of the work in sorting offices are leading to important results, and the more precise knowledge gained may make useful improvements in routing possible in the future. Experimental work on the mechanical sorting of mail was started before the Second World War, but was dropped for more urgent matters A new start has been made and an experimental letter-facing machine built, based on photoelectric selection. The general principle of photoelectric scanning is applicable to other purposes, such as the conversion of pencil-stroke codes on white tickets, to other forms, such as punched-hole codes which can be handled by conventional office machinery.

The Electronics Division has made considerable progress in its experimental studies of the factors affecting valve life. The manner in which valves fail is now largely understood, and effort is being concentrated on practical means for eliminating the principal causes of cathode failure, gas poisoning and interface growth. It is also concerned with the performance of crystal diodes and triodes, which are essential for some of the latest developments in communications techniques.

Much of the work in the radio laboratories is directed towards improved overseas radio-telephony services. The single-sideband technique is being more and more used in these services, and a new receiver for this type of signal has recently been developed. Efficient aerials are essential in long-distance services, and there is a group of workers concerned with aerial development. The steadily increasing number of aerials at large radio stations tends to cause congestion, and a model technique using centimetre wave-lengths has recently been brought into use in the investigation of the effects of obstructions upon the directional properties of aerials.

Turning to internal radio communications, the development of microwave systems for the transmission of multi-channel telephone or television signals between large cities continues. Precise information on propagation is necessary in the design of such systems, and several experimental links, over land and over water, are under observation. At the other extreme, radio links are useful for providing single-channel telephone communication with isolated communities, such as live on some of the small islands off the coasts of Britain: a primary-battery-operated, very-high-frequency system for this purpose is on trial. A radio service may be partly or completely upset by interference from electrical machinery or another radio service, and the Post Office tries to minimize such interference by regulation, licensing and technical assistance. In this connexion it is necessary to develop and test interference-measuring sets and to determine the degree of interference that can be tolerated in various radio systems. Recent work includes the determination of the amount of co-channel and adjacent-channel interference permissible in television reception.

Accurate frequency control is necessary in both line carrier and radio communication, and a frequency standard is maintained at Dollis Hill. It includes a number of quartz ring crystals, in improved mountings; these crystals have an outstandingly good performance, and some have been supplied to the National Physical Laboratory and to the Royal Observatory. Equipment similar to that at Dollis Hill has been installed at Rugby radio station to control the standard frequency transmission that the Post Office provides for the Department of Scientific and Industrial Research. The Post Office has recently taken part in international discussions to determine the best form of distress signal for use on 2,182 kc./s. in the marine radio-telephone band, for the operation of automatic distress-signal receivers. A simple device for use with a conventional receiver has been developed; although sensitive, it is remarkably immune to false operation by ordinary speech.

It should be remembered that the whole of the work in Great Britain on civil telecommunication research is not confined to Dollis Hill; all the large manufacturers of telecommunication equipment, radio and line plant have their own research departments where much original work is done. There is also the Radio Research Station at Slough, of the Department of Scientific and Industrial Research. Since the final development stages of equipment which is to be manufactured in quantity are best done in laboratories associated with factories, arrangements exist for the transition from laboratory model to large-scale production to be undertaken by contractors.

APPLICATIONS OF PHYSICS IN THE DIAGNOSIS AND TREATMENT OF CANCER

AMONG a number of scientific and medical gatherings to mark the centenary of the Royal Cancer Hospital, London, S.W.3, the Physical Society held a symposium on the "Applications of Physics in the Diagnosis and Treatment of Cancer" in the Physics Department of the Hospital during October 5–6; Prof. L. F. Bates, president of the Physical Society, took the chair for the first session.

Opening the meeting, Prof. W. V. Mayneord remarked that this was the first occasion on which the Society had met in a hospital and, in doing so, marked yet another stage in the recognition that the applications of physics in medicine now constitute an important branch of applied physics. He gave a brief historical sketch of the influence of the physical sciences on medical thought and practice from early times, and stressed the present need for physicists trained in biology and biophysics.

