaft 13 from the bearing tube 6.

The drive mechanism of the laundry machine above described includes an electric motor generally referenced 30 which in the preferred form is an inside but salient pole electronically commutated motor (herein referred to as an ECM). The ECM 30 is constructed according to the invention as follows:

A ferromagnetic magnetisable member 31 (Figure 3) is provided having salient poles 32, the poles 32 extending outwardly from a yoke 29 and the poles 32 having pole faces 33 lying on an outer circumference. The stator member 31 is manufactured by punching the poles 32 and yoke 29 out of a strip of electrical steel having a lightly insulated surface and then curving the strip of steel on edge into a continuous helix arranged with adjacent coils of steel having the light insulation thereon touching. The continuous helix is wound so that the resulting ferromagnetic magnetisable member has an outside diameter which is slightly larger than the preferred outside diameter of the stator member 31 in its completed form. The adjacent coils of steel are riveted together to maintain the desired shape. The plan shape is shown in Figure 3.

To provide a frame for the stator the stator member 31 is fitted in a space 24 of die 25 (Figure 4) with the pole faces 33 a close fit against a face 28 of a part of the die. The outside diameter of stator member 31 is shaped precisely by three sliding cones 71, spaced 120° apart, which move radially toward the centre of bearing mounting 27 (Figure 5). A plastics material preferably a Dupont Rynite FR543 plastics material is injected to encase the stator member 31 with the exception of the pole faces 33 in the plastics material. The position of the pole faces 33 is accurately determined by angled pins (not shown) and the poles 32 are mounted over shaped portions 26 of the die as may be seen in Figure 5. The die also includes provision to provide a shaft carrier mounting comprising a bearing mounting 27 in which the bearing 21 is later fitted to carry the shaft 11. The die 25 has shaped cavities 37, 38, 39 and otherwise to provide the shape of the stator frame as may be seen in Figure 2.

Referring now to that figure, the web 41 of the stator frame connects the plastics moulded section 36 to the bearing mounting 27. The web 41 has an annular shape containing a V shape 42 between a frustum of a cone portion 47 directed in one direction to a further frustum of a cone portion 48 directed away from the annular V shape 42 between the two portions 47 and 48. This shape has been found satisfactory in that after the plastics material has been injected any changes in volume thereof due to contraction of the plastics material while cooling result in changes of shape, for example, of the V shape 42 or change of angle between

the portions 47 and 48 rather than varying the relative position of the bearing mounting 27 and the encasement 36 which encases the stator member 31 which in particular is fixed in position by the engagement of the pole faces 33 with the die face 28. The injection moulding also covers the pole pieces except the faces thereof with the plastics material giving electrical insulation 45 to such pole pieces. At a later stage, a protective coating is applied to the pole faces eg. by spraying.

The moulding produced also provides terminal sockets 46. When the poles are wound the winding machinery places tails of winding wires automatically in the terminal sockets 46 and external wiring connections of spade type are then inserted in the sockets 46 giving a scraping action on the winding wires placed in the sockets 46, the insertion baring the tails of those wires and making electrical connection as desired.

To provide a rotor for the motor having a plastics rotor web and hub, a die is provided, and that die includes removeable members 66 and 67 (Figure 6) which fits in a further die part 68 and associated with the die parts 66 and 67 is a further male die part 69.

In use a series of pieces of magnetisable material (herein referred to as magnets) are placed in an unmagnetised condition in position in prepared slots (not shown) in the removable piece 67 and one such magnet is shown at 53 in Figure 6. The magnets are later magnetized in a separate process to be permanently magnetized in the known way. The material is preferably of the Neodymium type. The magnets are held in place by friction, being a reasonably tight fit in the slots or otherwise held temporarily in position and a strip of lightly insulated ferromagnetic material (steel) is then wound into a spiral coil in a clock spring manner over the magnets and in contact therewith until a suitable thickness is built up. The steel is shown at 54 in Figures 2 and 6. In order to resist forces acting during cooling of plastics web and hub the rotor after moulding, adjacent turns of the steel are fixed to each other preferably by the use of a suitable adhesive such as Loctite 290. The magnets are then held in a fixed position on the face of the removable die member 67 and the steel 54 is locked into a substantially solid form by the adhesive with the inner surfaces of the magnets each maintained in a circumferential position. The die parts are then assembled with the part 67 carrying the steel 54 and magnets 53 in position as shown in Figure 6. A plastics material preferably Rynite 545 made by Dupont is injected into the closed die parts.

In the preferred form for injection moulding both the stator and the rotor, the plastics material is injected at 290°-300°C into the die parts which are

maintained at 110°C. After injection, the die remains closed for about 15 seconds and the male and female die parts then separated. Ejection pins then eject the moulded part almost immediately. The plastics material encases the steel and all of the surfaces of the magnets except the face in contact with the die surface.

In the finished rotor, the web injected into space 58 of the die interconnects the encased steel 54 and magnets 53 to hub 51. The web 52 is formed to a shape such and the fixing of the steel and the magnets in the die is such that distortion of the position of the hub relative to the magnets and particularly concentricity are controlled during cooling of the plastics material to die temperature, we have found that an extended frustum of a cone shape of the portion 52 passing through an annular change of direction of the base of an annular 55 V from the cylindrical portion 57 to the plastics material 43 encasing the magnets and steel has been found satisfactory in this respect. Thus the web 52 is formed to a shape which resists distortion of the portion of the hub relative to the permanent magnets and we have found that a cone shape changing through a V shape to a cylinder is satisfactory in this respect.

