KOPF
CARRIER
June, 1989
PUBLISHED BY DAVID KOPF INSTRUMENTS • TUJUNGA, CALIFORNIA • NO 22

A Sliding Ventilating Chamber and Snout Clamp to Fix Small Animals in a Kopf Stereotaxic Instrument

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Anaesthesia and attendant respiratory problems introduce several complications in small animal neurosurgery. Anaesthesia must accompany placement of experimental animals in the stereotaxic instrument yet anesthetics commonly depress respiratory centers in the brain and may lead to hypoventilation, acidosis and hypoxia (Fink, et.al., 1963) that could be circumvented if artificially respirated until the anaesthetic wears off. Simple respiratory procedures are incompatible with upper incisor bars and nose clamps normally provided, for example, with the Kopf Model 900 Small Animal Stereotaxic Instrument or the Model 400 Student version and other more sophisticated models. With acute animal preparations one solution might be to perform a tracheotomy or insert an endotracheal tube expressly to respirate the animal and preclude any of the above problems. However, there is some risk involved with the procedures. For example, recovery from tracheotomy can have serious consequences in the chronic preparations frequently used by neuroscientists and endotracheal tubes can damage and potentially infect sensitive tissue in the respiratory passageways. In this article, I describe a simple aluminum fitting for the upper incisor bar which serves as a snout clamp and ventilation chamber that can be adapted to accommodate any commercially available small animal respirator.

CONSTRUCTION

Figure 1 (see page 3) shows the respirator fitting in frontal, ventral and orthographic projection. The fitting is machined from a solid 30 x 29 x 26 mm block of aluminum. The fitting features a 16 x 7 x 29 mm channel (I, Fig. 1, page 3) designed to slide smoothly over the tooth plate (upper incisor bar) on the 920 rat adaptor with the nose clamp removed. The ventilation chamber (2, Fig. 1, page 3), a truncated conical hole (15 mm o.d., 9 mm i.d.), is drilled 23 mm into the front of the block, parallel to the sliding channel to snugly accommodate the rat's snout and to provide room for air or volatile anesthetics to be delivered to the rear of the chamber. The frontal edge of the aperture is polished to prevent injury to the sensitive tissue of the snout. A notch (3, Fig. 1, page 3) is cut between the front edge of the aperture and the sliding channel to fit around the rat's upper incisor which fits into the tooth plate on the 920 Adaptor. Two 4 mm diam. brass tubes (4, Fig. 1, page 3) extend into the side of the respiratory chamber allowing pulses of air or volatile gasses to be delivered to the posterior part of the chamber and expired gasses to be removed. Finally, a knurled knob (5, Fig. 1, page 3) is used as a manual set screw to rigidly hold the adaptor in place on the tooth plate over the snout and upper incisor.

METHOD OF USE

The rat is first anesthetized with an appropriate

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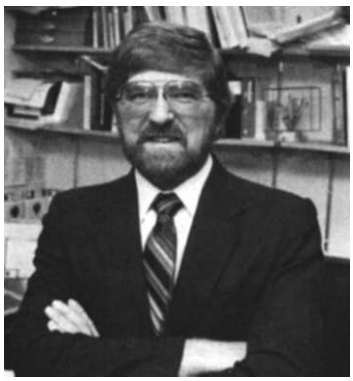

Editor's Column

The article in this issue of the Carrier is a very important one for many investigators. It describes a method for delivering a gas anesthesia to rats in the stereotaxic instrument. Such a device is a definite help for those who use rats and need the benefits of gas anesthesia while avoiding the trauma of tracheotomy or endotracheal tubes. Such a device will be a definite boon for those doing survival surgery and wanting to provide the least trauma for the animal. We must always be on the lookout for such devices which will help in providing the least trauma for the animals.

Unfortunately, we are now seeing more and more evidence that the animal rights movement is intent not on insuring humane treatment for animals in research, but in fact in stopping research altogether. Recent attacks on animal quarters and attempts by the more radical animal rights groups to stop research by individual scientists have very clearly indicated that the movement has become open about their intent not to foster better care within research, but to stop it altogether. This seems to most of us scientists to be so far fetched an idea that we are loath to pay much attention to these threats. However, we must rapidly start to pay more attention and begin to be heard by legislators and policy makers at every level. The situation is very'serious and we must educate not only the public but also the government about the issues of research and its necessity. One of the most effective ways is to write to your legislators and congressmen about the issues and your views on animals in research. Don't wait for someone else to do it for you, because it may then be too late.

If you would like to contribute an article for the Carrier please contact me at the address below. 1 would be happy to hear from you.

