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LETTER TO THE EDITOR

A SIMPLE DESIGN OF SHOCK-SCRAMBLER UNIT FOR STUDIES ON FOOT-SHOCK ELICITED AGGRESSION IN RATS

Sir,

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A simplified circuit design for fabricating a shock scrambler unit (SSU) is described in this note. This instrument finds application in research studies on aggression behaviour using rats for the experiments. In this experimental production of aggression, an aversive mood is generated in pair of rats kept in a test chamber by giving electric foot-shocks to them, and this evokes the fighting behaviour between them. The shock-scrambler unit causes alterations of state of electric charge in different bars of the floor grid of the experimental chamber at different moments. This prevents the rats from avoiding shocks by standing on grid bars of equal polarity.

Various classes of aggression have been recognised (1) on the basis of the response topography and the stimuli that elicit the responses, one of these is the pain-induced model of aggression in which foot-shocks elicit fighting between a pair of rats (2). The aversive stimulus is a short duration electric shock given through a shock scrambler to various bars of the grid floor of the experimental chamber grid. The electrical circuit gets completed through the rat when the feet of the rat come in contract with the floor bars of opposite polarity. This results in a foot-shock. After a few such pain-inducing shocks, the rats start fighting, perhaps each thinking that the other is the cause of the painful shocks. The shock-scrambler unit alternates the charge on different bars of the grid floor of the experimental chamber at prefixed intervals.

The main function of the SSU is to charge different bars of the grid at different moments. In an experimental chamber, if the steel bars of the grid are numbered consecutively, then at a time (t_1) the odd numbered bars should get charged. After a gap of time (t_2) neither of the bars is charged. Again, for a time (t_1) the even-numbered bars should get charged. In other words, the odd and even numbered bars of the grid get charged at different moments. This cycle would continue at a given rate (i.e. rate of shocks per minute) for an aggression session.

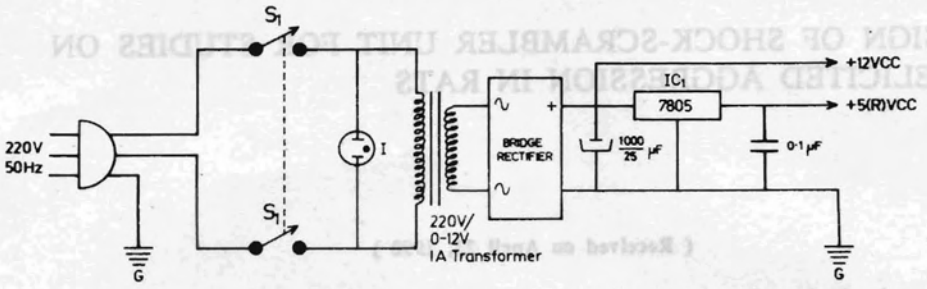
The SSU is designed to consist of a power supply to the circuit, an astable multi-vibrator, dual monoshot, relay driving circuit, and the mains source of electric shock (Fig. 1).

A mains voltage of 220V, 50Hz is applied to a step-down transformer (12V, AC). This is fed to a bridge rectifier to get an unregulated filtered DC output which is applied to a relay driving circuit, and to the input of IC regulator (IC 7805) to get a constant regulated output (CC) of +5V. This in turn is applied to IC 555 and IC 74123.

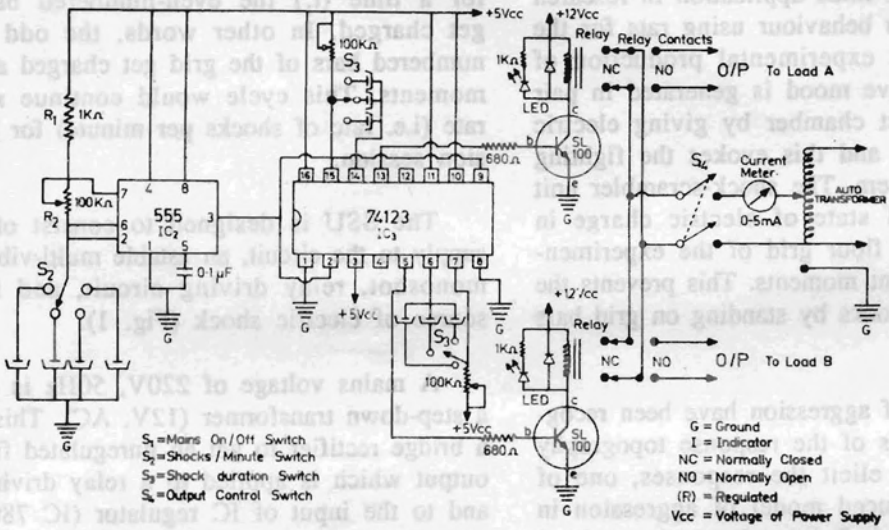
The IC 555 is used as an astable multi-vibrator. Pin numbers: 4 and 8 are given +5VCC, 1 is grounded, 7 for discharge, 6 for threshold and 5 for control voltage set. The reference, threshold and control voltage are set by R_1 and R_2. The frequency of the multi-vibrator can be varied in four steps by a single pole four way band switch to get different rates of shock per minute (e.g., 13, 25, 50 or 100 shocks per minute).

