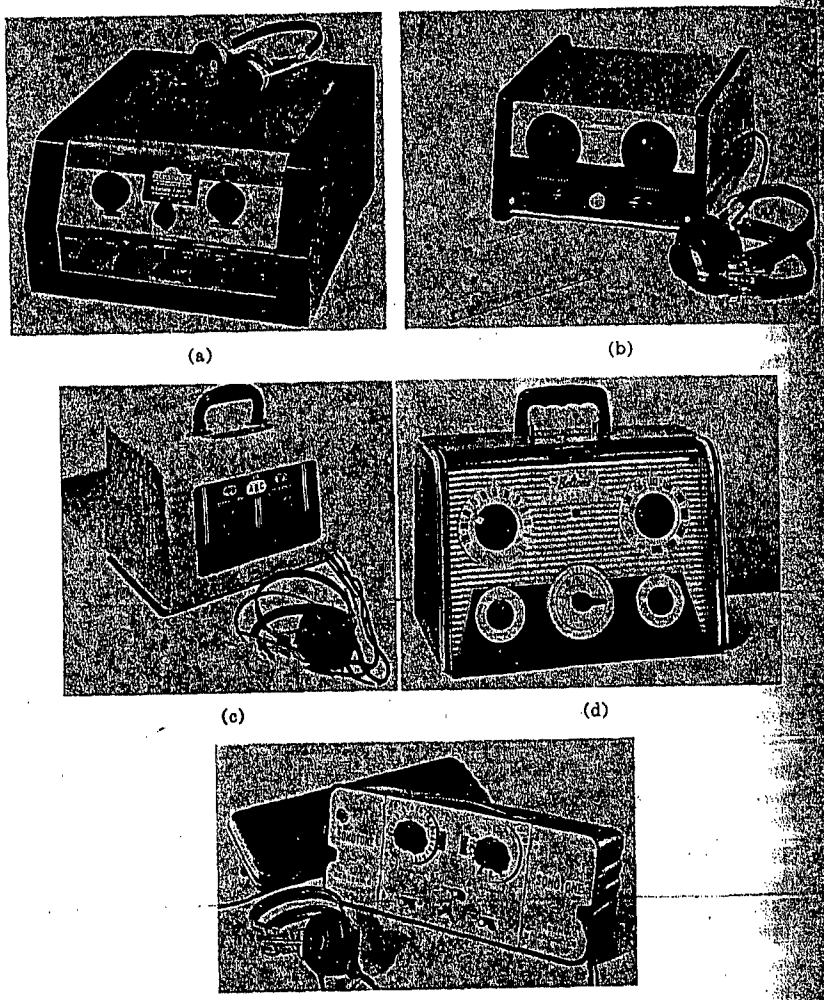

Figure 23. Air-conduction, pure-tone audiometers that can be used in industrial hearing conservation programs. (Courtesy Audivox, Inc. (a), U. S. Recording Co. (b), Audiometer Sales Corp. (c), Beltone Hearing Aid Co. (d), and Sonotone Corp. (e).)

dustrial applications, but more complete models are available for diagnostic purposes. Attached to each audiometer is a set of earphones fitted with rubber cushions for a snug fit over the ears. An electrical signal produced by the audiometer is transmitted to the earphones where it is converted to an acoustic signal.

Industrial programs for the conservation of hearing require knowledge of only the simplest aspects of audiometry. The following discussion is limited to these basic aspects, but this should not lead the reader to the conclusion that the measurement of hearing is an uncomplicated field. On the contrary, the diagnosis of the cause and nature of a hearing impairment by an otologist may involve the results of a dozen tests not described here and, in addition, may require careful judgment based on years of medical experience.

C. THRESHOLD OF HEARING

A sound is at the threshold of hearing when it is just intense enough to evoke a response from the listener. Since a listener's threshold may vary slightly from moment to moment, the average of the responses to a number of trials is usually obtained. To describe a threshold completely one must report the nature of the sound, the physical measurements made to specify the sound, and, in addition, the exact nature of the response or series of responses that the listener makes.

Many different sounds have been used in threshold measurements. Pure tones, speech, and noise are the major classifications of useful sounds, but each group may be subdivided many times. For instance, the pure tone may be presented at any frequency in the audible range, may be interrupted or steady, and may have a gradual or an abrupt beginning. The speech material may be sentences, words, or syllables. Noise may be presented with a vast variety of spectra and band widths. Only thresholds obtained with the same kind of sounds can be expected to be the same.

For most audiometric measurements the sound is specified in terms of the sound pressure level that the earphone of the audiometer produces in a small cavity whose volume is about the same as that of the outer ear when closed by the earphone. The sound pressure produced in this cavity is, throughout the middle frequency range, very nearly that produced in the ear canal when it is covered by the same earphone.

The exact nature of the response elicited from the listener is often less carefully specified. In measurements of the threshold of intelligibility for speech the response requested may be that the listener repeat words he has heard. In measurements of the threshold of detectability the response that may be requested is a signal from the listener at the instant that the sound becomes audible as the sound pressure is increased. Another response that may be requested is a signal from the listener at the instant the sound becomes inaudible as the sound pressure is decreased. Usually these two responses give slightly different thresholds. Averaging the results of a number of threshold determinations by each of these two methods is usually considered good audiometric procedure.