Referring again to Figure 2 the hub 51 is held in place on the shaft 11 by a screwed cap 56. A useful adjunct to the invention is the provision of a downwardly directed short cylinder 60 on the stator member 52 and this co-acts with an upstanding cylindrical member 61 on the rotor so that should the seal 23 leak water will pass downwardly to be expelled through apertures 62 in the rotor.

The number of poles in the stator and the rotor may be varied but for example for a 42 pole stator 56 permanent magnets are spaced equi-distantly on the rotor.

The lower end of the shaft 11 has a splined portion 50 and the hub 51 of the rotor is mounted on this splined portion.

During assembly the bearing 21 is placed with its outer race partly in the bearing mounting 27 and partly in the extruded liner 8.

The above construction has the advantage that an electric motor may be made by a plastics injection process in which in particular the bearing 21 maintains its concentricity relative to the pole faces 33 and thus enables a motor to be produced very quickly and very easily. Also the mounting of the tube 6 in the injection moulding of the outer container 3 enables the shaft 11 to be mounted quickly and readily. The whole arrangement has the advantage that the motor may be dismantled quickly and easily by undoing the cap 56, removing the rotor and then undoing screws 65 so that the motor may be dropped from the tube 6. The shaft may then be withdrawn and the bearings

replaced if necessary.

Although the preferred form of the invention has been described in relation to a laundry machine in which the shaft 11 drives an agitator, it will be apparent that the invention particularly though not solely the method of manufacturing the motor frame will be applicable to other drives where a pair of bearings rotatably support not only the motor rotor but also a rotatable part of a machine of which the motor and drive form parts.

The features disclosed in the foregoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A method of manufacturing a motor element of an electric motor (30) said motor element being selected from a rotor (51 to 55) having a ferromagnetic circuit (53, 54) spaced radially from a shaft carrier mounting means (51) thereof and a stator (31) having a ferromagnetic circuit (29, 32) including a set of poles (32) adapted to receive electrical windings thereon, said poles being spaced radially from a shaft carrier mounting means (27) thereof characterised in that said method comprises the steps of fixing the selected ferromagnetic circuit in a plastics injection moulding die (25; 66 to 69), said die having walls defining a cavity (37 to 39; 57, 58) to receive injection moulded plastics material, said walls including wall portions to define a part of the cavity into which plastics material is injected to form the appropriate selected shaft carrier mounting, and injecting a plastics material into said die to provide a plastics moulding to have embedded therein the selected ferromagnetic circuit; to form said shaft carrier mounting means; and to form a web (41, 52) between said ferromagnetic circuit and said shaft carrier mounting means, said die holding desired parts of said ferromagnetic circuit in a fixed radial disposition relative to said shaft carrier mounting means to maintain substantial concentricity between said desired parts of said ferromagnetic circuit and said shaft carrier mounting means after cooling of said plastics material.
2. A method as claimed in claim 1 which includes the step of selecting said stator (31) as said motor element.
3. A method as claimed in claim 2 which includes the step of providing said shaft carrier mounting means (27, 51) as a housing adapted in

use to receive a shaft (13) carrying bearing (21).

4. A method as claimed in either of claim 2 or claim 3 which includes the step of forming said web (41, 52) in a shape which includes members which form an annular V formation (42, 55) positioned so that contraction of said plastics material during cooling after injection causes a change in shape of said V formation.
5. A method as claimed in any one of claims 2 to 4 which includes the step of forming terminal sockets (46) in said plastics moulding.
6. A method as claimed in any one of claims 2 to 5 which includes the step of forming said ferromagnetic circuit as a yoke (29) having associated therewith a plurality of outwardly directed poles (32) with the pole faces (33) of the poles laying on a circumference.
7. A method as claimed in claim 6 which includes the step of forming said poles (32) and said yoke (29) integrally from a strip of ferromagnetic material and curving the strip edgewise to form said yoke with outwardly extending poles.
8. A method as claimed in claim 1 which includes the step of selecting said rotor (51 to 55) as said motor element.
9. A method as claimed in claim 8 which includes the steps of providing said shaft carrying mounting means (27, 51) as a hub in which a shaft (13) is mounted in use.
10. A method as claimed in claim 8 or claim 9 which includes the step of forming said web (41, 52) in a shape which includes members (47, 48, 52, 55) which form an annular V formation positioned so that contraction of said plastics material during cooling after injection causes a change in shape of said V formation.
11. A method as claimed in any one of claims 8 to 10 which includes the step of forming said rotor (51 to 55) with 30 pieces of inwardly facing magnetisable material (53) magnetisable to form permanent magnet poles.
12. A method as claimed in claim 11 which includes the step of mounting said pieces of magnetisable material (53) so as to be retained in slots in a removeable piece (67) of said die, wrapping a strip of ferromagnetic material (54) about said pieces of magnetisable material on



replaced if necessary.

Although the preferred form of the invention has been described in relation to a laundry machine in which the shaft 11 drives an agitator it will be apparent that the invention particularly though not solely the method of manufacturing the motor frame will be applicable to other drives where a pair of bearings rotatably support not only the motor rotor but also a rotatable part of a machine of which the motor and drive form parts.

