does locate the precise site of deoxyribonucleic acid.

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Sept. 22.

[1] Deriaz, R. E., Stacey, M., Teece, E. G., and Wiggins, L. F., *Nature*, **157**, 740 (1946).
[2] Dische, Z., *Microchemie*, **8**, 4 (1930).
[3] Feulgen, R., and Rosenbeck, H., *Z. physiol. Chem.*, **135**, 203 (1924).
[4] Danielli, J. F., *Symposia Soc. Exp. Biol.*, **1**, 101 (1947).
[5] Stedman, E., and Stedman, E., *Biochem. J.*, **43**, xxiii (1948).
[6] Tobie, W. C., *Indust. Eng. Chem.*, **14** (5), 405 (1942).
[7] Wieland, H., and Scheuing, G., *Ber.*, **54**, 2527 (1921); see also Rumpf, P., *Ann. Chim.*, **3**, 327 (1935).
[8] Widström, G., *Biochem. Z.*, **199**, 298 (1928).
[9] Gulland, J. M., and Jordan, D. O., *J. Chem. Soc.*, 1129 (1947).
[10] Stedman, E., and Stedman, E., *Symp. Soc. Exp. Biol.*, **1**, 232 (1947), and previous publications.

PROPERTIES OF THE α-PARTICLE SPARK COUNTER

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IT is the object of this communication to give a preliminary account of certain investigations of the Rosenblum-type spark counter for α-particles. In the course of this work it has been shown that the original wire-plate arrangement[1] is a particular case of a more general type of counter in which the anode is a fine wire and the cathode may be convex, planar or concave with respect to the anode, all these counters operating in air at atmospheric pressure, with electrode separations of the order of 1 mm.

The anode should be a wire of about 0·05 mm. diameter and, since it is important that this wire be kept taut, it should be of a material capable of withstanding considerable tension. Tungsten was chosen as the most suitable anode material on this account. Several cathode materials have been tested, and copper and brass have been found to be as good as any others, the cathode surface being polished to remove irregularities. If a wire cathode is used to give a convex cathode surface, the diameter of the cathode should be several times that of the anode wire, the axes of the two electrodes being parallel. Using a hollow cylinder to give a concave cathode, a slit or window should be provided in the cylinder to permit entry of the α-particles into the sensitive volume.

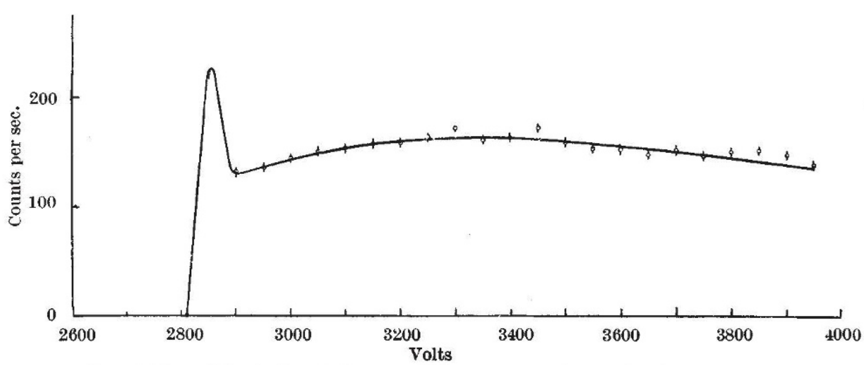

Fig. 1. 'Broadside position.' Gas, air (pressure 76·7 cm. mercury). Anode wire, tungsten 0·05 mm. diameter. Cathode wire, copper 0·9 mm. diameter. Electrode spacing 0·75 mm.