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dose of sodium pentobarbital (we use Nembutal or Somnotal, 65mg/kg I.P.). To prevent aspiration of excess saliva into the lungs, atropine sul-fate or atropine methyl nitrate may be given as required at this time. I find, however, that the forced air passing through the respiratory passages normally provides sufficient drying. Typically, the scalp is shaved, the ear bars set in the external auditory meatus and centered in the stereotaxic instrument. At this point, the entire Rat Adaptor is retracted and the ventilation chamber set to the rear of the tooth plate (Fig. 2A, page 3). As usual, the entire Adaptor unit is moved along its A-P travel to fit the upper incisors into the rectangular hole in the tooth plate (Fig. 2B, page 3). The Adaptor is normally retracted slightly and then screwed tightly to the frame to rigidly fix the head in three-dimensional space. The tongue is then gently retracted with blunt forceps to ensure that the oral passages are not blocked.

The respirator is normally attached to the inspiration-expiration tubes (4, Fig. 1, page 3) using appropriate sized Tygon tubing. Any small animal respirator may be used (e.g., E & M Instruments and Harvard apparatus have commercially available models). The ventilator unit is then slid across the tooth plate to fit snugly on the snout and the thumb screw (5, Fig. 1, page 3) fixes it rigidly to the plate (Fig. 2C, page 3). A thin film of petroleum jelly or other suitable lubricant on the tooth plate helps the chamber slide smoothly and provides a tight seal. If the ventilation chamber is not snug around the snout air escapes and does not register on air pressure monitors. A film of petroleum jelly around the aperhire-scab-this sufficiently. We-e«rrently use the E & M Instruments Small Animal Respirator with the inspiration-expiration ratio set at one to one, respiration rate at 30 pulses per minute and a pressure of 10 to 12 cm of water. Respiration rate can be checked by watching the rib cage rise and fall with the pulses of the machine. If they don't match, the chamber should be adjusted more snugly on the snout. Occasionally, excess air is swallowed and produces a noticeable distension of the stomach. This can be avoided by reducing the pulse pressure.

One further advantage of the ventilating chamber is that should the anaesthetic begin to wear off, a simple trap with ball valves to regulate the direction of flow containing an ether-soaked gauze pad can be easily attached to the brass tubes and removed when the appropriate anaes-

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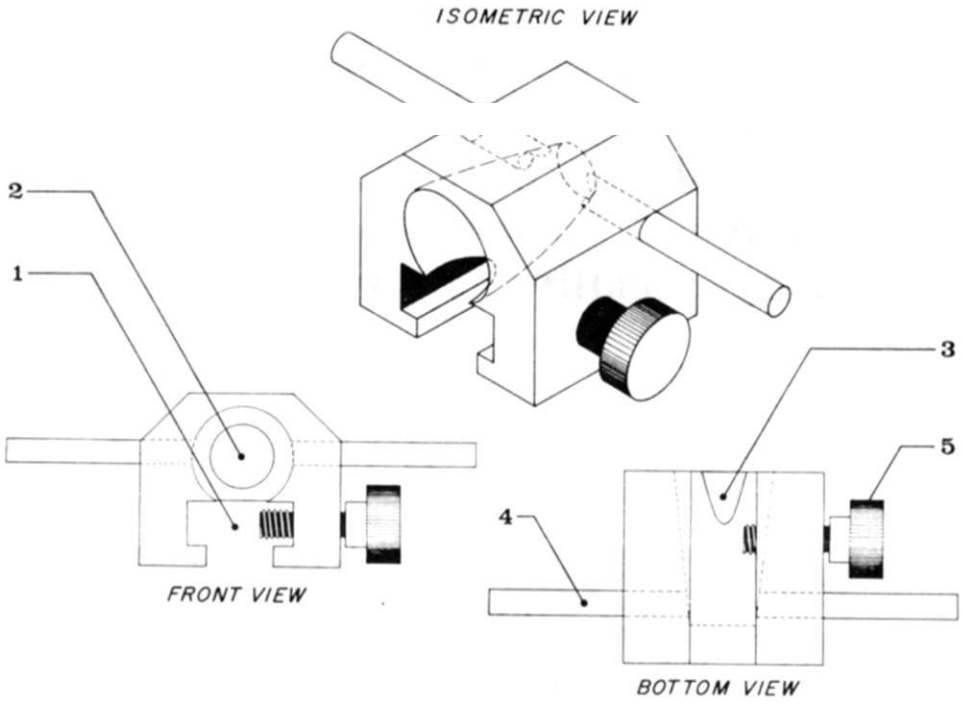
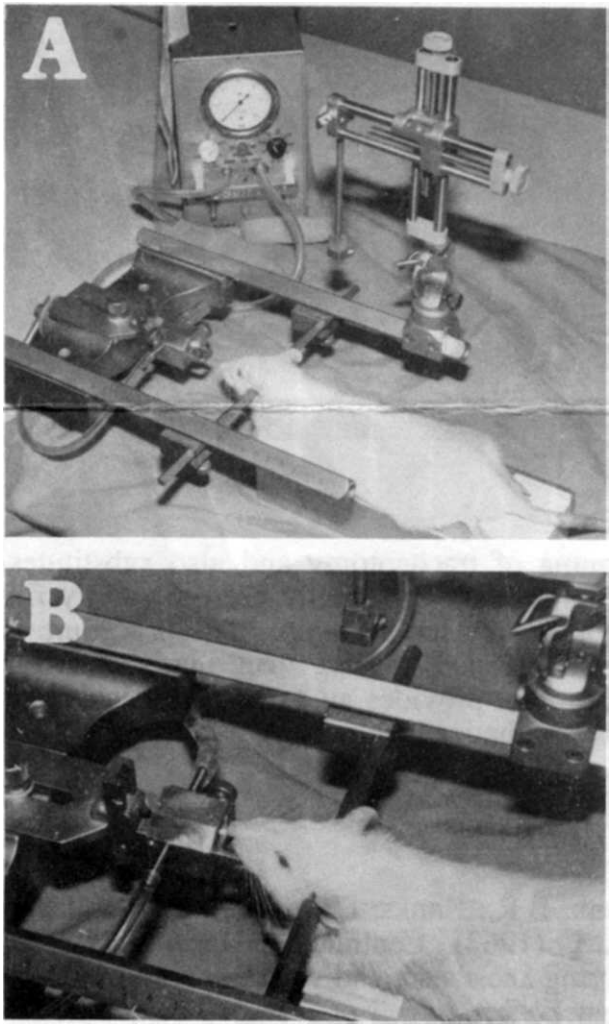


