with local conditions that would have to be investigated, in general, cannot be attempted, but appropriate inquiries may be addressed to the secretary, and effort will be made to supply the desired information.

LITERATURE

There are in the files of the chairman or other members of the committee copies of the literature that are referred to in this column, or the sources of such and other literature that may be of interest are known. Information will be supplied when requested, and in some instances copies may be available for reading and return. Address the secretary.

MEETING OF COMMITTEE

The committee on safety expects to hold a meeting January 23 at 2:00 p. m. during the 1945 winter technical meeting of the Institute. Institute members who are in attendance and are interested are invited.

Future Meetings of Other Societies

American Institute of Mining and Metallurgical Engineers. Annual meeting, February 18–22, 1945, New York, N. Y.

American Society for Testing Materials. Spring meeting, February 28, 1945, Pittsburgh, Pa.

American Society of Civil Engineers. Annual meeting, January 17–19, 1945, New York, N. Y.

Canadian Electrical Association. Annual winter conference, January 18–19, 1945, Montreal, Canada.

Edison Electric Institute. Transmission and distribution committee, February 15–16, 1945, Pittsburgh, Pa.; electrical equipment committee, February 14–15, 1945, Cincinnati, Ohio; accident prevention committee, February 15–16, 1945, Cleveland, Ohio.

Institute of Radio Engineers. Winter technical meeting, January 24–27, 1945, New York, N. Y.

Institute of the Aeronautical Sciences. 13th annual meeting, April 1945, Detroit, Mich.

OTHER SOCIETIES •

IES Appoints Technical Secretary

The appointment of Cazamer L. Crouch as full-time technical secretary of the Illuminating Engineering Society has been announced. This assignment constitutes one phase of IES plans for the expansion of its technical and research activities.

As technical secretary Mr. Crouch will act as consultant to the technical committees and to the council of IES. His major assignment will be the compilation, writing, and publication of the IES Illumination Design Handbook.

Mr. Crouch will also be available for assistance in the society's newly established research program, under the direction of the board of research trustees. Newly elected officers of this board are:

P. H. Daggett, dean of the college of engineering, Rutgers University, New Brunswick, N. J. chairman.

A. H. Nicoll, president, the Graybar Electric Company, New York, N. Y. treasurer.

A. Dexter Hinckley, secretary.

The board, a completely autonomous group, sponsored though not controlled by IES, will act as trustees of the IES research fund. Individual research projects are expected to be carried out with the co-operation of the research laboratories of leading universities and other institutions.

ASRE Elects 1945 Officers

J. F. Stone, manager of the refrigeration division, Johns-Manville Corporation, New York, N. Y., has been elected president of The American Society of Refrigerating Engineers according to a recent announcement.

Other officers elected are: Charles S. Leopold, consulting engineer, Philadelphia, Pa., and Roland H. Money, chief refrigeration engineer, the Crosley Corporation, Cincinnati, Ohio, as vice-presidents; John G. Bergdoll, Jr., chief engineer, York Corporation, York, Pa., as treasurer; and, as directors for three-year terms, B. H. Jennings, professor of mechanical engineering, Northwestern University, Evanston, Ill.; Charles S. Neeson, chief engineer of the cooling division, Airtemp division, Chrysler Corporation, Dayton, Ohio; John S. Forbes, president, Superior Valve and Fittings Company, Pittsburgh, Pa.; Warren W. Farr, president and treasurer, Refrigeration Maintenance Corporation, Cleveland, Ohio; and C. Hill Garrison, C. H. Garrison Company, Kansas City, Mo.

EDUCATION • • •

Engineering Scholarships Offered. Ten scholarships, now valued at $1,850 each, will be awarded for an engineering education at the Carnegie Institute of Technology, Pittsburgh, Pa., according to an announcement of the Westinghouse Electric and Manufacturing Company, sponsor of the 1945 George Westinghouse Scholarship contest. The contest is open to all senior high-school boys in the United States who present a good high-school scholastic record, are able to meet the Carnegie Institute of Technology's entrance requirements, and who did not compete in the 1944 competition. Applications will be accepted until February 1, 1945, and the tests will be administered by the college entrance examination board on April 7, 1945.

LETTERS TO THE EDITOR

INSTITUTE members and subscribers are invited to contribute to these columns expressions of opinion dealing with published articles, technical papers, or other subjects of general professional interest. While endeavoring to publish as many letters as possible, Electrical Engineering reserves the right to publish them in whole or in part or to reject them entirely. Statements in letters are expressly understood to be made by the writers. Publication here in no wise constitutes endorsement or recognition by the AIEE. All letters submitted for publication should be typewritten, double-spaced, not carbon copies. Any illustrations should be submitted in duplicate, one copy an inked drawing without lettering, the other lettered. Captions should be supplied for all illustrations.

Armature-Winding Resistance

To the Editor:

The a-c resistance of an armature winding is greater than the d-c resistance on account of the eddy currents produced in the conductors by the slot-leakage flux. The extra loss caused by these eddy currents can be computed with excellent precision by means of hyperbolic functions. The extra loss factor depends upon the frequency, the geometrical arrangement of the conductors, and their resistivity. If the resistivity is increased, the extra loss factor is reduced. That is, the extra loss factor for an armature winding is less when the winding is hot than when it is cold. For a well-designed armature winding in which the eddy-current loss is not excessive, the extra loss factor can be computed from the first terms of the series expansions of the hyperbolic functions. This is a common procedure. For example see reference 1. The first term of the hyperbolic series varies as the inverse square of the resistivity. Since the increase in the resistance caused by the a-c equals the d-c resistance (which varies directly with the resistivity) multiplied by the extra loss factor (which varies inversely as the square of the resistivity), the increase in the resistance varies inversely as the first power of the resistivity. Consequently in general:

$$R_{ac} = R_{dc} + \frac{K}{\rho}$$

where K/ρ, which equals $(R_{ac} - R_{dc})$, is due to the extra loss caused by the eddy currents. The resistivity, ρ, varies with the temperature.

$$\rho \text{ at } t_2 = \frac{234.5 + t_2}{234.5 + t_1} \times (\rho \text{ at } t_1)$$

Let the subscripts 1 and 2 indicate resistances at temperatures t_1 and t_2. The a-c resistance at temperature t_2 is:

$$R_{ac_2} = \frac{234.5 + t_2}{234.5 + t_1} R_{dc1} + \frac{234.5 + t_1}{234.5 + t_2} (R_{ac1} - R_{dc1})$$

Thus the a-c resistance of an armature winding at a temperature t_2 can be computed easily from the a-c resistance and the d-c resistance of the winding at a tempera ure t_1. This correction for the effect of temperature is applied to the transformer in reference 2. The correction can be used in many situations where the eddy-current loss is not excessive.

REFERENCES

1. Reduction of Armature Copper Losses, **Ivan H. Summers.** AIEE *Transactions*, volume 46, 1927, February section, pages 101–08.

2. Magnetic Circuits and Transformers (book). **Electrical-engineering staff,** Massachusetts Institute of Technology, Cambridge, Mass.

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