Nov. 16, 1948. F. J. JOHNS 2,454,180

FRAME-STRUCTURES OF DYNAMOELECTRIC MACHINES

Filed Aug. 28, 1947

Fig. 1.

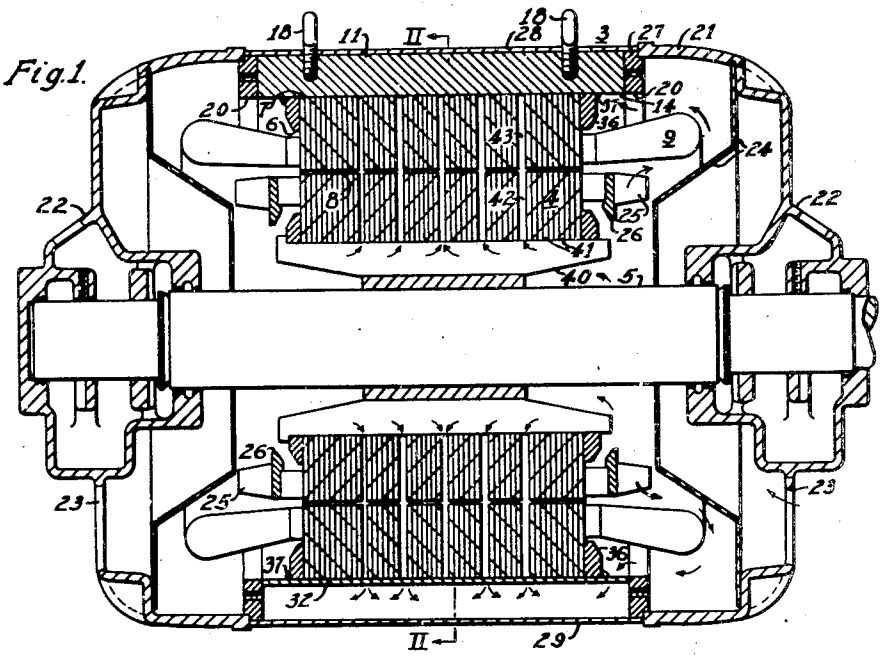
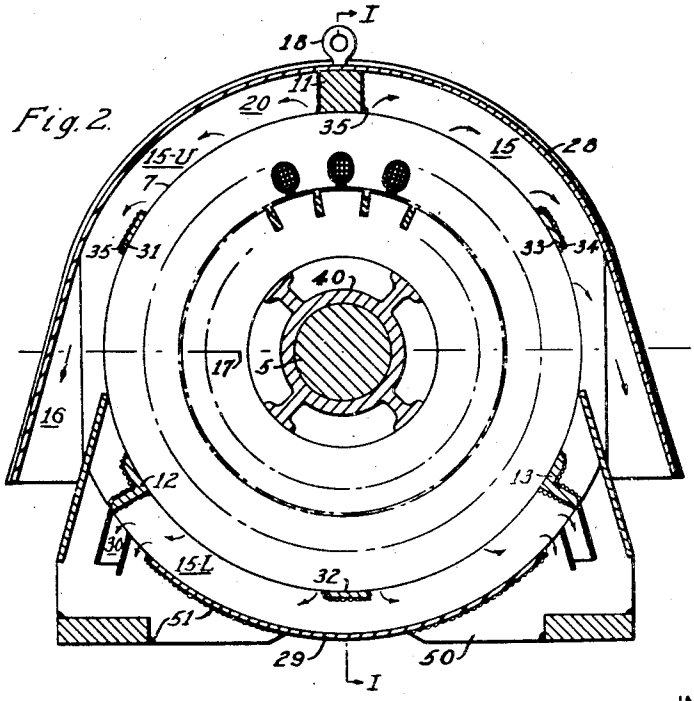


Fig. 2.



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Patented Nov. 16, 1948

2,454,180

UNITED STATES PATENT OFFICE

2,454,180

FRAME STRUCTURE OF DYNAMOELECTRIC MACHINES

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Application August 28, 1947, Serial No. 771,015

20 Claims. (Cl. 171—252)

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My invention relates to a novel structural assembly for the stator-members of large squirrel-cage motors or other dynamo-electric machines, in which various advantages are combined.

An object of my invention is to provide a stator member construction in which an annular ventilating-space is economically provided, in which air-obstructions are minimized, weight is reduced, and strength is maintained.

