resistance. This variation is greatly reduced and the rate of inflow more easily controlled when the region of constriction is extended by use of a long clamp.

The instrument described here is similar to that used by a group working on problems of renal physiology in man and animals in the Department of Physiology and Medicine, New York University College of Medicine, under the direction of Homer W. Smith. It was originally designed by J. E. Shannon and has been modified for use in clinical work at the Massachusetts Memorial Hospitals.

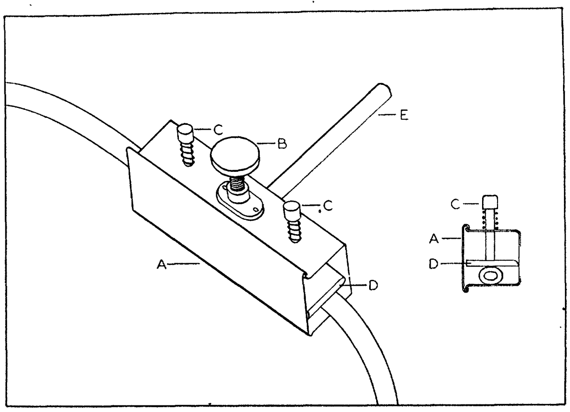

FIG. 1

The clamp[1] (Fig. 1) is constructed of nickel-plated brass with all attached parts riveted and joined with high-melting-point solder to permit sterilization. It is 4 inches long, and $\frac{3}{4}$ inch square in cross-section. The outer side is closed by a metal slip (A), so designed that the construction becomes tighter as the tubing is compressed. Uniform compression of the rubber tubing is assured by bolstering the centrally placed adjustment screw (B) by two pins (C) passing through a lateral wall of the clamp affixed to the compressor plate, and held in place by steel springs that expand between the terminal head of the pins and the lateral wall of the clamp to keep the compressor blade pressed against the adjustment screw. The pins are placed $2\frac{1}{2}$ inches apart, $\frac{3}{4}$ inch from each end of the clamp. A short bar (E) may be attached to the inner wall to support the clamp independently of the tubing.

This clamp has found intensive use whenever constant inflow rates are necessary, as, for example, in renal clearance (*3*, *4*) and hepatic blood flow (*2*) determinations, the administration of penicillin (*1*), and other chemotherapeutic agents. Where very slow rates of inflow (1–2 ml./minute) over long periods of time are required, as with the intramuscular injection of penicillin or the parenteral administration of fluids to infants, it has proved particularly valuable.

References

1. ANDERSON, D. G. *New Engl. J. Med.*, 1945, **232**, 400–405, 423–429.
2. BRADLEY, S. E., INGELFINGER, F. J., BRADLEY, G. P., and CURRY, J. J. *J. clin. Invest.*, 1945, **24**, 890–897.
3. GOLDRING, W., and CHASIS, H. *Hypertension and hypertensive disease.* New York: Commonwealth Fund, 1944.
4. SMITH, H. W., GOLDRING, W., and CHASIS, H. *J. clin. Invest.*, 1938, **17**, 263–278.

[1] This instrument may be obtained from the Harvard Apparatus Company, Dover, Massachusetts.

An Improved Alcohol Check for Rat Metabolism Apparatus

IRVING GOODMAN and R. G. GUSTAVSON
University of Colorado, Boulder

In connection with the open-circuit determination of basal metabolic rates of small animals, one of the most troublesome problems which arises is a method of alcohol combustion which will produce carbon dioxide at a rate comparable to that of the animal and yet result in complete combustion, thus allowing for an accurate check on a theoretical respiratory quotient (R.Q.). Schwabe and Griffith (*3*) encountered this difficulty and finally resorted to the mechanical withdrawal of oxygen and addition of carbon dioxide at rates comparable to those encountered in their experimental work with rats. Bunnell and Griffith (*1*) devised a metabolism check apparatus using illuminating gas. This method, however, is subject to criticism unless analyses of the illuminating gas are reported.

