Apr. 24, 1923. 1,453,159

P. A. H. MOSSAY ET AL

COOLING OF DYNAMO ELECTRIC MACHINES

Filed Jan. 16, 1919 4 Sheets-Sheet 1

Fig. 1.

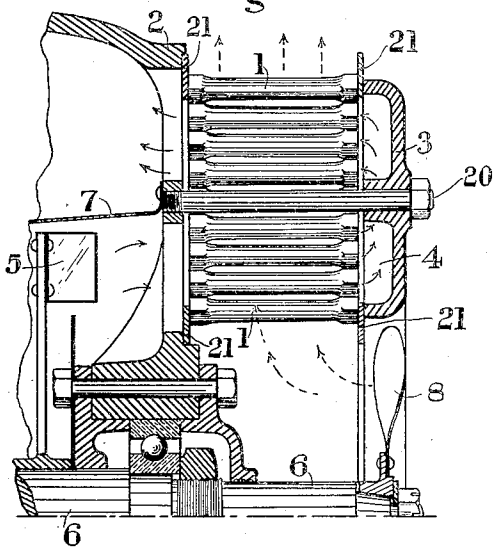


Fig. 2.

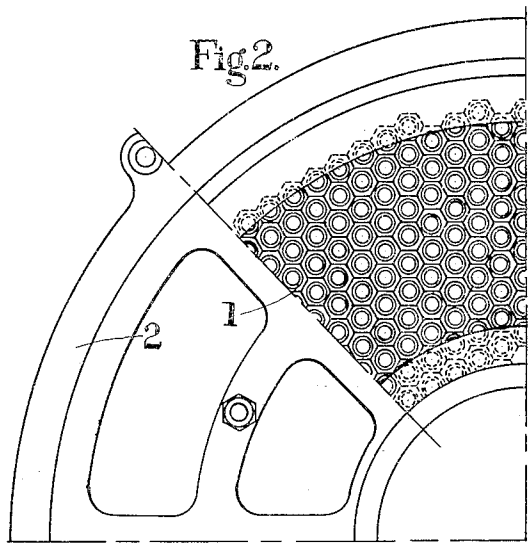
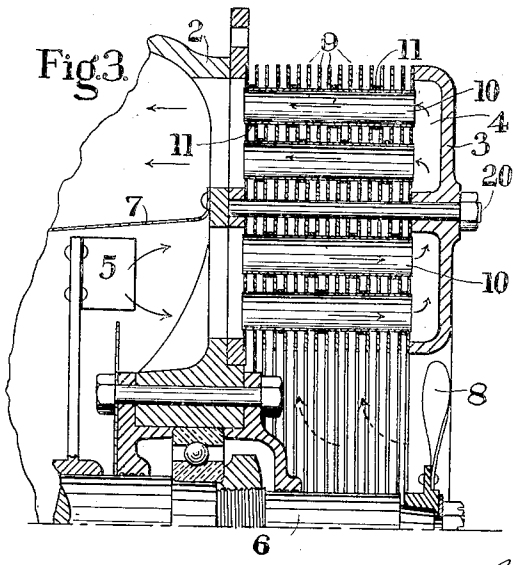


Fig. 3.



Inventors
Paul A. H. Mossay,
Henry C. E. Jacoby,
by
Kenyon & Kenyon
their Attorneys.