In his paper on "The Use of High-Energy Particle Accelerators", Dr. D. A. Layne discussed the difficulties of the treatment of deep-seated tumours by normal-voltage X-ray therapy and the ways in which the use of high-energy particle accelerators can help to overcome them. The application of high-energy beams of X-rays and particulate radiation were considered and also the most probable useful energy ranges for each type of radiation. It was emphasized that considerable preparation, both physical and biological, is necessary before any generator of this type can be applied clinically. Each machine has its own special problems, but, as an example, particular reference was made to those encountered in the clinical preparation of the 30-MeV. synchrotron at the Royal Cancer Hospital. Finally, attention was paid to experimental and theoretical work on the process of particle injection into betatron orbits, undertaken in the hope of increasing the X-ray output. It is normally supposed that, for most betatrons and electron-synchrotrons, only 1–2 per cent of the theoretical maximum charge is actually accelerated, but the work described suggests that this theoretical limit has been incorrectly assessed

and that the working efficiency is actually nearer 50–100 per cent.

Dr. W. K. Sinclair, in a paper on "The Use of Radioactive Isotopes", spoke of the early hopes of these substances in the diagnosis and treatment of cancer. It was thought that isotopes might be found which become localized specifically in tumour rather than in normal tissue, or in particular organs to the exclusion of other organs, and in specific parts, for example, the nucleus, of the living cell. Unfortunately these hopes have been realized in only a very limited degree, but other ways of using the substances have been found. They have, for example, been localized physically in particular regions of tissue and have provided medical men with a wide range of flexible sources which can be used to treat sites in the body inaccessible to beams of X-rays. The present use of isotopes in the diagnosis of thyroid conditions, skin lesions and brain tumours, and in the treatment of widespread systemic cancer by internally administered phosphorus-32 and physically localized gold-198, and the use of discrete sources in cavities, superficially and interstitially, were considered. Some of the principal physical aspects of these methods were outlined. Concluding, Dr. Sinclair reviewed briefly the principles of localization by external counting, beta-ray and gamma-ray dose estimation, the distribution of dose in tissues in a variety of circumstances, the measurement of beta-ray and gamma-ray sources, and the protection measures necessary in handling the high activities required for therapeutic techniques.

Concluding the first session of the meeting, Dr. R. C. Turner, in a paper on "Electronics", described the part played by this subject in the diagnosis and treatment of cancer, particularly in relation to the development of instruments for the measurement of ionizing radiations. He discussed electronic instruments which have been developed for the control of the radiation dosage delivered to specific sites in and on the bodies of patients undergoing radiation treatment, for the laboratory study and evaluation of new radiation techniques and for the monitoring of personnel and control of levels existing throughout the Royal Cancer Hospital. Various types of direct-reading instruments in routine clinical use were described. An experimental apparatus aimed at presenting a visual image on an oscillograph screen of a distribution of radioactive material or of radiation is in operation, and is yielding some promising results. Dr. Turner discussed the possibility of applying supersonic techniques to the localization of small tumours in specific sites and of its diagnostic significance.

During the evening of October 5 demonstrations were shown in the Physics Department of the Royal Cancer Hospital as follows: scintillation counting; instrument making; physical chemistry; clinical physics and treatment planning; electronics; photographic investigations; isotope investigations; biophysical investigations and autoradiography; and work on high-energy X-rays (30-MeV. synchrotron and 2-MeV. Van de Graaff generator).