With the foregoing and other objects in view, my invention consists in the machines, constructions, combinations, parts and methods of assembly and operation, as subsequently described and claimed, and illustrated in the accompanying drawing, wherein:

Figure 1 is a longitudinal sectional view of a 300-horsepower, 4-pole, 60-cycle, polyphase squirrel-cage motor, embodying my invention by way of illustration, the section-plane being indicated at I—I in Fig. 2; and

Fig. 2 is a transverse sectional view of the machine, the plane being indicated by the line II—II in Fig. 1.

My invention is particularly applicable, as shown, to a horizontal-shaft machine having double-end ventilation, that is, a machine in which the ventilating-air is drawn into the machine from both ends thereof, and is discharged laterally of the machine, as will be subsequently described.

The illustrated machine essentially has a stator-member 3 and a rotor-member 4, the latter being mounted on a horizontal shaft 5. The stator-member 3 comprises a stack of annular stator-punchings 6 having a substantially cylindrical outer periphery 7, and having a bore 8 which defines an air gap surrounding the rotor-member 4. Stator-windings 9 are carried by the stator-punchings 6, near the bore thereof.

In accordance with my invention, the outer periphery 7 of the stator-punchings 6 is engaged by a plurality of radially thick punching-holding frame-bars 11, 12 and 13, as shown in Fig. 2. These frame-bars extend axially across the outer periphery of the stack of stator-punchings, and they also extend beyond both ends of the stack, as shown at 14 in Fig. 1. The radial thickness of these punching-holding frame-bars 11, 12 and 13 is equal to the radial thickness of the annular ventilating-space 15 which is to be provided around the outer periphery of the stator-punchings, as will be subsequently described.

Since these radially thick punching-holding frame-bars 11, 12 and 13 close the annular ventilating-space 15 against any circumferential

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movement of air past any one of said bars, it is quite desirable that the number of these radially thick frame-bars should be limited to a small number, such as two or three, or possibly four. Since it is desirable that outlet-openings 16 shall be provided, along each side of the stator-frame, below the center-line 17 of the stator-member, it is desirable that one of these radially-thick frame-bars, such as the bar 11, shall be placed at the top of the stator-punchings 6, where no circumferential air-flow is needed; and it is further essential that no other radially thick frame-bar shall be provided above a point which is below the level of the outlet-opening 16 which discharges air from the top portion of the machine, along each side of the machine. Thus, in the illustrated construction, as shown in Fig. 2, the radially-thick frame-bars 11 and 12, which are not at the top of the machine, are disposed at points which are partway up on the underside of the stator-punchings 4, that is, below the center-line 17 of the stator punchings.

The disposition of one of the frame-bars 11 at the top center of the machine is advantageous in providing an anchorage for two lifting-rings 18, which are provided for the motor. This top frame-bar 11 is thus advantageously a solid bar of approximately square or rectangular shape. The other two radially-thick frame-bars 11 and 12 need not be solid, but may advantageously be of angular section, as shown in Fig. 2.

The ends of the three thick frame-bars 11, 12 and 13 are secured to two annular frame-rings 20, which are of sufficient thickness to provide an attachment-means for the two end-brackets 21. Each end-bracket 21 has a bearing-member 22 for supporting the rotor-shaft 5, and has also one or more inlet-openings 23 for ventilating-air. On the inside, each end-bracket 21 is also provided with baffle-means 24, for cooperating with rotor-member fan-means which are provided in the form of blower-blades 25 which are cast integrally with the squirrel-cage winding 26 of the rotor-member 4, these blower-blades 25 being provided at each end of the rotor-member.

Each of the annular frame-rings 20 has a substantially annular outer periphery 27 which is substantially flush with the outer surfaces of the thick frame-bars 11, 12 and 13. A sheet-like top enclosure-member 28 is provided, which extends over the top frame-bar 11, and the top portions of the two frame-rings 20, for defining an upper annular ventilating-space 15—U, between said top enclosure-member 28 and the periphery 7 of the stator-punchings 6. A sheet-like bottom en-

closure-member 29 is also provided, which extends over the bottom portions of the two frame-rings 20, for defining a lower annular ventilating-space 15—L, between the bottom enclosure-member 29 and the periphery 7 of the stator-punchings 6.