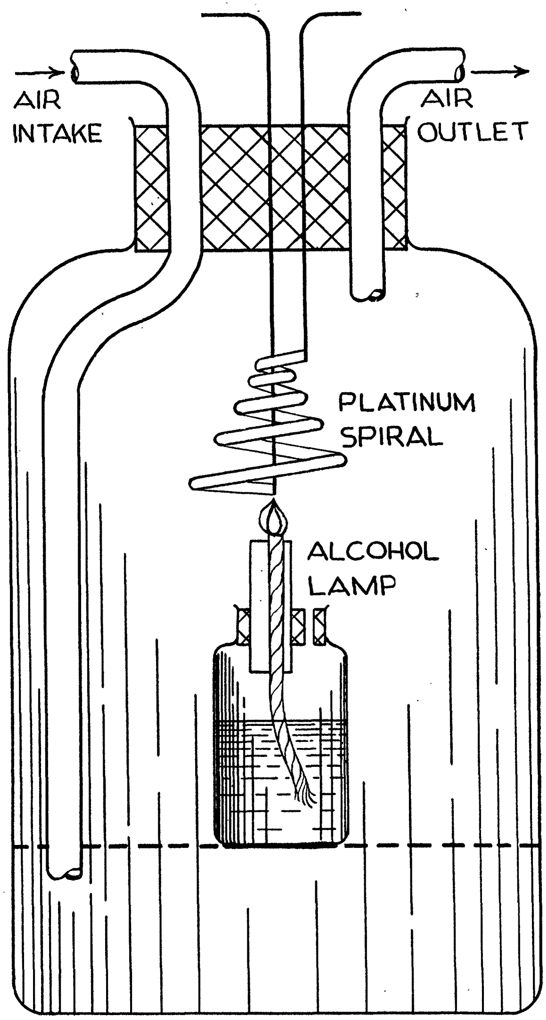

FIG. 1

Other methods have been used for checking larger metabolism machines. Among these are the complicated radiating alcohol burner of Jones (*2*), which is exceedingly cumbersome, and the ingenious method of Shelley and Hemingway (*4*), using a detachable, electrically ignited lamp that may be weighed before and after burning, which is not applicable to work with small animal chambers.

After many unsatisfactory attempts at obtaining a reasonable R.Q. for methyl alcohol, using a small alcohol lamp, an electrically heated platinum spiral, suspended above the small alcohol flame, resulted in complete combustion as demonstrated by the R.Q. The following R.Q.'s were obtained in burning absolute methyl alcohol in this manner: 0.673, 0.669, 0.659, 0.670, 0.655, with an average of 0.665. The theoretical value is 0.667.

References

1. Bunnell, I., and Griffith, F. R. *Proc. Soc. exp. Biol. Med.*, 1940, **44**, 509.
2. Jones, H. M. *J. lab. clin. Med.*, 1929, **14**, 750.
3. Schwabe, E. L., and Griffith, F. R. *J. Nutrition*, 1938, **15**, 187.
4. Shelley, W. B., and Hemingway, A. *Science*, 1940, **91**, 99.

A Simplified Encephalophone

Matthew Conrad and Bernard L. Pacella

Department of Experimental Psychiatry, New York State Psychiatric Institute and Hospital, and *Department of Psychiatry, College of Physicians and Surgeons, Columbia University*

A simple adapter has been developed which converts the low-frequency varying voltages observed with an electroencephalograph into variations in the pitch of an audible tone. An instrument which accomplishes this has already been described (*1*), but it is felt that the present highly simplified circuit will make this method more readily available to those who may wish to explore its possibilities.

