



SATURDAY, JUNE 8, 1935

No. 3423

Vol. 135

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Encouragement of Discovery and Invention*

A FEW years ago the International Committee of Intellectual Co-operation, "considering that intellectual property was not then sufficiently protected and that scientific property particularly was at that time not protected at all, entrusted a subcommittee consisting of MM. Destree, Millikan, Ruffini and de Torres Quevedo with the duty of examining the means by which this protection might be assured". Many schemes for affording protection were examined, among them being one for the establishment of an international bureau ; a second, for the creation of a fund contributed to by manufacturers ; a third, for the donation of Government funds to the discoverer ; and a fourth, for the extension of the patent system to include scientific discoveries. No definite scheme for protecting scientific discoveries was, however, adopted, and in consequence the problem of affording protection was afterwards reconsidered by a committee of the American Association for the Advancement of Science. After careful consideration of the problem the committee expressed the opinion, first, that the results of research (other than medical research) that have any possible commercial importance or industrial application should be patented ; and secondly, that apart from this variation of the means at present adopted for protecting scientific discoveries, no practicable and desirable alternative had been proposed. The opinion that the results of research should be patented is apparently being widely followed in Great Britain, if it is permissible to judge from the fifty-second Report of the Comptroller-General of Patents, which has just been published.

In a statement on the trend of invention during the year 1934, the Report states, for example, that considerable advance in the field of patented chemical invention has been shown in sensitising dyes used for photographic purposes, due to a closer understanding of the relationship between absorption spectra and chemical composition of the dyes, whereby sensitising action over increasingly diverse parts of the spectrum is obtained. Further, although the discovery of the hydrogen isotope, deuterium or diplogen, is at present mainly of academic interest, applications are being received of means for obtaining 'heavy water' and for the production of organic compounds containing 'heavy hydrogen'. Attention is being

* Patents, Designs and Trade Marks : Fifty-second Report of the Comptroller-General of Patents, Designs and Trade Marks, with Appendices for the Year 1934. Pp. 24. (London : H.M. Stationery Office, 1935.) 4d. net.

increasingly directed to sexual and other hormones, and a better knowledge of their chemical constitution has brought appreciably nearer the synthesis of some of these bodies and the manufacture of compounds or derivatives which exhibit to some extent the physiological properties of the hormones.

The Report states also that in the electrical arts there have been noteworthy developments in connexion with heavy-current arc rectifiers of the non-mercury type, arc-less switching in high-power switch gear, high-frequency induction coils with compressed powder cores of low permeability, and permeability tuning units in which the magnetic properties of the cores differ according to the positions of the coil and core. There has been a continued increase in inventions in connexion with electrical discharges through high vacua or gaseous media as, for example, in X-ray tubes of hitherto unknown proportions working on voltages of the order of half a million. In electrical impedance networks for filtering and other purposes, the mathematical technique is being developed in such a manner as to enable problems of increasing generality to be solved by systematic methods. The prospect of commercial broadcast television has made cathode ray tubes the focus of much invention, and is leading to the development of amplifiers suitable for handling a wide range of frequencies and to the use of special oscillators for producing deflecting potentials of saw-tooth wave form. It will be agreed from these examples in the Report that some scientific men in Great Britain at least appear to be following the advice of the American Association committee to patent those results of research that have any possible commercial importance or industrial application.

The American Association committee also expressed the opinion that, apart from patenting the results of research, no practicable alternative to the very inefficient means at present adopted for protecting scientific discoveries has been proposed. As this opinion has been generally accepted, it appears probable that the present inefficient means will perforce continue, and therefore it is advisable that consideration should from time to time be given to the question whether the existing machinery of the rewards for discoveries and inventions can be made to work more efficiently than it has hitherto done. An important part of this machinery is the publication in proper form of discoveries and inventions, because the

encouragement of work in those fields, whether it be by honours, professional appointments, patents or otherwise, is very largely dependent ultimately on public acknowledgment of the results. The Report brings to mind the different methods of considering and publishing those scientific discoveries that are not patented, and inventions that are, and leads to two suggestions for improving these methods.

The first suggestion relates to the form in which scientific papers and specifications of inventions are published. The specifications of all patented inventions have undergone examination in the Patent Office by examiners expert in the various subjects and have been accepted by the Comptroller and published in a form that ends with "a clear and succinct statement of claim" of what constitutes the invention. Further, the inventions have been classified according to the subject-matter and the classification published, although the Report states that:

"The rise of new arts and the rapid and unpredictable developments in others during the past few years have raised serious and urgent problems in the classification of the subject-matter of specifications. Some progress has been made in the solution of these problems, and it is hoped that a revised classification of such matters as the automatic control of machines and apparatus, and the manufacture of synthetic resins and cellulose and its derivatives, will soon be ready for publication."

