

18° C during the 8 h of darkness. The cucumber seedlings were grown in the greenhouse on a nutrient solution; 48 h before infection they were moved to fresh solutions to which the chemicals had been added and placed in the adjusted climate; 7-8 days after infection the solution which had been taken up was replaced; infection and assessment of the results 12-14 days later were performed in the same way as in the spray tests.

Our results generally agree with those reported by Zaracovitis: barbituric acid and a number of its derivatives did not show any activity, either after application on to the cotyledons or after addition to the nutrient solutions, whereas phenobarbital (luminal) and its sodium salt did protect the plants after application to the roots (complete control at 30 p.p.m.). Protection at about the same level was obtained by pentothobarbital sodium salt, but the best results were obtained with the sodium salt of pentobarbital (nembutal) which was active not only after root application but also after spraying (Table 1). A closely related compound, amylobarbitol sodium salt (amylal sodium), did not show any activity at all. In the systemic tests the three compounds caused symptoms of slight phytotoxicity: retardation of growth, yellowing of the leaves.

Zaracovitis<sup>1</sup> suggested that phenobarbitone and 6-azauracil could have a similar mode of action. Dekker obtained in a leaf disk test complete antagonism of 0.6 p.p.m. of 6-azauracil by 80 p.p.m. of uracil<sup>2</sup>. We performed a similar test with pentobarbital and phenobarbital. Uracil in a concentration of 500 p.p.m., however, failed to counteract the protective effect of 30 p.p.m. of these compounds.

Spraying with 3,000 p.p.m. of the compounds did not protect apple seedlings against powdery mildew after artificial infection with *Podosphaera leucotricha* (Ell. and Evenh.) Salm.

A. TEMPEL

N.V. Philips-Duphar  
Agrobiological Laboratory "Boeckesteijn",  
's-Graveland.

A. KAARS SIJPESTEIJN

Institute for Organic Chemistry T.N.O.,  
Utrecht.

<sup>1</sup> Zaracovitis, C., *Nature*, **206**, 954 (1965).

<sup>2</sup> Dekker, J., *Meded. Landbouwhogeschool, Opzoekstns Gent*, **27**, 1214 (1962).

## APPLIED SCIENCE

### Electrochemical Time Switch

AN electrochemical time switch for a.c. current has been developed. It consists of a copper electrode, two tantalum electrodes with oxide films produced by heating<sup>1</sup> and an electrolytic solution (see Fig. 1). The tantalum plate is 99.9 per cent pure tantalum heated for about 12 sec in an electric oven (enclosed heating element) at 670° C in air to form the oxide film. For convenience, the copper electrode is referred to as the control electrode and the tantalum electrodes are referred to as the main electrodes.

Under the open circuit conditions shown in Fig. 1, there is no d.c. voltage at the control electrode. The path between the main electrodes has an extremely high resistance and there is no current through the load resistance, apart from a negligible small leakage current.

In Fig. 1, the control switch is closed with the result that the control electrode becomes positive with respect to the main electrodes. The current which flows in the

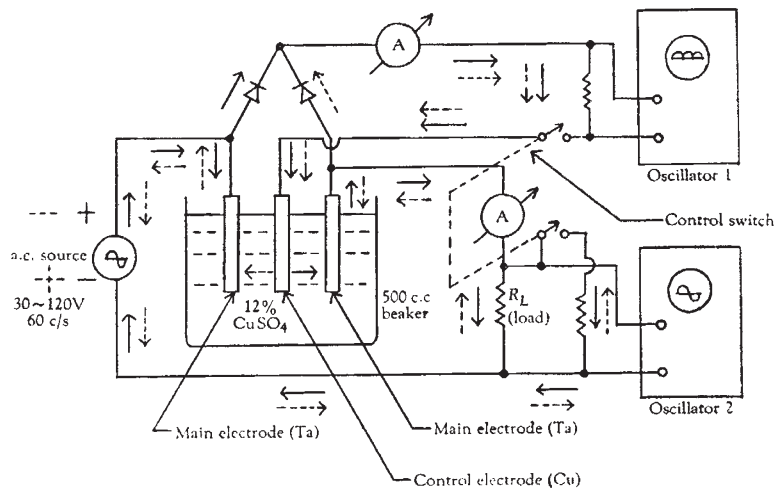


Fig. 1. Experimental apparatus.

circuit is shown by solid and dotted arrows in Fig. 1. Copper is deposited at the surfaces of the tantalum electrodes and the resistance between the main electrodes is decreased, so that the a.c. current through the load resistance is increased.

After the copper is deposited on the main electrodes, the current flows between them even when the control switch is open. The current between the main electrodes maintains its initial magnitude until the deposited copper is removed.

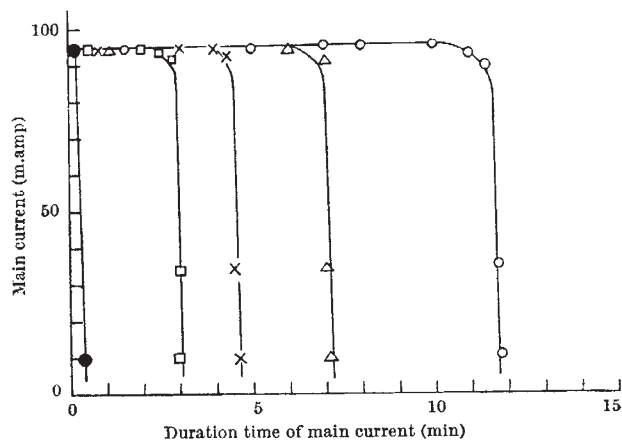


Fig. 2. Time switch characteristics. Temperature of electrolytic solution, 20° C. Time for which control switch keeps closed: ●, 1 sec; □, 2 sec; ×, 3 sec; △, 4 sec; ○, 5 sec.  $R_L$ , 100 V, 10 W lamp;  $R_s$ , 100 V, 100 W lamp; control current, 0.93 amp; a.c. source, 100 V.

The duration of the current between the main electrodes (main current) depends on the time for which the control switch is closed. Fig. 2 shows the relation between the duration of the main current and the time for which the control switch is closed. Fig. 2 also shows that this electrochemical device has the characteristics of a time switch. This type of time switch is extremely simple to produce in comparison with mechanical time switches.

K. YAMAGUCHI  
H. OGAWA

Faculty of Engineering,  
Yamaguchi University,  
Ube City, Japan.

Received November 30, 1966.

<sup>1</sup> Yamaguchi, K., *Oyo Buturi*, **32**, 344 (1963).