Proceedings of the Iowa Academy of Science

Volume 29 | Annual Issue Article 36

1922

The Scattering of Homogeneous X-Rays of Wave Length .712 A° Unit by Carbon, Lithium, and Hydrogen

C. W. Hewlett
State University of Iowa

A NEW KIND OF TELEPHONE RECEIVER AND TRANSMITTER

C. W. HEWLETT

The Tone Generator described in these proceedings a year ago has been used successfully as a telephone transmitter and receiver. A loud speaker about eight inches in diameter has been made which will speak loudly enough to address a small gathering of people, say a hundred. The main advantage of the instrument is its faithfulness of reproduction of speech and music, the failure to do which is the chief disadvantage of all other known telephone instruments. The instrument when used as a transmitter is free from all the usual transmitter noises, and from distortion due to resonance of the diaphragm. By means of a three stage amplifier the voice currents from the transmitter have been amplified 15,000 times without the introduction of noises. With this arrangement the transmitter has been able to reproduce in a telephone receiver, ordinary conversational speech spoken at a distance of 50 feet from the transmitter. The chief phase of the problem which is being studied at present is to introduce into the loud speaker a fairly large amount of electrical power in the form of undistorted voice currents.

One marked improvement which has recently been made in the use of the instrument is to use the direct plate current of the accessory vacuum tubes to serve as the polarizing direct current for the telephone instrument.

STATE UNIVERSITY OF IOWA.

THE SCATTERING OF HOMOGENEOUS X-RAYS OF WAVE LENGTH 0.712 A° UNIT BY CARBON, LITHIUM, AND HYDROGEN

C. W. HEWLETT

The angular distribution of the scattering of the $K\alpha$ radiation from a molybdenum X-ray tube by powdered graphite, diamond splints, benzene, mesitylene, and metallic lithium has been determined with an X-ray spectrometer by the ionization method. The solid substances give maxima of scattering in the places found by

the photographic method, but the relative intensities of the scattering at different angles measured by the ionization method is greatly different from that estimated from the photographic method. The liquids give only one maximum of scattering, which occurs a few degrees away from the incident beam. The scattering then decreases to a minimum at 90° and then slowly increases again. The measurements have extended from 2° to 166°. In all cases the scattering approaches zero close in to the incident beam. For the solid substances mentioned the intensity of the scattering actually becomes zero within a narrow region accessible to the ionization chamber.

The total amount of scattered radiation from the scattering substances has been estimated in the following way: It has been assumed that a beam of X-rays in passing through a piece of matter is partly scattered in a series of coaxial cones, the intensity of the scattered energy being uniform between two cones of semi-apex angles θ and $\theta+d\theta$. Measurements of the intensity of the primary beam of X-rays were made, and the total scattered energy calculated from the scattering curves on the above assumption was expressed as a fraction of the primary beam. The total mass absorption coefficient of the primary beam was determined at the same time. The mass scattering coefficient, and the true mass absorption coefficient of the substance can be determined from these measurements and a knowledge of the linear dimensions and density of the scattering material. Recently a method has been developed for determining the fraction of the primary beam scattered, by continuously rotating the ionization chamber at a predetermined variable speed, which is so determined as to automatically perform the integration which was previously worked out from the scattering curve. Both methods give mass scattering and true mass absorption coefficients in good accord with J. J. Thomson's theory. The hydrogen values were calculated from the results on benzene and mesitylene.

STATE UNIVERSITY OF IOWA.