It might be difficult for our scientific societies to deal in a similar manner with the various papers that they publish, but it would probably simplify their procedure, and it would certainly facilitate classification and future reference, if they were to insist that each paper should contain a clear and succinct statement of what the author claims as his discovery in view of the state of scientific knowledge at the date of publication. The mass of published scientific papers that are insufficiently classified, and contain only vague description, is increasing at such a rate that it seems likely to constitute a mountainous obstacle in the path of future generations of scientific research workers.

The second suggestion relates to the conditions under which scientific papers and specifications of inventions are accepted. Scientific societies appear to be more favourably placed for considering papers submitted to them than is the Comptroller-General of Patents for dealing with specifications of inventions, in that societies can refuse any paper on the ground of subject-matter or rather lack

of it, while the Comptroller is not, in general, empowered to refuse to accept a specification on the ground of lack of subject-matter of the invention. One result of this limitation of the power of the Comptroller is that there have come into existence many 'paper' patents that are clearly invalid and

are a nuisance to the public. It would certainly be no harm to the really meritorious inventor, and would probably be greatly in the public interest, if the Comptroller were empowered to refuse to accept a specification on the ground of lack of subject-matter.

Reviews

Relativity, Thermodynamics and Cosmology

Relativity, Thermodynamics and Cosmology. By Prof. Richard C. Tolman. (International Series of Monographs on Physics.) Pp. xv+502. (Oxford: Clarendon Press; London: Oxford University Press, 1934.) 30s. net.

THE general theory of relativity has now been before the scientific world for some twenty years, and the special theory considerably longer. Fifteen or sixteen years ago, the theory may be said to have definitely superseded Newtonian mechanics in the treatment of macroscopic phenomena, and the whole of physical science, with the partial exception of atomic problems, acquired a new foundation. The superstructure, of course, was in the main unaltered, for the new mechanics faded into the old for all but the most fundamental matters, but the basic laws and equations of physics demanded re-statement, and in a few particulars their requirements were at variance with those of classical theory. In these circumstances there was clearly a need for a general statement of the new position, and for more than a decade this need has been satisfied for English-speaking readers by one book—Eddington's well-known "Mathematical Theory of Relativity". There is now a second.

Comparison is inevitable, and fortunately can be made without invidiousness. In the first place, since Eddington's latest edition differs only slightly from its original, Tolman's book presents the achievements of twelve years' work of which "The Mathematical Theory of Relativity" takes no account. Eddington's treatment of cosmology, for example, is confined to a description, without details, of the now outgrown Einstein and de Sitter universes, while Tolman devotes 150 pages to a comprehensive discussion of all the models of the universe (except that of Milne, which stands outside the applications of general relativity) that have been proposed. Much of this section represents his own original work. Again, thermodynamics—which, as an important branch of mechanics, must obviously be re-expressed in relativity terms—is given full treatment by Tolman (whose book, in fact, must now be regarded as

the only up-to-date treatment of thermodynamics in existence) but is untouched by Eddington. This work is entirely Tolman's own, except for the contributions of collaborators in some of the applications. On the other hand, in order to cover so wide a field as Tolman has chosen, some sacrifice of detail has been necessary, and for the mathematical proof of many of the fundamental relations the reader is referred to Eddington. Useful appendixes summarise notation, formulæ and constants which frequently occur.

The most important difference between the books, however, arises from the difference in outlook of the writers. Eddington presents relativity as the spectacle seen from a certain extra-physical point of view. Tolman, adhering more closely to the historical development, may be said to describe the journey towards the present position from which Eddington looks back to survey the landscape: his culmination is Eddington's origin. Thus, while to Eddington special relativity is a particular case of the general theory in which the $g_{\mu\nu}$ happen to be constant, Tolman sees it as a necessary step to general relativity and gives it independent and equal treatment. Eddington is preoccupied with the idea, Tolman with the application; Eddington with the philosophical aspect of physics, Tolman with the physical aspect of philosophy.

It is a necessary consequence that the books will appeal to minds of different types. Those who find themselves responding to and enlightened by Eddington's treatment will tend to classify Tolman's work as a textbook valuable for occasional reference and for enabling one to pass examinations. Those, however—and they are many—to whom Eddington is mystical and even unintelligible, will probably find in Tolman precisely what they have been looking for—a clear, accurate, physical account of an important branch of pure and applied science. Blessed are they who can appreciate the qualities of both, for theirs is the kingdom of relativity.

It is impossible in a brief review to indicate more than the outstanding features of such a book as this. First and foremost, the admirable 'sanity' of the treatment calls for comment. By this we