United States Patent

Hunt

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[54] **DYNAMO ELECTRIC MACHINES**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.**.....**310/58**

[51] **Int. Cl.**.....**H02k 9/00**

[58] **Field of Search**.....310/52, 54, 53, 58, 59, 61, 310/64, 59

[56] **References Cited**

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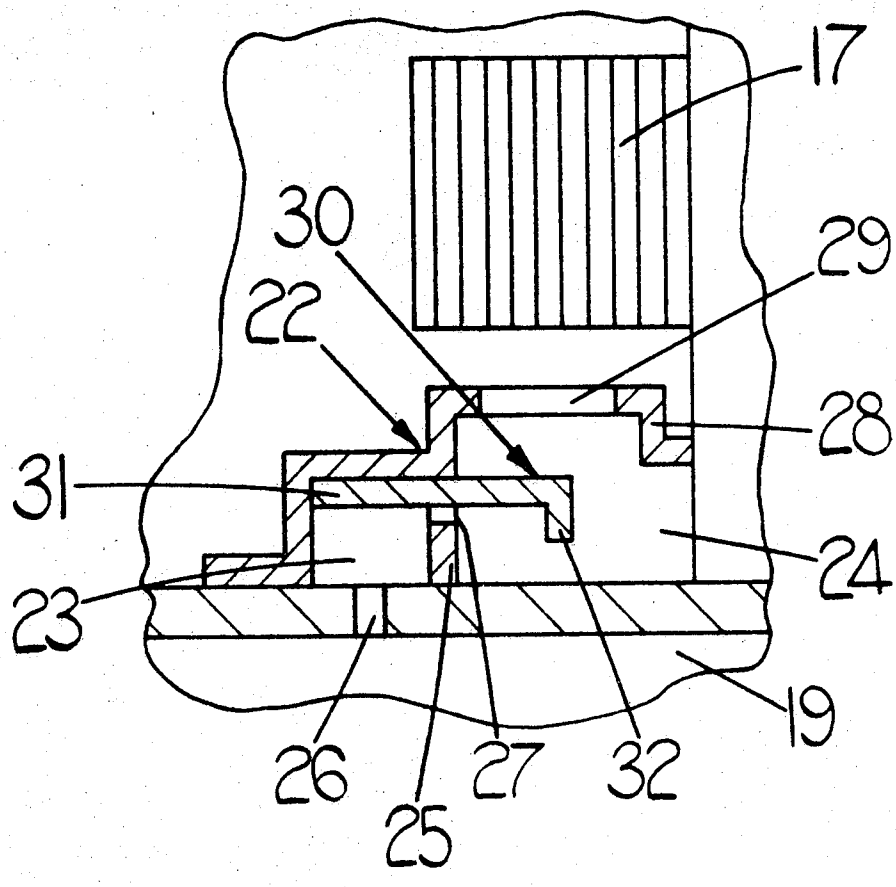
[57] **ABSTRACT**

This invention relates to a dynamo electric machine having a rotatable shaft with at least one machine component mounted on the shaft for rotation therewith. The shaft has an axial bore for the passage of a cooling fluid and cooling fluid distributor means mounted on the shaft for discharging cooling fluid on to the component. The cooling fluid distributor means comprises an annular chamber which communicates with the axial bore and with flow control means, the latter ensuring an even or substantially even discharge of fluid therefrom by means of centrifugal force when, in use, the shaft, the component, and the cooling fluid distributor means are rotated.

