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SELF-VENTILATED DYNAMOELECTRIC MACHINE HAVING AN AIR CLEANER

Filed Sept. 3, 1949

Fig. 1.

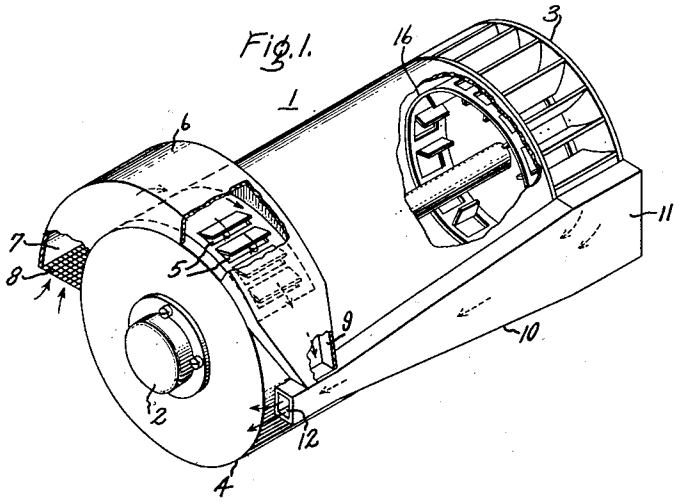


Fig. 2

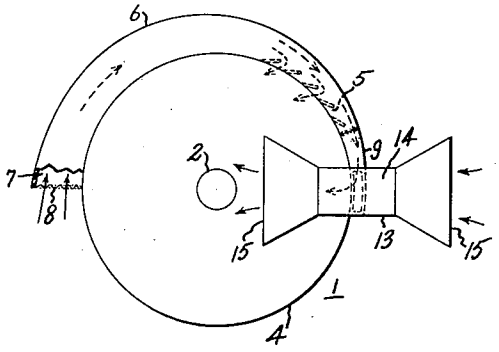
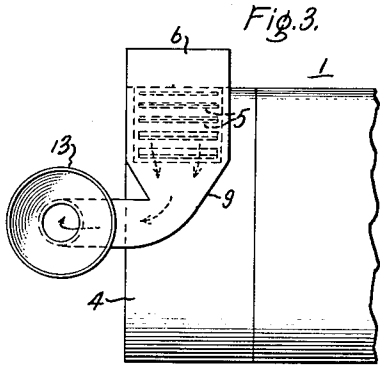


Fig. 3.



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SELF-VENTILATED DYNAMOELECTRIC MACHINE HAVING AN AIR CLEANER

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9 Claims. (Cl. 183—79)

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This invention relates to dynamoelectric machines of the self-ventilated type and more particularly to dynamoelectric machines having a dirt separating air cleaner, for example, traction motors.

Railway traction motors are commonly mounted either on the truck proper or partially supported by the axle. This location is particularly dirty in operation and, since traction motors are usually of the air cooled type, it is necessary to restrain dirt, dust, snow and other objects from entering the motor and thus causing sticking of the brushes in the holders, insulation damage, and adversely affecting heat transfer to the cooling air. In the past, cooling air has been taken from inside the body of the vehicle, thus obtaining cleaner air, but introducing many problems in duct design. It is, therefore, desirable in the design of some types of traction motors to provide a self-ventilated motor having its own fan for drawing ventilating air through the machine. However, in applications where the car or locomotive is operated over dirty roadbed in which the ballast consists of a considerable amount of cinders and sand, it has been found that the dirt blown up by the rapid motion of the vehicle and drawn into a self-ventilated motor will sand blast the insulation completely off the corners of the field coils and erode the copper winding. It is, therefore, desirable in the design of self-ventilated traction motors to provide air cleaning means which will present low restriction to the entrance of ventilating air into the interior of the machine, but which will separate a maximum amount of the dirt from the air before it is passed through the machine.

An object of this invention is to provide an improved dynamoelectric machine having a dirt separating air cleaner.

