

variations reaching 60 percent deflection in less than  $\frac{1}{3}$ th the electrode time constant ( $\sim 4$  msec) will be impossible (see Fig. 4).

(2) Electrical signals appearing between any two points of the resistor formed by the liquid under the glass electrode, the junction electrode and the potentiometer will be picked up by the electrode (electrical stimuli applied to biological preparation, action potentials, etc.). The electrode in this case (Fig. 9) forms a kind of high-pass filter with a band width value as high as 165 kc/sec if silver chloride electrodes of 3000 ohms are used. It follows that discrimination between oscillating electrical signals and  $pH$

changes in the output records will be easy above 50 c/sec for the former.

(3) Negative feedback from the preamplifier output to electrometer input grid increases the band width of the electrode for electrical signals (the electrode time constant is easily lowered to about 2 msec). The effect of feedback on the response to  $pH$  changes has not been studied: the gain loss is too great and the apparatus becomes unsuitable for physiological work. This question will be taken up again if some additional gain can be obtained from a modified version of the preamplifier.