promises a long period of confusion. Somewhere between the complete word and the arbitrary and ambiguous form of abbreviation, there is a well-established tradition which should not be entirely ignored if wide-spread use rather than mere official adoption is to be achieved.

E. H. McClelland
Carnegie Library of Pittsburgh

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE MICROPHONE AMPLIFIER

In the transmitter of the ordinary telephone, the vibrations of the diaphragm produce varying pressures upon carbon granules or a carbon button. The electrical resistance of the carbon varies with the pressure: so that an electrical current may be made to vary in accordance with the impressed sound waves. This current, although controlled by the sound vibrations, has much more energy. Hence, the carbon button acts as an amplifier for sound vibrations.

It is, therefore, possible to make use of the carbon transmitter as an amplifier for wireless signals. The circuit is shown in Fig. 1. The output from an ordinary detector valve AB is passed through the coils of a wireless receiving telephone. The type used in this circuit is a Brown telephone. The diaphragm of the Brown telephone is set in vibration by a little metallic reed which is itself actuated by the rectified current from the detector tube. The diaphragm of the Brown receiver is removed and a short light metallic rod is connected from the reed C to the middle of the diaphragm D of a telephone transmitter. Then when the reed vibrates in unison with the incoming signals the diaphragm of the transmitter D presses against the carbon button E. The current

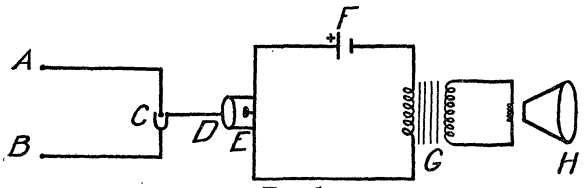


Fig. 1.

supplied from the six-volt storage battery F varies with this pressure. Accordingly a variable current passes through the primary of the audio transformer G. This causes a current in the secondary which actuates the loud speaker H. The audio transformer is inserted to prevent the direct current generated by the battery F from passing through the coils of the loud speaker.

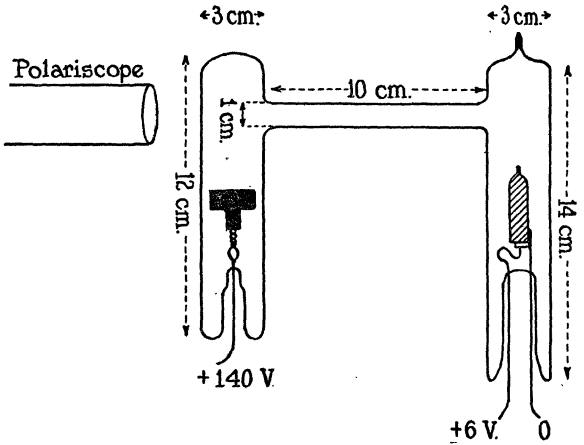
This arrangement gives plenty of amplification, but the quality is rather poor. The device is not very sensitive, as the carbon button will not respond to weak vibrations.

R. C. Colwell
L. Fullmer

Department of Physics,
West Virginia University

THE USE OF A HOT CATHODE HELIUM LAMP AS A SOURCE OF MONOCHROMATIC LIGHT FOR THE POLARISCOPE

A continuous spectrum in conjunction with suitable prism and diaphragms is not well adapted for precise measurement of rotatory power. The mercury arc unfortunately gives only two lines suitable for polarimetric purposes ($\lambda = 5460.7$Å and $\lambda = 4358.3$Å). The two yellow lines, 5790.7Å and 5769.7Å, are too near to one another to permit an easy separation, especially as a great intensity is needed for measurements of rotatory power. The helium spectrum shows two intense lines, a yellow one ($\lambda = 5875.6$Å) and a red one ($\lambda = 6678.1$Å). The yellow line permits measurements of great accuracy and can be used to great advantage in place of the inconvenient mercury yellow lines. Furthermore, it presents a second advantage in being situated very near the sodium doublet for which the rotations of the majority of organic compounds have been determined.



Hot cathode helium lamp

Except for the red line furnished by the Cd arc, which is difficult to operate for routine work, there is no red light readily available which is intense and pure enough for the purpose specified. The helium red line is located very far towards the red and is ideal for measurements in that part of the spectrum.

