Oct. 11, 1960 E. J. BUSS ET AL 2,956,189

ELECTRICAL MACHINE ROTOR

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Fig. 1

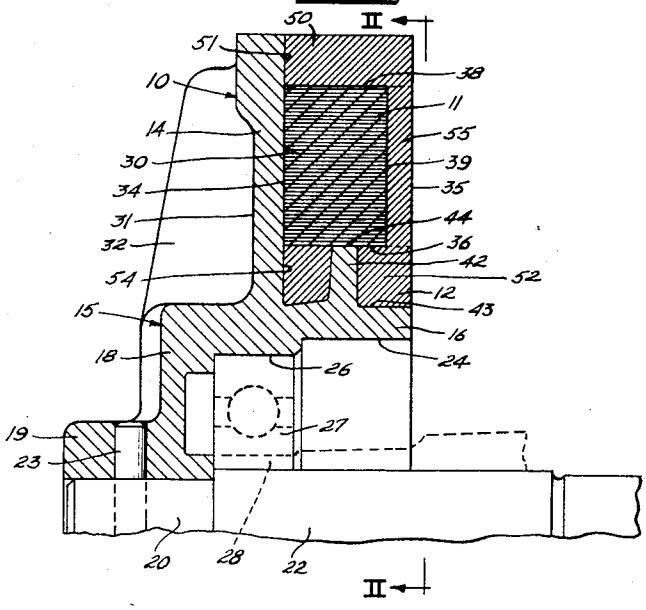
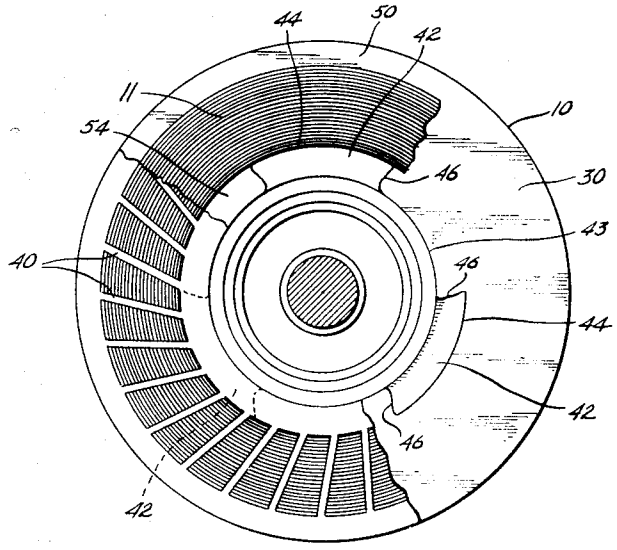


Fig. 2



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ELECTRICAL MACHINE ROTOR

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5 Claims. (Cl. 310—211)

This invention relates to improvements in rotors for electrical machines, and more particularly to an improved rotor construction for an electrical machine of the so-called axial air gap type.

An object of the present invention is to provide a unitary rotor comprised of a rotor frame, a magnetic core and a cast squirrel-cage type winding, wherein the rotor is characterized by an improved construction affording rigid assembly connection of the parts by the cast winding.

Another object is to provide a unitary rotor of the character indicated, wherein the rotor frame embodies means locating the core on the frame and serving in cooperation with the cast winding, to effect securement of the core and frame in rigid assembly.

A further object is to afford a rotor construction of the aforesaid character, which facilitates production of the cast winding by centrifugal casting to the frame and core.

Other objects and advantages attained will appear from the following description of a presently preferred embodiment of the invention, as such is illustrated by the accompanying drawing, wherein:

Fig. 1 is a sectional view of the improved rotor as taken at one side of its axis, and

Fig. 2 is a reduced, front elevation of the rotor with portions broken away to illustrate details thereof, the view being taken from line 2—2 in Fig. 1.

