

in phase and attenuation for the two directions of propagation, observed when a magnetic material in a waveguide is subjected to a transverse magnetic field. The Faraday effect, observed when there is a static magnetic field along the direction of propagation, is non-reciprocal—that is, waves travelling either with or against the direction of the static field have their planes of polarization rotated in the same direction in space.

B. G. Parkin (Post Office Research Station, Dollis Hill) discussed the properties required in the magnetic cores used for the 'memory' circuits of computers and similar apparatus. These cores should have nearly rectangular hysteresis loops and must be capable of reversing their magnetization in a few microseconds in a field of about 1 oersted. The time required for reversal is governed not only by the decay of eddy currents but also by the damping of changes of alignment of electron spins. The operating conditions can be met both with ferrites and with metal tapes a few microns thick. A rectangular loop in metals may be produced by grain orientation as the result of severe cold-rolling, or by annealing in a magnetic field. In the discussion, Dr. Gorter explained the rectangular loops of ferrites as the result of one source of anisotropy outweighing all others.

Dr. R. Street described the experimental methods developed at the University of Sheffield for the measurement of spontaneous magnetization. In the interesting range near the Curie point, the magnetization is markedly dependent on field, and the problem is to find methods which allow extrapolation to zero field. There are two main techniques available: the measurement of mechanical force in a non-uniform field, and the measurement of temperature rise on the removal of an applied field. The use of photo-electric amplifiers with galvanometers has so increased the sensitivity attainable by the second method that results obtained by the two methods can now be compared. The approximations made in deducing Curie temperatures are such that the methods lead to values differing by, for example, 4 deg. C., but the existence of anomalous shapes of saturation/temperature curves has been established beyond question.

Particles of iron, if small enough, are known to be magnetized as single domains and therefore to have very high values of coercivity. This coercivity depends on the shape of the particles, being high if they are acicular, and is also high if the anisotropy of the material is large, as in manganese bismuthide or in cobalt. Dr. E. P. Wohlfarth (Imperial College of Science and Technology, London) indicated the types of formula that have been calculated for the effect of interactions between particles in an aggregate, and for several possible distributions of particle shapes. This work has applications not only to the manufacture of permanent magnets and magnetic recording tapes, but also to the study of rock magnetism. He is now extending the theory to the properties of particles which are large enough to contain a single domain-wall.

Dr. N. C. Tombs (G.E.C. Research Laboratories, Wembley) described experiments to produce iron powders showing the properties of a permanent magnet. For practical purposes, a coercivity of about 200 oersteds is needed, which cannot be obtained with spherical particles. Particles of hydrated alpha-ferric oxide are known to have acicular shapes, and with the help of a series of electron micrographs Dr. Tombs was able to demonstrate this property on a number of these

powders prepared under laboratory conditions. X-ray analysis confirmed that the particles seen in the electron micrographs were in fact single crystals. If such powders could be reduced in a stream of dry hydrogen under carefully controlled conditions, without their shape and size being altered, then the resulting iron powder should exhibit useful magnetic properties. A further series of electron micrographs showed that during the reduction much of the acicularity of the particles was lost. Sufficient remained, however, to give a useful coercivity even after compacting. Although the $(BH)_{\max}$ product was much lower than the corresponding figure for barium ferrite, the ratio of B to H is so different in the two materials that each may be useful in particular applications.

Dr. G. E. Bacon (Atomic Energy Research Establishment) reviewed the rapidly expanding field of neutron-diffraction studies of magnetism. Elastic scattering of neutrons from either ferromagnetic or antiferromagnetic substances gives regular diffracted beams which are superposed on the ordinary scattering, and from which the order of the atomic magnetic moments can be inferred (though not without ambiguity unless the specimen is a single crystal). The evidence so obtained supports Néel's theory of ferrimagnetism in ferrites, and neutron diffraction is the main source of evidence for antiferromagnetism. Ordered forms of alloys such as Ni_3Fe have been detected. Inelastic scattering also occurs; in magnetic materials it disturbs the atomic magnetic moments and causes further inelastic scattering by which the disturbance can be detected. The most serious experimental difficulty is the weakness of the available 'monochromatic' beams of neutrons, the intensity of the beams used for X-ray diffraction being about 10^5 times as great. There is great scope for further experimental work, but much of it must necessarily wait until powerful sources of neutrons are more widely available in research establishments.

Each of these seven papers was followed by questions and discussion, and Dr. Gorter's contributions should be mentioned as being particularly helpful.

A. C. LYNCH
J. WATKINS

DAILY MAPS OF THE SUN

IN the study of solar-terrestrial relationships, obtaining solar data of a homogeneous nature over a period of years or of decades is one of the principal difficulties. Where daily observations of the Sun are required, co-operation between a number of observatories is essential if there are to be only a small number of unrepresented days. The difficulty then arises of obtaining uniform quality of original material from the different contributing observatories. Although suitable means of doing this have been available for many years in the case of solar photographs in integrated light, similar co-operation with instruments showing the features only visible in monochromatic light has in the past been hindered by difficulties in reaching agreement on the precise instrumental requirements, in maintaining the observing routine and standard of quality, and in providing suitable means for reduction and publication of material. A fresh attempt at co-operation between a number of observatories has now been

started by the Fraunhofer Institut, of Freiburg-im-Breisgau, Germany, for the purpose of producing daily maps of the Sun showing photospheric and chromospheric details and coronal intensities for λ 5303.