With the lamp described above, the intensity of this line was such as to permit a reading within ± 0.015° with a half shadow angle of 4°. Using a photographic process the angle could be read within ± 0.003° (exposure 60 seconds, half shadow angle 4°).

Measurements with the yellow line 5875.6Å were consistent within ± 0.002°.

The lamp used, which is reproduced in the above diagram, was an all-quartz hot cathode helium lamp built by the General Electric Vapor Lamp Company, Hoboken, N. J. The arc was operated under 160 volts and carried 5 amperes.

ALEXANDRE ROTHEN
THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH,
NEW YORK

SPECIAL ARTICLES

ACTION CURRENTS IN THE AUDITORY TRACTS OF THE MIDBRAIN OF THE CAT

IN the course of an investigation of action currents in the central nervous system of the cat by means of an amplifier in connection with ear phones or a string galvanometer, responses were obtained from the auditory tracts of the midbrain. The intensity, timbre and pitch (up to at least 1,000 per sec.) of the sounds applied to the ears of the cat were reproduced with considerable accuracy in the ear phones. The observations of Wever and Bray[1] on the auditory nerve were repeated and their results confirmed. Adrian's observations,[2] which led him to suggest that the effect in the nerve is due to a diffuse electrical spread from the cochlea, have also been confirmed, but with the following qualification: (1) The responses are much greater in the auditory pathways than in the surrounding tissue. (2) There appears to be a decrease in the size of the responses upon the local application of narcotics.

We believe that the effect in the brain stem represents at least two elements: primarily, action currents in the particular auditory tract to which the electrode is applied; and secondarily, electrical spread from more distant parts of the auditory mechanism.

Our method allows stimulation of either or both ears. A stethoscope is fitted to the decerebrate cat. Its bell receives taps at constant rate and intensity. Voice or other sounds may be delivered through a funnel in place of the stethoscope bell. The sound may be localized to one ear or the other by clamping the appropriate arm of the stethoscope. A diffuse silver electrode is placed subcutaneously on the muscles of the skull and a differentiated electrode consisting of a fine silver needle, insulated except for the very tip, is pushed down the brain stem caudally at right angles to the planes of decerebration.

Sharpness of localization is characteristic of responses in the brain stem. Using the string galvanometer with one stage of amplification the responses are obtained *only* from certain points. A movement of the electrode of one millimeter or less suffices to pass through a maximum and usually to loose the response. With a more sensitive amplifier and ear phones this point represents a very sharp maximum, many times louder than the responses from neighboring points. These active points have been shown by subsequent gross section to lie invariably upon the auditory pathways, including the trapezoid body, acoustic striae, and lateral lemnisci up to the inferior colliculi. Numerous other regions explored, not on the pathways, have never given any response with the less sensitive apparatus.

When electrodes are placed upon crossed tracts, such as the lateral lemnicus, the responses are chiefly contralateral, *i.e.,* the electrode in the left midbrain is much more sensitive to stimuli applied to the right ear than to those applied to the left ear. This contralateral relationship agrees well with the known anatomy of the auditory pathways.

When the cat dies in the course of an experiment the responses from the brain stem are lost as soon at the heart stops beating, and sometimes a few minutes before. The responses from the acoustic nerve persist after those from the brain stem are no longer detectable, and sometimes for several minutes after the heart has stopped.

Narcotization of parts of the brain stem by injecting 5 per cent. or 10 per cent. novocaine in Ringer's solution near the electrode obliterates responses on the string. The responses return after one to three hours. If the novocaine is injected on one side of the brain stem between the electrode and acoustic nerve, responses from that ear disappear, while those from the other ear persist.

Comparison of responses from the acoustic nerve with those from the brain stem shows that those from active points in the brain stem are usually slightly greater than those from the nerve. This is true even if the electrode pierces the sheath of the nerve, thereby yielding greater responses than if on its surface.

[1] E. G. Wever and Charles W. Bray, SCIENCE, 71, 215, 1930.

[2] E. D. Adrian, *J. Physiol.*, 71, 4: 1931.