

DISCUSSION ON "ALTERNATOR FOR ONE HUNDRED THOUSAND CYCLES." FRONTENAC, N. Y., JUNE 28, 1909

John B. Taylor: I wish to ask why, in Fig. 7, the voltage falls off with increasing field excitation?

J. C. Lincoln. I wish to ask why, in the design of a small machine of this sort, such a small diameter as one foot is selected for the diameter of the rotating part. The centrifugal strains would be less with a given peripheral speed if the revolving part were made 2 ft. or 18 in. in diameter. Also, larger pole space on the periphery would be obtained.

D. B. Rushmore. At one time the induction alternator was in general use in this country, especially when 133 cycles were in vogue. At 60 cycles the induction alternator easily held its own as a small high-speed machine, but became more expensive for other frequencies, and at 25 cycles could not compare with other machines. However, where high frequencies are desired it is necessary to use this form of machine.

The curve in Fig. 5 shows the increased output of the machine with the shunt condenser under somewhat the same conditions as exist in a transmission system. The critical speed is a matter of great interest and importance in many of the lines of mechanical work where, because of the type of prime mover, or to obtain higher efficiency at lower cost, the tendency is to use velocities limited only by the strength of material.

C. J. Fechheimer: I wish to ask Mr. Alexanderson if the critical speed is affected by the means of support with the flexible shaft used in this alternator; that is, will self-aligning or fixed bearings materially affect the critical speed?

I also wish to ask if careful tests were made of the tensile strength of the chrome-nickel steel. Mr. Alexanderson states that the elastic limit of the steel used is about 200,000 lb. per sq. in., whereas the chrome-nickel steel furnished by the steel mills has an elastic limit of about 110,000 lb. per sq. in.

A. E. Kennelly: It is interesting that a condenser should be considered as normally attached to the machine in order to obtain normal output; although this would be a dangerous precedent if it should be considered necessary in machines of larger proportions or lower frequencies, since rotary condensers might become necessary as part of the equipment of the machine.

I wish to ask Mr. Alexanderson whether he has made measurements of any kind, to show whether a physiological effect, or shock, can be felt from the machine at 100,000 cycles per second? We know that at the frequency of 2000 cycles per second a shock can be felt and that there is a certain high frequency at which a shock is not felt.

E. F. W. Alexanderson: Answering the question asked by Mr. Taylor: why the voltage of the generators decreased with increased field strength. The decrease of voltage is due to the nature of the inductor-alternator. The profile of the disc

looked at from the end is indicated in Fig. 1, showing one wire in each slot of the armature. The variation of field strength in the separate armature coils is produced by the varying air-gap when a tooth is opposite or when a gap is opposite to a coil. If the excitation is driven too high, the teeth saturate and the difference between maximum and minimum induction becomes less. That is the reason why a certain field excitation gives the maximum voltage.

It is, without doubt, true that a larger diameter would materially increase the capacity. A 1-ft. diameter was selected because in building the experimental machine the item of cost had to be considered. The machine now building, which is expected to have an output of 35 kw., is designed with a diameter of 3 ft.

The resonance of the shaft, so far as I have been able to observe, has nothing to do with the alignment of the bearings. The bearings are self-aligning. Whether it would be different with a non-lined bearing, I could not tell.

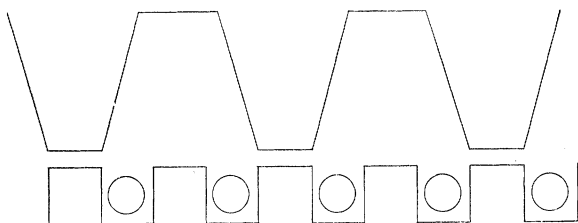


FIG. 1.

In making the disc in the lathe and in the milling machine, the opinion of those who worked on it is that it is an extremely tough material. It has, therefore, been attempted and will probably work out successfully, to have the material cut before it has been tempered, because the high tensile strength of 200,000 lb. per sq. in. is not inherent in the material until it has been tempered by a special process. It is hoped it can be treated without changing the shape. The same process has been used generally in automobile gears.

Dr. Kennelly asked if it were possible to feel a 100,000-cycle shock. I can assure him that it is. I could not feel any difference between alternating current at 100,000 cycles and direct current. 100 to 150 volt, at the high frequency gives the same sensation as a direct current of the same voltage.

In developing the 100,000-cycle generator one practical point was discovered which may be of interest in regard to the discussion of Dr. Kennelly's paper, as to the radiation from wires. The wire placed in the slot has a diameter of 0.016 in. It has a triple silk covering and coating of varnish. One of these wires, when placed in the slot, carries 15 amperes at a rise of 25

degrees centigrade; that is, twice as much as it will carry in the open air. Naturally the iron, which is closely in touch with the coil, takes off more heat than the air. The measurements are made by resistance, and the rise of temperature of the wire takes only a few seconds. The current density in it is about 75,000 amperes per square inch, against 2000 to 3000 in the ordinary machine.