A further object of this invention is to provide an improved dynamoelectric machine having a dirt separating air cleaner wherein low restriction is presented to the entrance of air into the motor and the maximum amount of dirt is separated from the air before it enters the motor.

Further objects and advantages of this invention will become apparent and the invention will be better understood from the following description referring to the accompanying drawings, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In accordance with one aspect of this invention, a cover is provided on the end of the motor

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remote from the fan having a plurality of louver openings formed therein for admitting the ventilating air to the interior of the machine. A curved scroll passage surrounds a part of the cover and communicates with the louver openings. The scroll passage has a converging configuration with its large end open to the atmosphere for collecting air and the passage is arranged so that the louver openings are adjacent the small end so that the ventilating air enters the passage at low velocity and is accelerated toward the louver openings. The louver openings face away from the exterior opening of the scroll passage so that the ventilating air must make a sharp bend to enter the interior of the motor. Thus, the dirt contained in the air, having been accelerated by virtue of the converging configuration of the scroll passage, due to its greater mass does not enter the louver openings but continues toward the small end of the scroll passage. The louvers are arranged so that dirt cascades thereover under the influence of gravity into the small end of the scroll passage. Another air passage is provided having a converging configuration with its large end arranged to collect a part of the air discharged by the fan and its small end open to the atmosphere. The small end of the scroll passage communicates with the small end of the second air passage to form an aspirator, the air collected from the fan being accelerated over the small end of the scroll passage to suck the separated dirt out of the scroll passage and to blow the dirt into the atmosphere. In accordance with a further aspect of this invention, a Venturi tube is substituted for the second air passage to provide the aspirator for sucking dirt out of the scroll passage.

In the drawing, Fig. 1 is a view in perspective, partly in section, illustrating the improved dirt separating air cleaner of this invention; Fig. 2 is an end view, partly in section, illustrating a modified form of this invention; and Fig. 3 is a side elevational view of the embodiment of Fig. 2.

Referring now to Fig. 1, there is shown a traction motor 1 having a shaft 2 adapted to drive the vehicle in any conventional manner. The motor 1 is provided with a fan, shown at 16, at one end thereof for drawing ventilating air through the interior of the motor and a shroud and baffle assembly 3 surround the fan to form a fan outlet. In order to provide for the admission of ventilating air into the interior of the motor under the influence of the fan and to separate dirt contained in the air prior to its entrance into the motor, the arrangement now to be described

is provided. A cylindrical cover member 4 is arranged on the end of the machine remote from the fan, usually the commutator end, and is provided with a plurality of louver openings 5 for admitting ventilating air into the interior of the machine. A curved converging scroll passage 6 is arranged surrounding a part of the cover member 4 and communicating with the louver openings 5 for directing the ventilating air thereto. The scroll passage 6 has an exterior air entrance opening 7 formed at its large end, which opening may be covered by a coarse mesh screen 8 for preventing the entry of very large particles such as leaves, sticks, etc. The scroll passage 6 is positioned so that the louver openings 5 are adjacent its small end 9 and the louver openings are arranged so that they face away from the exterior opening 7 and toward the small end 9 of the scroll passage 6. By virtue of the converging configuration of the scroll passage 6, ventilating air enters the exterior opening 7 at low velocity and is accelerated toward the louver openings 5. Since the louver openings 5 face away from the opening 7, the ventilating air is required to make a sharp bend to enter the interior of the motor. The acceleration of the air in the scroll passage 6 forces some of the entrained dirt against the outer surface of the scroll passage by centrifugal force. Furthermore, the air is able to negotiate the sharp bend into the louver openings while the dirt, because of its greater mass, continues toward the small end 9 of the scroll passage 6. The louvers 5 are arranged so that the heavy particles of dirt which may fall cascade thereover under the force of gravity into the small end 9 of the scroll passage 6 without entering the openings. The combined action of these three functions causes a large portion of the dirt contained in the air drawn into the opening 7 to enter the small end 9 of scroll passage 6 rather than entering the louver openings 5.