Among the observatories contributing chromospheric data are those of Freiburg, Kodaikanal, Wendelstein, Tokyo and Sydney. The coronal data are provided from the observatories of Climax, Sacramento Peak, Pic du Midi, Kanzelhöhe and Wendelstein. Istanbul, Potsdam, Arcetri and the German and Swedish stations on Capri also contribute material. The reduction of data and production of the daily maps are carried out at Freiburg and the printing is by a half-tone process to a scale of 15 cm. of the solar diameter. Conventions are used to show the areas occupied by calcium *plages* of low, intermediate and high intensity, and the shapes of dark filaments and limb prominences are shown, all against a background of lines giving heliographic co-ordinates. Limb coronal intensities and the positions and Zurich types of the sunspot groups are shown schematically. The aim is to produce these maps at intervals of two weeks with a delay of two weeks from the date of the latest map. Only a small number of gaps are expected to occur throughout the year.

These maps will provide a series for reference which with regard to the chromosphere should be more valuable than all other similar information published elsewhere. It remains to be seen how well the standards of indicating the various phenomena fluctuate from day to day and deviate from the initial standards over long periods of time. The possibility of such variations must be kept in mind when investigating solar-terrestrial relations, and it would be interesting to know if any special safeguards have been adopted in the present instance, where quantitative assessment apparently takes no part in the stages prior to publication. It certainly seems possible to draw quantitative information from these maps in a satisfactory manner; but it is the responsibility of the person who uses the information to make sure that it is inherently suitable for his purpose. Only the considerable task of collecting the raw material and making it available has been taken for him.

P. A. WAYMAN

B.B.C. ENGINEERING MONOGRAPHS

THE *B.B.C. Quarterly*, which has been issued since April 1946, ceased publication in the autumn of 1954, and in order to provide a vehicle for the publication of technical papers of the type hitherto included in this journal, the British Broadcasting Corporation has recently issued the first four of a series of "B.B.C. Engineering Monographs", about six of which will be produced every year (annual subscription £1); each monograph will deal with a technical subject within the field of television and sound broadcasting and will describe work that has been done by the Engineering Division of the Corporation, including, where appropriate, a survey of earlier work on the same subject. The series will also contain, from time to time, selected reprints of articles by B.B.C. authors that have been published in technical journals.

The first monograph, "The Suppressed Frame System of Telerecording", by C. B. B. Wood, A. V.

Lord, E. R. Rout and R. F. Vigurs, summarizes the fundamental and practical aspects of a telerecording system using standard 35 mm. film. The recording cycle consists of exposure during one whole television frame while the film is stationary in the gate, followed by pulldown of the film during the next, or suppressed, television frame. Thus the picture photographed on the film corresponds to a $202\frac{1}{2}$ line structure; but with the use of spot-wobble to broaden the lines, the recording is found to give an acceptable picture when the film is re-scanned by the standard 405 lines in the teleciné machine. Three photographs accompany the description of the equipment; and the results of tests have shown that the construction of an apparatus of this type using standard film-transport mechanism has been fully justified.

No. 2 in the series is a paper on "Absolute Measurements in Magnetic Recording" by E. D. Daniel and P. E. Axon, and describes work carried out in the B.B.C. Research Department to establish methods of measuring the absolute sensitivity of the component parts of the recording-reproducing system. Another contribution from the Research Department is the third monograph, that on "The Visibility of Noise in Television", by R. D. A. Maurice, M. Gilbert, G. F. Newell and J. G. Spencer. This describes a comprehensive investigation of the effect of random noise on a television picture, its dependence on the non-linearity in the relevant portions of the transmission channels and the visibility of the noise as a function of frequency. The third part of this monograph comprises four photographs illustrating the effect of noise on a television picture for four values of the signal-to-noise ratio.

The fourth monograph is entitled "The Design of a Ribbon Type Pressure-Gradient Microphone for Broadcast Transmission", by D. E. L. Shorter and H. D. Harwood. This describes work leading to the development of an improved studio microphone for both sound and vision broadcasting, with a greatly reduced weight and volume and an extension in the range of uniform frequency-response.

Summaries of recent patent applications by the B.B.C. are also included in two of the monographs, each of which is issued in a distinctive two-tone blue cover. It is likely that the series will be of interest and value to engineers engaged in broadcasting and telecommunications generally both in Great Britain and overseas.

THE METEOROLOGICAL OFFICE ANNUAL REPORT FOR 1954-55

THE annual report for 1954-55 of the Director of the Meteorological Office* records another year of steady progress and of honest endeavour by the Office to meet the ever-increasing demands for its services. There appears to be little need for special comment regarding two of its main functions: the provision of meteorological services for civil and military aviation, for shipping, for the general public by television, radio, telephone and through the Press, for special customers such as the railways, electricity and gas undertakings, farmers, river and road

* Annual Report of the Director of the Meteorological Office, presented by the Meteorological Committee to the Secretary of State for Air, for the Year April 1, 1954, to March 31, 1955. (M.O. 594.) Pp. 68. (London: H.M.S.O., 1955.) 2s. 6d. net.