

(force fields) by the route

Frequencies → { Equilibrium configuration.  
 { Vibration forms  
 (assigned to the frequencies). } → Force system,

because, in the first place, there was no definite, quantitative test to confirm a configuration, and an assignment of its vibration forms, assumed as the interpretation of an observed set of frequencies; and, because, secondly, with a correct molecular model and a correct assignment, the number of frequencies was, for all but the very simplest molecules, smaller than the number of parameters needed to specify the force field. The method of isotopic substitution overcomes both difficulties, because the product rule, applied to the frequencies of isotopically related molecules, provides a test for any assumed model and any assignment of its vibration forms; and because by measuring the frequencies of a sufficient number of isotopically related molecules it is possible, in

principle at least, to obtain a sufficient number of frequencies fully to specify the common force system.

The last three quarters of the book contain an exhaustive summary of the observations of Raman spectra over the whole field of organic and inorganic chemistry. Special points of physical or chemical significance are discussed in passing, and the text is illustrated with many interesting microphotometric traces of Raman spectra. These brief discussions will doubtless stimulate much research; indeed it is impossible to read five pages anywhere in this part of the book without wishing to investigate some question. A highly valuable feature is the bibliography and index of compounds, which together constitute a complete guide to the literature of the Raman effect. Heavy labour must have been expended on this compilation, but, writing so complete a work, the author has rendered a signal service to science, and to all interested in the subject of molecular vibrations.

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## HISTORY OF LIGHTING APPLIANCES

### The Story of the Lamp (and the Candle)

By F. W. Robins. Pp. xiv + 156 + 28 plates. (London, New York and Toronto: Oxford University Press, 1939.) 15s. net.

IT is surprising that such a commonplace subject as that of lighting appliances should be so poorly documented. There are plenty of references for those who have the time to find them, and there is always Hough's scholarly catalogue published some years ago as *Smithsonian Bulletin* No. 141. For the mechanical era, which title applies only to the last hundred years or so, there is a comprehensive account of earlier devices entitled "Chemical Technology", volumes 2 and 3, by Groves and Thorpe and published in 1895 by J. and A. Churchill, while for the present century information is not difficult to obtain.

In the volume under review, Mr. Robins has made an attempt to provide a treatise in which the subject shall be dealt with in some detail, and at the same time provide interesting reading as a narrative. The attempt has not been unsuccessful, although there are certain limitations such as the condensation of the final century, when illuminating power rose steeply, to a sketchy account of ten pages.

In the 5,000 years preceding Argand's invention of his doubly aerated burner, there was little improvement over the illuminating power of the lamps devised in Sumerian times; but of lamps,

candles and torches there were so many forms and independent origins that it has taken a considerable degree of skill to weld the history into a readable form.

The author, in obtaining the material for his book, has acquired a noteworthy private collection, of which some five hundred items are illustrated in the twenty-seven plates. Errors of fact are few, but occasionally there is evidence of the inevitable pitfalls of over-compression normal to the presentation of such a wide subject. Thus on page 21, the author boldly refers to the first American discovery of petroleum as having occurred in the year 1859, when the Pennsylvania wells were opened, whereas d'Allion, writing in 1629, recorded its use medicinally by the Indians, and there were many other records in the intervening years.

In the "Prologue" the author expresses the hope that the book will be a substantial nucleus to which additions may be made, and in particular there is a reference to the ethnological significance of lighting developments which appears not fully to have been explored.

It is to be hoped that this treatise may provide the stimulus for a fuller investigation of the influence of the lamp and candle on contemporary developments, and that the work which Mr. Robins has begun will lead to extensive research in a field which is at present most inadequately explored.

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