Apr. 24, 1923. 1,453,159

P. A. H. MOSSAY ET AL

COOLING OF DYNAMO ELECTRIC MACHINES

Filed Jan. 16, 1919 4 Sheets-Sheet 2

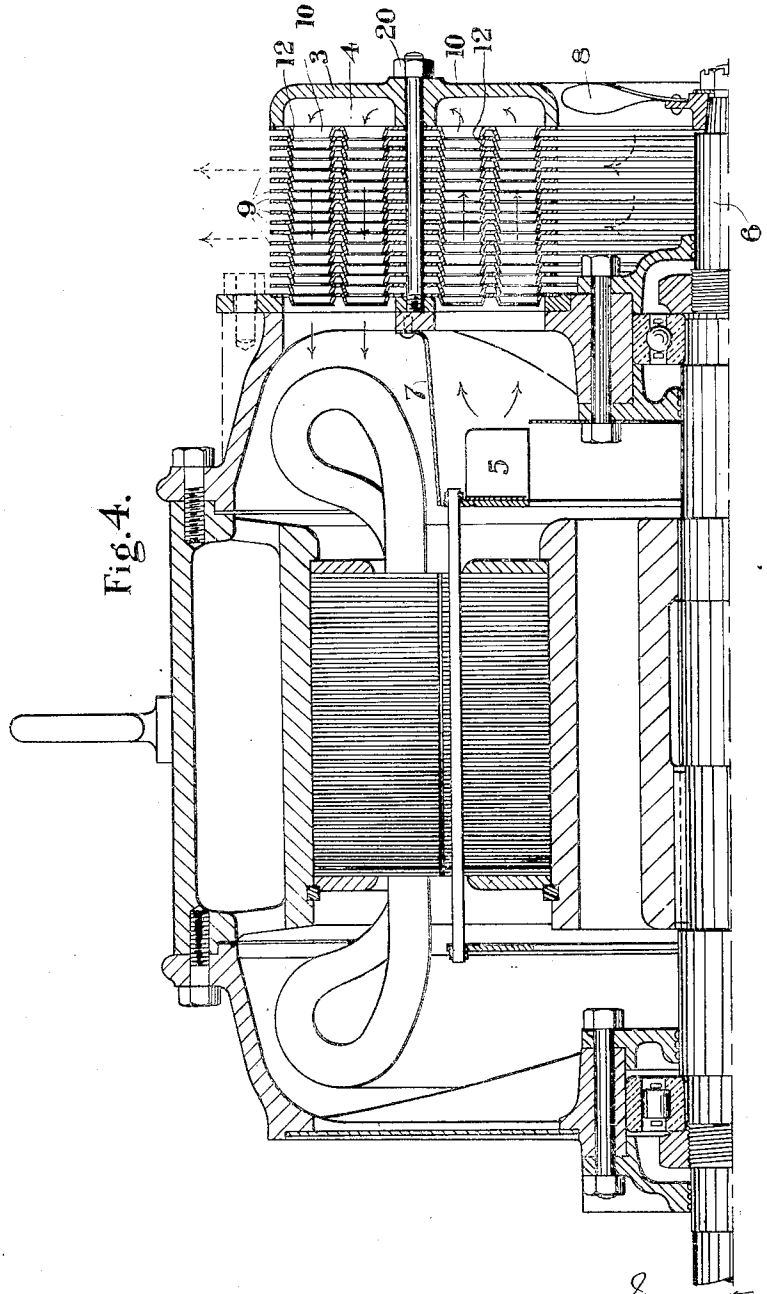


Fig. 4.

Inventors:
Paul A. H. Mossay
Henry C. E. Jacoby
by
Kenyon & Kenyon
their attorneys.