Referring to the drawing, the presently improved rotor is of the axial air gap type and comprises, essentially, a rotor frame **10**, a magnetic core member **11**, and a cast winding **12** of squirrel-cage form. Rotor frame **10** is a unitary member which is formed to provide a disc body **14** having a shaft-mounting hub structure generally indicated at **15**. The hub **15** includes an annular hub portion **16** projecting from one side of the body **14** and an annular hub portion **18** projecting from the other side of the body, the latter terminating in a shaft seating portion **19** receiving the end **20** of the rotor shaft **22** to which it is keyed or pinned, as by the pin **23**, for rotation of the rotor and shaft as a unit. The hub portion **16** presents an internal bore **24** providing access to a reduced internal bore **26** formed partly in hub portion **16** and in hub portion **18**, bore **26** receiving an anti-friction type bearing unit indicated at **27**, for rotatably supporting the rotor on a stationary part indicated at **28** in broken lines of the stator (not shown) with which the rotor cooperates.

The rotor frame body **14** provides an annular planar surface or face **30** on the side thereof from which the hub portion **16** projects, such face being in a plane transversely of the rotor axis and normal thereto. Integral with the opposite side **31** of the body and the hub portion **18** are a plurality of fan blades, one of which is shown at **32** in Fig. 1. Body surface **30** affords a mounting seat portion for the rotor core member **11** which, in rotor assembly, has its back planar side **34** in surface abutment with the frame face **30**. The core as shown, is an annular, laminated member of magnetic material, and preferably constructed of a single strip of sheet core iron punched to provide winding slots and wound in coil form. Construction of such a core may be in accordance with the teaching of Letters Patent 2,123,350 to G. R. Anderson. The core thus produced, has the back surface **34** heretofore noted, a parallel planar air gap face **35**, inner and outer circular peripheries **36** and **38** respectively, and winding slots **39** each extending to the gap face, as at **40** (Fig. 2) and open at the inner and outer core peripheries.

Location of the core on the frame seat portion **30** such that it will be in spaced, concentric relation to the frame hub portion **16**, on a center coincident with the rotational axis of the frame, is attained by hub projections or flanges **42** (three being shown in the present embodiment, Fig. 2) engaging the inner periphery **36** of the core. The projections or flanges **42** are generally radially outstanding on the outer circular surface **43** of hub portion **16**, and are equally angularly spaced about the hub, as shown in Fig. 2, and spaced outwardly from the body surface **30** as shown by Fig. 1. Each projection is elongate in the circular direction of the hub, and provides a curved peripheral edge or face **44** the curvature of which is on a radius having a center coincident with the rotational center of the rotor frame, and opposite end margins **46** which may be substantially radial or directed inwardly, as shown, at an acute angle to a radius. These projections or flanges **42** having the curved edges **44** in contact with the inner periphery **36** of the core, thus attain the desired centering of the core and serve in addition, as core mounting seat means in cooperation with the frame seat **30**, and as assembly locking means in a manner presently to appear.

In order to facilitate formation of the present unitary rotor, it is important that the rotor frame as now described, be constructed to afford both positional and dimensional accuracy of its parts, particularly in regard to the planar mounting face **30** and the hub-carried projections **42**. To such end, advantage is taken of the now well-known shell-molding process to produce the rotor frame as a shell-mold cast member of suitable material, such as iron or if desired, a non-magnetic metal. The resultant cast frame, presenting an improved casting characterized by uniform metal density and smooth, accurately formed surfaces, thus materially reduces the extent of any machining which may be necessary, as at the body surface **30** and projection edges **44**, for accurate core seating.

Having the rotor frame and core member each formed as now described, the core is positioned on the projections **42** and in abutment with frame body surface **30**, and the assembled parts are then placed in a mold for casting of the rotor winding **12** thereto. The winding, which may be of copper, aluminum or other suitable or desired conducting material, is cast preferably by centrifugal casting. For example, centrifugal casting thereof may be attained in accordance with the teachings of Letters Patent 2,304,067 to G. R. Anderson. The resulting cast winding provides an outer end ring **50** in cast connection to the outer periphery **38** of the core and to the outer annular face portion **51** of frame face **30** exposed beyond the core member; an inner end ring **52** in cast connection to the inner periphery **36** of the core, to the inner exposed portion **54** of frame face **30**, and to the hub projections **42**, the latter thus being embedded in the cast winding end ring **52**, and winding bars (such as bar **55** shown in Fig. 1) filling the core slots **39** and integrally joining the end rings **50** and **52**. The winding **12** as cast, thus effects a secure assembly connection of the rotor frame and core, wherein the projections **42** embedded in cast end ring **52** effectively key or lock the casting, and hence the core **11**, to the frame and its hub portion **16**.

