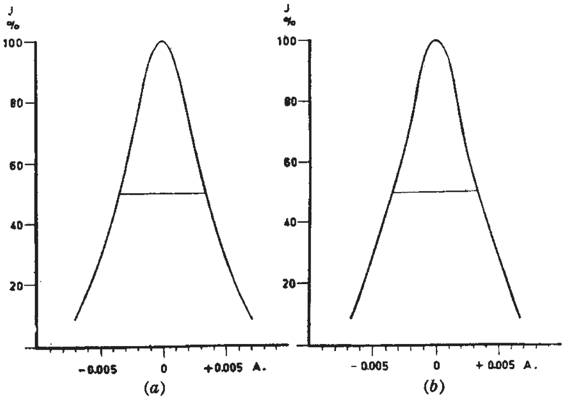

Fig. 1. Width of the green line of a mercury-198 lamp determined from the second (*a*) and third (*b*) fringes in a Fabry–Perot interferometer

indications of what to expect with a lamp of this kind under normal working conditions. No indication of self-reversal can be detected. However, the thickness of the discharge column was only about 5 mm. (giving quite sufficient light for most purposes) and water-cooling was used, so that the conditions were different from those reported in ref. 2. The half-width was found photometrically to be about 0·006–0·007 A., while the widths of the fringes measured by micrometer were found to be slightly smaller. Such a width is scarcely attainable so conveniently from any other light-source, and it is sufficiently small for investigations even with very powerful spectrographs. Moreover, this may not be the minimum width attainable since the values found here are restricted by the resolving power of the interferometer used, for which a longer spacer was not available. The real line-widths are probably very near the Doppler widths which, at room temperature, should be about 0·0055 A.

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A New Microwave Mixer

The Hall effect in semi-conductors has been used at microwave frequencies for the measurement of power. It has recently been demonstrated that a simple modification to the power-measuring equipment leads to a mixer. The principle of operation of this mixer is straightforward. A local oscillator is used for establishing a field in a resonant cavity and a small piece of semi-conductor is placed at a point in this cavity where there is maximum magnetic field and no electric field. The semi-conductor is coupled to a second wave-guide carrying a microwave signal, the coupling being effected by a probe which causes a current to flow in the semi-conductor; the direction of the current is selected to be at right angles to the local oscillator magnetic field. Since the signal is coupled to the semi-conductor by electric field, whereas the local oscillator field at the semi-conductor is magnetic, there is no interaction between the local oscillator and signal channels. A Hall electromotive force is established, the instantaneous value of which is proportional to the product of the local oscillator magnetic field and the signal current. This electromotive force has therefore components of frequencies equal to the sum of the local oscillator and signal frequencies and to their difference. The latter signal can be amplified as in a normal mixer.

This form of mixer has been examined with a signal of approximately 8 cm. wave-length, giving an output of 60 Mc./s., and it has been confirmed that the mixing operation described above does take place. A simplified theoretical analysis shows that the conversion efficiency of the mixer is independent of the semi-conductor dimensions and is directly proportional to both the local oscillator power and to the square of the electron mobility in the semi-conductor, assuming that this is an n-type material. The output power from the mixer is proportional to the signal power provided that the signal power dissipated in the semi-conductor does not cause an appreciable temperature rise. The conversion loss is rather high, being about 60 db. for indium antimonide with a local oscillator power of 100 watts at 8 cm. This figure is based on calculations; experimental results using germanium appear to be in reasonable agreement with the theory.

The present conversion loss is much too high for the mixer to be of practical value in receiver design, but it is hoped that lower figures can be achieved with more efficient design of the local oscillator cavity and for higher frequencies. The main interest in the mixer at present is that it can be developed to provide a method for measuring mobilities at microwave frequencies.

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Germanium Enrichment in Lignites from the Lower Lias of Dorset

Certain carbonaceous inclusions from the United States are exceptionally rich in germanium[1,2]; hitherto no such enrichment has been reported from the British Isles. A number of lignite specimens recently collected from the Lower Lias of Dorset have now been shown to have similar concentrations of germanium to those of the American samples.

The Lower Lias of Dorset consists of a series of marine shales and marls and subsidiary limestones attaining a thickness of about 170 m. Details of the succession, which is well exposed on the coast around Lyme Regis and Charmouth, are summarized by Arkell[3]. Scattered throughout these beds are fragments of lignite. The lignite is more common at certain horizons, for example, 'Grey Ledge' at the top of the Blue Lias and the 'Woodstone' of the Black Ven Marls. It is never easily detected in the