ordering of the alloy produced by a critical heat treatment. 'Supermalloy' is a ternary nickel–iron–molybdenum alloy; other members of the family contain copper also, but all have comparable magnetic properties.

The effect of impurities in high-permeability materials was discussed both on the basis of a simple theoretical model and with regard to the control which could be effected in manufacture. Surface layers, produced during either rolling or annealing (their exact source is not yet certain), often reduce the permeability of thin laminations of these materials. This effect and the reasons for it were fully discussed.

There is at present a considerable interest in magnetic materials having rectangular hysteresis loops and combining high remanence (more than 95 per cent of the saturation flux density) with low coercivity. The alloys generally used are the silicon–irons, nickel–irons and cobalt–nickel–irons. They may be either grain-oriented by cold rolling, followed by suitable heat treatment, or domain-oriented by annealing in a magnetic field, and they present interesting problems in measuring their performance. They are used in magnetic amplifiers, mechanical rectifiers, delay lines and switching devices.

Since the introduction of the complex ferrites, such as zinc–manganese ferrite, by Snoek and his colleagues, they have found many applications in telecommunications when moderately high permeability combined with high resistivity is needed. These materials have opened up new fields of study: their magnetic losses differ in some ways from those of the more normal ferro-magnetics; their high resistivity permits measurements to be made in the microwave region without trouble from eddy currents. Measurements of this nature have shown that, with increasing frequency, permeability tends to unity and resonance effects occur which are consistent with the theoretical work of Néel and his associates.

The customary separation of alternating-current losses into hysteresis, eddy current and 'residual' loss was shown to be unsatisfactory in several ways. Hysteresis loss is difficult to define, and if the power factor due to residual loss varies with frequency (as it certainly does), it cannot be clearly distinguished from eddy-current loss. The residual loss itself may have several components, and an interesting difference came to light between the French and German schools of thought on this subject. A source of loss recognized by both is the rapid migration of impurities within the crystal lattice (Snoek's 'disaccommodation'), giving rise to a strongly temperature-dependent loss. Another loss, less dependent on temperature, is thought by the German workers to be due to thermal effects accompanying magnetostriction, but by the French (and some British) workers to be due to thermally activated movement of domain walls. During discussion of these theories, a crucial experiment (measurement of A.C. loss in the presence of D.C. polarization) was devised for distinguishing between them, and it will shortly be tried on various materials. Although these effects are of technical interest mainly when they appear as A.C. losses, they are also observable at slow changes of D.C. magnetization, and some results were quoted of observations over periods of hours which can to some extent, though not fully, be reconciled with the known A.C. effects.

Several papers reported excess eddy-current losses, usually in material having well-aligned domains, including the rectangular loop materials. The measurements were all at low flux densities, and the effect may, or may not, be the same as the 'eddy-current anomaly' known in power engineering, for which another explanation was suggested. This excess loss may be the result of concentrating the eddy-current loss in the regions close to domain walls instead of distributing it uniformly through the material. A further suggestion was that non-uniform flux gives rise not only to excess eddy-current loss, but also residual loss.

Specialized methods of measurement have been developed to study such problems as the variation of permeability through the thickness of strips of high-permeability nickel–iron alloys. Two laboratories have made measurements at frequencies of the order of 10 Mc./s. at which only the surface layers of the material are effective; other studies have been made by measurement after electro-polishing of the strips and by metallographic examination of cross-sections. Some differences between results may be due to differences between British, French and German material, and exchanges of specimens have been arranged.

Several papers discussed the harmonic distortion and the intermodulation produced by magnetic cores. Some materials can produce intermodulation but not harmonics, so that the definition of 'linearity' requires close attention. Experiments have shown that the hysteresis loss due to two superposed signals may be less than that due to the two separately; this, however, can be explained by well-known theory.

A criticism of much work reported (not only at this meeting) by physicists and engineers is that they cannot describe adequately the materials with which they are working. They are generally dependent for supplies on industrialists who do not always realize how much help they could give by describing precisely the samples of materials which they so often generously give to academic workers for research. It is, for example, often difficult to decide from published work just what nickel–iron alloy has been used; the same name may describe different alloys in different countries, and, in fact, different alloys in one country at different times.

OBITUARY

Sir Charles Inglis, O.B.E., F.R.S.

SIR CHARLES EDWARD INGLIS, emeritus professor of mechanical sciences in the University of Cambridge, who died on April 19 at the age of seventy-six, was probably the greatest teacher of engineering of our day. His powers as a lecturer were unrivalled, as many, outside Cambridge, will know from the lectures he gave before the local centres of the professional engineering institutions throughout Great Britain. Especially to an academic audience, he gave the appearance that what he most wanted to do at that moment was to give that lecture to that particular audience. He loved teaching, and much of the success of his lectures was due to the enormous amount of work he devoted to preparing them; then he spoke fluently and to all appearances without a note.

