the same at A and A', the pressure of light will be uniform over this mirror. According to the new theory, particles of light will pass over the path SAD where D is in the bright band, but will not pass over the path $SA'C$ if C is in the dark band. Therefore, the light pressure upon this mirror will all be on the side A and a torsion of the mirror will result.

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[2] Bohr, Kramers and Slater, *Phil. Mag.*, **47**, 785 (1924).

[3] Slater, *Nature*, **116**, 127 (1925).

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THE RÔLE OF THE FARADAY CYLINDER IN THE MEASUREMENT OF ELECTRON CURRENTS

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Despite knowledge of the magnitude of reflection and secondary emission of electrons, Faraday cylinders have customarily been regarded as complete absorbers of electrons. For example Lehmann and Osgood[2] recently have brought forward evidence indicating that electrons passing through small apertures are not of homogeneous velocities—this conclusion resting on the assumption that the Faraday cylinder used in their experiments absorbed at least 99% of the impinging electron stream. An exception to this usual regard of the matter is recorded in some experiments of Professor J. T. Tate[3] who found that the most efficient Faraday cylinder he devised had an absorption coefficient of about 0.95 for relatively slow velocity electrons. In view of the very important relation of Lehmann and Osgood's conclusions to much other experimental work and, indeed, because of the uncertain yet crucial status of the Faraday cylinder itself, this preliminary experimental investigation was carried out.

Electrons were accelerated through a distance of 4 cms. from a tungsten filament to a plane anode through which extended a tube 2 mm. in diameter and 16 mm. in length, the tube end nearer the filament being in the anode plane. The electrons emerging from the tube impinged on a Faraday cylinder 2.2 cms. in diameter through an opening 1 cm. in diameter at a distance of 1 mm. from the end of the tube. The distance of the closed end of the Faraday cylinder—it's effective length—was made variable by a stopcock swivel arrangement. Since the absorbing power of the Faraday cylinder is a function of its length, measurement of the currents to the cylinder with various retarding potentials and cylinder lengths with this arrangement gave data indicative of the percentage of the impinging electrons absorbed.

Figures 1 and 2 are typical of the experimental data obtained. The ordinates of the curves are the currents to the Faraday cylinder corresponding to retarding potentials represented by the abscissae. Curve no. 1 is for the shortest cylinder length and succeeding numbers denote data obtained with longer cylinders. As is evident, the data of figure 1 correspond to an accelerating voltage between the filament and anode of about twenty-four volts while figure 2 is representative of an accelerating voltage of approximately 100 volts. It is seen that for the lower voltage electrons there is a quite regular increase of the electron currents to the Faraday cylinder as its length is made greater while for the higher voltage electrons there occur quite drastic alterations of the current-retarding potential curves with alterations of cylinder dimensions. These latter effects are to be explained on the basis of knowledge that emission of secondary electrons is greater for the higher velocity electrons. Take curve 2 of figure 2 for example. With a zero retarding potential the electrons impinge on the cylinder generating secondary electrons some of which get out of the cylinder so that the resultant current measured is smaller than the actual initial current entering the cylinder. Application of a small retarding potential increases the proportion of the secondary electrons emerging from the cylinder and at the same time reduces the number of secondaries generated because of the decrease in the velocities of the generating electrons. It is evident for the situation represented by curve 2 the former effect is greater than the latter up to retarding potentials of about 40 volts and between 40 and 60 volts the number of secondary electrons produced decreased markedly, thus enhancing the observed current. This general circumstance persists for all cylinder dimensions although, of course, as the absorbing efficiency of the cylinder increases

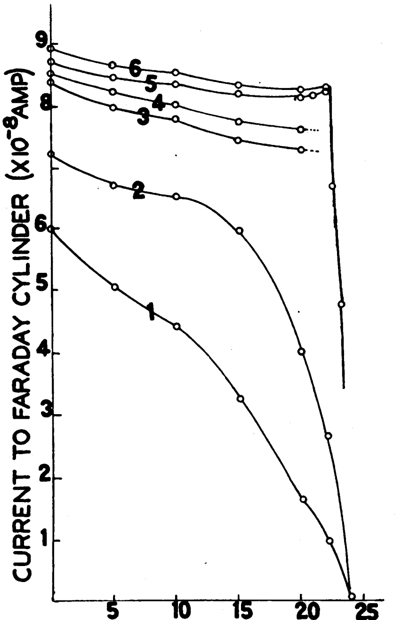

FIGURE 1

Cylinder lengths same as in Fig. 2.

these effects become less marked. Further elucidation of the data is hardly necessary. It is sufficient to emphasize the evident fact that *Faraday cylinders of quite usual dimensions do not retain all the entering electrons and current retarding potential measurements generally do not indicate accurately the distribution of velocities in an electron stream.*

These experimental results, together with other data not exhibited here, indicate that the measured currents to the Faraday cylinder are a function of several variables including the distribution of velocities of the electrons entering the cylinder as well as its absorbing efficiency. It has become clearly recognized that only by rather indirect evidence and inference is it possible to distinguish between the several factors in a manner employed in the present work. To clear up the questions here involved and, indeed, to establish on a firm, experimental basis many other doubtful facts in experimental physics an outstanding need is a beam of electrons moving with homogeneous velocities. With this in mind a method of magnetic analysis at the present moment is being developed designed to produce a beam of electrons of the order of ten volts' velocity with a velocity variation throughout the beam of about 0.1 volt.

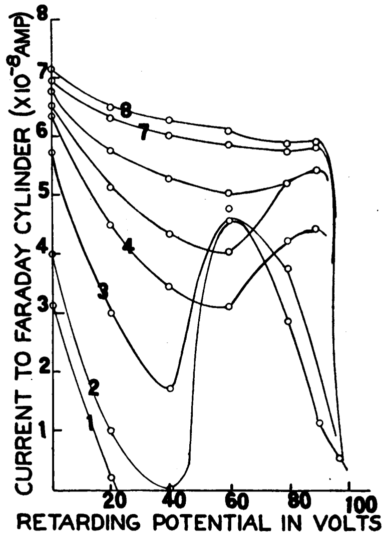

FIGURE 2

Cylinder lengths:

Curve	1,	for	cylinder	length	of 0.3	cm.
"	2,	"	"	"	" 0.8	"
"	3,	"	"	"	" 1.9	"
"	4,	"	"	"	" 3.0	"
"	5,	"	"	"	" 4.6	"
"	6,	"	"	"	" 5.7	"
"	7,	"	"	"	" 7.3	"
"	8,	"	"	"	" 9.5	"

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[2] Lehmann and Osgood, *Proc. Cam. Phil. Soc.*, **22,** 731.

[3] Tate, *Physic Rev.*, **17,** p. 394.