systems have their points and that it is unwise to copy either too rigidly or exclusively in other countries, particularly in those such as Australia and New Zealand, with small populations, in which government institutions such as his own Division of Industrial Chemistry may have to shoulder for many years to come wider responsibilities than their counterparts in Britain.

Dr. Wark's comments on the creation of the research associations are interesting. While he approves their creation close to the industries they serve, he suggests they would be doing better work if located in groups or in proximity to the universities. He believes that applied research only flourishes and continues to flourish when prosecuted in proximity to related fundamental work. After a quick glance at conditions in Europe, Dr. Wark points out that for years to come Australia must accept more than she gives in the field of research. Her universities are not developed to the same extent as those of Europe and America and must be built up both to do more research and to train more persons in research methods. They are more dependent on government aid, and Dr. Wark hopes that the Commonwealth Government will be as far-sighted as that of Great Britain and not attempt to curtail liberties in making its grants to the universities. Again, while Australian graduates go overseas for experience in research, those with an interest in fundamental work tend to remain overseas, and the flow in the reverse direction does not yet balance this very serious loss. Moreover, it will not be sufficient to strengthen Australian laboratories unless adequate subsidiary services such as workshops and libraries are provided, and unless the demands for immediate practical results from all research work are stopped. The research worker must be allowed to attack practical objectives on a sufficiently fundamental plane, and the human aspect must also be recognized. Dr. Wark says frankly that frustrations arising from regulations that are useful in other types of work have ruined completely the morale of half the government laboratories of the world.

# THE MATHEMATICAL ASSOCIATION

## ANNUAL MEETING

THE annual meeting of the Mathematical Association was held at the Regent Street Polytechnic, London, during January 3–4. For his presidential address, Sir Harold Spencer Jones, the Astronomer-Royal, spoke on "The Measurement of Time", describing the search for increasingly accurate methods of time determination, from the earlier transit instruments to the ingenious Shortt clock, with its correlated 'free' and 'slave' pendulums, and the recently devised quartz crystal clock, a time-keeper the accuracy of which is surprising.

On the afternoon of January 3, a discussion on "Mechanics in Schools" was opened by Mr. K. S. Snell (Harrow School) and Dr. E. A. Baggott (Regent Street Polytechnic). Should statics precede dynamics ? Should the novice begin with absolute or with gravitational units ? What is the place of experimental work in the school course, and what degree of correlation with the physics laboratory is desirable ? These questions raised a vigorous open debate, since on none of them was unanimity exhibited.

A paper from Prof. H. S. W. Massey, on "The Method of Mathematical Physics", described the four stages of investigation—the collection and classification of data, the grand inductive hypothesis, and the deductive predictions therefrom, and the experimental verification of these last two stages so as to provide a demonstration of the validity of the induction. Examples of this sequence were given, particularly with reference to fundamental problems in nuclear physics.

On the second day, the meeting began with a paper by Dr. Frank Smithies on "Abstract Analysis". The fundamental concept of the limit in mathematical analysis was successively generalized from the simplest form, familiar to beginners in the calculus, up to the highly abstract notion of a limit in a general topological space, depending on the work of H. Cartan on 'filters' and of E. H. Moore on 'directed sets'. This was followed by an account of "Automatic Calculating Machines" by Prof. D. R. Hartree, in which the recent great development in automatic calculators was illustrated from his wide experience of such machines, particularly the Harvard Mark 1 machine and the electronic delay storage automatic calculator (EDSAC), constructed at the Mathematical Laboratory in Cambridge by Dr. M. V. Wilkes, which is now in operation. Prof. Hartree paid tribute to the great but half-forgotten pioneer work of Charles Babbage (1792–1871) ; he also deprecated the use of the name 'electronic brain', since these machines "can only do what we know how to order them to perform".

The afternoon of January 4 was occupied with a discussion on "Mathematics in the Comprehensive School", opened by Mr. F. J. Swan and Miss Y. Guiseppi, both of West Norwood County Secondary School. Mr. Swan spoke of the general problems of mathematical teaching in a large Comprehensive School, and Miss Guiseppi described in detail various teaching methods she has designed to give children in the Comprehensive School the mathematics they need in a stimulating form. In the general discussion, it was evident that members of the Association are anxious to protest against the view sometimes held by parents that the Comprehensive School is a 'poor relation' of the Grammar School ; they are also deeply concerned with the problem of helping the teacher who may have to teach a good deal of mathematics in such a school but is not a mathematical specialist. Such a teacher cannot afford to join the teaching associations of all the subjects he may be called on to teach ; nevertheless, these associations must regard the helping of these teachers as one of the most urgent of their present-day problems.

The final paper, "A Theory of Measurement", by Prof. Herbert Dingle, discussed an interesting philosophical problem. The theory of relativity necessitates some change in the view that a measurement determines the magnitude of some intrinsic property of a body, and Prof. Dingle propounded a definition, developed from a suggestion due to P. W. Bridgman, that a measurement is simply a specifiable operation leading to a number. After exhibiting the ambiguities to which the older view can lead, the speaker showed how the new definition can be used to clarify some points in probability and in quantum theory.

The Association elected Prof. H. R. Hasse, formerly H. O. Wills professor of mathematics in the University of Bristol, as president for the forthcoming year.