In order to exhaust the dirt collected in the small end 9 of the scroll passage 6 into the atmosphere, another air passage 10 is provided having a converging configuration with its large end 11 arranged to collect a portion of the air exhausted by the fan through the fan outlet 3 and its small end 12 open to the atmosphere. The small end 9 of the scroll passage 6 communicates with the air passage 10 adjacent its small end 12. The converging configuration of the air passage 10 accelerates the air collected from the fan over the opening 9 of the scroll passage 6 so that a vacuum is produced at this point due to its effect as an aspirator. Thus, the dirt in the small end 9 of scroll passage 6 is sucked out of the scroll passage and blown into the atmosphere out of a small end 12 of the air passage 10. It will be readily apparent that this air cleaning construction is applicable not only to traction motors, but to any self-ventilated machine.

It may be found that the ventilating fan will not produce sufficient pressure to provide for efficient separation of dirt or, particularly in the case of a traction motor, the construction of the air passage 10 along the frame of the motor may not be practical. In such a situation, particularly where the vehicle speed is normally high, the arrangement of Figs. 2 and 3 may be utilized. Referring now to Figs. 2 and 3, in which like elements are indicated by like reference numerals, a Venturi tube 13 is arranged with its mid-point 14 communicating with the small end 9 of the scroll passage 6 and its enlarged ends 15 communicating with the atmosphere. In this arrangement, the Venturi tube 13 is oriented in a direction parallel to the direction of travel of the vehicle so that the motion of the vehicle forces air into the Venturi tube 13 producing a vacuum at the small end 9 of the scroll passage 6 to suck out the dirt and to blow it into the atmosphere. It will be readily apparent that this embodiment is operable in either direction of vehicle motion so that a motor equipped with this air cleaner would be completely interchangeable for either truck position or for either direction of vehicle motion.

Tests made with an air cleaner of the type disclosed above indicate that the cleaning efficiency based on the weight of the dirt separated as compared with the total weight of the dirt introduced at the opening 7 is 80% or better. It will now be seen that this invention provides an improved air cleaner for self-ventilated apparatus, particularly traction motors, which separates and discharges to the atmosphere a substantial quantity of the dirt contained in the cooling air without permitting the dirt to enter the interior of the machine.

While I have illustrated and described particular embodiments of this invention, modifications thereof will occur to those skilled in the art. I desire it to be understood, therefore, that this invention is not to to be limited to the particular arrangements disclosed, and I intend, in the appended claims, to cover all modifications which do not depart from the spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A self-ventilated dynamoelectric machine comprising a fan for drawing ventilating air therethrough, a cover member for said machine having an opening formed in its peripheral surface at one end thereof for admitting ventilating air to said machine under the influence of said fan and a second opening formed in its peripheral surface at the other end thereof for discharging air from said machine, a passage member having an air entrance at one end thereof and communicating with said first opening for directing air thereto, a second passage member having one end communicating with said second opening for collecting air discharged from said machine and its other end communicating with the other end of said first passage member for sucking dirt out of said first passage member and for blowing said dirt into the atmosphere.

2. A self-ventilated dynamoelectric machine comprising a fan for drawing ventilating air therethrough, a cover member having a louver opening formed in its outer periphery at one end thereof for admitting ventilating air to said machine under the influence of said fan and another opening formed in its outer periphery at the other end thereof for discharging air from said machine, a passage member having an air entrance at one end thereof and communicating with said louver opening for directing air thereto, said louver having its opening facing away from said air entrance so that ventilating air is required to make a sharp bend when entering said machine whereby dirt contained in said ventilating air due to its greater mass does not enter said louver opening but continues into the other end of said passage member, and a second passage member having one end communicating with said other

opening for collecting air discharged therefrom and its other end communicating with said other end of said first passage member for sucking dirt out of said other end of said first passage member and for blowing said dirt into the atmosphere.

