Table 1. ENERGY OUTPUT OF PuO_2 IN MCAL./HR.

Needle	Calculated	Measured (Mann)
1	61·92	62·26 ± 0·35
2	73·95	74·48 ± 0·35
1 ÷ 2 (measured)	0·8326 ± 0·0043 (Mann)	0·8292 ± 0·0089 (Rothschild)

and leads. This method of measuring heat production does not have the disadvantages mentioned earlier.

Using a modified Clarke–Rothschild calorimeter[2], volume 2·4 ml., for which the plutonium oxide needles were made, I obtained a value for the ratio needle 1/needle 2 of 0·829, as compared with Dr. Mann's value of 0·833. The difference, of about 0·6 per cent, between the calculated and observed energy outputs may be due to an error in the value taken for the half-life of plutonium-239, or to the sample not being pure PuO_2, or to the amount of americium-241 present.

I am greatly indebted to the U.S. National Bureau of Standards and, in particular, to Dr. W. B. Mann, for measuring the heat output of the plutonium needles; and to Dr. G. B. Cook, of the Isotope Division, Atomic Energy Research Establishment, Harwell, for much assistance and advice. This work is supported by the Medical Research Council.

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Visualization of Mode Conversion of an Ultrasonic Beam in Fused Quartz

IN investigating methods of bonding transducers to fused quartz for use in delay lines, it is very useful to be able to see how the ultrasonic beam travels through the quartz.

To visualize the paths of such beams, we have employed the optical system described by Sven Johnson[1], which makes use of the following two principles: (1) a diffraction grating is produced in the quartz by the periodic variations of density in the path of the ultrasonic beam[2]; if the quartz be viewed in a schlieren system, only the vibrating portions of the quartz should be visible; (2) in the regions of high ultrasonic strain the quartz becomes birefringent; thus, placing the quartz between crossed 'Polaroids' will cut out the effect of scattered light without blocking the ultrasonic field from view.

Fig. 1 is a photograph, taken by this method, which gives a vivid illustration of the phenomenon of mode conversion on reflexion.

On reflexion of a compressional wave at a plane interface between a solid and air, both compressional and shear waves will be reflected. Arenberg[3] has calculated that, in fused quartz at an angle of incidence of 44·8°, there will be complete mode conversion

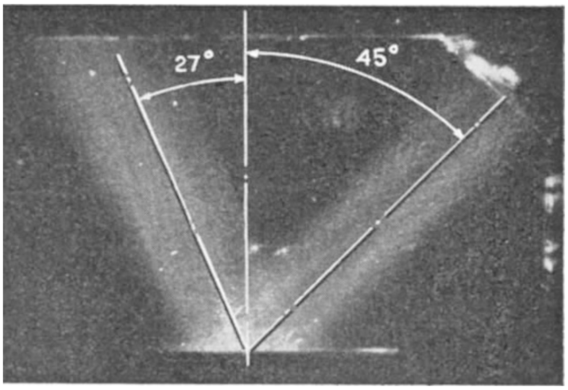

Fig. 1

from a compressional wave to a shear wave reflected at an angle of 27·2°:

$$\left(\frac{\text{sine angle incidence}}{\text{sine angle reflexion}} = \text{ratio of velocities}\right)$$

An X-cut quartz crystal, affixed to the Heraeus quartz blank by an indium bond, is excited at its resonant frequency of 8·5 Mc./s., thus injecting the compressional wave into the quartz (which has been machined to give the required angle of incidence). Fig. 1 shows the beam reflected at an angle of 27° and no sign of any reflexion at 44·8°. Some standing waves in the ultrasonic field are visible. Multiple reflexions have been reduced by absorbing material on the faces of the blank.

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Scattering of Microwave Radiation by a Plasma Column

THE purpose of this communication is to describe experiments performed to determine the angular distribution of the electromagnetic radiation scattered by the positive column of a mercury discharge under the resonant conditions which have been previously investigated[1,2]. The experiments reported here prove the multiple order of the three largest resonances shown in Fig. 1 to be dipole.

The conditions for production of the series of resonances in the scattered radiation are that (1) the E vector of the incident radiation be perpendicular to the axis of the plasma column, (2) the diameter of the column be small compared to the wave-length of the radiation, and (3) the frequency of the radiation be in the vicinity of the so-called plasma frequency.

The following experimental arrangements were made in order to satisfy the foregoing conditions.