His power of attracting the love and admiration of all his undergraduates was the greatest of all his

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outstanding qualities. For many years past there were fully two hundred new undergraduates each year, and thus only a few of them could have known him personally outside the lecture room: and yet it is true that all of them regarded him as the centre and genius of the place. Whenever one met Cambridge engineers, from any part of the world, their first questions were, in this order: "How is Professor Inglis, how is my College, how is Cambridge and how is the Engineering Laboratory ?"

Throughout his life Inglis was keenly interested in problems of education. He became a lecturer at the Engineering Laboratory at Cambridge in 1902 and was a strong influence in developing the Tripos course, the general pattern of which had been started by Ewing in the middle 'nineties. After seventeen years spent in the development of the School, he was called to be head of it in 1919 and continued as such until 1943. Thus it is scarcely surprising that the change of headship from Bertram Hopkinson to Inglis was not accompanied by any marked innovations in the general policy of the Tripos course. Together they had developed the academic discipline which Ewing had initiated, and Inglis, firm in his belief in it, allowed it to evolve steadily throughout his time. It was a discipline which laid great stress on making the undergraduate work out endless problems completely, and to become very practised in the application of the fundamental principles he was taught. It succeeded in giving engineering graduates from Cambridge certain characteristics and predictable qualities, which have come to be commonly recognized and counted on throughout the years. The engineering profession as a whole knows what to expect and what not to expect from a Cambridge graduate. It can be said with truth that Inglis was no great innovator: perhaps he believed firmly in gradual evolution.

Apparently he did not believe in a highly organized administration in an academic world. Years ago he had been known to say that when people realized that they had no marked original talent or strong interest in particular, then they turned to administration and became great men! In discussing the trials of a head of a university department, he would say that while research went hand in hand with teaching, administration went with neither. It can be said that he detested administration in a university or a research department; but he had great talents as the chairman of public service organizations or on the councils of the professional engineering institutions, and in such settings he may have held different views about administration.

Much of the day-to-day detail of the Department of Engineering at Cambridge was attended to very ably by his friend Mr. J. W. Landon, of Clare College, who was secretary of the Faculty Board of Engineering for very many years, and by Mr. A. H. Chapman, secretary of the Department. Landon and Inglis faced together the enormous task of expanding the Cambridge School to meet the demands made on it after the First World War, necessitating the move from Free School Lane to new laboratories built on the Scroope House site, which contained the Department adequately until another war made further expansion essential. He showed great insight in persuading the War Office to send the young officers of the Royal Engineers to Cambridge to read for the Tripos.

To the last Inglis remained an active research worker and could be found on any morning recently still engaged on those meticulous calculations which brought him so much satisfaction. His work on vibrations, particularly his monumental research for the Bridge Stress Committee, is likely to influence engineering science most; but he made important contributions in other fields, notably his early paper on the stresses near an elliptic hole and his work on flat plates for the Institution of Naval Architects.

Though a scholar, Inglis was essentially an engineer and was not afraid of the practical difficulties inherent in most engineering problems, as shown by his development of the once-famous Inglis military bridge, and as is known by the many firms who called on his services. He derived great satisfaction from his engineering contacts and was most happy as a member of Council of the Institution of Civil Engineers, of which he became president in 1941.

The last year of his life was almost as active as any. He had the satisfaction of seeing the publication of his book "Applied Mechanics for Engineers", which contains his elementary teaching on that subject, and of spending three months in South Africa as a visiting lecturer to the University of the Witwatersrand, continuing, what he did so superlatively well and loved so much, the teaching and inspiration of the young engineer.

Undoubtedly Inglis was born with very great gifts; but what mattered most was that, by his own self-discipline, he developed them very fully. He threw the whole of himself into what he was doing at any given moment and never lived at a low intensity. He did many things, and everything with distinction. He was an entertaining conversationalist, but recollection shows that he seldom talked about himself, though very commonly about things he had encountered. He was not one to pass strictures on people, though sometimes he spoke in condemnation of those who did not trouble to prepare their lectures adequately. His character seems to be made coherent if it is credited with an intense humility, which must not be construed as humbleness. He had a profound respect for the dignity of human beings; if men chose to go with him, then he was delighted; if they did not choose to do so, he did not bother them. He never preached at people nor did he proclaim his ideals: these he made apparent from his own personal example. Always mindful of others, he was incapable of actions which were consciously selfish and he was not self-centred. He inspired all the laboratory assistants with a trust which was absolute; and they responded with a loyalty appropriate thereto. When he was not giving the whole of himself to some person his natural preoccupation often made him appear detached, even aloof; this preoccupation was inevitable in a man who had so many interests and occupations. Because he was always calm and not apparently over-worked, some people may not have realized that he was always attending to several different jobs simultaneously.

