Radiotelemetry with the Big Brown Bat (*Eptesicus fuscus*)[1]

JAMES B. COPE, DONALD R. HENDRICKS and WILLIAM B. TELFAIR,
Earlham College

Abstract

A frequency modulated transmitter was designed specifically for the big brown bat, *Eptesicus fuscus*, to aid in studying movement in a hibernaculum. The signal from the 1.2 g transmitter was recorded on a tape for 1 second in every 6 minutes, providing recordings from a period of 7 days and 6 hours on a 30-minute tape.

The research worker dealing with live animals in the natural environment is plagued with the possibility of disturbing the subject sufficiently to make his data unreliable. We have been concerned about the disturbance factor in bat hibernacula. To aid in studying bat movement, we designed a transmitter which was light enough so it did not appear to hinder the bats in flight nor alter their behavior.

Methods

Cochran *et al.* (1) used a 2.5 g transmitter to study thrushes and found no hindrance in flight or change in behavior with transmitters up to 15% of the body weight. Because the weight of *Eptesicus fuscus* ranges from 14 to 24 g (3), the transmitter had to weigh less than 2.1 g to allow freedom in flight and movement.

A transmitter designed by Skutt *et al.* (2) was modified by constructing the body out of plexiglas 0.562 inch in diameter and 0.141 inch in thickness. The completed transmitter weighed 1.1 to 1.2 g as opposed to the 1.5 g transmitter built by Skutt *et al.* (2). Three turns of No. 28 magnet wire in the threads on the outside of the form (tapped at one turn) served as the inductor in an LC (Hartley) oscillator and also as the transmitting antenna (Figs. 1, 2, 3).

The signal is an unmodulated carrier which produced quieting in a normal FM radio. To produce an audio output from the receiver when the functioning transmitter was within range, the oscillation of the local oscillator was frequency modulated at an audio rate. Later, a 1000 ohm resistor was dropped from the construction to increase the efficiency of the transmitter and lengthen the life of the battery (Figs. 1, 2).

The original transmitter drew approximately 140 μ amp. When one resistor was dropped, it drew 65 μ amp which more than doubled the life of the battery. This caused the oscillator to "motor boat" at an audio rate. The expected battery life was approximately 14 days.

A gating circuit was also designed to turn on both the receiver and tape recorder for 1 second every 6 minutes. This was an astable oscillator, followed by a phase inverter (a mono-stable oscillator), then a current amplifier and power transistor switch (Fig. 4). This allowed a 30-minute tape to record for 7 days and 6 hours.

[1] Funds were provided by National Science Foundation Undergradute Research Participation grant No. GY5991 and COSIP grant No. GY4707.

