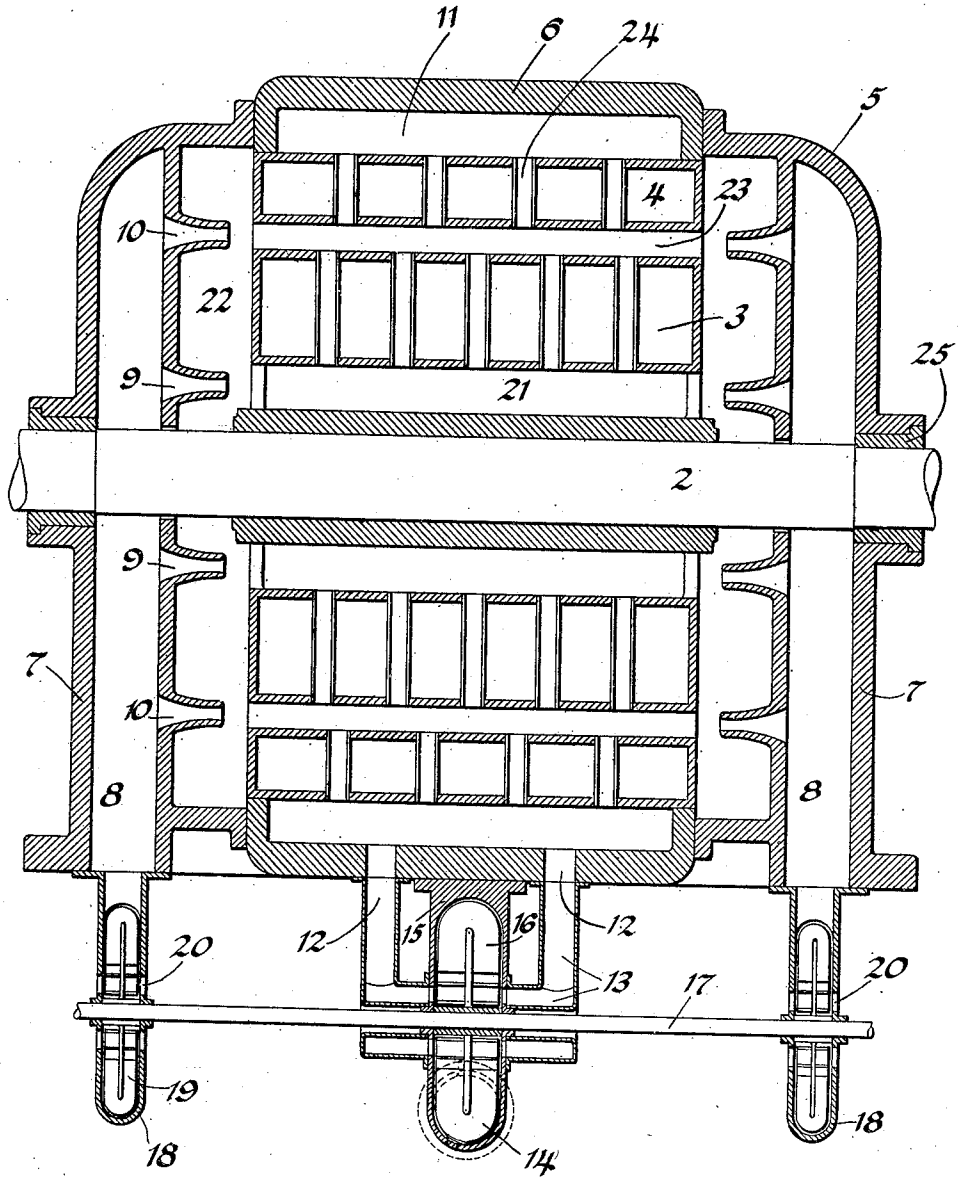
G. WESTINGHOUSE.

ELECTRICAL APPARATUS.

APPLICATION FILED DEC. 29, 1905.

994,810. Patented June 13, 1911.



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ELECTRICAL APPARATUS.

994,810. Specification of Letters Patent. Patented June 13, 1911.

Application filed December 29, 1905. Serial No. 293,816.

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electrical Apparatus, of which the following is a specification.

This invention relates to electrical apparatus and more especially to cooling and ventilating means for electrical apparatus including rotary and stationary parts. In an apparatus of this class, which includes generators, motors and rotary converters or transformers, heat, due to various causes, among which are parasite or eddy currents and hysteresis, is evolved in the various parts which comprise the mechanical and electrical elements entering into the make-up of the apparatus.