Two lateral outlet-means 16 and 30 are provided, along each side of the motor, for discharging air from the ends of the top and bottom enclosure-members 28 and 29 respectively, as shown in Fig. 2, the air-flow being indicated by the arrows. In the illustrated form of embodiment of my invention, these two outlet-openings 16 and 30 are in the vicinity of the lowermost thick frame-bars 12 and 13, respectively, the outlet-openings 16 being above the bars 12 and 13, while the outlet-openings 30 are below the same. The advantage of providing the upper outlet-opening 16 below the center-line 17 of the machine is that it can discharge its air downwardly so that the machine will be drip-proof.

Since the upper and lower enclosure-members 28 and 29 do not take any substantial part of the weight of the stator-member, they may be of relatively light plates, in a fabricated construction. Nevertheless, with respect to the rigidity of the complete stator-assembly, these top and bottom enclosure-plates 28 and 29 contribute considerable rigidity to the entire assembly.

It is desirable that there shall be at least one radially thick, axially extending frame-bar 11, placed at the top of the machine, and in general, it is desirable that there shall be no other radially thick bars around the top half of the stator-punchings, or until a point is reached which is considerably below the center-line 17, as indicated by the positions of the bars 12 and 13 in Fig. 2. In general, it is desirable, from considerations of structural rigidity, to have one or more radially thick axially extending frame-bars, such as 12 or 13, located somewhere along the lower portion of the stator-punchings, but preferably not at any point between the illustrated positions of the bars 11 and 12 and the extreme bottom of the punchings, so as not to interfere with the radial air-movement at this lower part of the stator-frame, as shown by the arrows in Fig. 2.

In large machines, to which my invention is primarily (but not altogether) applicable, it is not enough to provide such a small number of axially disposed punching-holding frame-bars as the bars 11, 12 and 13; because if this were the case, the punchings would tend to spread out axially, at points in between the radially thick frame-bars 11, 12 and 13. I therefore provide a plurality of radially thin, axially extending punching-retaining means, which are shown in the form of frame-bars 31, 32 and 33 which preferably have their ends secured to the two frame-rings 20. These thin punching-supporting frame-bars 31, 32 and 33 are disposed at a suitable number of intermediate points around the circumference of the stator-punchings 6, between the thick frame-bars 11, 12 and 13.

Preferably, all six frame-bars 11, 12, 13, 31, 32 and 33 are secured to the end-rings 20 by welding 34, and to the punchings 6 by welding 35. Preferably also, as shown in Fig. 1, each end of the stack of stator-punchings 6 is engaged by an end plate or ring 36, which is welded at 37 to the respective frame-bars 11, 12, 13, 31, 32 and 33.

In the operation of my invention, the rotor-mounted fan or blower 25 operates as a ventilating-means for causing ventilating-air to enter through the inlet-openings 23 at the respective ends of the machine, and to flow radially outwardly past the end-portions of the stator-windings 9 at that end of the machine, and to flow thence radially outwardly past the end-portions 14 of the frame-bars 11, 12, 13, 31, 32 and 33, where said frame-bars extend between the end of the stack of stator-punchings 6 and the frame-ring 20 at that end of the machine. The ventilating-air thus enters the upper and lower annular ventilating-spaces 15—U and 15—L, in which the air is free to spread out or flow both axially and circumferentially over the outer periphery 7 of the stator-punchings 6, cooling the same.

It is an important feature of my invention that the ventilating-air is discharged from the upper annular ventilating-space 15—U, as well as from the lower annular ventilating-space 15—L, at axially extending outlet-openings 16 and 30, respectively, which are below the center-line 17 of the machine, so that the top half of the machine is completely closed, so as to render the machine drip-proof. To this end, it is necessary to provide a frame-construction in which there is no radially thick frame-bar between the top center of the machine, at the position occupied by the frame-bar 11, and a point considerably below the center-line 17, on each side of the machine, as at the positions occupied by the frame-bars 12 and 13; but this long arcuate space, between the bar 11 and the bar 12, or between the bar 11 and the bar 13, is too long to leave the stator punching-stack unrestricted or free to bulge out axially; and hence I provide intermediate thin frame-bars 31 and 33, at intermediate points within this space. The thinness of these bars provides for an ample air-flow space, or radial-displacement, between the flat tops of these thin bars 31 and 33 and the top enclosure-plate 28, so that the circumferential flow of the ventilating-air is substantially unrestricted, as said air flows out of the top part of the upper ventilating-space 15—U to the exhaust-openings 16 on either side of the machine.

