A MINIATURE STIMULATOR FOR BEHAVIORAL STUDIES IN FREELY MOVING CATS

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Summary: A pocket stimulator is manufactured to stimulate hippocampal areas in freely moving cats, and study their instinctual behavior. The main features of this tiny stimulator are its size, the variable intensity control to match the shifting thresholds and its modest price of Rs. 30/- ($4.00).

Key words: transistorized stimulator, hippocampal stimulation, freely moving cats, behavioral studies

Transistorized circuits made it possible to manufacture tiny portable stimulators for different medical appliances including electrical stimulation of the brain. Delgado (1) deviced a small transistorized stimulator with built-in time programming unit so that the parameters and the periods of stimulation were preset; this stimulator attached to the animal's collar could stimulate brain areas while the animal was able to move freely in the cage (1). This method was claimed to be more reliable than remote control techniques with a promising future in Experimental Physiology and Psychology (2). But in this arrangement further control on stimulator by experimenter, was not possible.

Temporal lobe structures of limbic system like hippocampus and amygdala are known to control instinctual behavior including socio-sexual behavior and probably innate habits in cats like visiting selected places for urination and defecation in open air. For such studies the animal should be allowed to move freely. Hence it was felt necessary to construct a protable stimulator with a variable intensity control in order to reset the shifting threshold of stimulation which is known to occur in these areas during successive stimulations.

MATERIALS AND METHODS

The stimulator is made of a pair of transistors (OC 71) arranged as per astable multivibrator circuit (6) and represented in the circuit diagram in which the values of each component are also shown (Fig 1). The stimulator has cathodal stimulation only due to DC restorer — a positive peak clamping circuit, hence no choice of polarity change is provided in the stimulator. The components are arranged on a mica plate which is incorporated in a small plastic box (5 cm x 5 cm x 4 cm) alongwith 22.5 volts battery, the on/off intensity control knob being partially projected outside this box. The principal features of the stimulator are its small size, variable intensity control and its modest price of Rs. 30/-.

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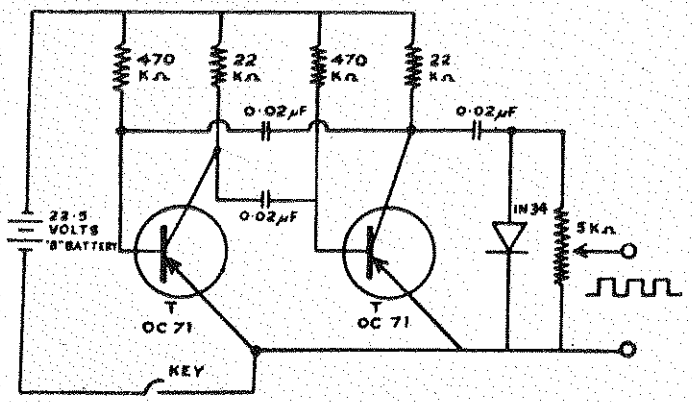

Fig. 1: Circuit diagram of the miniature square wave stimulator.

The output is a train of square wave pulses with fixed width of 4 msec, frequency of 110 cps

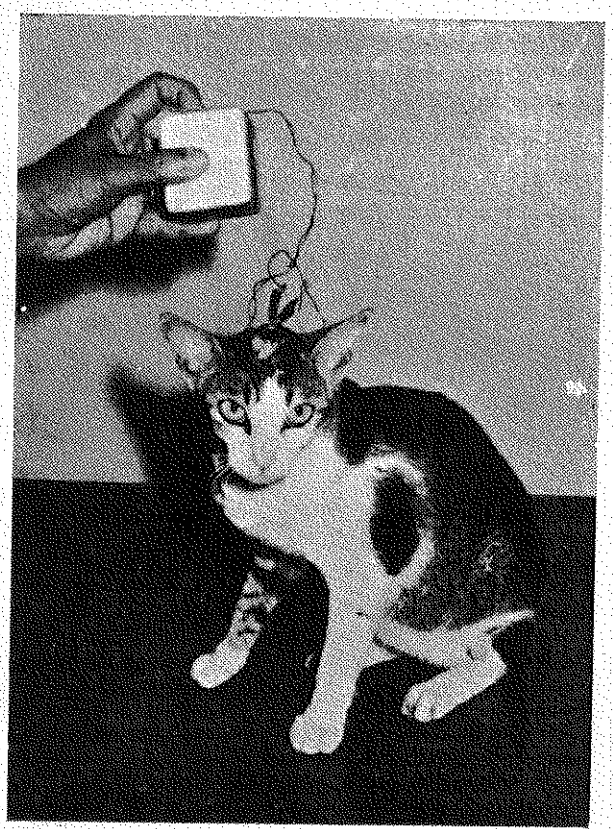

Fig. 2: Set up for hippocampal stimulation through implanted electrodes and miniature stimulator.

and intensity varying from 0-11 volts. The calibration was done before each session of stimulation. The life of the battery in the circuit is approximately 20 hrs.

The hippocampal areas were stimulated with this stimulator through implanted teflon coated electrodes in conscious cats and behavioural changes were studied. Fig 2, shows the set up used for stimulation in chronically prepared animals.

RESULTS

The preliminary results on behavioral changes produced by stimulation of hippocampal areas with this pocket stimulator are described elsewhere (4). On repeated stimulations, applied at intervals of 5 minutes, the subsequent responses were not identical probably due to habituation (5). When the stimulations were repeated with 24 hours interval the responses were seen to be identical. However, the same parameters used continuously for several days, precipitated epileptic seizures. The lowering of threshold on repeated stimulations is thought to be the characteristic feature of temporal lobe structures (3). Side by side histopathological changes consequent to electrical stimulation cannot altogether be neglected. The histological study of one of the animals, brain with implanted electrodes for a period of 52 days revealed slight tissue reaction along the track, the surrounding tissue having quite a normal appearance.

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