By properly subdividing the different parts and thereby increasing the amount of exposed surface some of the heat evolved may be carried away by the flow of air through and around the subdivided parts, which is caused by the fanning action of the rotor during the operation. This is only true, however, for a few specific types of apparatus in which the subdivision in both the rotor and stator are of such number and the air passages of sufficient area to permit large quantities of air to pass through them. Such a construction of necessity greatly increases the size as well as the cost of the apparatus, and when utilized in high speed machines is a source of objectionable noise.

The object of this invention is fourfold in character; reduction of size of an apparatus of a given speed and capacity, reduction in cost of manufucture, a lessening of the noise during operation and maintenance of a predetermined and safe temperature within the apparatus.

The invention particularly consists of inclosing the apparatus in a shell or casing within which the stationary or revolving elements of the apparatus are included in an inclosed air line. The casing is provided with an air inlet and air outlet, and means are provided, such for instance as an exhaust fan between the elements to be cooled and the air outlet end of the air line for causing a definite quantity of air to flow through the said line and the inlet openings are so proportioned with regard to the capacity of the exhaust fan that the flow of air is impeded or restricted, thereby causing a drop of pressure within the air line; or in other words, the invention consists in maintaining around the elements to be cooled a partial vacuum and at the same time maintaining a constant flow of a predetermined and sufficient quantity of the rarefied or expanded air for cooling the parts.

The drawing shows a diagrammatic sectional elevation of an electric generator illustrating my invention.

The generator is shown as including a revolving field 3 and high tension coils 4 supported by laminated cores, and is inclosed within a casing 5, which consists of an annular shell portion 6 and end portions 7. The end portions 7 are provided with passages 8, which include inlet nozzles 9 and 10. Between the shell portion 6 and the high tension coils 4 of the armature an annular passage 11 is maintained, which is provided with air outlet ports 12. The air outlet ports communicate through passages 13 with the intake ports of a centrifugal exhauster 14, which consists of a casing 15 and a rotor 16 rigidly mounted on a shaft 17. Air motors 18 are mounted on the shaft 17 at either side of the exhaust fan 14 and their exhausts communicate with the passages 8. The air motors consist of rotors 19 mounted on the shaft 17 and provided with blades which are so arranged with reference to the inlet ports 20 of the motor and the air passages 8 that they will convert a portion of the velocity of the air entering the casing 5 into rotary motion and therefore supply or pay back energy to the shaft 17. The shaft 17 is driven by a motor or engine through some suitable means, such as a pulley or gearing not shown.

Air passages 21 extend longitudinally through the rotating fields 3 and communicate with radially extending passages 22, which communicate with a space 23 maintained between the rotor and stator of the generator. Radially extending passages 24 extend through the laminated cores of the coils 4 and connect the passage 23 with the annular passage 11. The nozzles 9 are located adjacent to the ends of the passage 21 and the nozzles 10 adjacent to the ends of the passage 23. The shaft 2 is provided with suitable packing glands 25 located between the shaft and the casing 5.

The operation of the exhauster causes a drop in pressure within the casing 5 and air

rushing in is drawn through the motors 18 into the passages 8, from which it is discharged through the nozzles 9 and 10 into the interior ventilating passages 21 and 23. The combined area of the nozzles 9 and 10 is such that the flow of air is restricted, thereby causing a drop of pressure within the casing. It is a law of thermodynamics that rarefication of an elastic fluid is accompanied by a drop in temperature, so that by this arrangement I obtain a threefold advantage; that of thoroughly ventilating and cooling the different parts of the generator, the additional advantage of utilizing cooled or expanded air as a cooling medium and last but none the less important of surrounding the operating parts by a rarefied medium.

As has been before stated, the motors 18 are arranged in the air line to pay back to the shaft 17 some of the energy utilized by the exhauster in rarefying the air and they are arranged to utilize a portion of the velocity energy of the air which is occasioned by the expansion in passing through the somewhat restricted ports 20 of the motors.

It is obvious that the discharge nozzles 9 and 10 and the interior passages can be so located that the portion likely to evolve the most heat will be supplied with more cooling medium and therefore the working parts can within close limits be maintained at equal temperatures. It is also obvious that various modifications and changes of the cooling system may be made by those skilled in the art and still fall within the scope and spirit of this invention.

What I claim to be new and useful is:

In combination with the rotary and stationary parts of an apparatus of the character described, a system of fluid passages traversing the parts and provided with fluid inlet and fluid delivery ports, means communicating with the fluid delivery port for withdrawing fluid from said passages and thereby creating a flow of fluid through said passages, means communicating with the inlet port of said system and operated by the flow of fluid through said passages, and fluid directing nozzles for creating a high velocity of flow and for directing the flow through said passages.

In testimony whereof, I have hereunto subscribed my name this 27th day of December, 1905.

GEO. WESTINGHOUSE.

Witnesses:
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