Medical Electronics

Steps are being taken that might lead to federal standards and compliance testing of medical electronic equipment. The Federal Food and Drug Administration is now carrying out an inventory of medical devices in order to identify those devices that might be exempted from standards, those that will require evaluation and test because of present lack of standards, and those that can be tested for compliance by existing criteria. A study carried out at the University of New York's Downstate Medical Center revealed that approximately 40% of the equipment delivered failed to meet the Center's safety requirements or the manufacturers' specifications.

Notes

Modified nontraumatic headholder*

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Erickson (1966) has described a simple nontraumatic headholder for small mammals, that is easy to build and simple to use. It consists of a pressure bar that clamps down onto the animal's nose and a mouthpiece milled and drilled out of brass rod to fit the animal's incisors and molars. This note describes a modification of the mouthpiece to permit it to accommodate variations in head size which otherwise result in an improper fit and consequently an improper orientation of the head for stereotaxis.

Figure 1a shows a top view of the modified mouthpiece for the rat mounted on a block which fits directly onto a Kopf cat-monkey stereotaxic instrument in place of the plate bearing the cat-monkey infraorbital clamps and mouth bar. Figure 1b shows a side view of the headholder with the pressure bar over the mouthpiece. The rat's mouth is slipped over the rounded end of the mouthpiece, care being taken to keep the corners of the mouth from catching on the sides of the mouthpiece. The incisors fit into Hole I, and the molars fit inside the flanges created by milling out a

Figure 1

13/32-in.-wide depression in the mouthpiece. Sharp edges on the flanges should be rounded off. The basic modification of Erickson's design is the cut, C, down the middle of the mouthpiece to Hole H, and the two 3-48 screws, S₁ and S₂, on the side of the mouthpiece. The hole for S₁ is threaded only on the side opposite its head; tightening this screw pulls the flanges closer together to fit rats with smaller than average heads. Tightening S₂ spreads the flanges apart to accommodate larger than average heads.

When the mouthpiece is oriented in the horizontal plane of the stereotaxic instrument, the brain is positioned reasonably closely to the coordinate system used by König and Klippel's (1963) atlas of the rat brain. The bregma (intersection of the coronal skull suture and the sagittal or midline suture) can serve as the zero point. This point lies approximately in the 7,190-micron frontal plane of this atlas, about 5.5-6.0 mm above its horizontal plane. Because the skull sutures vary from animal to animal and because this atlas is based on rather small animals, the coordinates obtained by using this combination of atlas and head positioning system must be considered approximate, subject to modification based on anatomical

verification of electrode tracks aimed for the structures of interest. Specifically, the rostro-caudal dimensions of the atlas appear to be shorter than the brains of the 300- to 500-g albino rats used in this laboratory. That is, electrodes aimed for the midbrain and posterior thalamus, according to coordinates derived from the atlas using bregma as zero, are found to lie rostral to their intended position.

It is also possible to use this headholder with the DeGroot (1959) coordinate system. If the mouthpiece is kept in the horizontal plane, the 15-deg tilt of the skull in this coordinate system must be taken into account trigonometrically or graphically from the sagittal plates. The mouthpiece can be tilted at a 15-deg angle to orient the brain directly in this system. The Pellegrino-Cushman (1967) atlas provides coordinates referred to the bregma as well as to the earplug-incisor bar headholder.

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*Supported by NIH Grants MH-10852 and MH-16046.

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A fool-proof hurdle for two-way shuttlebox*

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The two-way shuttlebox has been extensively used for the avoidance conditioning of rats. Yet, unlike other common laboratory apparatus, such as the Skinner box, few attempts (Baum, 1965; Brush & Knaff, 1959) have been made to automate the shuttlebox to the same degree of sophistication. The apparatus presented here solves two problems often encountered in avoidance conditioning (Bitterman, 1966): fence straddling and partial crossing. They are rendered impossible by using a moving Plexiglas cylinder as a barrier instead of a rigid partition.

The revolving Plexiglas cylinder, 20 cm long, 5 cm in diam, and 7 cm

high, separates the box into two equal compartments (Fig. 1). The fact that the cylinder can rotate about its axis makes it impossible for the animal to straddle the fence. If the animal tries to do so, his weight on the cylinder rotates the device. Partial crossing is also eliminated by the diameter of the cylinder and its height in the box. It is impossible for a normal rat to lie crosswise over the cylinder, putting one set of paws in the first compartment and the other in the second.

An apparatus equipped with this kind of hurdle has been used for various experiments to condition approximately 150 rats. Not once was the intervention of the E required during training, nor did any problem develop in the apparatus. This kind of cylinder, which proved very effective, could easily be adapted to any home-made or commercial type of shuttlebox.

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Modification of an autotransformer to present a titrated aversive schedule

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We recently developed a reliable, accurate, relatively inexpensive apparatus for presenting a titrating aversive schedule. Although there are numerous variations of the titrating schedule, it always involves increasing the intensity of an aversive stimulus as a function of selected time intervals. The chosen operant response reduces shock intensity by a given amount (Weiss & Laties, 1961). Our particular variation involved a discrete-trials contingency in which the Ss were shocked every 7 sec with only the first level press of a given

increment-to-increment interval effective in reducing the intensity of the next shock.

Our apparatus was the endpoint of a series of modifications which originally began with a replication of the apparatus described by Weiss and Laties (1961). This Weiss and Laties apparatus coupled a Grason-Stadler recording attenuator to the intensity control shaft of a shocker. Our replica of this apparatus allowed at least 3% and up to 7% hysteresis, depending upon different methods of coupling. Since the goal of our particular project was to provide shock increments of 5%, this hysteresis involved an unacceptable amount of error.

Next, we coupled a bidirectional stepping motor to the intensity control shaft of the shocker. This method was plagued with overthrow and insufficient feedback to the drive and control circuitry for error correction and detection. The stepper adequately turned the shaft, but the inertia of the rotation armature caused an override of the stepper's internal detents. Externally mounted adjustable-tension detent springs were installed and found to prevent overthrow effectively when adjusted to approximately the same force required to stop the stepper. This method was abandoned.

These failures convinced us to break with previous electromechanical design and to develop a shocker containing a variable autotransformer as the intensity control. Six BRS SG-002 shockers were used, although any constant wattage shocker would do as well.

Disassembly of the transformer is a simple task, but care should be taken to protect the brush which is loosened early in the process. Since the increment between shock intensities is a function of the number of turns between taps, the number of windings must be as equal as possible. Decrements were within 0.5% in the most variant case, while increments were within 0.2% of the desired 5.0%.

Verifications of the accuracy of the six shocker outputs were accomplished by connecting all six shockers to a large regulated ac power supply. Standard calibration techniques were used, with a 4.0-K-ohm resistor used to simulate the resistance of the research Ss. The instruments used to measure the shocker output were a Hewlett-Packard Dymec Model 2410-B ac-to-ohms converter and a Hewlett-Packard Dymec Model 2401-C Integrating Digital Voltmeter. The results of these measurements showed very good agreement between range overlay, current regulation, and shock intensity period. Subsequent maintenance checks were made with

Fig. 1. Automated two-way shuttlebox for the avoidance conditioning of rats. (A = ventilating fan; B = CS speaker inlet; C = transparent door; D = revolving cylindrical barrier; E = mercury balance and selector switch; F = metal floors; G = stop microswitch; H = outlet to shock scrambler; I = removable trays; J = fulcrum of pivoting floor.)

*Development of this apparatus was aided by Grant APA-215 from the National Research Council of Canada.