

capacity. By a process of "heterodyning" familiar to the wireless expert, Cohen has been able to produce a very constant output for cycles varying from 50 to 5000 per second, and these oscillatory currents can be used to actuate "loud speakers." If only the loud speaker were devoid of resonance properties, the problem above referred to would be effectively solved.

Another useful piece of apparatus has been designed by E. A. Milne and Fowler in which the simple Seebeck siren is converted into a pure tone generator by so shaping the holes of the disc as to cause the flow of air to alter in quantity by a simple harmonic relation with time. If the pipes supplying the air can be made non-resonant this source of sound is probably the best available. An attempt is being made to devise pure tone centrifugal sirens in which pipes for conducting the air past the ports of the rotating part are dispensed with, but here we have the disadvantage of acoustical output increasing with the frequency of the note. With apparatus of this character and with suitable microphones, accurate resonance curves can be obtained for various sound receivers.

There are problems of sound transmission through the air which involve large scale experiments and the accurate knowledge of upper winds and temperatures. These might be considered under the heading of meteorological acoustics, and they are of increasing importance in long-range listening for aeroplanes. The work of Tyndall, Osborne Reynolds, Rayleigh, and, more recently, Van Everdingen and E. A. Milne, have resulted in the explanation of those phenomena of variation of range for sounds up-wind and down-wind. Milne has obtained expressions for range and corrections for refraction due to variations of upper wind and upper temperature when these follow a linear law. Explanations of zones of silence at some distance from the source have also been afforded. The Acoustical Section, working for the three Fighting Services and the Department of Scientific and Industrial Research, has been able to verify experimentally some of these laws, and the latter have been very helpful in the design of directional sound-receiving apparatus.

One of the features of recent developments in acoustics has been the production and improvement of the Service sound locators for detection and location of aeroplanes. These instruments will not in general point to the source of sound owing to (1)

lag of sound, if the source is a moving one, and (2) the departure of the wave front from the spherical owing to refraction due to wind and temperature variations. The ease with which these instruments can be used depends on the structure of the atmosphere in which, apart from refraction due to the above causes, there are irregularities due to local temperature and humidity variations, and local whirls and eddies.

These variations in the medium have all been grouped under the heading of "acoustic clouds." Contrary to what might be expected, these acoustic clouds are most in evidence on a warm sunny day of good visibility, and are undoubtedly due to unequal heating from the sun's radiation. After sunset these clouds dissipate, and we get, not only good listening as regards range, but also greatly improved powers of finding direction. The blurred acoustical image becomes well defined. On the other hand, a uniform fog is acoustically clear and it is only on the fringes of the fog that sound absorption takes place. Experiments have recently been performed with aeroplanes in which some idea of the dimensions of the acoustic clouds has been deduced. These have been obtained by taking a photographic record of the sound obtained from an aeroplane in flight, and observing the periodicity of the sound fluctuations.

One of the outcomes of the study of meteorological conditions has been the fixing of an "acoustic skyline," which, under adverse wind conditions, always lies above the visual skyline. A source of sound moving through the air may be observed to rise or set over the skyline, with a definiteness almost as complete as the rising and setting of the sun, and when the sound is below the skyline a kind of acoustic twilight is produced. At this stage sense of direction is lost, the sound is diffused, and only arrives at the observer or microphone by scattering.

Other problems involving big scale experiments are connected with the production of powerful directive sources of sound, and include the breakdown of the air as a medium of sound transmission when the displacements due to the source of sound become large.

The foregoing statement merely provides a summary of those problems which are engaging the attention of research workers in acoustics, but they may serve to indicate how very fruitful is this field of investigation for the expert experimental physicist.

### Obituary.

MR. A. E. CRAWLEY.

THE death took place on October 21 of Alfred Ernest Crawley, who was well known as the author of several works on anthropological matters. He was born in 1869, the son of the Rev. Samuel Crawley, Rector of Oddington, Oxford, was educated at Sedbergh and Cambridge, and entered the scholastic profession; he abandoned this for journalism in 1908. An adept in several branches of sport, his works on tennis and ball games are of recognised authority. In anthropology, besides contributing to the journals of several scientific societies, to *NATURE*, and to Hastings's "Dictionary of Religion and Ethics," he was the author of three books of some importance—"The

Mystic Rose, a Study of Primitive Marriage," published in 1902; "The Tree of Life, a Study of Religion," published in 1905, and "The Idea of the Soul," which appeared in 1909. Of these "The Mystic Rose" was the best known—it undoubtedly exercised no inconsiderable influence on the anthropological thought of that day, especially in so far as it emphasised the importance of marriage ceremonies, a side of the subject to which Westermarck had then paid too little attention in his monumental study of human marriage.

