of immersion, similar to those obtained with thin membrane electrodes. To eliminate the first of these sources of error, it is essential to make the pathway of leakage as long as possible. If this is attempted by increasing the length of the glass shank, the result is an unwieldy piece of apparatus. A more satisfactory procedure consists in using two glass shanks, one placed within the other, and carefully sealed together at the bulb end of the electrode so that they contact each other only at this point, as shown in Fig. 1. The

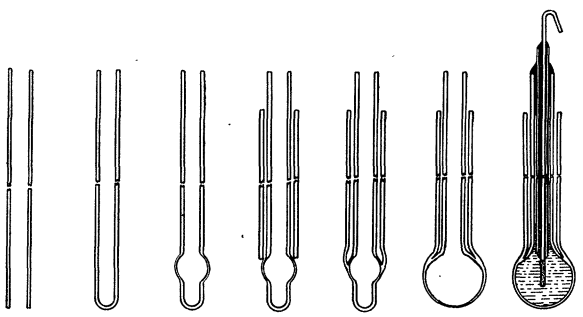

FIG. 1. Steps in the construction of the double-shank electrode.

pathway of leakage of an electrode with two shanks 5½ inches and 6½ inches long, respectively, is sixteen to seventeen inches in length, so that errors due to this source may be neglected. Moreover, since the inner shank of this electrode is completely insulated from the fluid which is being tested, the errors resulting from the effect of variation in the depth of immersion of the outer shank in the fluid are eliminated. It is essential of course to completely immerse the bulb.

An electrode of chemically pure silver wire is used as a reference electrode, and this is sealed inside a small glass tube completely filled with a sealing compound impervious to HCl, having one quarter inch of the wire protruding. After a silver chloride has been deposited upon the wire the latter is slipped inside the glass electrode until the treated tip is completely immersed in the N/10 HCl solution with which the bulb has previously been filled. The bulb is then sealed to prevent leakage of HCl by flowing hot sealing wax into the space between the silver electrode and glass shank.

A number of procedures can be used for assembling this form of glass electrode, one of which is illustrated in Fig. 1. Dry, chemically and physically clean Corning 015 glass only is used, and this is worked at the tip of a small oxy-gas flame, carefully avoiding the use of a carbon flame. Annealing of the glass junction must be thorough, and should be done only with a blue flame. It is essential to blow the bulb so as to form a thin, flexible junction between the two glass shanks, otherwise strains may be set up which eventually result in cracking. The bulb can be varied from 10 to 20 mm in diameter and from 0.05 mm to 0.5 mm in thickness without affecting the accuracy of the electrode. Repeated heating of the glass has no apparent deleterious effect upon its characteristics, provided it is worked at a sufficiently high temperature.

PHILIP L. VARNEY

WASHINGTON UNIVERSITY
SCHOOL OF MEDICINE, ST. LOUIS

A METHOD OF NUMBERING LABORATORY RATS

ALL those who have worked with a large number of rats and mice have experienced much difficulty in not being able to number the animals in a satisfactory manner. The method which I here suggest has been found easy and completely reliable. The plan of Dr. Strong, who uses the notches and holes in the ear, was incorporated in this scheme but was used in a different manner.

The toes of the hind feet are taken as units and the toes of the forefeet as 10's. The units begin on the small toe of the left hind foot, the animal being

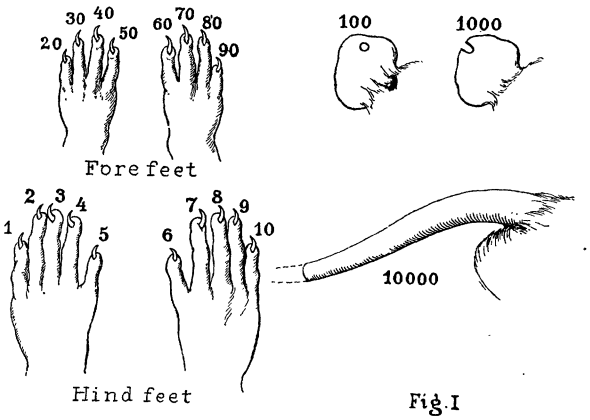

Fig. I

The numbering of the toes, the holes and notches in the ears and the clipping of the tail.

on its feet (see Fig. 1). No. 1 is the first toe, No. 2 the second toe and so on across to the other foot. From No. 5, the great toe on the left hind foot, the numbering goes directly across to No. 6, the great toe on the right hind foot. The last toe is No. 10. The first toe on the left forefoot is No. 20, and the last toe on the right forefoot is No. 90. To number the animal 13, the third toe, No. 3, on the left hind foot, and the last toe, No. 10, on the right hind foot, are clipped with a pair of scissors. No. 18 would be toe No. 8, right hind foot, and toe No. 10, right hind foot.

