region by virtue of its deactivating influence on the chain carriers in the gas phase. As the upper limit is approached, such deactivation diminishes until the rate of branching effects a balance between the two, and explosion occurs.

H. W. MELVILLE.
H. L. ROXBURGH.

Chemistry Department,
University of Edinburgh.
March 24.

¹ Ubbelohde, March 4, p. 328; Hinshelwood and Grant, March 11, p. 361.

² Melville, *Proc. Roy. Soc., A*, **138**, 374; 1932.

³ Dalton, *ibid.*, **A**, **128**, 263; 1930.

Interaction Between Soot Films and Oil

If a piece of glass, say a 3 in. $\times$ 1 in. microscope slip, is thinly smoked in a luminous flame, allowed to cool and a drop of oil allowed to fall from a height of a few centimetres on to the film, a circular pattern is formed immediately, radiating from the centre of the drop. This figure usually has a central part of concentric striae of soot, surrounded by a circle of clear dots formed by the withdrawal of soot and its concentration at their peripheries. These dots are surrounded by a further region of rather larger dots with an outer annulus of smaller ones, all formed by the concentration of soot into the surrounding areas. Breaks in the outlines in places show that the figure is strained. Outside the figure, annular regions of attenuation and concentration may be observed. The figure is usually about 0.5 cm. in diameter but varies with the size of the drop. The structure is strong enough for the oil to be washed off the glass with an appropriate solvent, when it may be preserved by mounting *in situ* with Canada balsam-xylene. It may also be formed by letting balsam, instead of oil, fall on the smoked slide.

The following liquids have been found to yield patterns: medicinal paraffin, which is very viscous, castor oil, cotton-seed oil, olive oil, and ordinary paraffin. Peripheral disruption was shown by bromoform, pentachloroethane, chloroform and nitrobenzene. Aniline yielded a pattern with central disruption and radiating effects. Cyclohexanol and cyclohexanone yielded patterns. With glycerol and with sulphuric acid, disruption of the film occurred.

Observation of the film as the drop falls shows that an evolution of gas occurs, the gas bubbles being responsible for surface stresses which drag the film away from the glass under them. Both new films and films formed overnight yield patterns. As oil which has been recently boiled forms patterns, it would appear that the gas is adsorbed by the soot as the film is formed and is not that dissolved in the oil.

I have not seen this effect described; if it had been, it would surely have been well known to microscopists, as the patterns form very beautiful objects under a magnification of from 20 to 50 diameters. They are easily visible to the naked eye and most of the structure can be seen under a hand lens. The general appearance is like a plant section or a coarse circular diatom.

J. H. COSTE.

Teddington.
April 8.

Production of Electronic Oscillations with a Two-Electrode Valve

In 1920, Barkhausen and Kurz discovered that an ordinary three-electrode valve could be made to give rise to oscillations of very high frequency (greater than 3×10^8 cycles per second) if the grid was maintained at a relatively high positive potential while the anode was made slightly negative with respect to the filament. The explanation for the occurrence of such oscillations appears to be that a condition of negative resistance is possible when the electrons are given a to and fro motion within the valve. It occurred to me some time ago that such a vibratory motion of electrons should be obtainable from a two-electrode valve of special design but circumstances prevented the construction of the valve until recently.

The valve, constructed by H.M. Signal School, Portsmouth, consists of a central metal rod anode of 1 mm. diameter around which are arranged four filaments in parallel spaced equally on a ring 12.5 mm. diameter. When the filaments are heated and the anode is maintained at a high positive potential, the electrons are attracted from the external cathode towards the anode. A certain number of electrons, however, escape capture by the anode and travel towards the filament diametrically opposite to that from which they were emitted. In this way the necessary to and fro motion of the electrons may be obtained in a diode without any external field being necessary as in the case of the magnetron. Preliminary experiments have shown that the valve behaves in exactly the way predicted and strong oscillations have been obtained. Another important feature is that by means of a tuned external circuit the frequency of the oscillations appears to be adjustable within fairly wide limits while all other operating conditions are kept constant.

A two-electrode valve of somewhat similar design has recently been described by J. Sahánek¹, but he gives a different explanation for the occurrence of oscillations.

J. S. MCPETRIE.

National Physical Laboratory,
Teddington.
April 4.

¹ J. Sahánek, *Phys. Z.*, **33**, 693; 1932.

Structure of the Lines of the Arc Spectrum of Silver

THE fine structure of the more important lines of the arc spectrum of silver was examined by means of a reflecting echelon grating of high resolving power. This instrument and its mounting have been previously described¹. The light source was a tube of fused silica fitted with external electrodes similar to those used by me in the investigation of the structures of the arc lines of indium¹, thallium², and gallium³, excited by means of a high frequency oscillator. The discharge tube was filled with neon at a pressure of about 0.5 mm. of mercury, and the capillary portion of the tube contained a small quantity of silver chloride. The capillary was heated to a temperature of about 600°C. All the lines examined were found to be simple. The half-value width of the lines was determined by obtaining two images of the line under investigation on the same plate, making two exposures at different pressures of the air surrounding the echelon grating; the separation of the