In July 1950 Inglis spoke to a gathering of old pupils who had met to honour him: much that he said was very characteristic of his happy buoyant nature: "Spontaneous generosity of mind is one of the highest of human attributes and it is all too rare". "Our ambition was to teach you to think for yourselves, to develop your reasoning powers rather than your memories, and to give you the power to strike out with equal facility along any line your future career might take you." "It is not by costly equipment but by the inspiring personalities of the

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teaching staff, and by the competence of the laboratory assistants, that the best results in education are achieved. Teaching ability is a rare and priceless commodity, and when you have found a first-class teacher give him his head and don't cramp his style with any soul-destroying examination syllabus." "I know the young are apt to pity old age, but there, as in many other ways, they are all wrong. Spring is glorious, and full of promise; summer is garish and a bit vulgar; autumn is, to my mind, the best part of the year. In the autumn of life one has acquired a sense of values—one has learnt to appreciate a lot one did not discern in the spring time."

He was very proud of our great and learned profession; and that profession, in which he moved naturally in his own right as an eminent engineer, was very proud of him. Moreover, it knows full well how much it owes to Charles Inglis.

This is not the place to list his many practical achievements or his continuous output of research or his chairmanships of boards or of committees, whether engineering or political. His life is too widespread to recount here: in this respect, at least, he had much in common with Keynes, Clapham and Barcroft, his peers and close contemporaries in King's College.

E. B. Moullin

NEWS and VIEWS

Education and Psychology at Exeter: Prof. S. H. Watkins

Prof. S. H. Watkins, holder of the chair of education and psychology in the University College of the South-West of England, Exeter, is retiring at the end of this session. Prof. Watkins went from Cardiff to Exeter in 1923, succeeding Prof. Wortley, the first occupant of the chair, who held it for only four years before he went as principal to the then University College of Nottingham; the Department of Education and Psychology at Exeter is therefore, to all intents and purposes, Prof. Watkins's creation. Prof. Watkins, who had studied under Wunt at Leipzig, has remained an experimental psychologist, and has increasingly stood aloof from the more modern trends, distrusting (perhaps with good reason) the statistical developments of recent years. At Exeter, while he founded no school, his influence has been considerable. Generations of undergraduates have learnt more from personal contact with him than they have, perhaps, been aware. He has always been easy of approach. But it is probably his colleagues in the Department who have been most influenced. His readiness to listen to the development of an idea and then his sudden and unerring descent on the weak spot in the argument—all done with an engagingly genial air—must have helped many to develop to the full their own line of thought. His influence is perhaps to be detected in the number of his former colleagues who are now occupying chairs in other universities or university colleges, or important administrative positions in the educational world at home and abroad. For Prof. Watkins education is a concrete thing, not abstract and remote, and it is for this reason that the work of the Department is human and not acrid. He has done much to bring the University College and the area which it serves into close and cordial relationship and has served on the Devon County Education Committee. As deputy principal, and now acting principal of the College, and warden of Mardon Hall, his influence has not been confined to the Department of which he is head; during long years of administrative activity he has also greatly served the whole College, and played no small part in evolving the policy of a future University of Exeter.

Dr. A. C. T. W. Curle

Dr. A. C. T. W. Curle, who has been appointed to succeed Prof. S. H. Watkins, went up to New College, Oxford, in 1935, where he read history and anthropology. In 1938 he was elected, first, Coltant exhibitioner and later scholar in anthropology of Exeter College, Oxford, and made field trips to Lapland and the Middle East while working for a research degree in the Oxford Institute of Social Anthropology. At the end of the Second World War he became senior research officer to the Army Civil Resettlement Department, and in this capacity, and later as a staff member of the Tavistock Institute of Human Relations, he has been applying the sort of methods used in the study of primitive communities, coupled with psychological techniques, to investigate problems of contemporary European society. Dr. Curle was appointed University lecturer in social psychology at Oxford in 1950, and has since been working in the University Institute of Experimental Psychology, where he has done much to bring about closer relationships between the social and biological aspects of psychological inquiry. During this time he has also been editing and co-ordinating the community studies carried out as part of Unesco's Tensions project, and has visited Germany on behalf of the Foreign Office to lecture on recent developments in social psychology in Britain. His outstanding work in both primitive and modern society has led him to believe that problems of intellectual development and emotional adjustment in a rapidly changing society like our own can best be met by the application of sociological and psychological findings to educational matters. Dr. Curle will be greatly missed at Oxford, both academically and personally.

Unesco Science Writing Prize: Prince Louis de Broglie

The first award of the Kalinga Prize given by Unesco for the best work in the field of popularization of science has been made to Prince Louis de Broglie, for his outstanding contributions to the popular interpretation of science. The Prize was established last year by Mr. M. B. Patnaik, a leading Indian industrialist, as a means of focusing attention on the need for greater understanding and broader use of science for human welfare. Prince de Broglie is known both for research in theoretical physics and for pioneer achievements in the popularization of science; he is the honorary president of the French Association of Science Writers and the permanent secretary of the Paris Academy of Sciences. The jury for the 1952 Kalinga award consisted of three members: Dr. Göran Liljenstrand, of the Caroline Institute in Stockholm, and Prof. M. N. Saha, professor of physics in the University of Calcutta, both selected by the International Council of Scientific Unions, and M. Paul Gaultier, member of the Institut de France, chosen by Unesco. The Prize,

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