Fig 1. is a schematic diagram of the adapter. The type 884 thyratron is used in a relaxation oscillator circuit. The condenser, C_1, is charged through the resistors, R_1 and R_2. When sufficient charge has accumulated on C_1 to raise its potential to the breakdown voltage of the 884, the condenser will discharge quickly through the tube, and the small resistor, R_3, until the condenser voltage reaches the maintaining voltage of the tube, at which point the tube will cease conducting. The cycle of charging and discharging will occur repeatedly, giving rise to audio-frequency oscillations, the frequency of which depends mainly on the time required for the condenser, C_1, to charge up to the breakdown voltage of the 884. Frequency modulation of these oscillations may therefore be accomplished by varying the potential of the grid of the 884, thereby varying the breakdown voltage of the tube.

The oscillations generated by the thyratron circuit are amplified in a single-stage amplifier, using a type 6K6 tube, and applied to a loud-speaker. A single 45-volt battery has been found entirely adequate for the plate supply. The current drain is only about 6 milliamperes. The heaters may be supplied by a transformer. If it is desired to obtain power for this adapter from the electroencephalograph with which it is used, care should be taken to see that the plate supply voltage applied to the adapter is within the range of about 40–100 volts. Stable operation outside of this range is unlikely with the circuit constants given.

Three controls are used in the operation of the adapter. The mean pitch of the tone is adjusted by varying R_1. Control

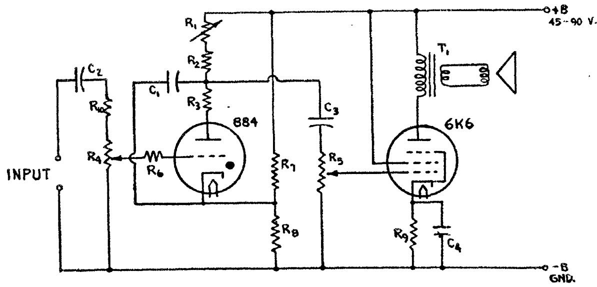

Fig. 1. R_1—100,000-ohm linear potentiometer; R_2—50,000 ohms; R_3—2,000 ohms; R_4—50,000 ohms; R_5—200,000 ohms; R_6—10,000 ohms; R_7—100,000 ohms; R_8—7,500 ohms; R_9—500 ohms; R_{10}—750,000 ohms; C_1—0.02 mfd.; C_2—1.5 or 2.0 mfd.; C_3—0.03 mfd.; C_4—25 mfd., 25 volts; T_1—10,000 ohms to voice coil; loud-speaker—5-inch permanent magnet dynamic.

over the sensitivity, or ratio of pitch deviation to input signal, is effected by the potentiometer, R_4. The loudness of the tone may be adjusted by means of the volume control, R_5. At maximum sensitivity a 50 per cent increase in audio-frequency is obtained when the grid of the 884 is made more positive by 1 volt.

The input terminals of the adapter are connected across the writing mechanism of the electroencephalograph. In most commercial electroencephalographs this connection may be made by means of binding posts on the writing mechanism unit. Sufficient voltage to operate the adapter will be available on any of the magnetic or piezoelectric writing mechanisms in current use. The adapter may be left permanently connected across the writing mechanism terminals, even when not in use.

The adapter was attached first to a low-frequency oscillator in order to test its response. Waves of about 8–12 cycles produced the effect of a fast musical vibrato applied to the tone. Waves in the range above 20 cycles produced a roughening of the tone that was decidedly unmusical—somewhat like the sound of a hornet. Waves of about 5–7 cycles produced the sensation of a musical vibrato of slow to moderate rate, while slower waves of about 1–4 cycles sounded more like a gliding variation in pitch which could be followed continuously.

Similar results were obtained when the adapter was attached to an electroencephalograph and human subjects were used. With a little practice, it was possible to estimate the frequency of the predominant activity quite closely by listening to the frequency-modulated tone.

The apparatus may be simplified by eliminating the power output stage and speaker and substituting headphones. This has the added advantage of confining the sounds only to the listener and eliminating any disturbing effect which they may have upon the subject and the recorded potentials, since auditory stimuli may affect the EEG pattern.

Reference

1. Furth, R., and Beevers, C. A. *Nature, Lond.*, 1943, **151**, 111; *Electronic Eng.*, 1943, **15**, 419.