side by side, energy diagrams in terms of atomic masses as well as in terms of nuclear masses for positron, negatron, and K-capture disintegration. The energy diagrams are markedly different, depending on whether one uses atomic masses or nuclear masses. This difference involves the energy equivalent of the mass of the electron. The effect of the binding energy of the electrons is ordinarily of negligible importance, but in some borderline cases, it may forbid K-capture disintegration while permitting L-capture disintegration. The terminology in assigning gamma-rays to isotopes is not as uniform as could be desired. A.L.H.

Energy Diagrams for Beta Disintegration. By A. L. Hughes. *Am. J. Phys. 16: 415, November, 1948.*

Hearing

The effects of sound can be transmitted to the inner ear in two different ways: by moving the eardrum and its attached ossicles (air conduction), and by vibrating the whole skull, which vibrations are then transferred to the inner ear (bone conduction). Now an obstruction of the first of these paths caused artificially, or naturally, by disease, does not affect the transmission by bone conduction in most cases. This fact raises an interesting question, do people whose middle ears have been destroyed hear by bone conduction alone, or is there still a residue of hearing by air conduction?

To investigate this question, we measured the amplitude of vibration of the head produced by plane progressive sound waves. For frequencies below fifteen hundred cycles per second the whole skull vibrates as a rigid body. At higher frequencies the skull breaks up into partial vibrations like a bell. Even the formation of nodal lines (lines marked by freedom from vibrations) can be detected. When you click your teeth, a wave of deformation travels over your skull at about 570 meters per second!

With the aid of these facts it was possible to determine the ratio between hearing by bone and by air conduction in ears subjected to a wide variety of impairments, both experimental and pathological. This information is essential for the improvement of earphones used in hearing tests, for the design of an ideal earplug, and for the localization of transmission defects due to hearing diseases. G.V.B.

Vibration of the Head in a Sound Field and Its Role in Hearing by Bone Conduction. By Georg v. Békésy. *J. Acous. Soc. Am. 20: 749, November 1948.*

High Altitude Speech

The whole problem of voice communication in flying, emphasized by military needs at extreme conditions of altitude and noise, has stimulated a concerted effort toward its solution. These papers contribute to a human phase of the problem by reporting measurements on how the voice and the sensitivity of the ear change with altitude.

The pressure of speech sound waves was measured by an instrument, the audio spectrometer, which analyzed the pressures in twelve frequency bands covering the range from a low pitch of sixty to a high pitch of nine thousand cycles per second. The speaking voices of eleven persons were so measured during the experiments, which were conducted in a decompression chamber for altitudes up to forty thousand feet.

The sound pressure for vowels and semivowels lessened with altitude, roughly in proportion to the logarithm of the decrease in density of the atmosphere. At thirty-five thousand feet this loss, for typical frequencies of the human voice, amounts to about ten decibels. (The smallest change of sound pressure that the normal human ear can detect is about one decibel.) In oscilloscope measurements the breath consonants showed no loss in sound pressure. Since consonants are very important to intelligibility it is fortunate that altitude weakens them less than vowels.

Talkers wearing ordinary (not pressurized) oxygen masks found speech easily possible at forty-five thousand feet. Since the oxygen pressure normally required by aviators must be kept greater than that of air at forty thousand feet, communication by voice seems possible at any altitude at which men will fly. An obvious effect of high altitude is the shortage of breath, which can easily aggravate the loss in voice level if sentences are not organized into short phrases. Fewer and fewer words can be spoken on a breath as the air density decreases. In normal speaking at thirty-five thousand feet, one must pause for breath two to three times as often as at sea level.

Measurements were also made of the effect of altitude on the threshold of hearing of single frequency tones. After a careful allowance for the change with altitude of the earphone performance and the acoustic coupling of the headset to the ear, the sound pressure sensitivity of the ear itself showed no change between sea level and thirty-five thousand feet. K.C.C.

The Effects of High Altitude on Speech. By K. C. Clark, H. W. Rudmose, J. C. Eisenstein, F. D. Carlson, and R. A. Walker. The Effect of High Altitude on the Threshold of Hearing. By H. W. Rudmose, K. C. Clark, F. D. Carlson, J. C. Eisenstein, and R. A. Walker. *J. Acous. Soc. Am. 20: 776 and 766, November, 1948.*

Incident and Reflected Power

Analyses of the propagation of electromagnetic waves through a stratified medium, or along transmission systems such as wave guides and paired conductors, are frequently expressed in terms of incident, reflected, and transmitted power components. Unlike the more fundamental concept of incident and reflected amplitudes, the concept of incident and reflected power is strictly correct only in the following situations: first, the medium in which the source is located, or the transmission system which connects source and reflecting junction, is either lossless; or second, if attenuating, of the distortionless type; or third, the phase angle of the characteristic admittance of the medium in which the source is located is equal to the phase angle of the terminating admittance. The usual definitions of incident and reflected power are unique and strictly correct only for these special situations. In contrast, the concept and terminology of amplitude components may always be used. B.S.

A Note on the Significance of Power Reflection. By Bernard Salzberg. *Am. J. Phys. 16: 444, November, 1948.*