6 Claims, 3 Drawing Figures



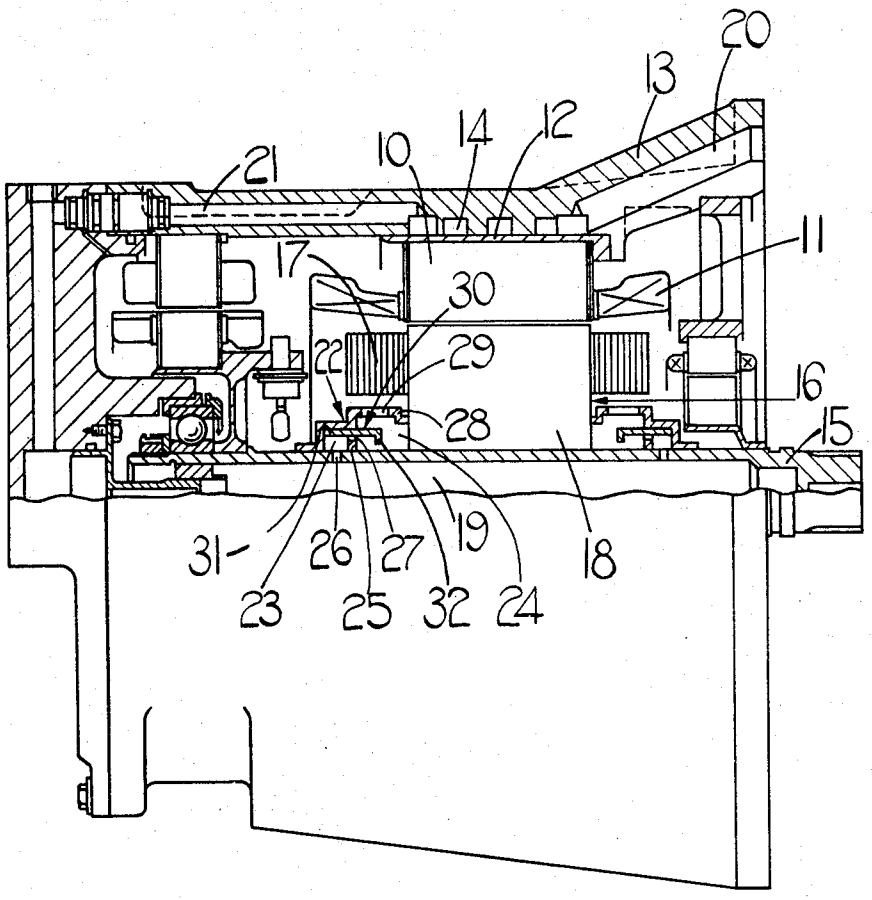


FIG. 1.

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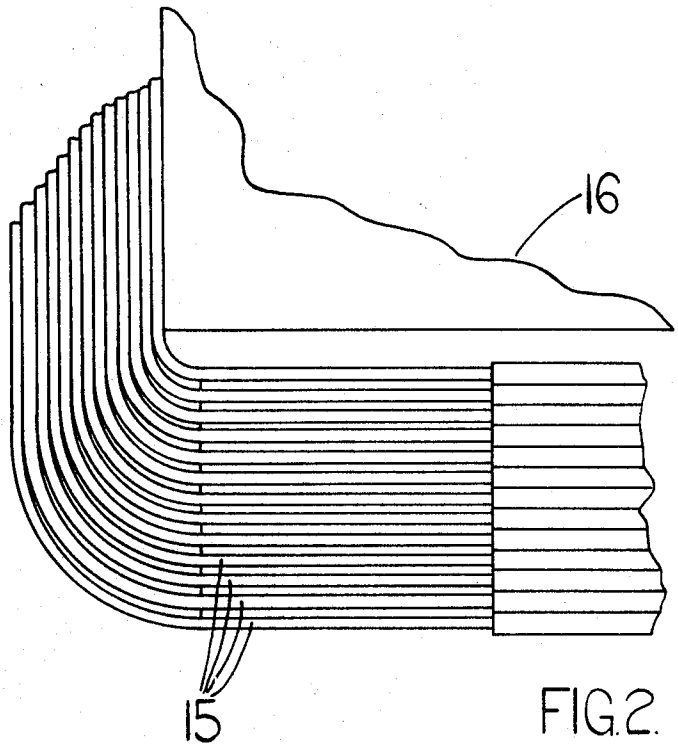

FIG. 2.

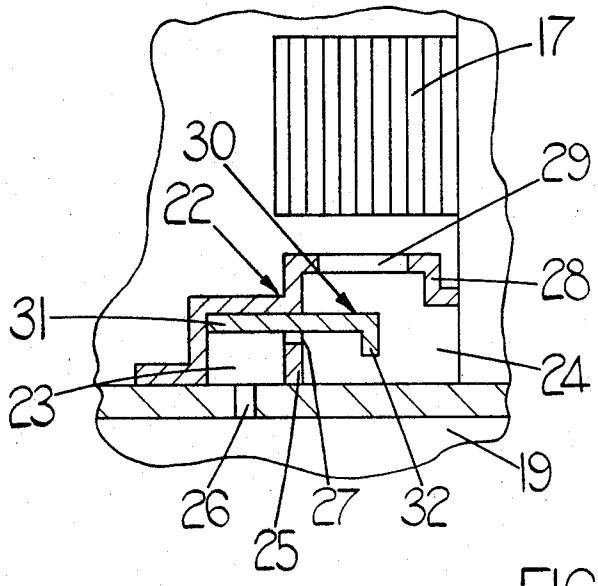

FIG. 3.