The features disclosed in the foregoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A method of manufacturing a motor element of an electric motor (30) said motor element being selected from a rotor (51 to 55) having a ferromagnetic circuit (53, 54) spaced radially from a shaft carrier mounting means (51) thereof and a stator (31) having a ferromagnetic circuit (29, 32) including a set of poles (32) adapted to receive electrical windings thereon, said poles being spaced radially from a shaft carrier mounting means (27) thereof characterised in that said method comprises the steps of fixing the selected ferromagnetic circuit in a plastics injection moulding die (25; 66 to 69), said die having walls defining a cavity (37 to 39; 57, 58) to receive injection moulded plastics material, said walls including wall portions to define a part of the cavity into which plastics material is injected to form the appropriate selected shaft carrier mounting, and injecting a plastics material into said die to provide a plastics moulding to have embedded therein the selected ferromagnetic circuit; to form said shaft carrier mounting means; and to form a web (41, 52) between said ferromagnetic circuit and said shaft carrier mounting means, said die holding desired parts of said ferromagnetic circuit in a fixed radial disposition relative to said shaft carrier mounting means to maintain substantial concentricity between said desired parts of said ferromagnetic circuit and said shaft carrier mounting means after cooling of said plastics material.
2. A method as claimed in claim 1 which includes the step of selecting said stator (31) as said motor element.
3. A method as claimed in claim 2 which includes the step of providing said shaft carrier mounting means (27, 51) as a housing adapted in use to receive a shaft (13) carrying bearing (21).
4. A method as claimed in either of claim 2 or claim 3 which includes the step of forming said web (41, 52) in a shape which includes members which form an annular V formation (42, 55) positioned so that contraction of said plastics material during cooling after injection causes a change in shape of said V formation.
5. A method as claimed in any one of claims 2 to 4 which includes the step of forming terminal sockets (46) in said plastics moulding.
6. A method as claimed in any one of claims 2 to 5 which includes the step of forming said ferromagnetic circuit as a yoke (29) having associated therewith a plurality of outwardly directed poles (32) with the pole faces (33) of the poles laying on a circumference.
7. A method as claimed in claim 6 which includes the step of forming said poles (32) and said yoke (29) integrally from a strip of ferromagnetic material and curving the strip edgewise to form said yoke with outwardly extending poles.
8. A method as claimed in claim 1 which includes the step of selecting said rotor (51 to 55) as said motor element.
9. A method as claimed in claim 8 which includes the steps of providing said shaft carrying mounting means (27, 51) as a hub in which a shaft (13) is mounted in use.
10. A method as claimed in claim 8 or claim 9 which includes the step of forming said web (41, 52) in a shape which includes members (47, 48, 52, 55) which form an annular V formation positioned so that contraction of said plastics material during cooling after injection causes a change in shape of said V formation.
11. A method as claimed in any one of claims 8 to 10 which includes the step of forming said rotor (51 to 55) with 30 pieces of inwardly facing magnetisable material (53) magnetisable to form permanent magnet poles.
12. A method as claimed in claim 11 which includes the step of mounting said pieces of magnetisable material (53) so as to be retained in slots in a removeable piece (67) of said die, wrapping a strip of ferromagnetic material (54) about said pieces of magnetisable material on



- said removeable die piece to provide a desired thickness, rigidifying the assembly and placing the removeable die pieces with the ferromagnetic assembly (54) thereon in association with the die parts (66 to 69) before injecting said plastics material.
13. A method as claimed in claim 12 which includes the step of rigidifying said ferromagnetic assembly (54) by applying a gap penetrating adhesive thereto.
14. A method of manufacturing an electric motor characterized in that said method comprises the steps of taking a motor element comprising a stator (31) made by a method according to any one of claims 2 to 7, placing electrical windings on the poles (32) thereof and taking a motor element comprising a rotor (51 to 55) made according to any one of claims 8 to 13, magnetizing part of said ferromagnetic circuit to a permanent magnet state, attaching said stator to a bearing housing (8) containing a distal bearing (20) separated from a proximal bearing (21) the outer surface of said proximal bearing being mounted partly in said shaft carrier mounting (27), mounting a shaft (13) in said bearings and mounting said rotor on said shaft so that on the windings on said stator being energized through an electronic commutation circuit magnetic coupling occurs to cause said rotor to rotate.
15. A motor element of an electric motor (30) said motor element being selected from a rotor (51 to 55) having a ferromagnetic circuit spaced radially from a shaft carrier mounting means (51) thereof and a stator (31) having a ferromagnetic circuit including a set of poles (32) adapted to receive electrical windings thereon, said poles being spaced radially from a shaft carrier mounting means (27) thereof characterised in that said motor element comprises a plastics injection moulding having embedded therein parts of said ferromagnetic circuit and having a web (41, 52) connecting said ferromagnetic circuit to said shaft carrier mounting means with parts of said ferromagnetic circuit held in a fixed radial disposition relative to said shaft carrier mounting means to maintain substantial concentricity between said desired parts of said ferromagnetic circuit and said shaft carrier mounting means.
16. A motor element as claimed in claim 15 which includes said stator (31) as said motor element.
17. A motor element as claimed in claim 16 wherein said shaft carrier mounting means (27, 52) is provided as a housing adapted in use to receive a part of shaft (13) carrying a bearing (21).
18. A motor element as claimed in claim 16 or claim 17 wherein said web (41, 52) is formed in a shape which includes members which form an annular V formation (42, 55) positioned so that contraction of said plastics material during cooling after injection causes a change in shape of said V formation.
19. A motor element as claimed in any one of claims 16 to 18 wherein said ferromagnetic circuit is formed as a yoke (29) having associated therewith a plurality of outwardly directed poles (32) with the outer faces (33) of the poles lying on a circumference.
20. A motor element as claimed in any one of the claims 16 to 19 wherein said poles (32) and said yoke (29) are formed integrally from a strip of ferromagnetic material and the strip is curved edgewise to form said yoke with outwardly extending poles.
21. A motor element as claimed in claim 15 wherein said rotor (51 to 55) is selected as said motor element.
22. A motor element as claimed in claim 21 wherein said shaft carrier mounting means is provided as a hub (51) in which a shaft (13) is mounted in use.
23. A motor element as claimed in claim 21 or claim 22 wherein said rotor web (52) is formed in a shape which includes members which provide an annular V formation (55) positioned so that contraction of said plastics material during cooling after injection causes a change in shape of said V formation.
24. A motor element as claimed in any one of claims 21 to 23 wherein said rotor (51 to 55) is formed with pieces of inwardly facing magnetic material (53) magnetisable to form permanent magnet poles.
25. A motor element as claimed in claim 24 wherein said pieces of inwardly facing magnetic material (53) are wrapped in a strip of ferromagnetic material (54) to a desired thickness and the assembly is rigidified.