Apr. 24, 1923. 1,453.159

P. A. H. MOSSAY ET AL

COOLING OF DYNAMO ELECTRIC MACHINES

Filed Jan. 16, 1919 4 Sheets-Sheet 3

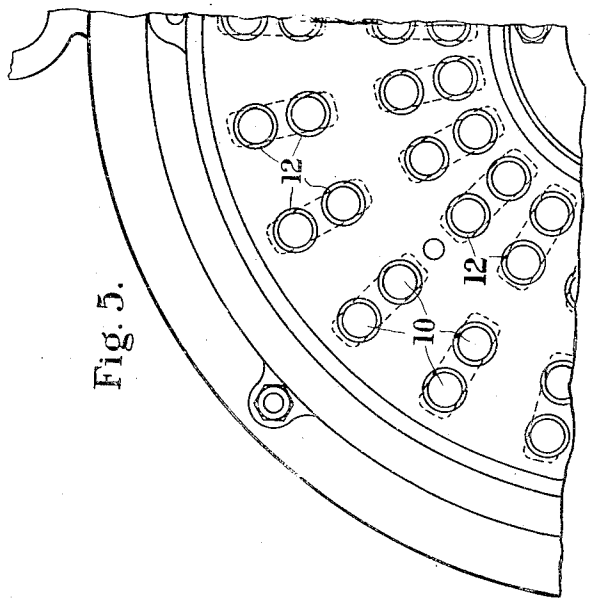


Fig. 5.

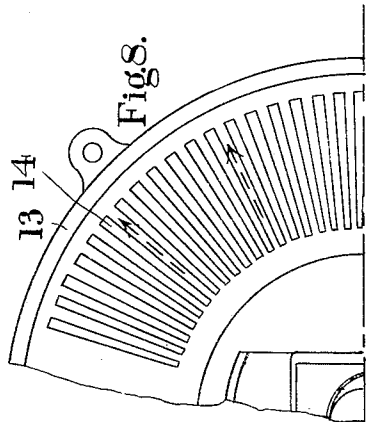


Fig. 8.

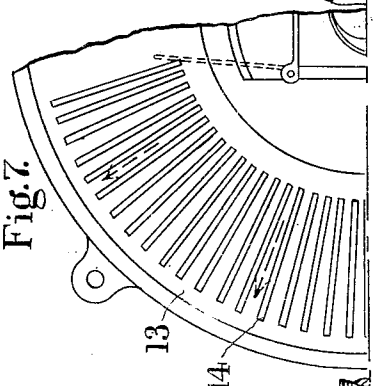


Fig. 7.

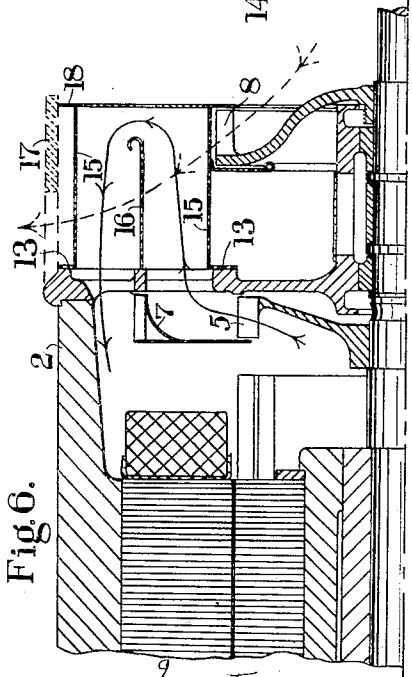


Fig. 6.

Inventors:
Paul A. H. Mossay
Henry C. L. Jacobby
by
Kenyon & Kenyon
their attorneys.