Figure 1. Schematic illustration of the ventilation adaptor in front, bottom, and isometric views. 1. Channel fitting over tooth plate. 2. Ventilation chamber. 3. Upper incisor notch. 4. Brass tubes to respirator. 5. Manual set screw.



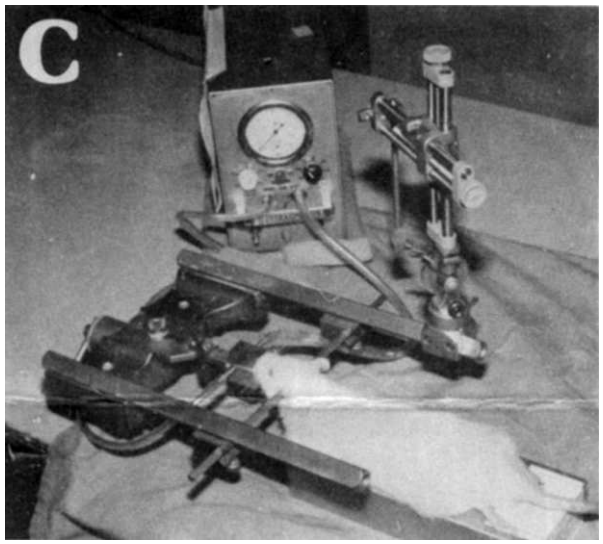


Figure 2. Showing the rat fixed in the ear bars, with the tooth plate and ventilation chamber in the retracted position (A); with the upper incisors in position (B); and with the ventilation chamber fixed over the snout (C).

thetic plane is attained.

On completion of surgery the procedure is reversed, the thumbscrew is loosened, the chamber slid back, and the respirator turned off. Respiration should be observed for several minutes to make sure the animal is breathing on its own. If respiration is shallow, the chamber and respirator can be easily reattached. Typically, we observe the animal closely until it recovers muscle tone, at which time they are removed from the frame.

The sliding ventilation chamber provides a simple and effective means for respirating or delivering volatile substances to small animals without the additional surgical intervention and trauma of tracheotomy and also substitutes for the nose clamp normally used to rigidly fix the snout to the tooth clamp. The procedure is no more difficult to use than the standard nose clamp but provides an extra dimension of safety for anesthetized animals.

REFERENCE

Fink, B.R., Hanks, E.G., Ngai, S.H. and **Papper, E.M.** (1963). Central regulation of respiration during anesthesia and wakefulness. *Annals of the New York Academy of Science.*, 109,. 898.