26. A motor element as claimed in claim 25 wherein said assembly is rigidified by a gap penetrating adhesive between parts thereof.

27. An electric motor characterized in that said motor comprises a motor element comprising a stator (31) according to any one of claims 15 to 20, said stator having electrical windings on the poles (32) thereof and a further motor element comprising a rotor (51 to 55) made according to any one of claims 21 to 26 having some of said ferromagnetic circuit magnetized to a permanent magnet state, a bearing housing (8) attached to said stator (31), said housing containing a distal bearing (20) separated from a proximal bearing (21), the outer surface of said proximal bearing being mounted partly in said bearing housing and partly in said shaft carrier mounting (27), said bearings and said rotor being mounted on said shaft so that on windings on said stator being energized through an electronic commutating circuit, magnetic coupling occurs to cause said rotor to rotate.

28. A laundry machine (1) having an outer casing (2), a water container (3) within said casing, a spin tub (4) rotatable within said container, an agitator (7) mounted for agitation within said spin tub interconnecting means between said spin tub, and said agitator being operable to enable said agitator alone to be agitated backwards and forwards or said spin tub and said agitator to be rotated in a single direction and spinning speed, characterised in that said agitator is driven by an electric motor (30) according to claim 27, said shaft (13) driving said agitator and said bearing housing being fixed to a lower part of said container.

Patentansprüche

1. Verfahren zur Herstellung eines Motorelements eines Elektromotors (30), wobei besagtes Motorelement aus einem Rotor (51 bis 55), der einen Eisenkreis (53, 54) aufweist, der radial beabstandet von einer Achsträgerbefestigungseinrichtung (51) desselben ist, und aus einem Stator (31) ausgewählt ist, der einen Eisenkreis (29, 32) aufweist, der einen Satz von Polen (32) einschließt, die zum Aufnehmen von elektrischen Wicklungen darauf angepaßt sind, wobei besagte Pole radial von einer Achsträgerbefestigungseinrichtung (27) desselben beabstandet sind, dadurch gekennzeichnet, daß besagtes Verfahren die Schritte des Befestigens des ausgewählten Eisenkreises in einem Kunststoffspritzgußgesenk (25; 66 bis 69), wo-

bei das Gesenk Wände aufweist, die einen Hohlraum (37 bis 39; 57, 58) zum Aufnehmen von Spritzgußkunststoffmaterial bilden, wobei die Wände Wandabschnitte einschließen, um einen Teil des Hohlraums zu bilden, in den Kunststoffmaterial gespritzt wird, um die geeignet ausgewählte Achsträgerbefestigung zu formen, und des Spritzens eines Kunststoffmaterials in besagtes Gesenk umfaßt, um eine Kunststoffform zur Verfügung zu stellen, um darin den gewählten Eisenkreis einzubetten; Formen besagter Achsträgerbefestigungseinrichtung; und Gestalten eines Arms (41, 52) zwischen besagtem Eisenkreis und besagter Achsträgerbefestigungseinrichtung, wobei besagtes Gesenk gewünschte Teile besagten Eisenkreises in einem festen radialen Ansatz relativ zu besagter Achsträgerbefestigungseinrichtung hält, um feste Konzentrität zwischen besagten gewünschten Teilen besagten Eisenkreises und besagter Achsträgerbefestigungseinrichtung nach dem Abkühlen besagten Kunststoffmaterials zu erzielen.

2. Verfahren nach Anspruch 1, das den Schritt des Auswählens besagten Stators (31) als besagtes Motorelement einschließt.

3. Verfahren nach Anspruch 2, das den Schritt des zur Verfügungstellens besagter Achsträgerbefestigungseinrichtungen (27, 51) als ein im Gebrauch angepaßtes Gehäuse, um eine Achse (13) aufzunehmen, die ein Lager (21) trägt, einschließt.

4. Verfahren nach Anspruch 2 oder 3, das den Schritt des Gestaltens besagten Arms (41, 52) in eine Form einschließt, die Elemente einschließt, die ein ringförmiges V-Gebilde (42, 55) bilden, das so positioniert ist, daß eine Kontraktion besagten Kunststoffmaterials während des Abkühlens nach dem Spritzen eine Formänderung besagten V-Gebildes bewirkt.

