TITLE (to be typeset) AN IMPLANTABLE MULTI-CHANNEL TEMPERATURE TRANSMITTER

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A multichannel transmitter suitable for the simultaneous measurement of four independent temperatures has been designed and constructed. The low power consumption and small size make this unit suitable for use in chronic implant experiments. The measurement of body temperature via radio telemetry has proved useful in many physiological experiments, especially the study of circadian rhythms where the animal must be monitored continuously without outside influences. Single-channel systems for this purpose have been reported[1,2,3] and widely used. Because of the significant temperature gradients that exist in the body it was deemed desirable to measure a number of temperatures simultaneously for a more complete study of the mechanisms involved in circadian rhythms.

Although a number of single-channel transmitters could be employed, the need for multiple receivers, etc., makes the use of a single transmitter with a number of sensors desirable. The telemetry system shown in Fig. 1 is designed to measure four or more temperatures using one radio transmitter. A ring counter activating a series of solid-state switches is used to periodically sample a reference resistor and each of four thermistor sensors. The resistance change is used to control the interval between pulses in the subcarrier oscillator. The operation of the subcarrier oscillator and its modulation of the RF transmitter is similar to the system described in Ref. 1 for single-channel operation. The addition of a low-power nand gate ring counter has extended the capability to multichannel use.

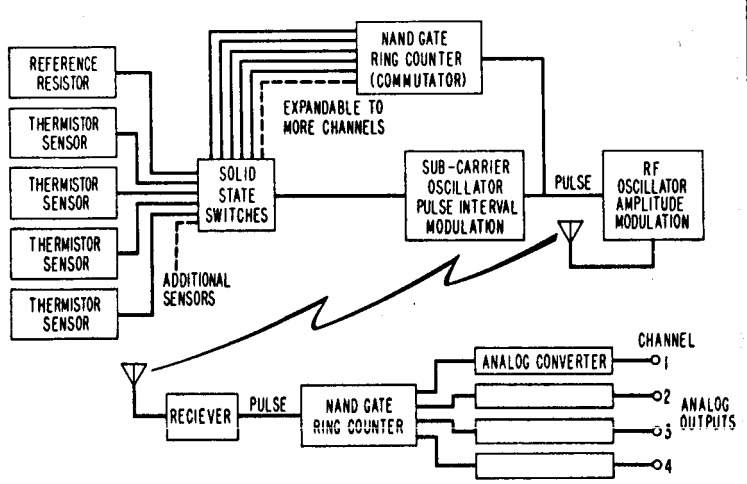

Fig. 1. System Block Diagram

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Fig. 2 shows a photograph of the transmitter. The sealed and potted unit, including battery, weighs 22 grams with a volume of 8 cc. Since the power supply (battery) is the largest and heaviest component, it is significant that the entire system is designed to operate from one mercury cell (1.4V) and consumes only 27 μA of current. An RM675 cell weighing 3 grams will provide 6000 hours of operation.

Fig. 2. Signal Conditioning and Transmitter Electronics Prior to Assembly in An Implantable Hermetic Container.

1. T. Fryer, "Micropower Transmitter for Temperature Measurements," Proceedings of the 8th Annual Conf. on Engineering in Medicine and Biology, Vol. 7, 1965 - Phila., Penn.
2. J. S. Brown, J. P. Pedico, "Micropower Miniature Temperature Telemetry," 5th Annual San Diego Symposium of Biomedical Engineering, June 6-8, 1965, San Diego, Calif.
3. R. S. Mackay, "Telemetering from Within the Body," pp. 148-233 of Biomedical Telemetry, by C. A. Caceres, Academic Press 1965.
4. T. Fryer, H. Sandler, B. Datnow, "A Multichannel Implantable Telemetry System," the 7th International Conference on Medical and Biological Engineering, Stockholm, Sweden, Aug. 14-19, 1967.