Apr. 24, 1923. 1,453,159

P. A. H. MOSSAY ET AL.

COOLING OF DYNAMO ELECTRIC MACHINES

Filed Jan. 16, 1919 4 Sheets-Sheet 4

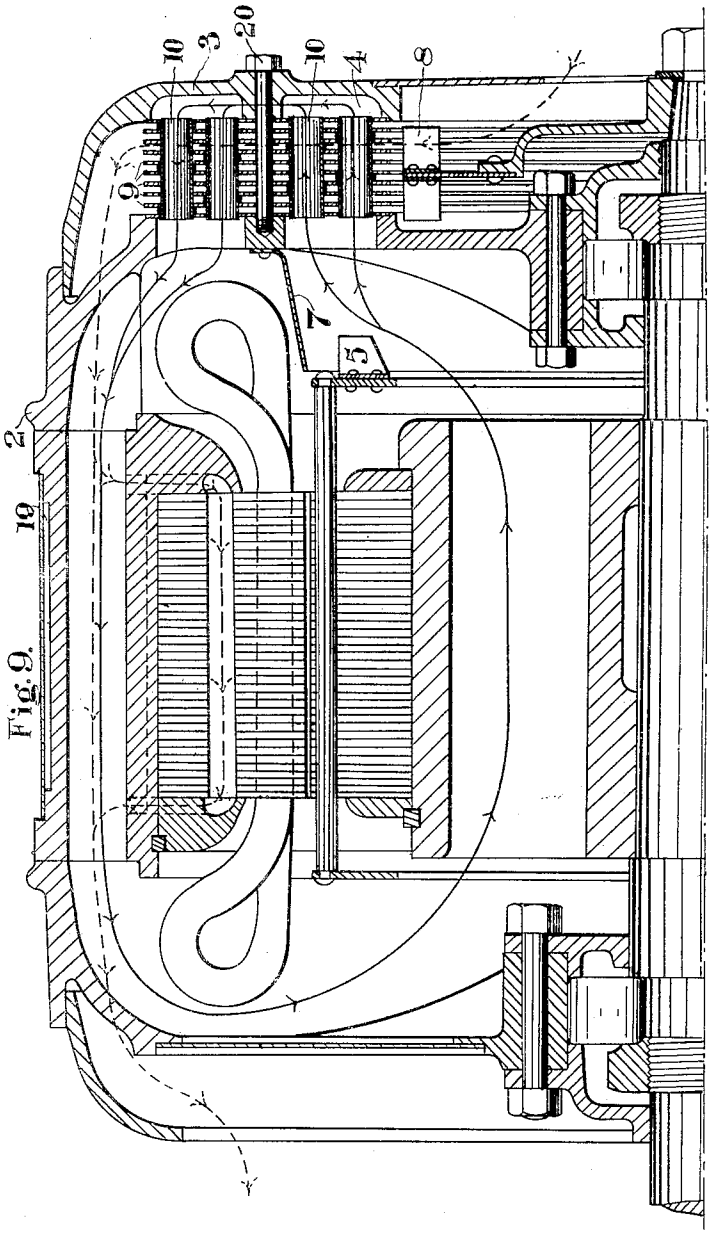


Fig. 9.

Inventors:
Paul A. H. Mossay,
Henry C. E. Jacoby
by Kenyon & Kenyon
their Attorneys

Patented Apr. 24, 1923. 1,453,159

UNITED STATES PATENT OFFICE.

PAUL ALPHONSE HUBERT MOSSAY AND HENRY CHARLES EDWARD JACOBY, OF LONDON, ENGLAND.

COOLING OF DYNAMO-ELECTRIC MACHINES.

Application filed January 16, 1919. Serial No. 271,381.

To all whom it may concern:

Be it known that PAUL ALPHONSE HUBERT MOSSAY and HENRY CHARLES EDWARD JACOBY, subjects of the King of the Belgians and the King of Great Britain, respectively, residing at London, England, have invented certain new and useful Improvements in the Cooling of Dynamo-Electric Machines, of which the following is a specification.

This invention relates to improvements in the cooling of dynamo electric machines, for example enclosed motors for use in dusty, explosive damp or other deleterious atmospheres. In order to cool machines of this type it has been proposed, for example in Patent No. 1,320,781, to circulate the hot internal air of the machine through channels in the casing, and to pass streams of cooling fluid, such as cold air, through other channels separated from the hot air channels by thin metallic walls so that the internal air is cooled by the rapid heat exchange through the walls.

The arrangement referred to necessitates a specially designed casing.

The primary object of the present invention is to provide highly efficient cooling means which can be applied to casings of ordinary design, and if desired, without necessitating any material alteration in such design, although the invention may be combined with a casing of the particular kind referred to when a still higher cooling efficiency is required.