5. Verfahren nach einem der Ansprüche 2 bis 4, das den Schritt des Formens von Endbuchsen (46) in besagte Kunststoffform einschließt.

6. Verfahren nach einem der Ansprüche 2 bis 5, das den Schritt des Formens besagten Eisenkreises als ein Joch (29), das damit verbunden eine Mehrzahl von nach außen zeigenden Polen (32) aufweist, wobei die Polseiten (33) der Pole auf einem Kreisumfang liegen, einschließt.

7. Verfahren nach Anspruch 6, das den Schritt des Formens besagter Pole (32) und besagten



Jochs (29) eine Einheit bildend aus einem Streifen ferromagnetischen Materials und des Hochkantbiegens des Streifens, um besagtes Joch mit sich nach außen erstreckenden Polen zu formen, einschließt.

8. Verfahren nach Anspruch 1, das den Schritt des Wählens besagten Rotors (51 bis 55) als besagtes Motorelement einschließt.

9. Verfahren nach Anspruch 8, das die Schritte des zur Verfügungstellens besagter Achsträgerbefestigungseinrichtung (27, 51) als eine Lagerbuchse, in der eine Achse (13) im Gebrauch befestigt ist, einschließt.

10. Verfahren nach Anspruch 8 oder 9, das den Schritt des Formens besagten Arms (41, 52) in eine Form einschließt, die Elemente (47, 48, 52, 55) einschließt, die ein ringförmiges V-Gebilde formen, das so positioniert ist, daß eine Kontraktion besagten Kunststoffmaterials während des Abkühlens nach dem Spritzen eine Formänderung besagten V-Gebildes bewirkt.

11. Verfahren nach einem der Ansprüche 8 bis 10, das den Schritt des Formens besagten Rotors (51 bis 55) mit Teilen nach innen zeigenden magnetisierbaren Materials (53), das magnetisierbar ist, um Dauermagnetpole zu bilden, einschließt.

12. Verfahren nach Anspruch 11, das den Schritt des Befestigens besagter Teile magnetisierbaren Materials (53) derart, daß sie in Schlitzen in einem entfernbaren Teil (67) besagten Gesenks gehalten werden können, des Umwickelns eines Streifens ferromagnetischen Materials (54) um besagte Teile magnetisierbaren Materials auf besagtem entfernbaren Gesenkteil, um eine gewünschte Dicke zu liefern, des Versteifens des Aufbaus und des Anordnens der entfernbaren Gesenkteile mit dem ferromagnetischen Aufbau (54) darauf in Verbindung mit den Gesenkteilen (66 bis 69) vor dem Spritzen besagten Kunststoffmaterials einschließt.

13. Verfahren nach Anspruch 12, das den Schritt des Versteifens besagten ferromagnetischen Aufbaus (54) durch darauf Anwenden eines in einen Spalt eindringenden Klebers einschließt.

14. Verfahren zur Herstellung eines Elektromotors, dadurch gekennzeichnet, daß besagtes Verfahren die Schritte des Verwendens eines Motorelements, das einen Stator (31) umfaßt, der

nach einem Verfahren nach einem der Ansprüche 2 bis 7 hergestellt ist, das Anbringen von elektrischen Wicklungen auf die Pole (32) desselben und des Verwendens eines Motorelements, das einen Rotor (51 bis 55) umfaßt, der nach einem der Ansprüche 8 bis 13 hergestellt ist, des Magnetisierens eines Teils besagten Eisenkreises in einen Dauermagnetzustand, des Befestigens besagten Stators an einem Lagergehäuse (8), das ein distales Lager (20) separat von einem proximalen Lager (21) enthält, wobei die äußere Fläche besagten proximalen Lagers teilweise in besagter Achsträgerbefestigung (27) befestigt ist, des Befestigens einer Achse (13) in besagten Lagern und des Befestigens besagten Rotors an besagter Achse derart, daß auf die Wicklungen auf besagtem Stator, der mittels einer elektronischen Kommutatorschaltung mit Strom versorgt wird, magnetische Kopplung eintritt, um zu bewirken, daß besagter Rotor sich dreht, umfaßt.

15. Motorelement eines Elektromotors (30), dadurch gekennzeichnet, daß besagtes Motorelement aus einem Rotor (51 bis 55), der einen Eisenkreis aufweist, der radial beabstandet von einer Achsträgerbefestigungseinrichtung (51) derselben ist, und aus einem Stator (31) ausgewählt ist, der einen Eisenkreis aufweist, der einen Satz von Polen (32) einschließt, die zum Aufnehmen von elektrischen Wicklungen angepaßt sind, wobei besagte Pole radial von einer Achsträgerbefestigungseinrichtung (27) desselben beabstandet sind, dadurch gekennzeichnet, daß besagtes Motorelement eine Kunststoffspritzgußform umfaßt, in der Teile besagten Eisenkreises eingebettet sind und die einen Arm (41, 52) aufweist, der besagten Eisenkreis mit besagter Achsträgerbefestigungseinrichtung verbindet, wobei Teile besagten Eisenkreises in einem festen radialen Ansatz relativ zu besagter Achsträgerbefestigungseinrichtung gehalten werden, um feste Konzentrität zwischen besagten gewünschten Teilen besagten Eisenkreises und besagter Achsträgerbefestigungseinrichtung zu erzielen.

16. Motorelement nach Anspruch 15, das besagten Stator (31) als besagtes Motorelement einschließt.

17. Motorelement nach Anspruch 16, worin besagte Achsträgerbefestigungseinrichtung (27, 52) mit einem im Gebrauch angepaßten Gehäuse versehen ist, um einen Teil der Achse (13) aufzunehmen, die ein Lager (21) trägt.