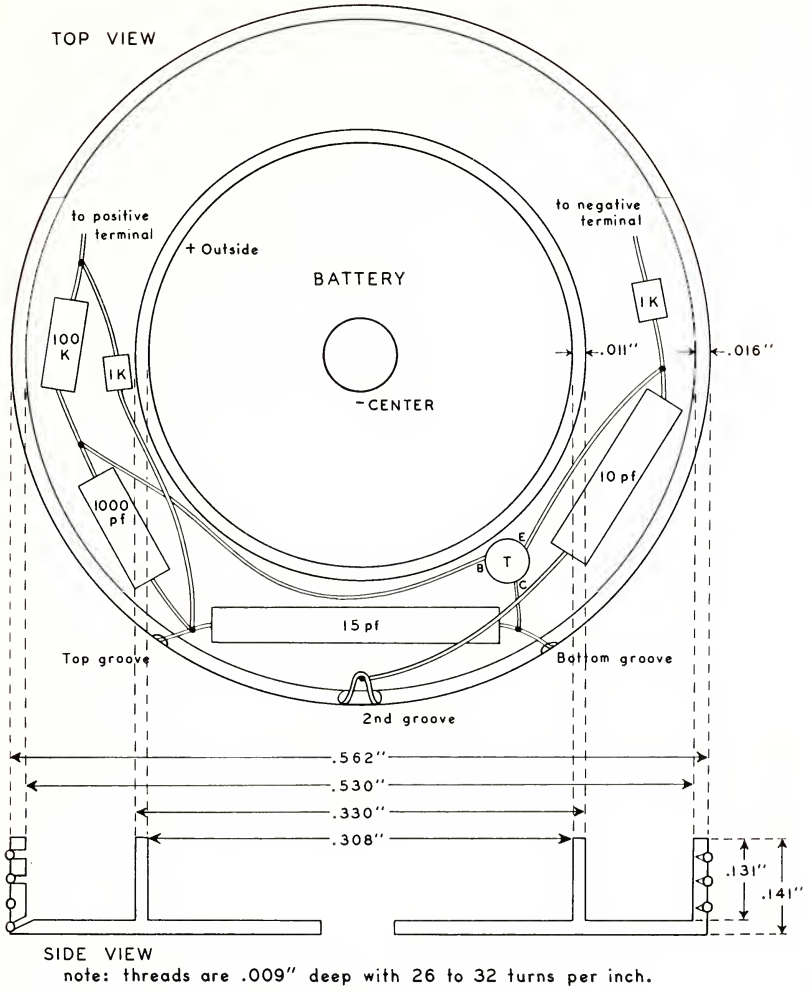

FIGURE 1. *Modified Skutt transmitter.*

A mock transmitter was built by using a soft aluminum shell measuring 0.562 inch in diameter and 0.125 inch in thickness. It was filled with lead shot to give it a weight of 1.5 g. The mock transmitter was attached to a bat with adhesives to test: 1) irritation from glue and, 2) irritation from placement. Surgical cement (Vi-drape) was used but proved unreliable because it caused loss of hair and skin irritation. A benzoin tincture first applied to the hair, then contact cement (Weldwood) to both the hair and transmitter surface gave the best bond and least irritation. When the transmitter was attached to the neck region or the scapular region, the bat refused to fly, and bit and scratched at the transmitter until it was pulled off. When attached just above the caudal region, it caused no irritation and no noticeable

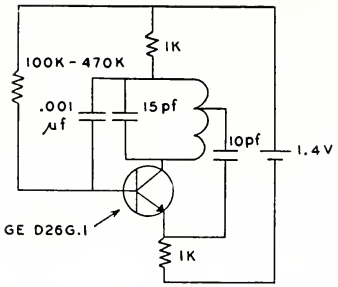

FIGURE 2. *Circuitry of transmitter.*

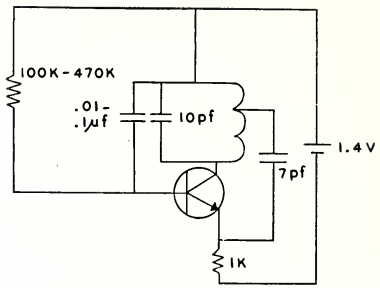

FIGURE 3. *Modified transmitter.*

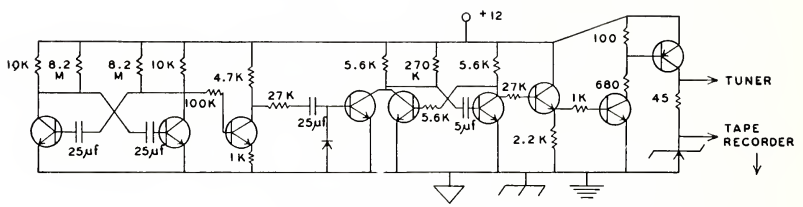

FIGURE 4. *Gating circuit.*

change in flight pattern or feeding behavior (Fig. 5). A sample of 8 bats, 4 males and 4 females, with an average weight of 18 g was used for testing.

The bats and all equipment were taken to the hibernaculum. A transmitter was attached to a bat and, hand-held, the bat was moved

FIGURE 5. Eptesicus fuscus *with transmitter attached.*

to different possible locations in the site to determine effectiveness of equipment and antennae. Best reception was with a half-loop antenna at the range 0-15 m. The signal could be picked up within this range despite placement of the bat behind jagged walls or in holes in the ceiling. Because the study area is a tunnel, no interference was found inside the center half of the tunnel from FM stations.

All equipment was tested for temperature stabilization at —8°C; all proved effective.

Acknowledgement

We thank Dr. Richard W. Stow of Ohio State University for assistance and use of his laboratory, Margaret Brown for art work, and Richard Otis for a photograph.

Literature Cited

1. COCHRANE, W. W., G. G. MONTGOMERY, and R. R. GRABER. 1967. Migratory flights of *Hylocichla* thrushes in spring: a radiotelemetry study. *In* The Living Bird, 6th Ann. Lab. of Ornithology, Cornell Univ., Ithaca, N.Y. 249 p.
2. SKUTT, H. R., R. G. BESCHLE, D. G. MOULTON, and W. P. LOELLA. 1967. New subminiature amplifier-transmitters for telemetering biopotentials. Electroencephal. and Clin. Neurophysiol. 22:275-277.
3. WALKER, E. P., and associates. 1964. Mammals of the World, v. 1. The Johns Hopkins Press, Baltimore. 644 p.