At the extreme bottom edge of the stator-punchings 6, I provide a third thin frame-bar 32, but there is no substantial circumferential air-flow at this point, and hence, so far as ventilation is concerned, this bottom frame-bar 32 can have any radial thickness which may be dictated by considerations of strength and weight,

A second ventilating-path is also provided, which involves an air-flow from the inlet-openings 23 in the end-brackets 21, into the inner portions of the rotor-member 4, where a rotor-spider 40 supports the rotor-core or stack of rotor-laminations 41. The rotor-spider 40 also provides a plurality of central axial ducts or passageways through the rotor-members 4. The rotor-core 41 is provided with a plurality of radially extending ventilating-openings 42, which are in alignment with corresponding radial ventilating-openings 43 in the stator-core or punchings 6. The rotation of the rotor-member 4 causes this member to act as a centrifugal fan, which draws in ventilating-air, from both ends of the machine, and causes it to flow radially outwardly through the radial ventilating-spaces 42 and 43 in the rotor and stator-members respectively, whence it discharges into the upper and lower annular ventilating-spaces 15—U and

15—L, where the air is free to move or expand both axially and circumferentially, while it ventilates the outer periphery of the stator-punchings 6, on its way to the lateral outlet-vents 16 and 30 respectively.

As is common in the art, a foot-assembly 50 is made separately, and secured to the cylindrical frame-assembly by suitable welding 51.

My novel frame-construction thus provides a completely fabricated stator-assembly, all parts of which are made from standard steel sections, involving no burning or other expensive operations. The machine is drip and splash-proof, rugged, and light in weight. Experience has shown that the machine has unusually good ventilation, due to the fact that there are no obstructions in the necessary air-paths, thus causing the machine to run appreciably cooler than similar machines of the same rating.

While I have illustrated my invention in a single illustrative form of embodiment, I wish it to be understood that my invention is not limited to this single precise form, as many changes of substitution, omission and addition can be made by those skilled in the art, while still embodying one or more of the essential features of my invention. I desire, therefore, that the appended claims shall be given the broadest construction consistent with their language.

I claim as my invention:

1. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, a plurality of radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, only one of said thick frame-bars being in the region extending from the top to a point below the centerline of the stack of stator-punchings on either side thereof, and that one being at the top, an annular frame-ring secured to the ends of the plurality of thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, ventilating-means for causing ventilating-air to enter through said inlet-openings at the respective ends of the machine and to flow radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, and a plurality of radially thin, axially extending, punching-retaining means, secured to the outer periphery of the stack of stator-punchings at intermediate points between the thick frame-bars, for preventing axial spreading of said stack while permitting annular airflow in radial spaces between said thin punching-retaining means and the associated enclosure-member.

2. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, three radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, one of said thick frame-bars being at the top, and the other two being at the sides below the center-line of the stator-punchings, an annular frame-ring secured to the ends of the three thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, ventilating-means for causing ventilating-air to enter through said inlet-openings at the respective ends of the machine and to flow radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, outlet-means for providing outlets, in the vicinity of the two lowermost thick frame-bars, respectively, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, below the centerline of the stator-punchings, and a plurality of radially thin, axially extending, punching-retaining means, secured to the outer periphery of the stack of stator-punchings at intermediate points between the thick frame-bars, for preventing axial spreading of said stack while permitting annular airflow in radial spaces between said thin punching-retaining means and the associated enclosure-member.

3. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, a plurality of radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-

punchings, only one of said thick frame-bars being in the region extending from the top to a point below the centerline of the stack of stator-punchings on either side thereof, and that one being at the top, an annular frame-ring secured to the ends of the plurality of thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, and end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, and a plurality of radially thin, axially extending, punching-retaining means, secured to the outer periphery of the stack of stator-punchings at intermediate points between the thick frame-bars, for preventing axial spreading of said stack while permitting annular air-flow in radial spaces between said thin punching-retaining means and the associated enclosure-member; the stack of stator-punchings having one or more radial ventilating-openings therein, and said rotor-member having one or more corresponding radial ventilating-openings therein, and one or more central axial ducts therethrough, whereby ventilating-air flows radially outwardly through said radial ventilating-openings and then distributes itself axially and circumferentially in said annular ventilating-spaces on its way out to said outlet-means.

4. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, three radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings, one of said thick frame-bars being at the top, and the other two being at the sides below the centerline of the stator-punchings, an annular frame-ring secured to the ends of the three thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two-frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, and a plurality of radially thin, axially extending punching-retaining means, secured to the outer periphery of the stack of stator-punchings at intermediate points between the thick frame-bars, for preventing axial spreading of said stack while permitting annular air-flow in radial spaces between said thin punching-retaining means and the associated enclosure-member; the stack of stator-punchings having one or more radial ventilating-openings therein, and said rotor-member having one or more corresponding radial ventilating-openings therein, and one or more central axial ducts therethrough, whereby ventilating-air flows radially outwardly through said radial ventilating-openings and then distributes itself axially and circumferentially in said annular ventilating-spaces on its way out to said outlet-means.

5. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said rotor-member having fan-means for drawing in air, at both ends of the machine, for ventilating purposes; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, a plurality of radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, only one of said thick frame-bars being in the region extending from the top to a point below the centerline of the stack of stator-punchings on either side thereof, and that one being at the top, an annular frame-ring secured to the ends of the plurality of thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, and having baffle-means carried by each end-bracket for causing at least some of the inlet-air to enter the rotor fan-means at that end of the machine and to flow thence radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, and a plurality of radially thin, axially extending, punching-retaining means, secured to the outer periphery of the stack of stator-punch-

ings at intermediate points between the thick frame-bars, for preventing axial spreading of said stack while permitting annular air-flow in radial spaces between said thin punching-retaining means and the associated enclosure-member.

6. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said rotor-member having fan-means for drawing in air, at both ends of the machine, for ventilating purposes; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator windings carried by the stator-punchings near the bore thereof, three radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, one of said thick frame-bars being at the top, and the other two being at the sides below the centerline of the stator-punchings, an annular frame-ring secured to the ends of the three thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, and having baffle-means carried by each end-bracket for causing at least some of the inlet-air to enter the rotor fan-means at that end of the machine and to flow thence radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, outlet-means for providing outlets, in the vicinity of the two lowermost thick frame-bars, respectively, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, below the centerline of the stator-punchings, and a plurality of radially thin, axially extending, punching-retaining means, secured to the outer periphery of the stack of stator-punchings at intermediate points between the thick frame-bars, for preventing axial spreading of said stack while permitting annular air-flow in radial spaces between said thin punching-retaining means and the associated enclosure-member.

7. The invention as defined in claim 5, characterized by the stack of stator-punchings having one or more radial ventilating-openings therein, and said rotor-member having one or more corresponding radial ventilating-openings therein, and one or more central axial ducts therethrough, whereby ventilating-air flows radially outwardly through said radial ventilating-openings and then distributes itself axially and circumferentially in said annular ventilating-spaces on its way out to said outlet-means.

8. The invention as defined in claim 6, characterized by the stack of stator-punchings having one or more radial ventilating-openings therein, and said rotor-member having one or more corresponding radial ventilating-openings therein, and one or more central axial ducts therethrough, whereby ventilating-air flows radially outwardly through said radial ventilating-openings and then distributes itself axially and circumferentially in said annular ventilating-spaces on its way out to said outlet-means.

9. The invention as defined in claim 1, characterized by said thin, axially extending, punching-retaining means being frame-bars having their ends secured to said frame-rings.

10. The invention as defined in claim 2, characterized by said thin, axially extending, punching-retaining means being frame-bars having their ends secured to said frame-rings.

11. The invention as defined in claim 3, characterized by said thin, axially extending, punching-retaining means being frame-bars having their ends secured to said frame-rings.

12. The invention as defined in claim 4, characterized by said thin, axially extending, punching-retaining means being frame-bars having their ends secured to said frame-rings.

13. The invention as defined in claim 5, characterized by said thin, axially extending, punching-retaining means being frame-bars having their ends secured to said frame-rings.

14. The invention as defined in claim 6, characterized by said thin, axially extending, punching-retaining means being frame-bars having their ends secured to said frame-rings.

15. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, a plurality of radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, only one of said thick frame-bars being in the region extending from the top to a point below the centerline of the stack of stator-punchings on either side thereof, and that one being at the top, an annular frame-ring secured to the ends of the plurality of thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, ventilating-means for causing ventilating-air to enter through said inlet-openings at the respective ends of the machine and to flow radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclo-

sure-member and the periphery of the punchings, and outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine.

16. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, three radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, one of said thick frame-bars being at the top, and the other two being at the sides below the centerline of the stator-punchings, an annular frame-ring secured to the ends of the three thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, ventilating-means for causing ventilating-air to enter through said inlet-openings at the respective ends of the machine and to flow radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, and outlet-means for providing outlets, in the vicinity of the two lowermost thick frame-bars, respectively, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, below the centerline of the stator-punchings.

17. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, a plurality of radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings, only one of said thick frame-bars being in the region extending from the top to a point below the centerline of the stack of stator-punchings on either side thereof, and that one being at the top, an annular frame-ring secured to the ends of the plurality of thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, and outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine; the stack of stator-punchings having one or more radial ventilating-openings therein, and said rotor-member having one or more corresponding radial ventilating-openings therein, and one or more central axial ducts therethrough, whereby ventilating-air flows radially outwardly through said radial ventilating-openings and then distributes itself axially and circumferentially in said annular ventilating-spaces on its way out to said outlet-means.

18. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, three radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator punchings, one of said thick frame-bars being at the top, and the other two being at the sides below the centerline of the stator-punchings, an annular frame-ring secured to the ends of the three thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, and outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine; the stack of stator-punchings having one or more radial ventilating-openings therein, and said rotor-member having one or more corresponding radial ventilating-openings therein, and one or more central axial ducts therethrough, whereby ventilating-air flows radially outwardly through said radial ventilating-openings and then distributes itself axially and circumferentially in said annular ventilating-spaces on its way out to said outlet-means.

19. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said rotor-member having fan-means for drawing in air, at both ends of the machine, for ventilating purposes; said stator-member com-

prising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator-windings carried by the stator-punchings near the bore thereof, a plurality of radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, only one of said thick frame-bars being in the region extending from the top to a point below the centerline of the stack of stator-punchings on either side thereof, and that one being at the top, an annular frame-ring secured to the ends of the plurality of thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame-ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, and having baffle-means carried by each end-bracket for causing at least some of the inlet-air to enter the rotor fan-means at that end of the machine and to flow thence radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, and outlet-means for providing outlets, below the centerline of the stator-punchings, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine.

20. A horizontal-shaft dynamo-electric machine having a stator-member and a rotor-member; said rotor-member having fan-means for drawing in air, at both ends of the machine, for

ventilating purposes; said stator-member comprising a stack of annular stator-punchings having a substantially cylindrical outer periphery, and having a bore defining an air gap surrounding the rotor-member, stator windings carried by the stator-punchings near the bore thereof, three radially thick punching-holding frame-bars extending axially across the outer periphery of said stack of stator-punchings and extending beyond both ends of the stack, one of said thick frame-bars being at the top, and the other two being at the sides below the centerline of the stator-punchings, an annular frame-ring secured to the ends of the three thick frame-bars at each end of the machine, said frame-rings having a substantially annular outer periphery which is substantially flush with the outer surfaces of the thick frame-bars, an end-bracket secured to each frame ring, each end-bracket having a bearing-member for supporting the rotor-member, and having one or more inlet-openings for ventilating-air, and having baffle-means carried by each end-bracket for causing at least some of the inlet-air to enter the rotor fan-means at that end of the machine and to flow thence radially outwardly over the end-turns of the stator-windings and thence to flow radially outwardly past the end portions of the frame-bars where they extend between the end of the stack of stator-punchings and the frame-ring at that end of the machine, a sheet-like top enclosure-member extending over the top frame-bar and the top portions of the two frame-rings for defining an upper annular ventilating-space between said top enclosure-member and the periphery of the punchings, a sheet-like bottom enclosure-member extending over the bottom portions of the two frame-rings for defining a lower annular ventilating-space between said bottom enclosure-member and the periphery of the punchings, and outlet-means for providing outlets, in the vicinity of the two lowermost thick frame-bars, respectively, for discharging air from the ends of the top and bottom enclosure-members, along the sides of the machine, below the centerline of the stator-punchings.

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No references cited.