18. Motorelement nach Anspruch 16 oder 17, worin besagter Arm (41, 52) in einer Form gestaltet ist, die Elemente einschließt, die ein ringförmiges V-Gebilde (42, 55) bilden, das so positioniert ist, daß eine Kontraktion besagten Kunststoffmaterials während des Abkühlens nach dem Spritzen eine Formänderung besagten V-Gebildes bewirkt.

19. Motorelement nach einem der Ansprüche 16 bis 18, worin besagter Eisenkreis als ein Joch (29) geformt ist, das damit verbunden eine Mehrzahl von nach außen zeigenden Polen (32) aufweist, wobei die äußeren Seiten (33) der Pole auf einem Kreisumfang liegen.

20. Motorelement nach einem der Ansprüche 16 bis 19, worin besagte Pole (32) und besagtes Joch (29) eine Einheit bildend aus einem Streifen ferromagnetischen Materials gebildet sind und der Streifen hochkant gebogen ist, um besagtes Joch mit sich nach außen erstreckenden Polen zu formen.

21. Motorelement nach Anspruch 15, worin besagter Rotor (51 bis 55) als besagtes Motorelement gewählt ist.

22. Motorelement nach Anspruch 21, worin besagte Achsträgerbefestigungseinrichtung als eine Lagerbuchse (51) zur Verfügung gestellt ist, in der eine Achse (13) im Gebrauch befestigt ist.

23. Motorelement nach Anspruch 21 oder 22, worin besagter Rotorarm (52) in einer Form gestaltet ist, die Elemente einschließt, die ein ringförmiges V-Gebilde (55) bilden, das so positioniert ist, daß eine Kontraktion besagten Kunststoffmaterials während des Abkühlens nach dem Spritzen eine Formänderung besagten V-Gebildes bewirkt.

24. Motorelement nach einem der Ansprüche 21 bis 23, worin besagter Rotor (51 bis 55) mit Teilen nach innen zeigenden magnetischen Materials (53) geformt ist, das magnetisierbar ist, um Dauermagnetpole zu bilden.

25. Motorelement nach Anspruch 24, worin besagte Teile nach innen zeigenden magnetischen Materials (53) in einen Streifen ferromagnetischen Materials (54) in einer gewünschten Dicke gewickelt sind und der Aufbau versteift ist.

26. Motorelement nach Anspruch 25, worin besagter Aufbau durch in einen Spalt eindringenden Kleber zwischen Teilen desselben verstärkt ist.

27. Elektromotor, dadurch gekennzeichnet, daß dieser Motor ein Motorelement, das einen Stator (31) nach einem der Ansprüche 15 bis 20 umfaßt, wobei besagter Stator elektrische Wicklungen auf den Polen (32) desselben aufweist, und ein weiteres Motorelement, das einen Rotor (51 bis 55) umfaßt, der nach einem der Ansprüche 21 bis 26 hergestellt ist, der einen Teil besagten Eisenkreises in einen Dauermagnetzustand magnetisiert aufweist, ein Lagergehäuse (8) umfaßt, das an besagtem Stator (31) befestigt ist, wobei besagtes Gehäuse ein distales Lager (20) separat von einem proximalen Lager (21) enthält, wobei die äußere Fläche besagten proximalen Lagers teilweise in besagtem Lagergehäuse und teilweise in besagter Achsträgerbefestigung (27) befestigt ist, wobei Lager und besagter Rotor an besagter Achse so befestigt sind, daß auf Wicklungen auf besagtem Stator, der mittels einer elektronischen Kommutatorschaltung mit Strom versorgt wird, magnetische Kopplung eintritt, um zu bewirken, das besagter Rotor sich dreht.

28. Waschmaschine (1), die ein äußeres Gehäuses (2), einen Wasserbehälter (3) innerhalb besagten Gehäuses, eine Drehtrommel (4), die innerhalb besagten Behälters drehbar ist, einen Rührer (7) umfaßt, der zum Rühren innerhalb besagter Drehtrommelverbindungseinrichtung zwischen besagter Drehtrommel befestigt ist, und besagter Rührer so betreibbar ist, daß besagter Rührer alleine rückwärts und vorwärts gedreht werden kann oder besagte Drehtrommel und besagter Rührer in eine einzige Richtung und mit einer einzigen Geschwindigkeit gedreht werden können, dadurch gekennzeichnet, daß besagter Rührer von einem Elektromotor (30) nach Anspruch 27 angetrieben wird, besagte Achse (13) besagten Rührer antreibt und besagtes Lagergehäuse an einem unteren Teil besagten Behälters befestigt ist.