The IC 555 output (Pin No. 3) is fed to IC 74123 input (Pin Nos. 2 and 9). While Pin Nos. 1 and 8 are grounded, Pin Nos. 3, 10, 11, and 16 are applied + 5VCC. This stage is used as a dual monoshot such that one of the inputs is triggered

CIRCUIT DIAGRAM OF POWER SUPPLY FOR SHOCK-SCRAMBLER UNIT



CIRCUIT DIAGRAM OF SHOCK-SCRAMBLER UNIT



PIN CONFIGURATION OF IC 555 and IC 74123

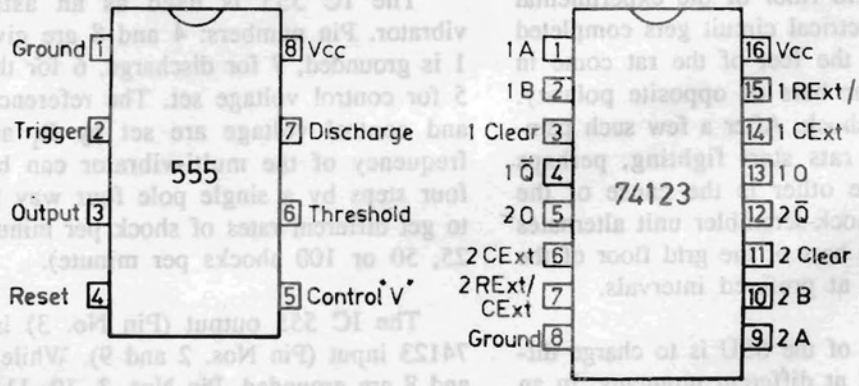


Fig. 1

at the rising edge of the incoming pulse and the other at the falling edge. Thus the dual output of the monoshot is obtained by sequential switching operations of the dual monoshot to incoming pulses. The duration of the output pulse is set in four steps by choosing a combination of the RC time constant (0.25 seconds, 0.50 seconds, 1.0 second and 2.0 seconds).

The dual monoshot output cannot drive the relay directly; so an SL 100 NPN transistor is used in the driver circuit. The IC 74123 output (Pin Nos. 5 and 13) is fed to each of the driving stages through a dropping resistor (680 ohms). The relays are connected at the collector circuit of the transistors, and the emitter is grounded. Depending on the sequential switching operations of the dual monoshot, the driver transistor conducts and drives the relay. This stage is applied an unregulated filtered DC voltage of 12V. The shock voltage is fed to the poles of the relay (heavy duty, dual pole, double throw type) through a double pole switch and an ammeter (0.5mA range) is connected in series to the circuit, to indicate the amount of current being passed to the loads. In parallel to the coils of the relay, two LED's are connected for display of the output. The load connected is to the normally open contacts of the relay so that when the relay operates for a given duration the load receives the voltage, i.e., the electric shock.

The unit operates on mains voltage of 220V, 50Hz, to give a shock current intensity from 0 to 5mA. The duration of the shock can be varied between 0.25 seconds to 2.0 seconds (0.25, 0.50, 1.00, 2.00 sec). So also the rate of shocks administered per minute can be varied (13, 25, 50 or 100 shocks per minute. It should be noted that lower rates of shocking (13-20 shocks per minute) are sufficient enough in the rats to elicit shock-elicited fighting behaviour.

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