after their technical training. Much can be done by relatively formal teaching, but—if I may judge from personal experience—more depends on the extent to which students are given the time and opportunity to educate themselves by contact with men and women with entirely different interests and outlook from themselves. This is the great strength of the older residential universities; but, here again, they may have something to learn from North Staffordshire.

But the older we get the less inclined we are to go back to school. If we want every member of the population to keep in touch with what is going on in the scientific world and to realize its impact on their lives, we must rely on the Press and on the broadcasting authorities. Neither of these is primarily an educational medium; in both cases the main objective is to put science across in a form that readers and listeners find interesting. In respect to music, the B.B.C. has been outstandingly successful; other fields of broadcasting may be less amenable, and it is not altogether easy to know how far an increase in factual knowledge concerning a number of isolated fields of science enables listeners to appreciate the broad social and international implications of science as a whole.

But when all is said and done, science can only play its full part in furthering the welfare of mankind if it is used at a very early stage of education, as a means of encouraging a dispassionate but optimistic attitude towards all aspects of human affairs. To move from national traditions and aspirations to others based on international welfare may prove less painful if we are prepared to look on man and all his problems as a phase in the evolution of the universe, and if we have the courage to believe and to teach that he can, by means of his intellect, control and direct his own evolution and destiny.

[1] See Blackett, P. M. S., *Advancement of Science*, **15**, 367 (1959).
[2] Presidential address to the British Association (1952).
[3] Presidential address to the British Association (Dublin, 1957).
[4] Haskins, C. P., "Of Ants and Men" (1945).
[5] "The Herd Instinct in Peace and War".
[6] *Nature*, **182**, 965 (1958).
[7] Thirteenth Report of the Nuffield Foundation, 66 (1958).
[8] Proc. B.A. Conference "Science in Schools" (1958).
[9] Report of the Advisory Council for Secondary Education in Scotland, 25 (1946).

SUMMARIES OF ADDRESSES OF PRESIDENTS OF SECTIONS

THE VISUALIZATION OF MAGNETIC PROCESSES

In delivering the presidential address to Section *A* (Mathematics and Physics), Prof. L. F. Bates prefaces his remarks with a brief outline of the ferromagnetic domain concept. He then describes the several ways in which the boundaries and surfaces of such domains in single crystal and in polycrystalline materials may be manifested. He shows how the original Bitter figure technique has given results of great value concerning main domain and closure domain configurations; it has provided considerable support for the ideas of Néel and others as applied to the magnetization processes which occur when single crystal specimens of appropriate shape are exposed to magnetizing fields, and has given visual proof of the important effects of inclusions, defects and strains on magnetization phenomena.

The technique has recently been much extended first by Craik's development of a detachable colloid film carrying with it a record of domain configuration, which can be examined optically and also in a commercial form of electron microscope. Craik and Griffiths have shown that the film technique can be successfully used to examine fine domain structures on ferrite surfaces prepared by the simple cleavage of single crystal specimens. By using films of ever-decreasing colloid concentration, Craik found the minimum thickness of a continuous deposit above a 180°-domain wall on a cobalt crystal to be 10^{-5} cm.

The colloid film techniques restrict the experiments to static observation and to limited ranges of temperature, and recently attempts have been made to develop dynamic methods. Perhaps the most successful is the polarized-light technique of Lee, Callaby and Lynch, which has been applied to the motion of a domain wall in a thin sheet of polycrystalline 'Perminvar', an alloy of approximate constitution $Ni_{45}Fe_{30}Co_{25}$, which has been magnetically annealed by cooling it in a magnetic field. Davis has followed the motion of such a wall by pick-up in a search coil wound on the specimen. Lee, Callaby and Lynch have used the transverse Kerr effect. The specimen is illuminated by a beam of plane polarized light, which forms a small strip on the specimen surface, roughly parallel to the wall, and which acts as a light probe. The reflected light is collected by a microscope, passes through a 'Polaroid' and is thrown upon the cathode of a photomultiplier. As a domain wall moves across the beam, the intensity of the collected light changes, the change being made periodic by the application of a weak alternating field to the specimen. The current from the photomultiplier is amplified and a signal displayed on a cathode-ray oscillograph. By using two light probes a domain wall can be made to move through each in turn, so that the velocity of wall movement can be followed. It is found that the velocity is fixed almost entirely by the eddy currents in the specimen.

An electron microscope has been directly applied by M. Blackman and others to examine the stray fields at the edges of ferromagnetic specimens, and in this way it has been shown that the domains in hematite are unexpectedly large. Spivak and his collaborators in Moscow have obtained direct photographs using the secondary electrons released by a primary beam on the specimen surface. They have also used an electron mirror method. Kaćzer, in Prague, has used a thin 'Permalloy' probe vibrating above the surface of a specimen to map domains. However, all these methods have to date been less informative than the colloid method, and may more readily manifest surface imperfections and inhomogeneities than domain walls, but they may, of course, be greatly improved in future.