Revendications

1. Un procédé de fabrication d'un élément de moteur d'un moteur électrique (30), ledit élément de moteur étant choisi parmi un rotor (51 à 55), à circuit ferromagnétique (53, 54) espacé radialement d'un moyen de montage du support d'arbre du moteur, et un stator (31), à circuit ferromagnétique (29, 32) incluant un ensemble de pôles (32) aptes à recevoir des enroulements électriques, lesdits pôles étant espacés radialement d'un moyen de montage (27) du support d'arbre du moteur, caractérisé en ce que ledit procédé comprend les étapes



- consistant à: fixer le circuit ferromagnétique choisi dans un moule à injection (25; 66 à 69) pour plastique, ledit moule comportant des parois définissant une cavité (37 à 39; 57, 58) pour recevoir des matières plastiques moulées par injection, lesdites parois incluant des parties de parois afin de définir une partie de la cavité dans laquelle une matière plastique est injectée de manière à former le montage approprié choisi de support d'arbre, et injecter une matière plastique dans ledit moule afin de réaliser un moulage en plastique dans lequel le circuit ferromagnétique choisi doit être encasté; former ledit moyen de montage du support d'arbre; et former une nervure (41, 52) entre ledit circuit ferromagnétique et ledit moyen de montage du support d'arbre, ledit moule tenant les éléments souhaités du circuit ferromagnétique selon une disposition radiale fixe par rapport audit moyen de montage du support d'arbre afin de maintenir sensiblement une concentricité entre lesdits éléments dudit circuit ferromagnétique et dudit moyen de montage du support d'arbre après le refroidissement de ladite matière plastique.
2. Un procédé selon la revendication 1 qui inclut l'étape consistant à choisir comme dit élément de moteur ledit stator (31).
 3. Un procédé selon la revendication 2 qui inclut l'étape consistant à réaliser ledit moyen de montage (27, 51) du support d'arbre en tant que boîtier apte à être utilisé pour recevoir un palier (21) supportant un arbre (13).
 4. Un procédé selon l'une des revendications 2 ou 3 qui inclut l'étape consistant à former ladite nervure (41, 52) selon une configuration qui inclut des éléments qui forment une formation annulaire en V (42, 55) positionnée de manière telle qu'un retrait de ladite matière plastique pendant le refroidissement après injection provoque une modification de la configuration de ladite formation en V.
 5. Un procédé selon l'une quelconque des revendications 2 à 4 qui inclut l'étape consistant à former des douilles (46) de bornes dans ledit moulage en plastique.
 6. Un procédé selon l'une quelconque des revendications 2 à 5 qui inclut l'étape consistant à donner audit circuit ferromagnétique une forme de culasse (29) à laquelle est associée une série de pôles (32) dirigés vers l'extérieur, les faces (33) de pôles étant situées sur une circonférence.
 7. Un procédé selon la revendication 6 qui inclut l'étape consistant à former lesdits pôles (32) et ladite culasse (29) d'un seul tenant à partir d'une bande de matière ferromagnétique et à incurver la bande sur le bord afin de former ladite culasse à partir de laquelle les pôles s'étendent vers l'extérieur.
 8. Un procédé selon la revendication 1 qui inclut l'étape consistant à choisir comme dit élément de moteur ledit rotor (51 à 55).
 9. Un procédé selon la revendication 8 qui inclut les étapes consistant à réaliser ledit moyen de montage (27, 51) du support d'arbre sous forme d'un moyeu dans lequel un arbre (13) est monté en utilisation.
 10. Un procédé selon la revendication 8 ou la revendication 9, qui inclut l'étape consistant à former ladite nervure (41, 52) selon une configuration qui inclut des éléments (47, 48, 52, 55) qui forment une formation annulaire en V positionnée d'une manière telle qu'un retrait de ladite matière plastique au cours du refroidissement après injection provoque une modification de la configuration de ladite formation en V.
 11. Un procédé selon l'une quelconque des revendications 8 à 10 qui inclut l'étape consistant à former ledit rotor (51 à 55) d'une manière telle qu'il inclut des pièces de matière susceptible d'être aimantée tournées vers l'intérieur (53) qui peuvent être aimantées de façon à former des pôles magnétiques permanents.
 12. Un procédé selon la revendication 11 qui inclut l'étape consistant à monter lesdites pièces en matière susceptible d'être aimantée (53) de façon qu'elles soient retenues dans des fentes dans une pièce amovible (67) dudit moule, enrouler une bande de matière ferromagnétique (54) autour desdites pièces de matière susceptible d'être aimantée sur ladite pièce amovible du moule afin de réaliser une épaisseur souhaitée, rigidifier l'ensemble et placer les pièces amovibles de moule portant l'ensemble ferromagnétique (54) en association avec les éléments de moule (66 à 69) avant d'injecter ladite matière plastique.
 13. Un procédé selon la revendication 12 qui inclut l'étape consistant à rigidifier ledit ensemble ferromagnétique (54) en y appliquant un adhésif qui pénètre dans l'intervalle.