Prof. G. I. Finch presided over the second session of the meeting on the morning of October 6, and the opening paper was read by Dr. E. H. Belcher on "Scintillation Counting". He reported that the scintillation counter has found an increasing variety of applications in the field of medical physics during the past three years, by virtue of its high detecting-efficiency for gamma-radiation and the small size of the luminophor used as the detecting element. Dr. Belcher outlined the fundamental principles of the device. The mechanism of production of scintillations varies with the luminophor used, but it is possible to distinguish between pure luminophors such as calcium tungstate in which the emission process is restricted to the luminescent centre, and impurity-activated luminophors such as the thallium-activated alkali halides in which luminescence depends upon the existence of electron-trapping sites in the lattice, which may be remote from the luminescent centre. The design of practical counters for clinical measurements was discussed. It is frequently desirable to separate the luminophor from the photomultiplier tube by a light guide, and in such cases it is often necessary to cool the photomultiplier by liquid nitrogen. Directional and probing counters making use of such techniques were described. Dr. Belcher discussed the absolute sensitivity of scintillation counters. Where a pure luminophor is used, the observed counting-rate may be related directly to the rate of absorption of gamma-ray quanta in the luminophor. In impurity-activated luminophors, on the other hand, the observed counting-rate may be many times greater, because of the phosphorescent emission resulting from the slow release of electrons from trapping sites. Experimental results demonstrating these effects were presented. Further experimental results relating to the luminescence of 'Perspex' and of transparent liquids under gamma-irradiation were also discussed, which suggest that the luminescence of such media may be attributed to the Cerenkov effect. The significance of these results in the fields of biology and radiation chemistry was assessed. Experimental work is in progress on luminescence produced by dissolved radioactive isotopes.

In his paper on "Photographic Measurements of Ionizing Radiation", Dr. G. Spiegler discussed the sensitivity of photographic films per unit of dose as measured by ionization methods, and the sensitivity per unit of absorbed energy. He described the problems involved when a film is used in dosimetric work, emphasizing the energy dependence of the photographic emulsion and the problems of determination of the energy of the incident quanta from the film itself. The chief methods used, such as the 'filter' method and the 'metal foil' method, were described, the former depending upon the absorption in a test filter as indicator of the quality, and the latter making use of the variation with energy of the electronic emission from metal foils. The result of work on the sensitivity of emulsions to beta-particles and investigations on the Ilford *PM*-1 film, used for personnel monitoring, were reported. The absorption of beta-particles in the clothing of personnel, and the relationship between 'tolerance dose' and blackening, were discussed. Dr. Spiegler showed radiographs taken with the 30-MeV. synchrotron, demonstrating the significance of conditions in the high-energy region.

Concluding the meeting, Dr. L. F. Lamerton, in a paper on "Autoradiography", remarked that, when radioactive materials are used either as therapeutic agents or as tracers for the investigation of normal body function, it is always an advantage, and often quite essential, to have precise knowledge of the distribution of the isotope throughout the tissue. The autoradiographic method provides a means of obtaining this information, subject to two main limitations: first, in the preparation of the tissue for

autoradiography some of the radioactive material may be lost or its position change; and secondly, when isotopes are used as tracers, the amount of isotope necessary to give a satisfactory autoradiograph may be such as itself to produce biological effects.

Various types of autoradiographic techniques are available, differing in sensitivity and resolution, in general a high resolution being obtained only at the expense of sensitivity. By the use of nuclear emulsions a sufficiently high resolution can be obtained to give information on the intracellular distribution of isotopes, such work so far being done using a Kodak nuclear emulsion, 4 microns thick, in stripping form. However, work is now being carried out on the possible use of more sensitive nuclear emulsions poured over the specimen. In this way, individual electron tracks can be observed for low-energy electrons. This method will undoubtedly be of considerable value for low-energy beta-ray emitters, but its value is problematic for the high-energy beta-ray emitters such as phosphorus-32. An investigation was described which showed the application of various types of autoradiographic technique. This concerned the non-uniform distribution of radioactive phosphate in certain tissues following intravenous administration, and was shown to be due to the concentration of activity on particulate material. It has been shown that the particulate material can arise in the preparation of the active solution and also by allowing the solution to stand in a syringe, unless special precautions have been taken. The non-uniformity of activity resulting may affect considerably the dosage distribution in the tissue.

