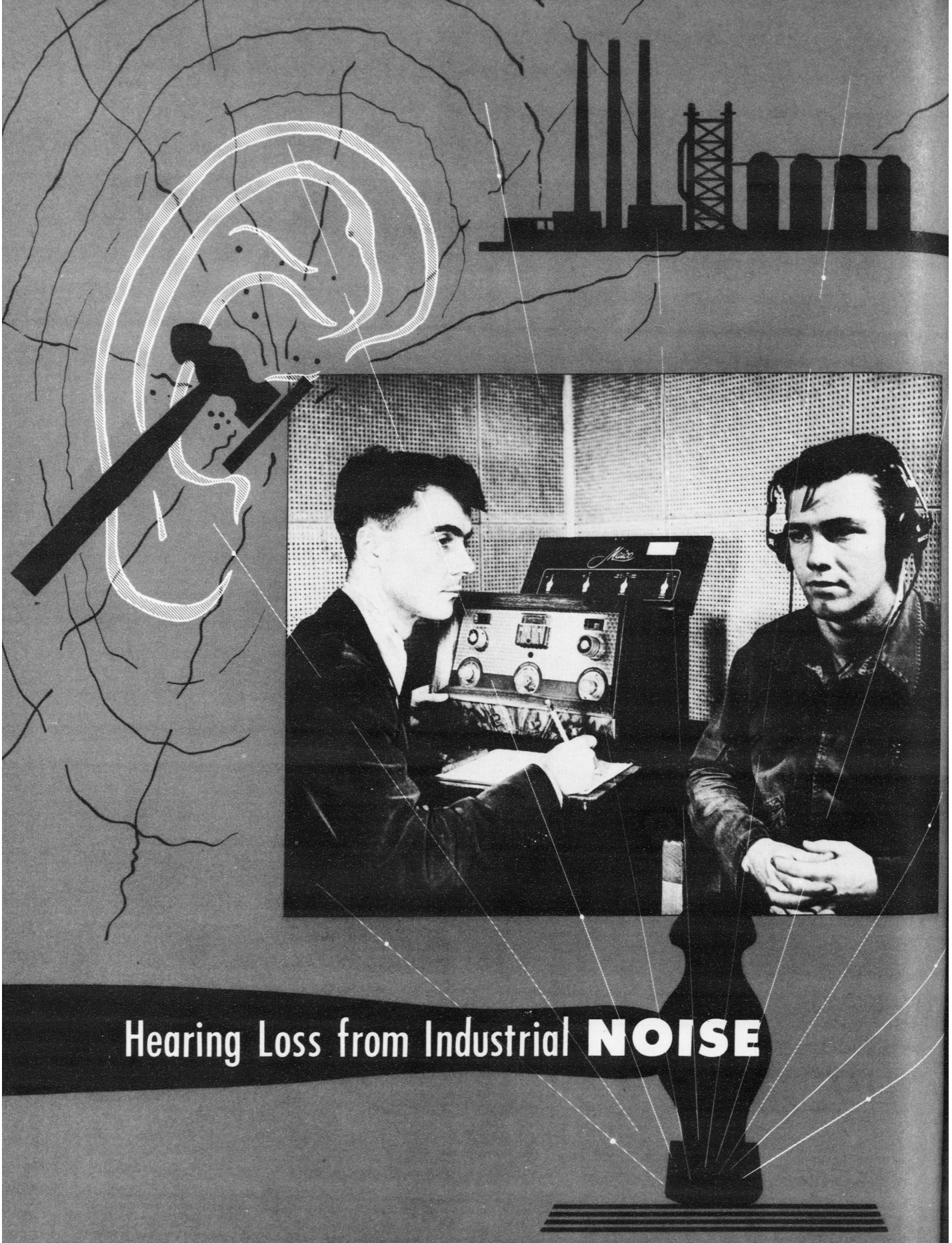

Hearing Loss from Industrial **NOISE**

see overleaf

Electronics and Hearing

A patient at the Audiology and Speech Correction Center, Walter Reed Army Hospital, is shown being tested for loss of hearing (frontispiece). The instrument pictured is a pure tone audiometer.

