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DIE-CAST SQUIRREL CAGE AND BLOWER

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Fig. 1.

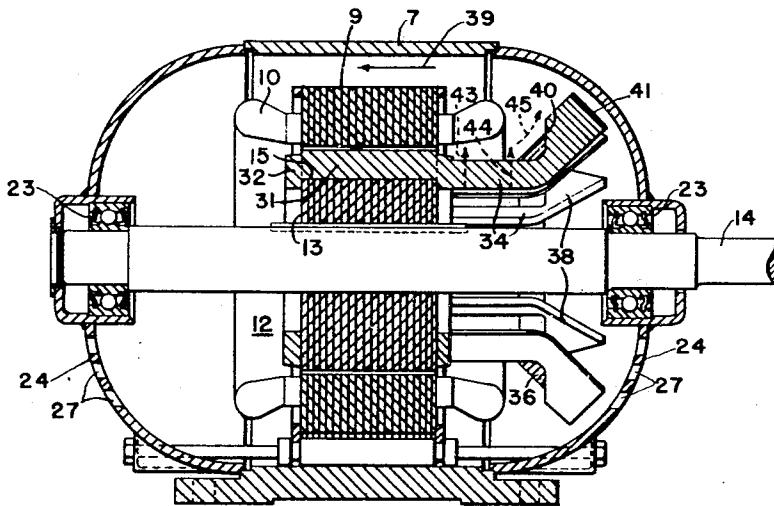
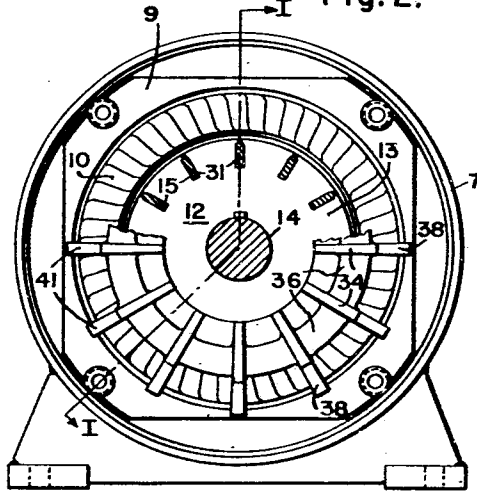


Fig. 2.



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DIE-CAST SQUIRREL CAGE AND BLOWER

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2 Claims. (Cl. 172-120)

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Our invention relates to single-end ventilated motors or other dynamo-electric machines, and it has particular relation to a die-cast squirrel-cage and blower-combined.

In some types of motors, it is desirable to utilize single-end ventilation, that is, to utilize an axial-flow fan or blower disposed at only one end of the rotor-member. In order to obtain sufficient pressure-head, it is desirable to have a blower with outwardly flaring vanes, the outer or peripheral diameter of which is greater than the outer or peripheral diameter of the rotor-core.

In squirrel-cage motors, it has also been customary to die-cast the squirrel-cage secondary winding, with straight, axially extending fan-vanes projecting out from one or both of the end-rings of the squirrel-cage, all cast integrally, in one operation. When over-diameter, axial-flow blowers have been utilized, with such a motor, it has been customary, because of casting difficulties, to build the axial-flow blower, with its outwardly projecting, over-diameter blades or vanes, as a separate, detachable blower-unit, mounted on a separate spider and hub of its own, and pressed onto the rotor-shaft, or otherwise detachably secured thereto. This has involved difficulties, due to the separate fan or blower occasionally becoming loose in operation, due either to errors in machining, or severe vibration-conditions, and when such a fan has become loose, it would either destroy the primary end-winding of the motor, or rub on the bracket.

We have found that proper attention to the design of the mold, with proper attention to removable fitted parts and split jackets, will overcome the molding difficulties in producing the required blower-shape, with the straight vanes projecting out from one of the squirrel-cage end-rings, parallel to the shaft, as before, and with outwardly inclined blade-extensions, extending out beyond the straight portions of the vanes, to provide the over-diameter, axial-flow blower-vanes. We have found that such an integral, die-cast, squirrel-cage and composite fan-construction can be made substantially as cheaply, or even more cheaply, than a construction utilizing a separate, detachable, axial-flow, over-diameter blower, thus overcoming the difficulties incident to a loosening of the detachable blower in service, and obtaining other advantages.

We have also found, however, that a functional difficulty is encountered, as well as a mechanical weakness, when the straight-vaned fan and the inclined-vane over-diameter fan are combined into a single fan, having vanes with a bend in

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them, at the joint between the straight part and the inclined part. The functional difficulty arises from the greater pressure-head which is created by the inclined outer portions of the blades or vanes, thus producing a tendency for the air which is blown toward the rotor-core, by the inclined blade-portions, to overcome the pressure-head of the radially flowing air which should flow radially outwardly from the straight blade-portions, thus producing a back-circulation, of air flowing radially inwardly across the straight part of the blades. The mechanical weakness that has been encountered is, of course, the insufficient ruggedness of the bent-blade construction, rendering it subject to breakage, before the complete assembly of the motor, when the rotor-part may be rolled around on the floor, or handled in any other way. The fact that the inclined blade-portions project out to a larger diameter than the diameter of the rotor-core, puts a severe strain on these blades in handling, necessitating the use of some kind of blade-reinforcement.

In accordance with our present invention, we have found that the functional difficulties, due to recirculation of air, can be cured at the same time as providing a circumferential bracing or reinforcement of the blades, by utilizing an inclined shroud-ring, which is cast integrally with the blades, at the bend therein, between the straight blade-portion and the inclined blade-portion, the outer face of the shroud-ring being funnel-shaped, with its smaller diameter next to the axial or straight blade-portions. The funnel-shaped outer surface of such a shroud-ring tends to direct the air, in a similar funnel-shaped path, away from the straight or axial blade-portions, and toward the outwardly inclined blade-portions, thus counteracting the tendency for the air to recirculate radially inwardly across the straight part of the blades.