Briefly stated the invention consists in a cooling device, capable of being applied as an adjunct to the end or other appropriate part of the casing of a dynamo electric machine, and through which device the internal air of the machine, and a cooling fluid, can be passed, either in the same or in different directions, without intermixing, and in the form of a multiplicity of small streams, separated by thin walls or partitions of heat conductive material. In this way a very large aggregate area of metallic heat exchange surface is obtained with a relatively small increase in the overall dimensions of the machine, in contradistinction to known cooling devices comprising cumbersome corrugated or gilled water-boxes let into extensions of the motor casing, and external air or water cooled radiators, arranged as superstructures.

The accompanying drawings illustrate several modes of carrying out the invention, similar numerals, where used, denoting corresponding parts.

Figures 1 and 2 are respectively a side sectional elevation and end elevation of part of a dynamo electric machine with one form of cooling device applied, the cover of the cooler being omitted in one part to expose the cooling tubes, and the cooler being removed in another part to expose the end of the machine casing.

Figure 3 is a side sectional elevation of part of a dynamo electric machine with another form of cooler applied.

Figures 4 and 5 are respectively a side sectional elevation and an end elevation with cover removed, of a third form of cooler.

Figure 6 is a side sectional elevation of a further form of cooler.

Figures 7 and 8 being end elevations of two forms of parts thereof.

Figure 9 is a side sectional elevation showing one form of the invention applied to a dynamo electric machine of the type described in Patent No. 1,320,781.

In one form of the invention as illustrated by Figures 1 and 2, a cooling device comprising a large number of small tubes 1, similar to the so-called honeycomb type of radiator used for cooling the cooling-water of internal combustion engines, is applied in an annular form, to the end of the casing 2 of an enclosed motor in place of the usual end cover of the casing. At the end of the cooler, remote from the motor, a hollow annular cover 3 is bolted or otherwise secured to the casing 2 as for instance by screws 20. Packing rings 21 are clamped between the tubes 1 and the casing 2 and cover 3. The interior of the cover 3, forms a return air chest 4. A fan 5 is mounted on the rotor shaft 6 inside the casing, or the rotor is adapted to act as a fan, and an annular deflector or baffle 7 is arranged to direct the internal air of the machine outwardly through those tubes 1 of the cooler encircled by the baffle 7. The air after passing in one direction through tubes 1 enters the return air chest 4 from which it passes back into the casing 2 of the machine through the remainder of the tubes 1. The hot internal air is thus circulated through the cooler, and divided into a multiplicity of small streams. Another fan 8 on the rotary shaft 6, outside the ma-

chine casing, propels or induces a current of cold air through the interstices of the cooler, situated between the tubes 1. The cold air also is thus divided into a multiplicity of small streams. The two sets of streams cannot intermix as they are separated by the thin metallic walling of of the tubes 1. The two currents of air are thereby spread over a very large aggregate area of thin heat conductive material and a very rapid heat exchange occurs. The internal air, cooled in the cooler returns to the inside of the machine and passing across the pole pieces, windings or rotor windings and other internal parts extracts heat therefrom and again enters the radiator to be cooled. Air passages may be made in both the stator and rotor.

In another form of the invention as illustrated by Figure 3 the cooler comprises numerous thin perforated plates 9 of annular form mounted on numerous thin tubes 10 which are passed through the perforations, suitable distance pieces 11 being provided to maintain the plates at determined distances apart.

In the third form of the invention as illustrated by Figures 4 and 5, numerous thin annular plates 9 are stamped with numerous perforations in such a manner that the material adjacent to each perforation is extruded to form a conical spigot 12. The plates 9 are then nested and bolted together so that the spigots 12 on one plate engage within those of the one in front of it and so on whereby tubular passages 10 are formed without necessitating separately made tubes. By suitably shaping the spigots 12 they also act as distance pieces to maintain the plates at suitable distances apart.

In a fourth form of the invention as illustrated by Figures 6, 7 and 8, the cooler comprises an annular plate 13 applied to the end of the machine casing 2, the plate 13 being provided with numerous radial slots 14 of rectangular form as in Figure 7 or of tapering form as in Figure 8. Thin metal boxes 15 of similar form and each having one end only open, are applied with their open ends to the slots 14 in the plate 13 and secured by soldering or otherwise.