The hind toes permit the numbering up to 19, above that figure a combination is made of the 10's on the

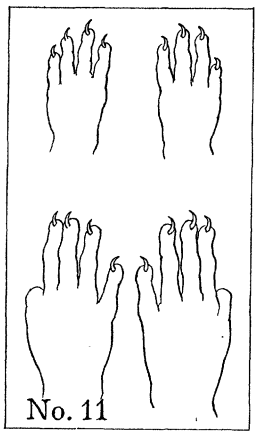

Fig. II
An animal's foot No. 11.

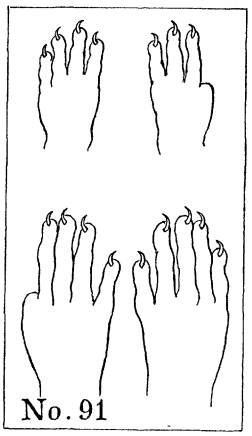

Fig III
An animal's foot No. 91.

front toes and the units on the hind toes. For instance, No. 20 would be made by clipping the first toe on the left forefoot; No. 21 by clipping the first toe on the left forefoot and the first toe on the left hind foot. No. 56 would be made by clipping the fourth toe on the left forefoot and the great toe on the right hind foot. No. 91 (Fig. 3) would be the last toe on the right forefoot and the first toe on the left hind foot.

By using all the toes we can bring the numbers up to 99. No. 100 is made by punching a small hole in the ear with a small metal punch. One punched hole designates rat No. 100. No. 171 would be obtained by making one hole in the ear, clipping the second toe on the right forefoot and the first toe on the left hind foot. No. 271 is designated by two holes in the ear with the same clipped toes. Rat No. 571 would have five holes in the ears with the same toes. The ears, if the holes are placed carefully, will permit from four to five in each. Four will prove to be quite satisfactory. The punched holes heal quite promptly as definite perforations or holes unless they are made too close to the head; in that case they will be apt to close almost completely. No. 1,000 is signified by notches made in the margin of the ear. These can be done with the same punch. Care must be taken to punch the margin deeply enough so that healing will give clear-cut notches. No. 1,171 would be represented by 1 notch, 1 hole, and by clippings on the second toe of the right forefoot and the first toe of the left hind foot. No. 5,283 would be shown by 5 notches, 2 holes, and by a clipping of the third toe on the right forefoot and the third toe on the left hind foot, respectively. The notches, the holes and the toes carry the numbers up to 10,000.

No. 10,000 is made by clipping about half an inch off the tail. After this clipping, the same method with the toes and ears is used again. No. 11,235 (see Fig. 4) is represented by a clipped tail, 2 holes and 1

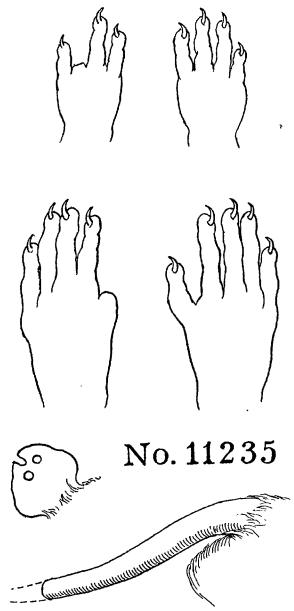

Fig. IV
Toes, ears and tail of animal No. 11,235.

notch in the ear and the clipping of the second toe of the left forefoot and the fifth toe of the left hind foot.

This system has been used for a colony of 13,000 animals and found quite satisfactory. It was possible to recognize the number of any animal which had escaped from the cage and by reference to the records to put it back into its proper place.

Rabbits and guinea pigs may be numbered in the same way.

GEORGE WALKER

BALTIMORE, MD.

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