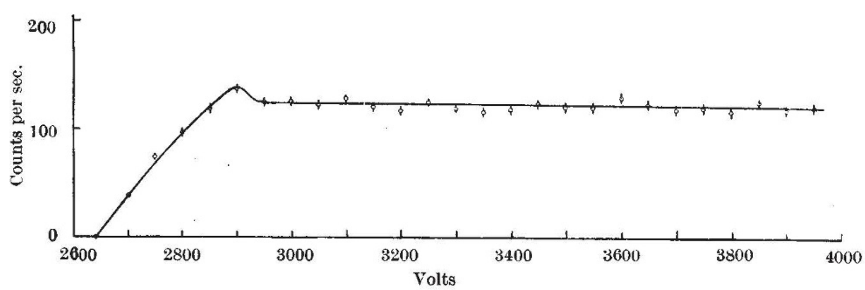

Fig. 2. 'End-on position.' Same counter as in Fig. 1

With the cathode connected to a negative high-tension supply, stabilized but variable up to 4 kV., and a resistance-capacity potentiometer connected from anode to earth, such arrangements have been found to be simple and convenient α-counters, giving visible and audible sparks when a source is brought within α-range of the counter. The potentiometer serves to quench the spark discharge; also, by tapping off a small fraction of the impedance of the potentiometer, a pulse of suitable size can be obtained for the operation of a scaler or cathode ray oscillograph. In this connexion it has been shown that the pulse developed across the total quench impedance is approximately equal to the voltage appearing across the electrode gap prior to discharge. The leading edge of the pulse is sharp, the time of rise being estimated as less than 10^{-7} sec. The recovery-time is largely determined by the time-constant of the quench circuit, and values of the order of 50 μsec. have been found convenient. It has not been found possible to achieve stable operation when the time-constant is less than about 20 μsec.

For the counter to spark, the electron avalanche reaching the anode must exceed a critical size. The probability of sparking will therefore be a function of the gas pressure, the geometrical arrangement and applied voltage which produces the field in the electrode gap, and the specific ionization of the α-particle in the sensitive region of the counter. It is found experimentally, over a wide variety of conditions, that the counting efficiency varies with the residual range of the α-particle, being a maximum when the residual range is small. β-Rays are not counted, the avalanches they create being insufficient to produce a spark; also, in the absence of an α-emitting contamination, the background is zero.

In all its forms the spark counter is 'directional', having greatest sensitivity for α-particles arriving normally to the anode wire and very small sensitivity for particles entering parallel to the electrodes. With

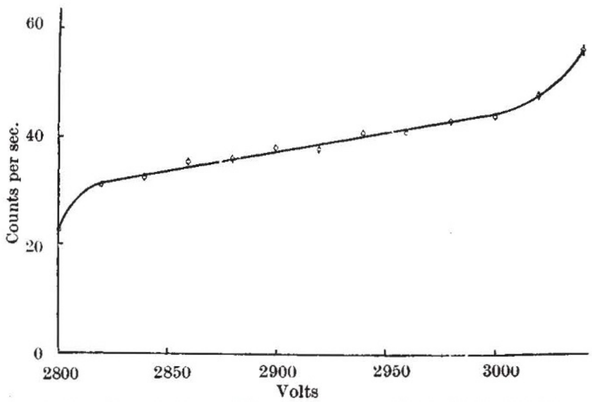

Fig. 3. 'Broadside position.' Gas, oxygen (pressure 75 cm. mercury). Anode wire, tungsten 0·05 mm. diameter. Cathode wire, copper 0·86 mm. diameter. Electrode spacing 0·625 mm.

a wire or plate cathode, two 'principal' directions, both at right angles to the axis, must be distinguished, namely, 'broadside', in which the particles pass between the electrodes and perpendicular to the plane of symmetry of the system, and 'end-on', in which the particles arrive parallel to that plane. Typical counting characteristics for these arrangements are shown herewith (Figs. 1–4), ordinates giving counting-rates and abscissæ voltages between cathode and earth.

It will be observed that the characteristics for counters operating in air are not typical of those obtained with other gases. In air, near the counting threshold and in the absence of a source, a corona spreads evenly over the anode surface, and it would seem that it is this quiescent discharge which produces comparatively large space charges in the gap, giving the air counter its long counting plateau. The corona exhibits the spectrum of molecular nitrogen in the visible and those of nitrogen and nitric oxide in the ultra-violet, much as is obtained from an air Geissler tube, with some variation in the relative band intensities.