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DYNAMO ELECTRIC MACHINES

This invention relates to dynamo electric machines and more particularly to machines in which rotating components are cooled with cooling fluid. The object of the present invention is to provide a dynamo electric machine having improved means for discharging cooling fluid onto said rotating components of such a machine.

In accordance with the present invention there is provided a dynamo electric machine having a rotatable shaft with at least one machine component mounted on the shaft for rotation therewith, the shaft having an axial bore for the passage of a cooling fluid and cooling fluid distributor means mounted on said shaft for discharging cooling fluid onto said component, said cooling fluid distributor means comprising an annular chamber which communicates with said axial bore and with flow control means, the latter ensuring an even or substantially even discharge of fluid therefrom by means of centrifugal force when, in use, the shaft, said component, and said cooling fluid distributor means are rotated.

Conveniently, said component may be a rotor winding or a rectifier.

Preferably, said flow control means comprises an annular weir arranged so that the free edge of the weir is disposed radially inwardly of a plurality of apertures formed in a wall of said annular chamber and through which apertures cooling fluid can in use pass between said annular chamber and said annular weir, the arrangement being such that in use an annular reservoir of cooling fluid will be formed behind the weir when the shaft is rotated, said reservoir being in fact filled by means of cooling fluid which flows through said apertures and which is then held in position behind the weir by centrifugal force.

Desirably, said annular weir is disposed within a further annular chamber which is formed in its outer wall with a plurality of openings through which cooling fluid will, in use, be discharged, said apertured wall forming a partition between the two annular chambers.

Conveniently, where said component is a rotor winding, the end turns of said winding are axially spaced from each other, the arrangement being such that fluid discharging from the flow control means passes between the end turns to effect more efficient cooling thereof.

The invention will now be more particularly described with reference to the accompanying drawings wherein:

FIG. 1 is a partially sectioned view of one embodiment of a dynamo electric machine according to the present invention,

FIG. 2 shows the end turns of a rotor winding which is mounted on the shaft of the dynamo electric machine.

FIG. 3 is a fragmentary sectional view illustrating part of the dynamo electric machine shown in FIG. 1 on an enlarged scale.

Referring now to FIG. 1 of the drawings, there is shown an alternator, by way of example, which includes a stator **10** having stator windings **11**. Preferably, the stator is mounted inside a cylinder **12** which lies in contact with the inner surface of a casing **13** of the alternator. A scroll **14**, formed on the inside

of the casing **13**, is covered by said cylinder to provide a path for oil or other cooling fluid, which on passing through said scroll effects cooling of the stator.

A shaft **15** is journalled for rotation in bearings provided at each end of the shaft and the right hand end of the shaft **15** (as viewed in FIG. 1) is adapted to receive a driving device (not shown) for the alternator.

A machine component in the form of a rotor assembly **16** is mounted on the shaft **15** for rotation therewith and windings (only the end turns **17** of which are shown) are mounted on a rotor core **18** so as to provide a number of poles. The shaft **15** is formed with an axial bore **19** to provide a passage for the cooling fluid which is pumped (by means not shown) through a duct **20** formed in the casing, into the scroll **14** and thence through a further duct **21** and into the bore **19**.