The modern audiometer owes its development to the phonograph, to the radio, to the telephone, and more recently, to advances in the field of electronics. The audiometer is a high-precision instrument, in which the many component parts are specifically constructed. Designed to reveal accurate information concerning the acuity of hearing, its success depends on the skill and the training of the technician who operates it.

Standard audiometers are calibrated in decibels, to correspond to the threshold of normal human hearing at each frequency. A decibel is one-tenth of a bel, the original unit of loudness. The word "bel" is appropriately derived from the name of the inventor of the telephone, Alexander Graham Bell. (What Price Decibels? appears on p. 953 of this issue of *Public Health Reports.*)

Generally speaking, two types of sound stimuli are commonly used in the testing of hearing: speech and pure tones. The traditional speech audiometer was essentially a phonograph with several pairs of earphones instead of a loud speaker. The recording employed "fading numbers." Since a group of individuals could be tested at one time, this technique was used primarily for screening. Introduced by the Western Electric Company in 1926, the speech audiometer is widely used today in schools, where it is desirable to detect hearing losses at an early age. (See Dahl, Public School Audiometry: Principles and Methods.)

Currently, the speech audiometer employs two types of selected words. One group of words (spondees) is used to determine acuity of hearing. The second group is used to determine the subject's ability to understand speech.

The pure tone audiometer may be either of the discrete (fixed) frequency type or the sweep (continuous) type. The pure tone audiometer uses "funny buzzing or whistling sounds" for auditory stimulation. Although it was originally developed for use in individual testing, recent adaptations have made it possible to employ the pure tone audiometer as a "group" or "screening" audiometer.

Since the speech audiometer tests ability to perceive speech, it is concerned principally with the middle range of frequencies. On the other hand, the pure tone audiometer tests hearing acuity over a wide frequency range. Hence, slight losses of hearing, particularly in the high tone range, may not be picked up by the speech audiometer but will show up on the pure tone audiogram.

For the most part, modern audiometers are replacing the older and simpler "whisper" and "watch tick" tests in clinical examinations. Tuning fork tests, although relatively obsolete in measuring acuity of hearing, are still widely used by otologists as an aid in pathological diagnosis.

The search for more accurate testing methods turned to electrical devices in the late 19th century. Bunch in his Clinical Audiometry and in the History of the Development of the Audiometer has recorded the history of the various types of apparatus which replaced the tuning fork for measurement of acuity of hearing.

Early models were called variously the "acoumeter," the "electric acoumeter," the "sonometer," and the "induction coil audiometer." These inventions used a tuning fork or a buzzer as a vibration source to activate an electric circuit.

Guttmann in 1921 produced the first vacuum tube audiometer in America. Fowler and Wegel presented a model in 1922 which used storage batteries. The Western Electric Company in 1936 eliminated the battery operation and produced the first audiometer to incorporate a dynamic or moving coil type receiver. In the Maico audiometer introduced in 1936, for the first time an electrical circuit automatically followed the threshold of the normal human ear, making possible the "sweep check" test for normal hearing.

Basically, the modern pure tone type audiometer is a combined transducer and audio-oscillator. It has four essential parts: an electric power supply; a generator for producing an oscillating electric current; a series of resistances for regulating this current; and a telephone receiver—or loud speaker unit—for transforming the oscillating current into sound energy. Batteries are still used in certain portable models. Vacuum tubes are employed in an oscillating circuit to generate tones of different frequencies through the audible range.

Frontispiece photograph courtesy of Armed Forces Institute of Pathology.

PUBLIC HEALTH REPORTS

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OVETA CULP HOBBY, *Secretary*

PUBLIC HEALTH SERVICE
LEONARD A. SCHEELE, *Surgeon General*

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

If you do not desire to continue receiving this publication, please CHECK HERE ☐; tear off this label and return it to the above address. Your name will then be promptly removed from the appropriate mailing list.

PHR