ANOTHER SIMPLE INTERVAL-PROGRAMMING CIRCUIT¹

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We have simplified the interval-programming circuit of Clark and Caudill (1960) so that it does not require a resistance-capacitance network or rectifiers, yet maintains the versatility of the Clark and Caudill circuit and commercially available units. Figure 1 shows the arrangement.

Fig. 1. Interval-programming circuit. Relay transfer switches shown in unoperated position; timer switch up (on tape).

With snap-on panel units, the switch contacts and motor line from the interval timer can be brought through suitable connectors to a separate panel, which includes toggle switch Sw 1 (SPDT, center off) and connection to a 115-VAC source. Points X and Y may be externalized on the panel *via* insulated binding posts (a safe, economical, and efficient means of externalizing 115-VAC lines without risk of confusion with low-voltage DC on Nu-Way studs).

For use with punched-tape timers for programming FI, VI, or intertrial intervals (*e.g.*, in classical avoidance or CER experiments) timed from the termination of trial n to the

onset of trial $n + 1$, Sw 1 routes the timer motor line through Y. The motor runs as long as Relay B is unoperated. When the timer switch enters a hole in the tape, Relay A is operated and locked up through itself and normally closed contacts on Relay B. As the timer switch emerges from a hole in the tape, Relay B is operated and locked up through its own normally open contacts and a normally closed set of external contacts, W. With Relay B locked up, the timer motor is cut off and Relay A is released. Contacts at W open to release Relay B and start the timer motor on the occurrence of a specified event. Such an event may be reinforcement in FI or VI programs, an avoidance or escape response in classical avoidance training, or the delivery of shock in a CER procedure.

In FI or VI, response pulses are conducted through points C and T.O. to an external reinforcement-control relay or directly to the reinforcement dispenser. For programming intertrial intervals, closure between C and T.O. initiates a trial by activation of suitable apparatus (*e.g.*, warning signal duration timer).

As Clark and Caudill have described, this circuit can be used in limited hold, signaling of Relay A operation (at S or U), continuous recycling, and multiple schedules. (The relevant contact points are lettered identically.) In continuous recycling, the pulse at the T.O. stud may be too brief for most purposes, but a longer pulse is available at V.

For continued timing during Relay B lock-up (in programming intertrial intervals from trial onset to trial onset, or in shortening each interval by the duration of the preceding lock-up), Sw 1 routes the timer motor through X. Additional reinforcements or trials may be programmed by momentarily grounding either Relay A or B at U or V, respectively.

When Relay B is operated, it may fail to lock up if the time required for its contacts to

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transfer exceeds the time required for Relay A to release. However, we have not encountered critical operating or release-time problems in over 25,000 operations with use of Clare Type J or Automatic Electric Type BQA relays (350-ohm coils, 4 C springs) on 24-28 VDC with Federal Type 8A2PS1 contact protectors across the relay coils. Furthermore, we have

not needed to include a current-limiting resistor in series with the coil of Relay B during lock-up.

REFERENCE

- Clark, F. C., and Caudill, C. W. A simple interval-programming circuit. *J. exp. Anal. Behav.*, 1960, **3**, 5-7.