Cooling fluid distributor means indicated generally by the reference numeral **22** are also mounted on the shaft **15** for rotation therewith, said cooling fluid distributor means being disposed radially inwardly of the end turns **17** of the rotor windings. The cooling fluid distributor means **22** comprise a first annular chamber **23** and a second annular chamber **24** which have an annular partition **25** disposed therebetween. The first annular chamber **23** is connected to the bore **19** for communication therewith by one relatively large aperture **26** and is connected to the second annular chamber **24** for communication therewith by a plurality of smaller axially extending apertures **27** provided near the radially outward edge of the partition **25**. The second chamber **24** is formed in its outer peripheral wall **28** with a plurality of openings preferably in the form of axially extending circumferentially spaced slots **29** through which cooling fluid, in use, is discharged. This second chamber is further provided with flow control means **30** for ensuring an even or substantially even discharge of fluid from the slots **24** in the outer peripheral wall **28** of the second chamber **24** by means of centrifugal force when, in use, the shaft **15**, the rotor assembly **16** and the cooling fluid distributor means **22** are rotated. The aforesaid flow control means **30** comprises a cylindrical tube **31** the outer periphery of which engages at its end remote from the rotor assembly **16** the interior of the outer peripheral wall of the first chamber **23** and which has a radially inwardly extending annular abutment **32** secured to or formed integrally with the other end thereof, the abutment **32** in effect, forming an annular weir. The latter is so arranged that its free edge is disposed radially inwardly of the apertures **27** formed in the partition **25** so that in effect an annular reservoir of cooling fluid will be formed behind the weir when the shaft **15** is rotated, said reservoir being filled by means of cooling fluid which is flung out through the aperture **26** and into the first chamber **23** by centrifugal force, said cooling fluid thence flowing through the partition apertures **27** and is then held in position behind the weir by centrifugal force. When the reservoir is, in use, full, the cooling fluid will flow past the weir and will thence be discharged through the slots **29** in the outer peripheral wall of the second chamber by centrifugal force. The provision of the weir ensures an even or substantially even discharge of fluid from the aforesaid slots which, by nature of their size, will not become clogged and this thus reduces the occurrence of possible hot spots (due to uneven cooling)

on the rotor windings to a minimum. Cooling fluid used in cooling the rotor windings falls into a sump (not shown) and may then be pumped away to a heat exchanger.

Conveniently, where said component is in the form of a rotor winding as is the case in the above described embodiment of the invention, then the end turns **17** of the rotor winding may be axially spaced from each other (as is more clearly shown in FIG. **2**) such that cooling fluid discharging from the slots **29** will pass between the end turns thus effecting more efficient cooling thereof.

In hitherto known arrangements for effecting cooling of components mounted on the shaft of a dynamo electric machine either small apertures have been formed in the wall of the shaft or spraying nipples have been mounted directly on the shaft or on a sleeve connected to the shaft. However, due to the smaller diameter of apertures through which the fluid has previously been discharged, these apertures have been subject to clogging, thus resulting in hot spots occurring on components which are to be cooled.

Although the invention has been described in relation to an alternator and the cooling of a rotor thereof, it could of course be applied to any other type of dynamo electric machine in which any component, such as a winding or a rectifying element, is to be cooled by cooling fluid.

Moreover, it is to be understood that the scroll **14** is not essential and it may thus be dispensed with if desired. In this case the ducts **20** and **21** may also be dispensed with, cooling fluid entering the axial bore **19** through an axially extending passage formed in one end of the alternator casing.

In addition, it is also to be understood that if desired the second annular chamber **24** may also be dispensed with.

I claim:

1. A dynamo electric machine having a rotatable shaft, at least one machine component mounted on the shaft for rotation therewith, an axial bore within the shaft for the passage of a cooling fluid and cooling fluid distributor means mounted on said shaft for discharging cooling fluid onto said component, said cooling fluid distributor means comprising an annular chamber which communicates with said axial bore and flow control means with which said annular chamber also communicates, said flow control means comprising an annular weir arranged so that the free edge of the weir is disposed radially inwardly of a plurality of apertures formed in a wall of said annular chamber and through which apertures cooling fluid can in use pass between said annular chamber and said annular weir, the arrangement being such that in use an annular reservoir of cooling fluid will be formed behind the weir when the shaft is rotated, said reservoir being filled by means of cooling fluid which flows through said apertures and which is then held in position behind the weir from which it is subsequently evenly discharged by means of centrifugal force.

2. A dynamo electric machine as claimed in claim **1** wherein said component is a rotor winding.

3. A dynamo electric machine as claimed in claim **1** wherein said component is a rectifier.

4. A dynamo electric machine as claimed in claim **1** wherein said annular weir is disposed within a further annular chamber which is formed in its outer wall with a plurality of openings through which cooling fluid will, in use be discharged, said apertured wall forming a partition between the two annular chambers.

5. A dynamo electric machine as claimed in claim **4** wherein said openings formed in the peripheral wall of said further chamber are in the form of axially extending circumferentially spaced slots.

6. A dynamo electric machine as claimed in claim **2** wherein the end turns of said winding are axially spaced from each other, the arrangement being such that fluid discharging from the flow control means passes between the end turns to effect more efficient cooling thereof.

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