A CALORIMETRIC DETERMINATION OF CORE LOSSES IN HIGH FREQUENCY TRANSFORMERS.

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The data reported below were obtained by Ernest O. Johnson, B. S. in E. E., '27, Rose Polytechnic Institute, while making a study of multiple stage radio frequency amplification.

The method used for the determination of the iron loss is essentially that previously reported by Prof. R. R. Ramsey for the measurement of condenser losses. The iron sample was placed in a one-half by six-inch test tube which in turn was sealed into a three-quarter by eight-inch test tube. A bent glass tube connected the inner test tube with a similar calorimeter containing a heating element. Each tube connection was sealed with a mercury seal. A short column of water in the connecting tube served as a pressure indicator.

The calorimeter containing the iron sample was placed inside a heavy coil of three and one-half turns. A heavy high frequency current was passed around this coil and the test sample was heated by the eddy currents set up in it. This rise in temperature expanded the air in the inner test tube and forced the water column to the right. Current from a storage battery was then passed through the heating element in the second test tube until equilibrium was restored. In most cases conditions became constant after 30 minutes of operation, and the observations were continued for a second 30 minutes. The power supplied to the heating element in the second test tube was very carefully determined and under conditions of equilibrium should be an accurate measure of the iron loss. Figure 1 is a photograph of the complete apparatus.

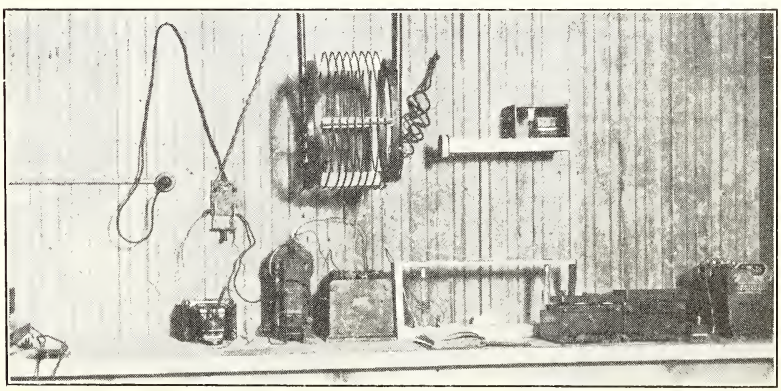

Fig. 1—Complete apparatus used in calorimetric determinations.

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Three core materials were tested. The first was made from commercial power transformer laminations of silicon steel .017 inches in thickness. The second was a core prepared from steel taken from a well known radio transformer with laminations of .004 inches in thickness. The third sample was prepared by molding together fine filings of the second steel with a binder of paraffin and rosin. A power hack saw was used to produce the filings. The results of the tests showed losses as follows: Silicon steel .017 inches in thickness gave 4.570 watts loss per cubic centimeter or .290 watts loss per gram; radio transformer steel .004 inches in thickness gave 3.702 watts loss per cubic centimeter or .225 watts per gram; ground transformer steel .394 watts loss per cubic centimeter or .049 watts loss per gram. These comparative results were all taken with a constant power input to the high frequency circuit. The frequency of the exciting circuit was 603 kilocycles and was thus inside the longer wave length broadcasting band.

A radio frequency transformer was built with a removable core and placed in the circuit of a radio frequency amplifier. Resonance curves were plotted using both cores two and three with a constant input to the circuit. These curves showed the maximum ordinate of the resonance curve for the laminated steel to be only 11.66 per cent of that for the ground steel. This compares very favorably with the ratio of the losses which was 10.62 per cent for equal volumes. Cutting down the iron losses thus very greatly increases the efficiencies of these transformers.

A MAGNETIC METHOD FOR THE DETERMINATION OF THE ELASTIC LIMIT OF IRON AND STEEL.

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This report is a summary of a portion of the thesis work done by Victor E. Schlossberg, B. S. in E. E., '26, and Paul E. Duffendach, B. S. in C. E., '27, at the Rose Polytechnic Institute.

While studying the elongation of a sample of steel due to its magnetization, Mr. Schlossberg investigated the effect of applying a tensile stress to the sample while it was subjected to a fairly strong magnetic field. The sample, a 1½-inch cylindrical steel bar, was placed in a 100-ton Olsen testing machine which could be run at a very uniform speed. Two primary coils supplied with constant current from a 32-volt storage battery gave the required magnetomotive force while a secondary coil, placed between the two primary coils and connected through a damping resistance to a ballistic galvanometer, served to indicate any change in flux due to the stress applied. A strain gauge was also attached to the sample to indicate the elongation.

Considerable care was taken to shield the apparatus from stray fields which might mask the effect to be studied. With this arrangement, a uniform change in flux would produce a correspondingly uniform deflection of the galvanometer. With the testing machine running