can be ejected from the electrode. The potential appearing at the summing junction in the normal state provides the backing current.

The Current Switch (Figure 1) is normally used in conjunction with a 3-decade Counter (Bradley & Wolstencroft, 1964) which counts neuronal action potentials over preset sampling periods, referred to as epochs. The Counter produces a pulse at the end of each epoch (Epoch pulse). A single-decade counter is fitted to each channel of the Iontophoretic Current Switch and this counts the Epoch pulses; it can be preset to count any number of epochs from 1 to 9. The selected number of epochs is therefore preset on this counter and the START initiated.

On receipt of the first epoch pulse, the switch changes over, ejecting the drug for the number of epochs selected and, having attained this number, both epoch counter and switch are reset, re-establishing the required backing current.

The unit demonstrated has been used continuously over the past 18 months very successfully, freeing the experimenter from many tasks and providing precisely timed drug applications and accurate recording of data.

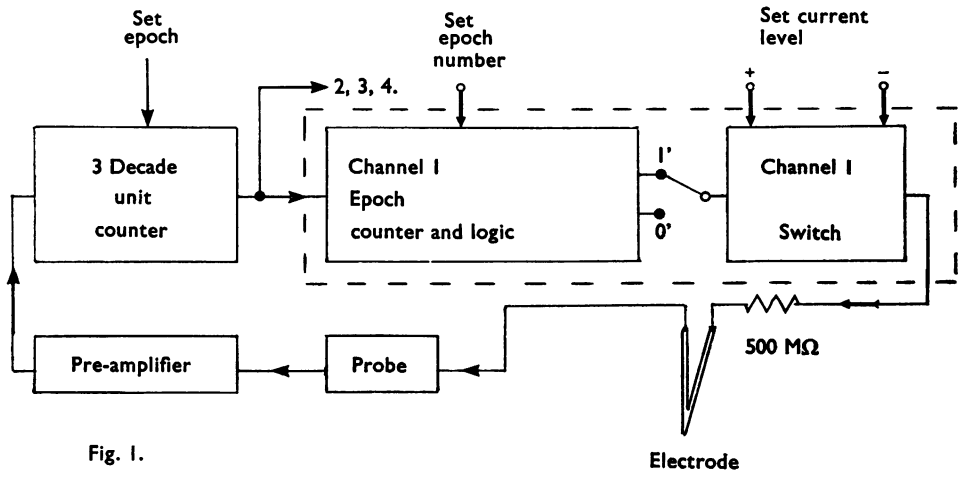

Fig. 1.

REFERENCE

BRADLEY, P. B. & WOLSTENCROFT, J. H. (1964). A counter and print-out unit for recording the frequency of neuronal action potentials. *J. Physiol. Lond.*, **170**, 2–3*P*.

An improved electrically operated microtap

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The original microtap was introduced by Comis, Evans & Whitfield (1964) as a means of applying drugs to single neurones. The microtap uses a concentric system of glass micropipettes, the outer one containing drug solution, while the inner one acts as a recording electrode and can also be used to block the tip of

the outer micropipette to prevent drug from spontaneously leaking out. When it is required to apply drug, the inner micropipette is withdrawn slightly (about 6 μ) thus allowing drug to diffuse towards the neurone. Although the original microtap has been successfully used since its introduction, it suffered from a few minor disadvantages. The micropipettes were nested by means of a hydraulic system, so that even microscopic air bubbles in the system would at times introduce an unsatisfactory degree of backlash ; also the whole manufacturing process was rather lengthy. The present design has eliminated these disadvantages.

The main features of the new microtap are illustrated in Fig. 1. The inner micropipette A is inserted into the holder B and the whole assembly is then drawn back into the perspex block C by releasing the chuck D. The outer micropipette is then filled with the required drug solution and placed in position. The inner micropipette is now pushed into the outer, and the chuck D tightened. The inner micropipette is advanced under microscopic observation by turning the microdrive screw E until the tip is approximately 10 μ from its final closed position. The final closing is done on the preparation by monitoring the impedance between the drug solution and the animal, as described by Comis, Evans & Whitfield (1964). Subsequent opening and closing of this microtap is effected by the ceramic piezo-electric tube (Vernitron, type PZT 5H) F which contracts when suitably polarized, giving a movement of 3 μ per 500 volts.

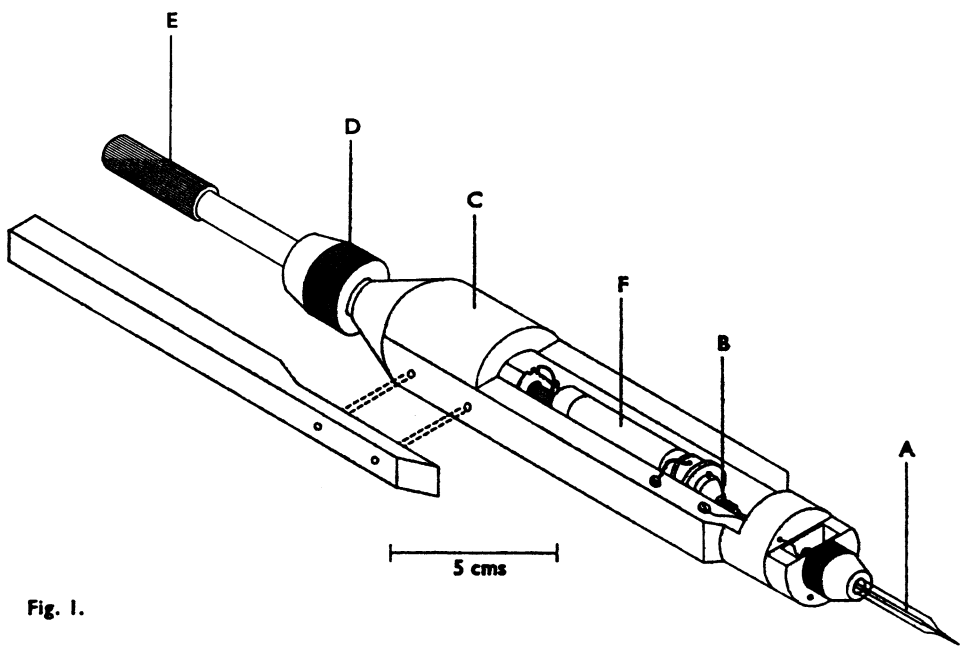

Fig. 1.

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REFERENCE

COMIS, S. D., EVANS, E. F. & WHITFIELD, I. C. (1964). A micro-tap for controlling the application of drugs to single neurones. *J. Physiol., Lond.*, **173**, 4–6*P*.