3. A self-ventilated dynamoelectric machine comprising a fan for drawing ventilating air therethrough, cylindrical cover member having a plurality of louver openings formed in its peripheral surface at one end thereof for admitting ventilating air to said machine under the influence of said fan and a plurality of other openings formed in its peripheral surface at the other end thereof for discharging air from said machine, a scroll passage member surrounding part of the peripheral surface of said cover and communicating with said louvers for directing air thereto, said passage member having an air entrance at one end thereof, said louver openings facing away from said air entrance so that said ventilating air is required to make a sharp bend when entering said machine whereby dirt contained in said air due to its greater mass does not enter said louver openings but continues toward the other end of said passage member, said louvers being arranged so that said dirt cascades thereover under the influence of gravity into said other end of said passage member, and a second passage member having one end communicating with at least a part of said other openings for collecting air discharged therefrom and its other end communicating with said other end of said first passage member for sucking dirt out of said other end of said first passage member and for blowing said dirt into the atmosphere.

4. A self-ventilated dynamoelectric machine comprising a fan for drawing ventilating air therethrough, a cover member having a plurality of louver openings formed in its peripheral surface at one end thereof for admitting ventilating air to said machine under the influence of said fan and a plurality of other openings formed in its peripheral surface at the other end thereof for discharging air from said machine, a passage member communicating with said louvers and having a converging configuration with an air entrance formed at the large end thereof, said passage member being positioned so that said louvers are adjacent the small end thereof whereby air enters said passage member at low velocity and is accelerated toward said louvers, said louver openings facing away from said air entrance so that said ventilating air is required to make a sharp bend when entering said machine so that dirt contained in said air due to its greater mass does not enter said louver openings but continues to small end of said passage member, and a second passage member having one end communicating with at least a part of said other openings for collecting air discharged therefrom and having its other end communicating with said small end of said first passage member for sucking dirt out of said small end of said first passage member and for blowing said dirt into the atmosphere.

5. A self-ventilated dynamoelectric machine compring a fan for drawing ventilating air therethrough, a cylindrical cover member for said machine having a plurality of louver openings formed in its peripheral surface at one end thereof for admitting ventilating air to said machine under the influence of said fan, and a plurality of other openings formed in its peripheral surface at the other end thereof for discharging air from said machine, a curved scroll passage member surrounding a part of the peripheral surface of said cover and communicating with said louvers, said passage member having a converging configuration with an air entrance at its large end, said passage member being positioned so that said louvers are adjacent the small end thereof whereby air enters said passage member at low velocity and is accelerated toward said louvers, said louver openings facing away from said air entrance so that said ventilating air is required to make a sharp bend when entering said machine whereby dirt contained in said ventilating air due to its greater mass does not enter said louver openings but continues toward the small end of said passage member, said louvers being arranged so that said dirt cascades thereover into said small end of said passage member under the influence of gravity without entering said openings, and a second passage member having one end communicating with at least a part of said other openings for collecting air discharged therefrom and its other end communicating with said small end of said first passage member for sucking dirt out of said small end of said first passage member and for blowing said dirt into the atmosphere.

6. A self-ventilated dynamoelectric machine having a fan at one end thereof for drawing ventilating air therethrough, a cover member having a louver opening formed in its peripheral surface at the end remote from said fan for admitting ventilating air to said machine under the influence of said fan and another opening in its peripheral surface at the end adjacent said fan for discharging air from said machine, a passage member having an air entrance at one end thereof and communicating with said louver for directing ventilating air thereto, and a second passage member having one end communicating with said other opening for collecting air discharged therefrom and its other end opened to the atmosphere, the other end of said first passage member communicating with said second passage member so that said air collected from said other opening is passed over the other end of said first-mentioned passage member whereby said second passage member acts as an aspirator for sucking dirt out of said first-mentioned passage member and for blowing said dirt into the atmosphere.