14. Un procédé de fabrication d'un moteur électrique caractérisé en ce que ledit procédé comprend les étapes consistant à prendre un élément de moteur comprenant un stator (31) fabriqué par un procédé selon l'une quelconque des revendications 2 à 7, placer des enroulements électriques sur ses pôles (32) et prendre un élément de moteur comprenant un rotor (51 à 55) fabriqué selon l'une quelconque des revendications 8 à 13, aimanter à un état d'aimant permanent une partie dudit circuit ferromagnétique, attacher ledit stator à un logement (8) de palier qui contient un palier distal (20) séparé d'un palier proximal (21), la surface extérieure dudit palier proximal étant montée en partie dans ledit montage (27) du support d'arbre, monter un arbre (13) dans lesdits paliers et monter ledit rotor sur ledit arbre de façon qu'il se produise un couplage magnétique, lorsque les enroulements dudit stator sont excités à l'aide d'un circuit électronique de commutation, de manière à amener ledit rotor à tourner.
15. Un élément de moteur d'un moteur électrique (30) caractérisé en ce que ledit élément de moteur est choisi parmi un rotor (51 à 55) incluant un circuit ferromagnétique, espacé radialement d'un moyen de montage (51) du support de rotor du moteur, et un stator (31) à circuit ferromagnétique incluant un ensemble de pôles (32) qui sont aptes à recevoir des enroulements électriques et sont espacés radialement d'un moyen de montage (27) du support d'arbre du moteur, caractérisé en ce que ledit élément de moteur comprend un moulage par injection d'une matière plastique dans lequel sont incorporés des éléments dudit circuit ferromagnétique et inclut une nervure (41, 52) reliant ledit circuit ferromagnétique audit moyen de montage du support d'arbre, des éléments dudit circuit ferromagnétique étant tenus dans une disposition radiale fixe par rapport audit moyen de montage du support d'arbre afin de maintenir une concentricité sensible entre lesdits éléments souhaités dudit circuit ferromagnétique et ledit moyen de montage du support d'arbre.
16. Un élément de moteur selon la revendication 15 qui inclut comme dit élément de moteur ledit stator (31).
17. Un élément de moteur selon la revendication 6 dans lequel ledit moyen de support (27, 52) de porteur d'arbre est réalisé sous forme de boîtier apte à recevoir en utilisation un élément d'arbre (13) portant un palier (31).
18. Un élément de moteur selon la revendication 16 ou la revendication 17 dans lequel ladite nervure (41, 52) est formée selon une configuration qui inclut des éléments qui forment une formation annulaire (42, 55) en V positionnée d'une manière telle qu'un retrait de ladite matière plastique au cours du refroidissement après injection provoque une variation de la configuration de ladite formation en V.
19. Un élément de moteur selon l'une quelconque des revendications 16 à 18 dans lequel ledit circuit ferromagnétique est réalisé sous forme d'une culasse (29) à laquelle est associée une série de pôles (32) dirigés vers l'extérieur, les faces (33) de pôles étant situées sur une circonférence.
20. Un élément de moteur selon l'une quelconque des revendications 16 à 19 dans lequel lesdits pôles (32) et ladite culasse (29) sont formés d'un seul tenant à partir d'une bande de matière ferromagnétique et la bande est incurvée sur le bord afin de former ladite culasse à partir de laquelle les pôles s'étendent vers l'extérieur.
21. Un élément de moteur selon la revendication 15 dans lequel ledit rotor (51 à 55) est choisi comme dit élément de moteur.
22. Un élément de moteur selon la revendication 21 dans lequel ledit moyen de montage du support d'arbre est réalisé sous forme d'un moyeu dans lequel un arbre (13) est monté en utilisation.
23. Un élément de moteur selon la revendication 21 ou la revendication 22, dans lequel ladite nervure (41, 52) est formée selon une configuration qui inclut des éléments qui forment une formation annulaire en V (55) positionnée d'une manière telle qu'un retrait de ladite matière plastique au cours du refroidissement après injection provoque une modification de la configuration de ladite formation en V.
24. Un élément de moteur selon l'une quelconque des revendications 21 à 23 dans lequel ledit rotor (51 à 55) est formé d'une manière telle qu'il inclut des pièces de matière susceptible d'être aimantée tournées vers l'intérieur (53) qui peuvent être aimantées de façon à former des pôles magnétiques permanents.
25. Un élément de moteur selon la revendication 24 dans lequel lesdites pièces de matière magnétique (53) tournées vers l'intérieur sont en-



roulées pour former une bande de matière ferromagnétique d'une épaisseur souhaitée et l'ensemble est rigidifié.

26. Un élément de moteur selon la revendication 5
25, dans lequel ledit ensemble est rigidifié par un adhésif pénétrant dans un intervalle entre les éléments de l'ensemble.
27. Un moteur électrique caractérisé en ce que
ledit moteur comprend un élément de moteur
comprenant un stator (31) selon l'une quelconque des revendications 15 à 20, ledit stator incluant des enroulements électriques sur ses pôles (32) et un autre élément de moteur
comprenant un rotor (51 à 55) réalisé selon l'une quelconque des revendications 21 à 26 dans lequel une partie dudit circuit ferromagnétique est aimantée à un état d'aimant permanent, un logement (8) de palier attaché audit stator (31), ledit logement contenant un palier distal (20) séparé d'un palier proximal (21), la surface extérieure dudit palier proximal étant supportée en partie dans ledit logement de palier et en partie dans ledit montage (27) du support d'arbre, lesdits paliers et ledit rotor étant montés sur ledit arbre d'une manière telle qu'un accouplement magnétique se produit, lorsque ledit stator est excité à l'aide d'un circuit de commutation électronique, de manière à amener ledit rotor à tourner.
28. Une machine à laver (1) incluant une enveloppe extérieure (2), un récipient d'eau (3) à l'intérieur de ladite enveloppe, une cuve rotative (4) qui peut tourner à l'intérieur dudit récipient, un agitateur (7) monté en vue d'une agitation à l'intérieur d'un moyen d'interconnexion de ladite cuve tournante entre ladite cuve tournante, et ledit agitateur pouvant être mis en oeuvre pour permettre audit agitateur seul d'être agité vers l'arrière et vers l'avant de ladite cuve rotative et audit agitateur d'être tourné dans un seul sens et à une seule vitesse de rotation, caractérisé en ce que ledit agitateur est entraîné par un moteur électrique (30) conforme à la revendication 27, ledit arbre (13) entraînant ledit agitateur et ledit logement de palier étant fixé à une partie inférieure dudit récipient.

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