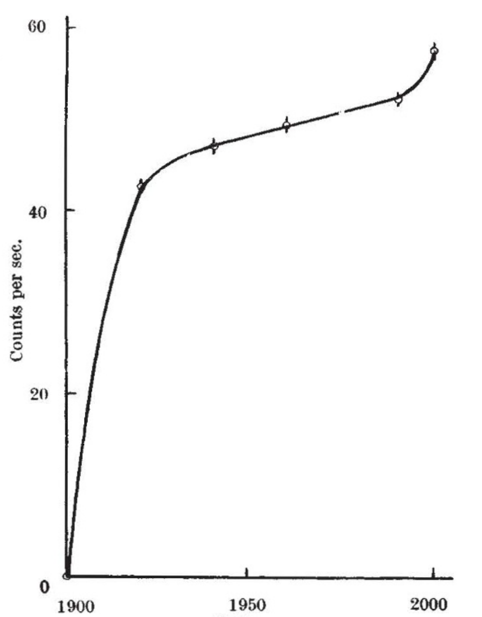

Fig. 4. 'Broadside position.' 69 cm. argon + 7 cm. air. Same counter as in Fig. 3

No corona is visible in oxygen, carbon dioxide, argon or mixtures of these gases at pressures approximately atmospheric, and the voltage-range from threshold to continuous discharge in all cases is small, being of the order of 100 volts for gas mixtures and less for 'pure' (tank) gases. The plateaux obtained with the mixed gases are usually not more than 20–30 volts long, while a pure gas frequently fails to give any plateau at all. Using tank nitrogen alone, a beaded corona is obtained with an applied voltage of about 3 kV. Such an effect has previously been described by others[2–4] in several gases at pressures of the order of 2 cm. mercury and less. Apparently this is the first report of a beaded corona having been observed in nitrogen at atmospheric pressure, other workers having insufficiently high fields at the anode. The beaded corona at atmospheric pressure appears to possess most of the properties found at low pressures. The beading is detrimental to the proper functioning of the counter, since sparks pass preferentially to the luminous regions of the anode. No beading appears when the counter operates in air or in a wide range of nitrogen – oxygen mixtures. Tank oxygen, and nitrogen – oxygen and argon – air mixtures are generally suitable for use in the counter.

[1] Chang and Rosenblum, *Phys. Rev.*, **67**, 222 (1945).
[2] Rubens and Henderson, *Phys. Rev.*, **58**, 446 (1940).
[3] MacKaye, *Phys. Rev.*, **15**, 309 (1920).
[4] Thomas and Duffendack, *Phys. Rev.*, **35**, 72 (1930).

A NEW FLUORESCENT SCREEN FOR THE ELECTRON MICROSCOPE*

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THE fluorescent screen mostly used in electron microscopes and other similar instruments is composed of the well-known willemite, of which there seems to exist a great variety, differing widely so far as grain, brightness and contrast are concerned. The main disadvantage of willemite, at least for the examination of biological material, appears to be its low brightness.

In the search for a material of greater brightness, I selected finally a screen made of zinc–cadmium sulphide (silver-activated) because of its better performance in every way. This screen, as well as a number of experimental ones, was made for me by Dr. H. Meyer[1] and Co., of Derby, to whom I wish to extend my thanks for their interest and generosity. Its characteristics are summarized in the accompanying table, giving measurements under identical conditions of beam current, etc., with the *S.E.*1 exposure photometer :

Brightness measurements of fluorescent screens (log foot-lamberts)

	Willemite	Zinc–cadmium sulphide
Ordinary sample	1·7	5
Brightest obtainable	2·3	5·6

Colours of fluorescent screens matched to Ilford gelatin filters

	Willemite	Zinc–cadmium sulphide
	matched to	
Characteristics of filters	407 (dark green)	401 (yellow-green)
Transmission	60 per cent	72 per cent
Wave-length	5220 A.	5500–5600 A.

* From a paper read at a conference at Cambridge arranged by the Electron Microscopy Group of the Institute of Physics on September 20–23, 1948.