The object of our invention is to provide a composite fan, with inclined vanes as well as straight or axial vanes, having an inclined shroud-ring, which serves also as a bracing-ring, disposed at the bend between the inclined blade-portions and the axially directed blade-portions.

With the foregoing and other objects in view, our invention consists in the dynamo-electric machines, the die-cast rotor-construction, the composite-fan construction, and the other combinations, parts, methods and assemblies hereinafter described and claimed, and illustrated in the accompanying drawing, wherein:

Figure 1 is a longitudinal sectional view of a

motor embodying our invention on the line I—I of Fig. 2; and

Fig. 2 is an end-view thereof, with the bracket removed to show the fan-construction in elevation.

The illustrated motor comprises a stator frame 7, having a laminated stator core 8, carrying stator-windings or primary windings 10; and a rotor-member 12 comprising a laminated rotor-core 13 carried by a shaft 14. The rotor-core has peripheral winding-receiving slots 15 therein. The rotor-shaft is supported in bearings 23 which are carried by brackets 24, which are secured to the stator-frame 7. The lower halves of the brackets 24 are perforated to provide air-vents 27.

In accordance with our invention, an integral squirrel-cage and fan are cast, on one integral piece, comprising squirrel-cage bars 31, lying in the rotor-core slots 15, a squirrel-cage resistance-ring or end-ring 32, joining the ends of the squirrel-cage bars at each end of the rotor-core, a plurality of substantially axial vanes 34 which extend from one of the squirrel-cage end-rings 32 in a direction approximately parallel to the shaft, an inclined, substantially triangular-sectioned shroud-ring 36 which is secured to the outer ends of the axial vanes 34, and a plurality of inclined vanes 38 having their inner ends secured to the shroud-ring 36. All this is cast in one die-cast operation. It will be noted that the shroud-ring 36 has an outer face 40 which is funnel-shaped, with its smaller diameter next to the axial vanes 34. It will be further noted that the inclined vanes 38 are directed, in the main, at an angle to the shaft, and that the extreme outer periphery of these inclined vanes, at the point furthest removed from the shaft, as shown at 41, has a diameter, which we may call the peripheral diameter, to designate the maximum diameter, which is greater than the peripheral diameter of the rotor-core 13. It will further be noted that the shroud-ring 36 is located in, and substantially confined to, the bend between the radially outward edges of the axial vanes 34 and the axially inward edges of the inclined vanes 38.

In operation, the inclined vanes 38 produce a pressure-head causing an axial flow of air through the machine, as shown by the arrow 39. The straight blade-portions 34 tend to produce an air-flow radially outwardly, as indicated at 43 and 44, thus ventilating the end-turns of the primary winding 10 at that end of the machine. The inclined or funnel-shaped outer surface 40 of the shroud-ring 36 cooperates with the outwardly projecting portions of the inclined blades 38, which project out radially from the large end of the funnel-shaped surface 40, to produce a corresponding funnel-shaped air flow, flowing outwardly, away from the shaft, as shown by the arrow 45, thus opposing any tendency for the air, as it is blown axially backwardly from the inclined blades 38, as shown at 39, to recirculate back inwardly, counter to the radial arrows 44, because of the greater pressure-head produced by the larger diameter of the inclined blades 38. At the same time, the shroud-ring 36 serves as a reenforcement or circumferential tie or brace, between the several blades, thus providing the blades with the necessary ruggedness and mechanical strength.

As a result of our invention, the cost is reduced, as compared to constructions utilizing separate, removable, axial-flow, over-diameter blowers; the heat-transfer is improved, by direct conduction from the resistance-ring of the squirrel-cage to the inclined vanes of the blower; and the blower is at once strengthened and functionally improved by the addition of the inclined shroud-ring at the bend of the vanes.

We claim as our invention:

1. A dynamo-electric machine characterized by a rotor-member including a shaft, a rotor-core member, and a fan comprising a plurality of substantially axial vanes which are approximately parallel to the shaft, at one end of the rotor-member, an inclined, substantially triangular-sectioned shroud-ring secured to the outer ends of the axial vanes, and a plurality of inclined vanes having their inner ends secured to shroud-ring, the outer face of the shroud-ring being funnel-shaped, with its smaller diameter next to the axial vanes, and the inclined vanes being directed, in the main, at an angle to the shaft, their outer ends having a peripheral diameter greater than the peripheral diameter of the rotor-core, the shroud-ring being located in, and substantially confined to, the bend between the radially outward edges of the axial vanes and the axially inward edges of the inclined vanes.

2. A dynamo-electric machine characterized by a rotor-member including a shaft, a laminated rotor-core carried by the shaft, the rotor-core having peripheral winding-receiving slots therein, and an integral squirrel-cage and fan construction comprising, in one integral piece, squirrel-cage bars lying in the rotor-core slots, a squirrel-cage end-ring joining the ends of the squirrel-cage bars at each end of the rotor-core, a plurality of substantially axial vanes which extend from one of the squirrel-cage end-rings in a direction approximately parallel to the shaft, an inclined, substantially triangular-sectioned shroud-ring secured to the outer ends of the axial vanes, and a plurality of inclined vanes having their inner ends secured to shroud-ring, the outer face of the shroud-ring being funnel-shaped, with its smaller diameter next to the axial vanes, and the inclined vanes being directed, in the main, at an angle to the shaft, their outer ends having a peripheral diameter greater than the peripheral diameter of the rotor-core, the shroud-ring being located in, and substantially confined to, the bend between the radially outward edges of the axial vanes and the axially inward edges of the inclined vanes.

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