Certain characteristic lines of thought are common to all Crawley's books, and indeed so early as 1895 he had outlined in the *Journal of the Anthropological*

Institute his fundamental principle that the aim of analysis of social institutions and religions should be to arrive at the mental attitude of primitive man towards his institutions and beliefs. In his view the study of marriage, for example, had been too exclusively sociological, and his book represented an attempt to bring marriage institutions and ceremonies as well as other primitive customs into the domain of psychology by defining the psychological needs which were satisfied by the magical or religious observances by which they were accompanied. Crawley's work was accurate and scholarly and was based upon wide reading and a critical appreciation of his authorities. Some at least of his work is of enduring value.

DR. E. O. HOVEY.

EDMUND OTIS HOVEY, curator of the Department of Geology and Invertebrate Palæontology in the American Museum of Natural History, had just entered his sixty-third year when he was struck with paralysis in his office and died on September 27. In his younger days Dr. Hovey filled some teaching posts; he was brought by his installation of the mineralogical exhibit of Missouri at the Chicago Exposition to the notice of the American Museum, and entered its service in 1894.

Dr. Hovey was perhaps best known to geologists for his work in connexion with the eruption of Mont Pelé, Martinique, which took place on May 8, 1902. He was immediately sent as representative of the American Museum of Natural History, arrived at Martinique on May 21, and after distributing supplies to the impoverished inhabitants, spent about three weeks in studying the Soufrière on St. Vincent and

four weeks on Mont Pele. His results were published in a preliminary report issued by the Museum in its Bulletin on Oct. 11 of the same year. In February 1903 Hovey was again sent to note what changes had taken place and to extend his studies to the other recent volcanoes of the Caribbean chain; and again in 1908 to bring the observations up-to-date. Other expeditions made by Hovey on behalf of the Museum were to South Dakota and Mexico.

As museum curator Hovey took a keen interest in his professional work, being responsible for several attractive models in the public gallery. Though in charge of the fossil invertebrata, he can scarcely be considered a palæontologist. He did, however, collaborate with R. P. Whitfield, and with him produced the very helpful catalogue of the types and figured specimens among those fossils in the American Museum (1898-1901). We have lost in E. O. Hovey a useful worker, a cheery companion, and a constant friend.

F. A. B.

WE regret to announce the following deaths:

Prof. W. A. Locey, professor and director of the Department of Zoology, Northwestern University, since 1896, who was known for his work on the embryology of the nervous system, aged sixty-seven.

Dr. Clara S. Ludlow, of George Washington University and the United States Army Medical School, Washington, who carried out work in the Philippines on the transmission of disease by mosquitoes, on September 28, aged seventy-one.

Prof. G. Pruvot, honorary professor in the Faculty of Science of the University of Paris, and formerly Director of the Laboratory of Marine Zoology at Banyuls-sur-Mer (Pyrénées-Orientales).

Prof. W. A. Macfadyen, professor of philosophy in the Transvaal University College, Pretoria.

### Current Topics and Events

GREAT BRITAIN is beginning to appreciate the importance of broadening the education of the mathematician and the scientific worker. In all subjects new knowledge has been and is piling up at a great rate. The universities demand more and more for a degree, and the student is constantly becoming more overloaded. At the same time, the lines of demarcation between the subjects are breaking down, and the importance for every scientific worker of a knowledge of allied sciences is growing greater every day. Sir William Pope expounded this idea in a lecture delivered in July last before the Royal Society of Arts. He pointed out the importance for chemists of a knowledge of physics and the need of a reform by which natural philosophy (that is, physics and chemistry) would become a single whole instead of being made up of half-a-dozen disconnected subjects. He would unite them into one by emphasising the fact that they are all based upon the electronic constitution of matter and energy. The importance of a knowledge of physics to the mathematician was emphasised at the conference held recently at the University College of Southampton, and the October issue of the *Mathematical Gazette* contains a valuable article by Prof. Piaggio on the subject. The main

value of this article lies in the author's discussion of the means by which it can be made possible for the mathematician to attain a knowledge of physics in addition to mathematics within a reasonable time. He goes through the various branches of applied mathematics as at present taught at universities and picks out a considerable number of items that could well be dropped in order to make room for more important matter.

A CORRESPONDENT sends us copies of the journal, *La Province de Namur*, of June 1 and October 15, containing descriptions of a large pearl, reported by M. E. de Ceuster, of Moustier-sur-Sambre, to have been found in a coconut. Where pearls come from has always been a mystery in India, and so long ago as 1240 A.D., a Kashmir physician records them as coming from bamboos, coconuts, heads of elephants, fish, etc. Pearls are definite animal concretions of carbonate of lime around a core which may be a foreign body, the egg or some part of the body of the organism, or the egg or part of the body of a contained parasite. True pearls only occur in molluscs, and they are microscopically and chemically identical with the nacre—the inner lining of the shell—