Each box is preferably provided with a thin horizontal baffle 16 corresponding in position to an annular baffle 7 inside the machine casing. The hot internal air is impelled by a fan 5 or by the rotor and directed by the baffle 7 into the boxes 15 around the ends of the baffles 16 therein and again into the casing of the machine. An external fan 8 propels or induces a current of cold air through the spaces between the exteriors of the boxes 15. An outer annular plate 18 closes the outer end of the boxes 15, strengthens the structure and also acts as a baffle for the cold air. A baffle ring 17 may cause the cold air to take an inclined path between the boxes. The modification of the invention last described permits of easy cleaning of the outside surfaces or channels for the cold air, which in some atmospheres are liable to be coated with dust or other deleterious matter.

Any of the forms of cooler described may be applied to the casing 2 of a dynamo electric machine of the kind described in Patent No. 1,320,781. For example the form hereinbefore described with reference to Figure 3, is shown so applied in Figure 9, wherein the internal air of the machine is indicated by the arrows in full lines first passing through the tubes 10 of the external cooler and thence through the hollow ribs or cooling channels 19 in the casing 2 of the machine back into the interior of the machine. The path of the cooling air is indicated by arrows in dotted lines, this air first passing between the plates 9 of the external cooler and thence through the outer casing of the machine in contact with the outside of the walls of the hollow ribs 19. It will be understood that the end plates of the casing 2 are formed with openings alternately arranged for the passage of the internal air and cooling fluid as described in Patent No. 1,320,781.

In all forms of cooler described the internal air has a longer path in the cooler than the cold air. This is an advantage as the supply of cold air is ample and it is desirable that it shall pass away immediately it extracts heat from the internal air.

We claim:—

1. The combination of a dynamo electric machine, having a casing, a cooling device arranged co-axial with and applied to the casing of said dynamo electric machine, said cooling device comprising an air-chest arranged coaxial with and in spaced relation to one end of said casing, a multiplicity of thin walled conduits adapted to connect said air chest to the interior of said casing at the adjacent end thereof to said air-chest, means for circulating the internal air of the machine through said conduits and said air-chest, and means for passing cooling fluid among and in contact with the exterior surfaces of said conduits, substantially as and for the purpose hereinbefore set forth.

2. In combination an enclosed dynamo electric machine having a casing and a cooling device arranged co-axial with and applied to one end of the casing of said machine, said cooling device comprising a multiplicity of thin walled conduits of heat conductive material, adapted to communicate with the interior of said casing at the adjacent end thereof, a fan within said casing for circulating the internal air of said machine through said conduits, and another fan, outside said casing, for passing cool air

among said conduits and in contact with the exterior of said conduits, substantially as and for the purpose hereinbefore set forth.

3. In combination an enclosed dynamo electric machine and a radiator arranged co-axial with and adjacent to one end of said machine, said radiator comprising a multiplicity of thin walled closely spaced conduits arranged co-axially with said machine and in communication with the interior thereof and at the adjacent end thereof, means for circulating the internal air of the machine through the interiors of said conduits, and means for blowing cold air between and in contact with the exteriors of said conduits, substantially as and for the purpose hereinbefore set forth.

4. In combination an enclosed dynamo electric machine and an annular radiator adapted to form an end cover for said machine, said radiator comprising a multiplicity of small thin walled conduits in communication with the interior of the machine, said conduits being spaced apart in close relation to one another, means for circulating the internal air through said conduits, and means for blowing cold air among and in contact with the exteriors of said conduits, substantially as and for the purpose hereinbefore set forth.

In testimony whereof we have signed our names to this specification.

PAUL ALPHONSE HUBERT MOSSAY.
HENRY CHARLES EDWARD JACOBY.