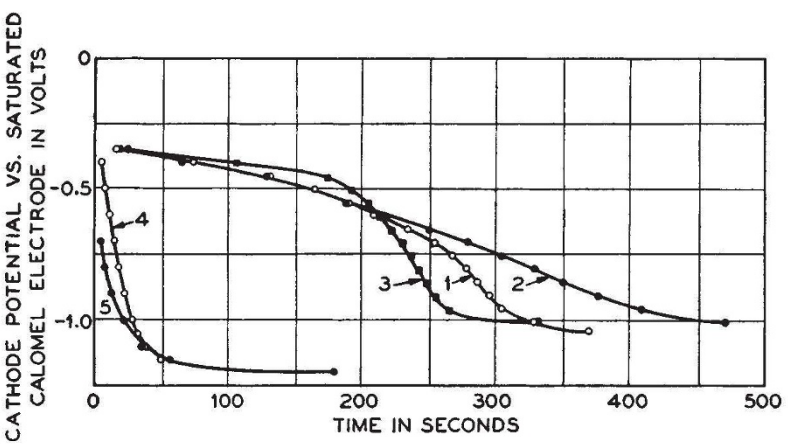
experiments 4 and 5. Typical curves are given in the accompanying figure.

THICKNESS OF FILMS ON FRESHLY ABRADED COPPER SURFACES.

Experiment No.	Treatment of surface	Milli-equivalents of film reduced* per sq. cm. × 10^3	Thickness of film as Cu_2O*(A.)
1	Abraded 000 emery paper under benzene	3·2	41
2	Abraded 000 emery paper in air ..	3·9	47
3	Abraded 000 emery powder under water	2·8	33
4	Abraded 000 emery paper, reduced in hydrogen	No detectable film	
5	Abraded 000 emery paper, reduced in hydrogen, immersed in benzene 20 mins.	0·16	2

* Area of surface calculated from measured dimensions.

The edges and both faces of the specimens, which were milled to 2 cm. × 2 cm. × 0·2 cm. from oxygen-free high-conductivity copper, were abraded. Abrasion under benzene was carried out in a very similar manner to that described by Dobinski[2]. The benzene was a high-quality thiophene-free grade which had been twice redistilled over activated copper. The specimens were placed wet in the electrolytic cell



CATHODE REDUCTION OF FILMS ON FRESHLY ABRADED COPPER.

Current density, 0·01 ma./sq. cm.; area of surface, 9·6 sq. cm. Arrows indicate inflection point. Numbers refer to accompanying table.

and were dried in a stream of purified nitrogen. The cathode potential measurements were made in an oxygen-free solution over which nitrogen was passed.

Recently Dobinski[2] has shown that the electron diffraction pattern obtained for a metal polished under benzene is different from that for a metal polished in air, and has inferred that the pattern is characteristic of an unoxidized surface. The experiments reported here show that abrasion of copper surfaces under benzene by a very similar technique produces a surface film, probably oxide, which is comparable in thickness to that produced by abrasion in air. Submersion of copper in benzene without abrasion produces a considerably thinner film. Dobinski assumes that polishing under benzene means polishing in the absence of air. Actually the solubility of oxygen in benzene is appreciable[3]. He also believes that polishing with a moist abrasive in air produces a thicker film than polishing with a dry abrasive. Our experiments indicate that this is not the case when copper is abraded with emery.

Our results may be explained on the assumption that combination of the copper takes place with oxygen dissolved in the benzene or the water at the high local transient temperatures developed on the surface during abrasion[4]. More detailed results and experimental technique will be published shortly.

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[1] Evans and Miley, NATURE, **139**, 283 (1937); Miley Carnegie Scholarship Memoirs, **25**, 197 (1936); *J. Amer. Chem. Soc.*, **59**, 2626 (1937).

[2] Dobinski, NATURE, **138**, 31 (1936); *Phil. Mag.*, Ser. 7, **23**, 397 (1937).

[3] Bowden and Ridler, *Proc. Roy. Soc.*, A, **104**, 640 (1936); Bowden and Hughes, NATURE, **139**, 152 (1937); *Proc. Roy. Soc.*, A, **160**, 575 (1937).

[4] "Inter. Crit. Tables", **3**, pp. 263, 255. The Bunsen absorption coefficients for oxygen in benzene and water are 0·163 and 0·031, respectively.

Electron-Inertia Effects in Thermionic Tubes

I WAS extremely interested in the communication by Messrs. Ratcliffe and Kownacki[1] on the investigation of electron-inertia effects in thermionic tubes. As these writers state, the difficulty in the experimental determination of inertia effects in ordinary valves is that they occur at such high frequencies that accurate measurement is practically impossible. In order to increase the inter-electrode transit time and so decrease the frequency at which the inertia effects become appreciable, Messrs. Ratcliffe and Kownacki propose using a thermionic tube in which the electrons are replaced by relatively slowly moving ions.

I have described[2] an alternative way by which the inertia effects may be made to occur at sufficiently low frequencies for accurate measurement. The inter-electrode transit time of electrons in a cylindrical diode can be increased many times if a magnetic field of suitable magnitude is applied to the valve in the direction of the electrode axis. I have investigated experimentally the effect of these long transit times and have determined the equivalent electrical circuit of any thermionic tube in which the inter-electrode transit time of electrons is predominant. I have shown that the long transit times possible in magnetrons are responsible for the production in these valves of relatively low-frequency oscillations similar in character to the high-frequency Barkhausen-Kurz oscillations generated in positive-grid triodes. It would be interesting to know whether Messrs. Ratcliffe and Kownacki obtain the same results for inertia-effect with their novel type of triode as I have with the magnetron.

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[1] NATURE, **141**, 1009 (1938).

[2] *J. Inst. Elect. Eng.*, **80**, 84–97 (1937).