Delayed activity in the trigeminal nerve following peripheral stimulation was first demonstrated by King and Meagher in 1955 and has since been studied in animals under various conditions. These studies suggested a relationship between such delayed trigeminal potentials and tic douloureux. The activity disappeared after the trigeminal posterior root was divided, but remained unchanged after the ipsilateral cranial motor roots were sectioned. Therefore, the delayed activity was shown to be a recurrent efferent discharge in a nerve generally believed to contain only sensory and autonomic fibers. The present study was designed to demonstrate directly which way the late potentials are conducted, to measure their velocity and central delay, and to confirm some of their other characteristics reported previously.

METHODS

Recordings were made from 12 cats. Ether and pentobarbital were used for anesthesia. The infraorbital nerve was exposed in the face where it emerges from the infraorbital foramen. The eye on the same side was enucleated and the soft tissues of the floor and medial wall of the orbit were removed to expose a portion of the infraorbital nerve about 1.5 cm. in length. The animals were given d-tubocurarine chloride and ventilated through a tracheotomy with air under positive pressure.

A silver bipolar stimulating electrode was placed on the infraorbital nerve in the face. Two monopolar stainless steel needle-recording electrodes were inserted into the nerve where it crosses the floor of the orbit (Fig. 1). A metal plate buried subcutaneously over the vault of the skull served as an indifferent electrode. The cat was maintained at 38°C, and the orbit was filled with mineral oil at that temperature. After each run used to determine velocity, the recording electrodes were withdrawn together and the distance between their tips was measured.

The stimuli used were rectangular pulses delivered through a radiofrequency isolation unit. Signals from the recording electrodes were displayed on a cathode-ray tube. The stimuli and a time-mark scale were shown through a second channel on the same time base as the impulses from the nerve. A step was introduced in the time-mark baseline to permit identification of a specific portion of the sweep when expanded and viewed alone. The display was photographed on 35 mm. film and suitable frames were enlarged to 10×12 cm. The velocity of the action potentials was determined from these prints.

When a good delayed response was observed the duration and strength of the stimulus were left unchanged while a complete series of sweeps of varying length and amplification were viewed and photographed, the rate of stimulation never exceeding once every 2 sec. The velocities of the primary afferent potentials and of the delayed impulses were determined under the same conditions.

RESULTS

Delayed activity was recorded in 9 of the 12 cats; the remaining 3 cats displayed only
primary afferent potentials. In one of these 3, the table heater was left off and the rectal temperature fell to 33°C. The rest of the cats were maintained at 38°C. Of the 9, 2 showed too low an amplitude of response to permit measurement of velocity of the delayed activity on an expanded sweep, and 2 were not measured as the duration of the sweep used was found subsequently to be too long for accuracy. Each sweep was repeated and photographed many times.

The primary afferent volley goes off scale in Fig. 2 (7) immediately after the stimulus which was locked to the 1 msec. mark. Both channels show the delayed response starting between the 4 and 5 msec. marks. In this figure a number of tracings are superimposed and the delayed activity is seen to consist of about 3 sharp peaks occurring on the slope of a negative wave, followed by a slow positive wave. The whole complex lasts just over 10 msec. The large negative and positive waves were not seen in preparations having sharp-peaked activity of low amplitude.

Anoxia. When the animal was allowed to become anoxic the primary afferent volley could be elicited, but the delayed activity disappeared. It reappeared when oxygen was again provided.

Threshold. The threshold for the delayed activity was slightly higher than that of the primary afferent response. However, since activity dispersed in time and occurring in relatively few fibers gives a very low-amplitude recording, a stimulus at threshold level for the afferent volley could have caused a delayed response which was lost in the background noise.

In Fig. 2 (3), the stimulus was just above the threshold for both responses. The primary afferent volley is not off scale and the sharp spikes of the delayed activity are present but are of low voltage. An increase in amplitude of all components follows an in-