

graphic images in order to determine the successive positions at different times of the planet Venus in its passage across the sun. It was Janssen also who, in 1876, first suggested the idea of applying successive photograms to the study of animal locomotion. The analysing of such movements was first accomplished by Muybridge of San Francisco. The method has been largely extended and perfected by M. Marey, who has employed it in studying the locomotion of all sorts of subjects, from men to insects.

*Electric Transmission.*—The electric transmission of sound was first accomplished by Philipp Reis in 1861. The discovery, however, not having been properly announced to the scientific world, did not receive the attention it deserved. Had it been published by Poggendorff, to whom it is said a preliminary note on the subject was sent, Graham Bell's invention of the telephone (1876) would probably have been reached at an earlier date.

*The Wave-Siren Method.*—The last of the methods to be noticed is that employed by Rudolph Koenig in his Wave-siren. In this instrument a metal band or disc with curvilinear edges passes before a narrow slit from which issues a current of compressed air. By means of these discs we can produce either simple sounds, or sounds of various timbres, containing such harmonics as we please, the intensities and phases of the latter being varied at will. The first wave-siren was constructed in 1867, and the account of the first series of experiments was published in 1881.

The mere enumeration of the methods of acoustical research which have been devised since the days of Chladni is an indication of the enormous advances which have been made in this branch of science. It remains now to state more particularly what these additions to our knowledge of acoustical phenomena have been. This can be most conveniently done under the following heads, viz:—the velocity and diffraction of sound; its pitch, intensity and timbre; and the phenomena produced by the coexistence of two or more sounds.

*The Velocity of Sound.*—Long before the beginning of the last century it had been observed that the propagation of sound was not instantaneous. Mersenne in fact had tried to estimate the velocity by experiments on echoes, and by counting the time which elapses between the flash of a gun and the report. The latter experiments were also repeated by Kircher as well as by the Academy of Florence in 1660. The same experiments were subsequently, in 1738, undertaken by members of the Academy of Sciences at Paris; by savants, such as Kæstner, Benzenberg, Goldingham, and by others; but the results obtained did not gain the confidence of the scientific world. A new series of experiments was accordingly undertaken in 1822, on the sug-