It will be appreciated now that the present improve-

ments afford an electrical machine rotor characterized by simplicity and greater dimensional accuracy of construction, and by a unitary structure wherein the frame and core members are rigidly retained in assembly by the cast winding, as in the manner described.

Having described and illustrated one preferred embodiment of the invention, it is to be understood that various alterations and modifications may be made therein without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A rotor for an electrical machine of axial air gap type, comprising a rotor frame having a hub and providing a core-engaging surface, an annular magnetic core on said frame surface, flange means on said hub and in engagement with the core solely at its inner periphery, locating the core concentrically of the hub, and a winding of conducting material in cast assembly to the core, rotor frame and flange means, securing the frame and core in rigid assembly.

2. A rotor for an electrical machine of axial air gap type, comprising a rotor frame having a hub and providing a core-engaging surface, an annular slotted magnetic core on said frame surface, said core having a circular inner periphery, integral hub projections equally spaced about the hub and spaced from said frame surface, said projections engaging the said circular inner periphery of the core and locating the core concentrically of the hub, and a winding of conducting material in cast assembly to the slotted core, rotor frame and projections, securing the core and frame in rigid assembly.

3. A rotor for an electrical machine of axial air gap type, comprising a rotor frame having a hub providing a circular outer surface, said frame providing a planar core-receiving surface normal to the axis of the hub, an annular core on said planar surface, said hub having integral elements projecting radially from said outer hub surface and spaced axially from said planar surface, the elements engaging the core at its inner periphery and locating the core concentrically of the hub, and a winding of conducting material in cast assembly to the core, frame and elements, securing the frame and core in rigid assembly.

4. A rotor for an electrical machine of axial air gap type, comprising a rotor frame providing a disc body and a central hub, said body having a planar core-mounting face normal to the rotor axis, said hub including a shaft-engaging portion and a hub portion projecting axially from the planar face of said body, the hub further providing an axial bearing-receiving recess, a plurality of flange elements radially outstanding on said projecting hub portion and spaced from said planar face, an annular slotted core member of magnetic material, positioned in abutment with said planar body face and having its inner periphery engaging said flange elements, said flange elements disposing the core member in a position concentric of said hub portion, and a cast winding providing an outer end ring in cast connection to the frame and the outer periphery of the core member, an inner end ring in cast connection to the frame, the inner periphery of the core member and said flange elements, and winding bars in the slots of the core member and integral with the end rings, said cast winding thereby securing the frame and core member in rigid assembly.

5. A rotor member for electrical machines of axial air gap type, comprising a unitary, shell-mold cast rotor frame providing a hub, a disc body having a planar face normal to the axis of the hub, the hub including a hub portion projecting from said planar face, and flange elements radially outstanding on said hub portion and spaced from the planar face, said rotor frame being characterized by smooth as-cast surfaces; an annular core of magnetic material, having planar front and back surfaces and slots open at the front surface and at the inner and outer peripheral surfaces of the core, said core being disposed on the rotor frame with its back surface against said planar face and its inner peripheral surface in seating engagement with said flange elements, the flange elements seating the core concentrically of said hub portions; and a body of conducting material in centrifugally cast assembly to the core and rotor frame, providing an outer end ring embracing the core over its outer peripheral surface, an inner end ring in engagement with the inner peripheral surface of the core and with said hub portion and flange elements, and bars in the core slots between said end rings, said conducting material body as cast, securing the rotor frame and core in rigid assembly.

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Disclaimer

2,956,189.—*Edward J. Buss*, *Guy Russell Fansher*, *John H. Groves*, and *George E. O'Donald*, Freeport, Ill. ELECTRICAL MACHINE ROTOR. Patent dated Oct. 11, 1960. Disclaimer filed Jan. 3, 1966, by the assignee, *The Imperial Electric Company*.

Hereby enters this disclaimer to the remaining term of said patent. [*Official Gazette May 24, 1966.*]

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