NOTE ON THE GRAPHICAL REPRESENTATION OF NON-SINUSOIDAL ALTERNATING CURRENTS.¹

BY FREDERICK BEDELL.

THE current in an inductive circuit without iron lags ninety degrees behind an impressed sinusoidal E.M.F. and is itself sinusoidal. In the graphical representation, the current is represented by a line at right angles to the line which represents the E.M.F., these two lines determining a plane.

Iron causes a hysteresis loss and harmonics. The hysteresis loss introduces a power component of current of fundamental frequency, so that the total fundamental component of the current is advanced in phase, remaining in the plane of fundamental frequency.

The harmonics are wattless and hence are in quadrature to the E.M.F. It can be shown that graphically they are also in quadrature to the fundamental component of current, and accordingly are represented by a line at right angles to the plane of fundamental frequency.

THE CALIBRATION OF CAPILLARY TUBES.¹

BY WILLARD J. FISHER.

IN connection with researches on the viscosity of gases, H. Schultze² has described a method of calibrating tubes based on the combined use of long and short mercury threads. The following method, suggested by his, differs in the adoption of a graphical reduction, and a greater number of measurements. It is adaptable to calibrations for any purpose.

Fig. 1.

Fig. 2.

¹ Abstract of a paper presented at the Ithaca meeting of the Physical Society, June 29-July 3, 1906.

² H. Schultze, *Ann. d. Physik*, 5, p. 147, 1901.

I. *For Volumes.* — From any arbitrary position (in practice marked by etching the tube) designated by l_0 , measure the position l of the center of a *short* mercury thread, also the length λ of the thread (Fig. 1). At the point l the cross-section of the tube is $Q = V/\lambda$, very nearly, in which V is the volume of the thread. Measured from l_0 the total volume of the tube to l is $v - v_0$. Also $dv = Qdl = V/\lambda dl$. If V is kept constant by temperature control,

$$v - v_0 = V \int_{l_0}^l \frac{dl}{\lambda}.$$

Plot a curve with $y = 1/\lambda$, $x = l$. Its area

$$= \int y dx = \int_{l_0}^l \frac{dl}{\lambda} = \frac{v - v_0}{V}.$$

If the cross-section of the tube is small the volume of the short thread cannot be computed accurately from weighings, since the container must be of greater mass than the mercury itself. Hence a more accurate way to find V is to find the total volume of the tube by a *long* thread between two points l' and l'' . Call this volume $v'' - v'$. Then

$$V = \frac{v'' - v'}{\int_{l'}^{l''} \frac{dl}{\lambda}},$$

and is determined in terms of known quantities.

For thermometers the integral

$$\int_{l_0}^l \frac{dl}{\lambda}$$

can be taken between the limits given by the steam and ice points, and its value equal to 100° ; then the intervening points may be interpolated.

II. *Viscosity Tubes.* — The current of fluid is proportional to r^4/l , for uniform tubes, therefore to $1/(l/r^4)$. For nonuniform tubes put the sum of the quantities l/r^4 equal to F , which is then proportional to the resistance experienced by the fluid;

$$F = \sum \frac{l}{r^4} = \int \frac{dl}{r^4}.$$

Assuming the cross-section circular, $Q = \pi r^2 = V/\lambda$

$$\therefore \frac{1}{r^4} = \frac{\pi^2}{V^2} \lambda^2$$

and between the limits l_0 and l_1 ,

$$F_1 - F_0 = \frac{\pi^2}{V^2} \int_{l_0}^{l_1} \lambda^2 dl.$$

Plot a curve with $y = \lambda^2$ and $x = l$. V is known from the curve for volumes; then $F_1 - F_0 = \pi^2/V^2$ into the area under the curve between the limits l_1 and l_0 .

This theory can evidently be extended to calibration for other functions of the radius.

In practice it is advisable to run the thread through the tube more than once, as the points on the curve of one run may not exactly coincide with those for another.

THE PRODUCTION OF OZONE BY A PHOTO-ELECTRIC CURRENT IN OXYGEN.¹

BY HARRY S. HOWER.

ULTRA-VIOLET light was allowed to fall upon a polished platinum knob in an oxygen atmosphere.

The knob being changed to about $-1,500$ volts, the discharge current from it to the earthed wires opposite it was measured by a galvanometer in series. The ozone produced was detected by its effect on a piece of platinum foil. The foil changes its position in the voltaic series when it absorbs O_3 .

NOTE ON ELECTRIC DOUBLE REFRACTION IN CARBON-DISULPHIDE AT HIGHER TEMPERATURES.¹

BY L. B. MORSE.

AT a former meeting of the Physical Society the late D. B. Brace reported that he had not been able to observe the "Kerr effect" in air. A beam of plane polarized light showed no trace of ellipticity after passing back and forth several times in the air between long charged plates.

Schmidt's curve, for the effect of temperature on the Kerr effect in CS_2 , shows a more rapid rate of decrease of the effect with increase in temperature, at the higher than at the lower temperatures at which he worked.

At the time this work was begun an apparatus was being constructed in which ordinary gases, gaseous CS_2 , etc., were to be tested under varying conditions of temperature and pressure.

In view of the above and other considerations it seemed important to

¹ Abstract of a paper presented at the Ithaca meeting of the Physical Society, June 29-July 3, 1906.