NEWS and VIEWS

Astronomy at University College, London: Prof. W. C. Allen

A SUBSTANTIAL bequest from the estate of the late Mr. F. Perren has made possible the establishment of the Perren chair of astronomy in the University of London at University College. The chair will be associated with the Observatory at Mill Hill. The first holder of the new chair is Dr. W. C. Allen. Since 1927 he has been on the staff of the Commonwealth Solar Observatory at Canberra. He has also carried out research work at the Solar Physics Observatory, Cambridge, and at Mount Wilson, and later took part in eclipse expeditions to Japan and to South Africa. Prof. Allen has been concerned actively in many different aspects of astronomical research work. He was one of the first to carry out accurate photometric measurement of the Fraunhofer lines in a very thorough investigation, the results of which are still widely referred to as standard. In recent years, Prof. Allen has made many important contributions to the study of solar and terrestrial relations and to solar physics generally. In collaboration with Prof. R. van der R. Woolley he has worked out a theoretical description of the outer region of the sun's atmosphere, and he has been closely associated on the astronomical side with the fruitful developments of radioastronomy in Australia.

Inter-African Bureau of Epizootic Diseases: Mr. W. G. Beaton

UNDER the auspices of the Commission for Technical Co-operation in Africa south of the Sahara, an Inter-African Bureau of Epizootic Diseases is to be set up in Kenya on the site of the East African Veterinary Research Organization at Mugaga, near Nairobi, and Mr. William Gaudenz Beaton, the retiring director of veterinary services, Nigeria, has been appointed director of the Bureau. Mr. Beaton, who has spent his entire career in Nigeria, was born in 1900 and educated at the Royal Veterinary College, London, the Universities of Edinburgh and Liverpool and at the Pasteur Institute, Paris. He entered the Colonial Veterinary Service as a veterinary officer in 1925, becoming a research officer in 1929 and then senior veterinary officer in 1938. In the same year he became deputy director of veterinary services, and in 1948 was appointed director. Mr. Beaton was delegate for Nigeria to the Anglo-French Colonial veterinary conference, held at Dakar in 1946, and in 1948 he attended three conferences: the Colonial genetic conference at Edinburgh, the international rinderpest conference at Nairobi and the United Nations Food and Agriculture Organization conference on rinderpest, also at Nairobi.

Royal Naval Scientific Service: Chief Scientific Officers

THE following promotions to the rank of chief scientific officer in the Royal Naval Scientific Service have been announced:

Mr. J. Anderson, C.B.E., chief scientist at the Admiralty Signal and Radar Establishment, Haslemere. Mr. Anderson was educated at the Royal Technical College, Glasgow. After two years postgraduate training in the Rugby works of the British Thomson-Houston Co., Ltd., he joined the Admiralty Experimental Station at Parkeston Quay, Harwich, in May 1918. Mr. Anderson assisted Prof. R. W. Boyle in the very early stages of the development of Asdic equipment for the detection and location of submarines, and has been associated with the subsequent development of this equipment, first at H.M. Signal School, and later at H.M. Anti-Submarine Experimental Establishment. In 1943 he became chief scientist at this Establishment, which in 1946 was renamed H.M. Underwater Detection Establishment. He went to his present post in May 1951.

Colonel A. V. Kerrison, director of Aeronautical and Engineering Research, Admiralty. After service in France throughout the First World War, and two years on intelligence missions in South Russia, Colonel Kerrison returned to England to work on mathematical analyses of artillery ballistics and anti-aircraft gunnery problems. He eventually became Army liaison officer at the Admiralty Research Laboratory, Teddington, where he initiated systematic research in the development of gunnery fire control. His experimental work on aided laying opened up a new line of development in anti-aircraft gunnery fire control, his design of a close-range predictor based on it being adopted by both the British and United States armies.

Dr. E. C. S. Megaw, director of physical research, Admiralty. After graduation in electrical engineering at Queen's University, Belfast, Dr. Megaw