All three constants were derived from measurements made along the single [110] direction. Calculations show that a longitudinal and two shear waves can be generated, all having different velocities. There is no coupling between the longitudinal and shear modes so that shear motions are at right angles to the direction of propagation whereas the longitudinal motion is along the direction of motion. Table I shows the orientations, the associated elastic constants, the velocities determined and the calculated elastic constants, with $\rho=8.90$. From it one has the following values of elastic constants accurate to within a percent.

$c_{11}=2.50\times10^{12}$ dynes/cm^2; $c_{12}=1.60\times10^{12}$; $c_{44}=1.185\times10^{12}$.

The anisotropy factor $2c_{44}/(c_{11}-c_{12})$, is equal to 2.63.

The absorption is very high for a single metal crystal, indicating damping of the magnetic type. The two crystals gave somewhat different results but agreed in showing a considerably higher damping for shear waves than for longitudinal. Within the experimental error the attenuation measured was proportional to the square of the frequency, indicating a damping due to micro-eddy currents. At 10 megacycles the Q's for the first three orientations of the table were

$$Q_1=\frac{\pi}{\delta_1}=385;\quad Q_2=90;\quad Q_3=85.$$

A New Type of Focusing in a Magnetic Lens Field

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SINCE some time ago we have been using a β-lens spectrometer (see Fig. 1) which operates according to a new

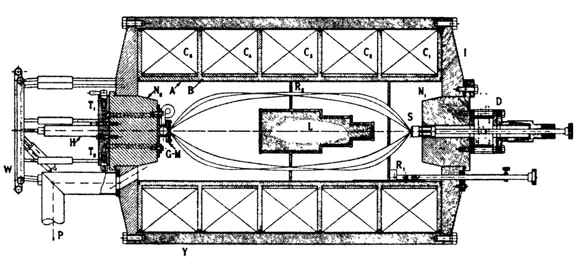

FIG. 1. Section of the β-spectrometer.

focusing principle. This was actually found when we were investigating the possibilities of decreasing the spherical abberation error by changing the field form along the axis of the lens. Such investigations have been made in our laboratory before.[1] Besides ordinary measurements of line profiles with G-M counters we also used a photographic tracing technique to investigate the behavior of the different electron paths in the spectrometer. This method was previously used here in another connection to study electron paths in a spectrometer.[2] We have found that if the magnetic gradient in the spectrometer is made sufficiently strong (the magnetic field having a minimum halfway between source and counter) a first or intermediate ring-formed "image" of the source is obtained midway between source and detector. If a ring-formed shutter is placed here, which transmits the beam, a second ***point*** image is formed at the G-M slit (see Fig. 2). It is found that quite a substantial solid angle of the total radiation can be utilized at a good resolving power. Thus at a resolving power of 4 percent a transmission of ~8 percent can be obtained. Furthermore, another essential advantage is that an ordinary small counter still can be used since we get essentially a point image. If wanted the resolution can, of course, be increased.

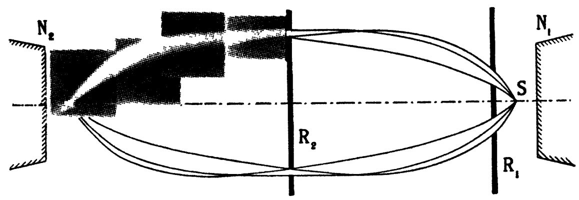

FIG. 2. A photographic record of the focused electron beam.

Thus we have also adjusted the spectrometer for a resolving power of 1.7 percent.

Some general features of this focusing system may briefly be mentioned here. To a certain radius of the central ring baffle a certain magnetic field gradient is related. In our case this gradient was found simply by changing the ratio of the current $I_{2,3,4}$ through the coils 2, 3, 4, to the current I through all coils at a given radius of central shutter. A series of measurements of this kind is given in Fig. 3. As can be seen, there

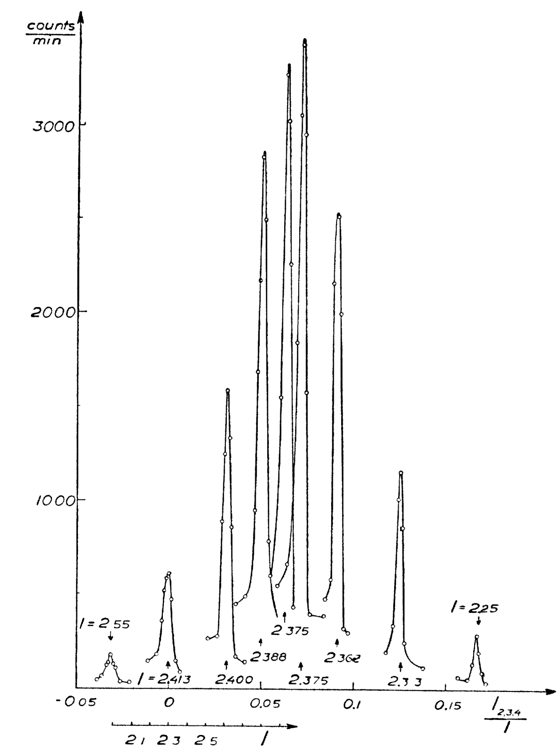

FIG. 3. Adjustment of the magnetic gradient for a given radius of the central shutter.

is a very pronounced maximum at a ratio of these two currents equal to 1:15 for the radius used. Another interesting feature is the strong dependence of the number of counts in the detector on the position of the source. Actually, if the source is moved only a few mm from its correct position no electrons will hit the G-M slit and be counted, no matter what the current is. This means that scattered radiation emanating from other places than the source will not contribute to the counting.

A full description of the spectrometer is given in Arkiv. für Fysik.

[1] Kai Siegbahn, Phil. Mag. **XXXVIII**, 162 (1946).
[2] Hilding Slätis, Arkiv. f. Mat., Astr. o. Fysik **32A**, No. 20 (1945).

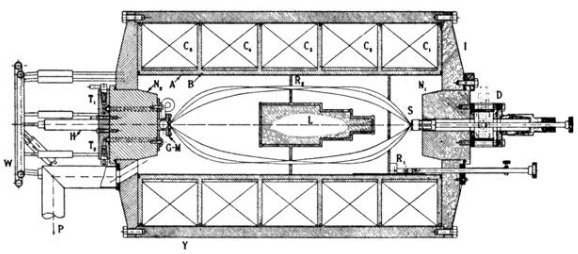

FIG. 1. Section of the β-spectrometer.

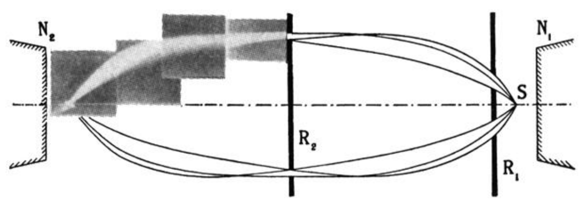

FIG. 2. A photographic record of the focused electron beam.