A Square-Wave Electrical Anesthesia Current Generator

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The electrical anesthesia current generator reported here was designed to satisfy a need for a low-cost, square-wave generator which can be adjusted over a wide range of pulse durations and frequency.

The instrument's circuitry (fig. 1) is a modification from Smith and Cullen.[1] Among the major differences was a re-design of the pulse generator section; a 2D21 tube and associated circuitry were substituted, as well as more decoupling filtration in the B-plus supply to the section. Switching and appropriate capacitors were also included to provide a wider range of frequency. The frequency ranges can be changed by changing capacitor values. Maximum frequency in any range is limited by the pulse width. However, with the present capacitance values and a narrow pulse width, the low frequency range extends from 63 to 122 c.p.s., and the high frequency range extends from 550 to 1,100 c.p.s. This design permits a range of pulse widths at 100 c.p.s., for example, of 0.7 to 5.2 msec.

Other changes included a manually operated pulse height control, with a 5 to 1 reduction drive. The switch between B-minus and the chassis was provided to eliminate ground loops when bioelectrical potentials are recorded during electrical anesthesia. The facilities for

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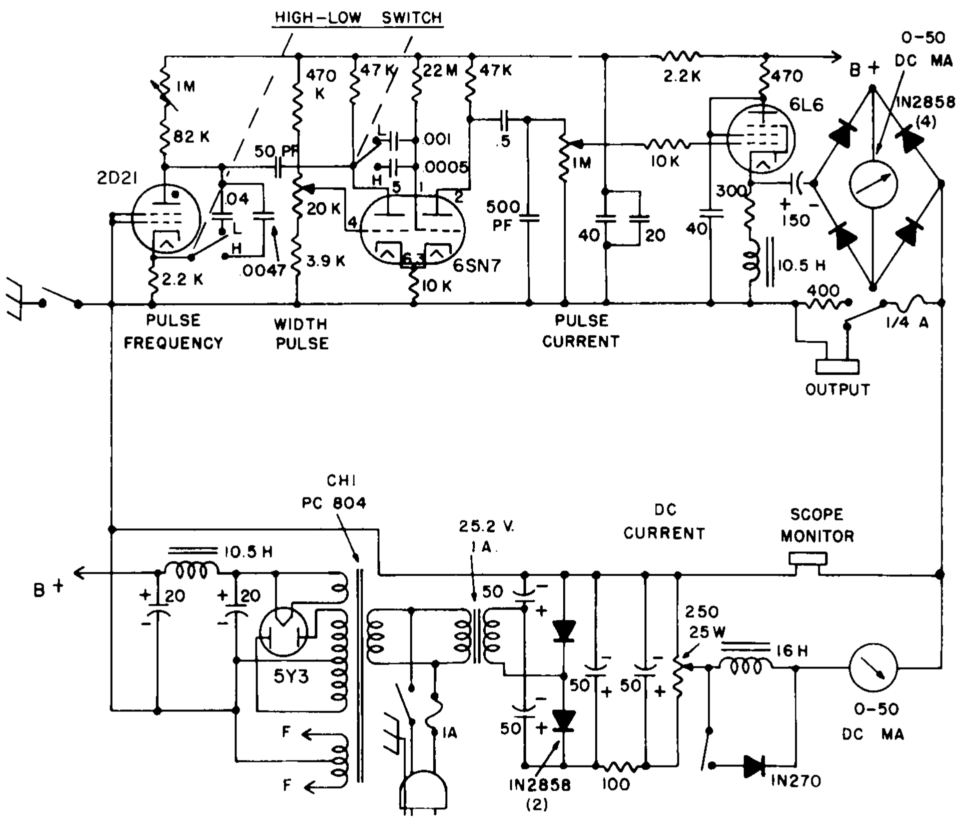

FIGURE 1.

chassis grounding were provided to reduce any shock hazard.

A major feature of this circuit is a diode clamp, which blocks negative portions of the a.c.-origin square wave and thereby obviates the need for using large amounts of d.c. current to bias the waveform. For example, without the diode the amount of d.c. current needed to elevate 30 ma. of the a.c. waveform above the baseline is 20 ma. This biased relation between a.c. current and the base-line is fixed, independent of frequency or amplitude, and is maintained automatically, allowing changes in a.c. gain or frequency without simultaneous adjustments of d.c. bias.

The meter which measures a.c. current actually reads the "average" current. However, when the diode is in the circuit, it forms a low resistance shunt around the high reactance inductor, and the meter no longer reads correctly because some of the current is diverted through the diode. A linear relationship does exist between the observed meter readings and calculated average current values obtained by analysis of the displayed waveform across a precision resistor in series with the animal.

The unit, as described above, cost less than $100, plus labor. The unit has been tested on cats and rabbits on alternate days for 4 months. During this time typical electrical anesthesia was always produced, and there have been no repairs nor deterioration in the generator's performance.

This work was supported by a grant from the Morris Animal Foundation, Denver, Colorado. Mr. Don Love of the Engineering Experiment Station's Electronics Shop constructed the current generator and furnished technical advice.

REFERENCE

1. Smith, R. H., and Cullen, S. C.: Electronarcosis—a progress report, Amer. J. Med. Elec. 1: 308, 1962.

Tracheostomy Cannula for Speaking During Artificial Respiration

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A tracheostomy cannula was developed which allows artificially ventilated patients to talk by using their own expired air (fig. 1). The cannula is designed for the use in combination with the Bird Respirator. No alterations and no additional equipment are necessary, and the cannula can be used with controlled or assisted respiration.

The cannula consists of a head which measures 33 × 32 × 29 mm. and which has two openings; one opening is for bronchial toilet, and may be occluded with a cork; the other opening is for the connection to the respirator. The head also contains a cylinder with a spring-loaded piston. These parts are mounted in plexiglass on a metal base which is connected to the cannula. The head can be easily separated from the cannula, without removing the cannula from its position in the neck. The cannula itself is divided into two parts. The outer portion lies in the soft tissue of the neck, and contains a hollow slide valve. This slide valve is connected to the piston by a short pin and these parts can be easily dismantled (fig. 2). The inner portion of the cannula lies within the lumen of the trachea, and contains an oval opening for exhalation. The diameter of the exhalation opening should correspond to the internal diameter of the cannula. An inflatable cuff surrounds the distal portion of the cannula.

The two portions of the cannula are straight and measure about 5 and 3 cm. The curved angle of the cannula is about 100°, and is a more acute angle than that of the common silver tracheostomy tube. A shield is mounted

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The opinion expressed is that of the authors and not that of the United States Army.