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.

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**Reference**


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**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...
Fig. 1. Photograph of the cannula.

on the outer portion of the cannula, and its position is adjustable so that it lies on the skin. This helps to maintain the correct position of the cannula. The piston and slide valve can be locked in the inspiratory position by a screw inserted on the head of the cannula. This screw keeps the exhalation port of the cannula constantly closed. The cylinder and piston are made of brass, while the spring is of stainless steel. The tube and the slide valve are of German silver. The weight of the cannula with shield and cuff is about 100 g.

The exhalation valve of the Bird Respirator is activated by pressure within the nebulizer pressure line. This pressure line is connected with the cylinder of the cannula by a small T-piece. During inspiration there is a high pressure within the nebulizer pressure line and this pressure closes both valves synchronously. The pressure is high enough to move the piston in the cylinder of the cannula downwards and to occlude the exhalation opening in the cannula. By this maneuver the inspiratory gas is directed to the lungs of the patient. At the end of the inspiration the pressure within the nebulizer pressure line falls rapidly and both valves open. The exhalation gases can now escape through the larynx of the patient.

Fig. 2. Photograph of the dismantled cannula.

Fig. 3. Diagram of the cannula in inspiratory position. The exhalation opening in the curved portion of the cannula is occluded by the slide valve. This allows the inspired gas to reach the patient’s lungs, as indicated by the arrow.

Fig. 4. Diagram of the cannula in expiratory position. The exhalation opening in the curved portion of the cannula is open, and allows the expired gas to escape through the larynx, as indicated by the arrow.
provided the exhalation valve of the respirator is capped. The two positions of the slide valve within the cannula may be seen in figure 3 and 4. The cannula functions as a common tracheostomy tube when the slide valve is locked in the inspiratory position and when the cap on the exhalation port of the respirator is removed. Under these conditions a negative phase during expiration can be used.

The slide valve does not completely occlude the outer portion of the cannula during expiration. This is important, as it allows the patient to create a subatmospheric pressure within the respirator. Assisted respiration of the patient is possible by appropriate adjustment of the sensitivity of the respirator.

The cannula contains no joints, only three movable parts and one spring. The piston is lubricated with silicon oil, and the humidity of the expired gas is sufficient for the lubrication of the slide valve. Cleaning of the cannula is easy, because the head, piston, and slide valve can be dismantled. The cannula can be sterilized in detergent or ethylene oxide.

The clinical trials with the cannula on five patients were encouraging. Only one patient was not able to talk for an unknown reason.

The cannula was used continuously for nine hours in one patient. If certain conditions exist and if a high pressure must be used for ventilation, the patient can talk after some air has escaped from his lungs. With the remaining air of lower pressure, he can then speak.

Assisted respiration seems to be more suited for speaking with this cannula than controlled respiration. The patient can prolong the expiration time and thus the time available to speak at will. The patients were able to say at least ten words distinctly during one exhalation period, and one patient was even able to sing. Some patients were able to clear their throat and to cough.

Coughing is important in the prophylaxis against pneumonia and atelectasis. However, the ability to cough with the cannula in place depends largely on the clinical condition of the patient. Coughing alone is not sufficient for bronchial toilet, and endotracheal suctioning is necessary. It can be performed when the slide valve is locked in the inspiratory position, and can also be accomplished by removal of the cork during the inspiratory cycle.

We believe this cannula provides definite advantages for patients during prolonged periods of artificial respiration.

Endotracheal Cuff Arrangement to Facilitate Topical Anesthetization

Richard R. Jackson, M.D.*

There are occasions when it is desirable to maintain topical anesthesia of the tracheal mucosa for a longer period of time than is provided by a single application of the anesthetic agent. Such a technique allows the conscious patient to tolerate an endotracheal tube with less discomfort. It also decreases the incidence of straining ("bucking") when an endotracheal tube is used in the lightly anesthetized patient.

Smith and Bonner have accomplished this by using a standard cuffed endotracheal tube with a spray tube built in.1 This requires periodic deflation of the cuff for reapplication of the topical agent. In addition, rather large quantities of the topical agent are often required.

Described herein is an endotracheal cuff arrangement that permits efficient application of a topical anesthetic agent to the tracheal mucosa for an indefinite period of time.

Two tracheotomy cuffs are placed on an endotracheal tube as illustrated. An inflation tube from a discarded endotracheal cuff is passed along the concave surface of the endotracheal tube beneath the proximal cuff termi-