7. A self-ventilated dynamoelectric machine having a fan at one end thereof for drawing ventilating air therethrough, a cylindrical cover member having a plurality of louver openings formed in its peripheral surface at the end remote from said fan for admitting ventilating air to said machine under the influence of said fan and a plurality of other openings formed in its perpiheral surface at the end adjacent said fan for discharging air from said machine, a passage member communicating with said louvers and having a converging configuration with an air entrance at its large end, said passage member being arranged so that said louvers are adjacent the small end thereof whereby air enters said passage member at low velocity and is accelerated toward said louvers, and a second passage member communicating with at least a part of said other openings for collecting air discharged therefrom and having its other end open to the atmosphere, the small end of said first-mentioned passage member communicating with said second

passage member, said second passage member converging from said one end toward said other end, so that said air collected from said other openings is accelerated over the small end of said first-mentioned passage member whereby said second passage member acts as an aspirator for sucking dirt out of said first-mentioned passage member and for blowing said dirt into the atmosphere.

8. A self-ventilated dynamoelectric machine comprising a fan at one end thereof for drawing ventilating air therethrough, a cylindrical cover member having a plurality of louver openings formed in its peripheral surface at the end remote from said fan for admitting ventilating air to said machine under the influence of said fan, and a plurality of other openings formed in its peripheral surface at the end adjacent said fan for discharging air from said machine, a curved scroll passage member surrounding a part of said peripheral surface of said cover and communicating with said louvers for directing air thereto, said passage member having a converging configuration with an air entrance at its large end and being positioned so that said louvers are adjacent its small end whereby air enters said passage member at low velocity and is accelerated toward said louvers, said louvers being arranged with their openings facing away from said air entrance so that said ventilating air is required to make a sharp bend when entering said louver openings whereby the dirt contained in said air due to its greater mass does not enter said louvers but continues toward said small end of said passage member, said louvers being arranged so that said dirt cascades thereover under the influence of gravity into said small end of said passage member without entering said louver openings, and an air passage member having one end communicating with at least a part of said other openings for collecting air discharged therefrom, said small end of said scroll passage member communicating with said last-named passage member adjacent its end remote from said other openings, said remote end of said last-named passage member being open to the atmosphere, said last-named passage member converging from said one end toward said open end for accelerating the air collected from said other openings over said small end of said scroll passage member whereby said last-named passage member acts as an aspirator for sucking dirt out of said small end of said scroll passage member and for blowing said dirt into the atmosphere.

9. A self-ventilated dynamoelectric machine comprising a fan at one end thereof for drawing ventilating air therethrough, a cover member having a louver opening formed in its peripheral surface at one end thereof for admitting ventilating air to said machine under the influence of said fan and another opening formed in said peripheral surface at the other end thereof for discharging therefrom said machine, a passage member communicating with said louver for admitting ventilating air thereto, said passage member having a converging configuration with an air entrance at its large end and being positioned so that said louver is adjacent the small end thereof whereby air enters said passage member at low velocity and is accelerated toward said louver, said louver opening facing away from said air entrance so that said ventilating air is required to make a sharp bend when entering said louver opening whereby the dirt contained in said air due to its greater mass does not enter said louver but continues toward said small end of said passage member, said louver being arranged so that said dirt cascades thereover into said small end of said passage member under the influence of gravity without entering said louver opening, and another passage member having one end communicating with said other opening for collecting air discharged therefrom, said small end of said first-mentioned passage member communicating with said last-named passage member adjacent its end remote from said other opening, said remote end of said last-named passage member being open to the atmosphere, said last-named passage converging from said one end toward said open end for accelerating the air collected from said other opening over said small end of said first-named passage member whereby said last-named passage member acts as an aspirator for sucking dirt out of the said first-mentioned passage member and for blowing said dirt into the atmosphere.

JOHN H. CRANKSHAW.

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