THE USE OF AN ELECTRONIC CURRENT REGULATOR FOR EFFECTIVE ELECTROCOAGULATION OF BRAIN TISSUE

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In the course of research activities the need for electrolytic destruction of the neurosecretory nuclei of the hypothalamus (the supraoptic and paraventricular nuclei) of rats arose. However, the technical methods available for obtaining foci of electrocoagulation could not ensure the required stability of the results. In some investigations, for example, an electric battery and set of two resistors connected in series—one variable (50-150 kΩ) and the other constant (6.8 kΩ), imitating the electrical resistance of the animal, has been recommended [1, 4]. After the desired strength of the current has been obtained by means of the variable resistor, it is switched over from the 6.8 kΩ resistor to the animal fixed in a sterotaxic apparatus.

The definite scatter of the values of the electrical resistance of the animals used, resulting from differences in their weight and other physiological factors, requires the experimenter to take additional steps to regulate the working current when performing experiments on several animals in succession and interferes with the reproducibility of the results. Besides this, changes in the electrical resistance of the animal in the course of electrocoagulation prevents the maintenance of the working current at the prearranged level, thereby affecting the quality and reproducibility of the results.

These difficulties may easily be removed by the use of a stabilized source of current. A current regulator designed and constructed in the designing office of the institute was used.

This apparatus consists of an electronic current stabilizer designed for working in conjunction with a sterotaxic apparatus. Within the working range of currents from 1 to 15 mA, and with a load of 6.8 kΩ (the animal used was a rat) the deviation from the assigned value of the current during changes in the load of ±25% do not exceed ±0.5%. The stabilization of the current is parametric, and a 6ZhEP beam tetrode is used as the nonlinear element of the circuit. The stabilizer works from the 220 V ac mains. The circuit permits fluctuations in the mains voltage of ±10%. The rectifier is assembled on 4 D7Zh diodes connected in a bridge circuit. The apparatus measures 120×200×90 mm. As the figure shows, it can be earthed at the positive supply terminal only. According to R. M. Meshcherskii [4], however, during electrocoagulation the needle must be at a positive potential relative to the animal's body. To satisfy this condition, the ear clips and the dental adapter must be insulated from the body of the stereotaxic apparatus by means of intermediate plugs and plates of insulating material (organic glass, for example) and the ear clips attached to the negative output terminal of the stabilizer (see Figure, B). The needle in this circuit is connected to the earthed body of the stereotaxic apparatus, itself connected to the positive output terminal (see Figure, A).

The switch for changing the type of operation (see Figure, Sw 2) is placed in the position C (control). The resistor R_1 (6.8 kΩ) is thus included in the anode circuit of the tube. The required value of the working current, as shown by the milliammeter M, is obtained by turning the manual control of the potentiometer R_2. After the needle has been inserted into the animal's brain, the switch Sw2 is changed into the position P (the working position). As stated above, the selected value of the current is maintained automatically, and the experimenter need only switch off the apparatus after obtaining the desired effect.

Since the time required for producing a focus of electrocoagulation of the required size is found empirically, and before satisfactory results can be obtained it is often necessary to perform several

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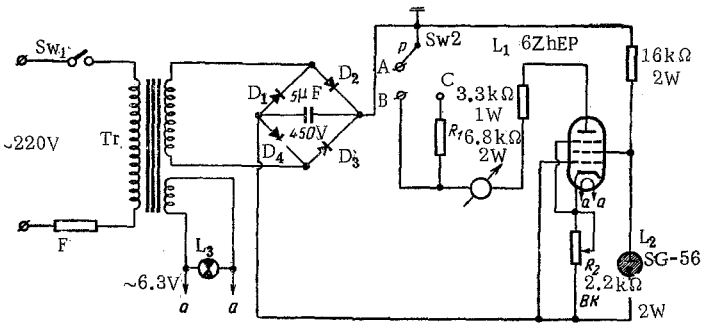

Fig. 1. Theoretical circuit of the stabilizer. D_1–D_4–type D7Zh diodes; M–15 mA milliammeter; F–0.25 A fuse; L_3–pilot light, 6.3 V; Tr–power transformer: core VIII 19×38; windings–primary 1980 turns ϕ 0.2 mm, secondary 2130 turns ϕ 0.15 mm, heater 65 turns ϕ 0.5 mm; all windings of mark PEL wire. Remainder of explanation in the text. BK-switch.

experiments, an attempt was made to obtain objective criteria of the degree of electrocoagulation during the actual experiment and to design an apparatus which could switch itself off automatically when the required effect had been obtained.

Because of the satisfactory results obtained during work with the apparatus described, the use of current stabilizers of this or another type can be recommended for obtaining effective electrocoagulation.

The reader is advised to familiarize himself more fully with the principles of construction of current stabilizers, which are described adequately in books [3, 5] and interesting articles in journals [6, 7]. For designs of semiconductor current stabilizers, which for these parameters are unfortunately rather complex and expensive, the book by S. D. Dodik [2] is recommended.

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