THE THERMIONIC CATHODE

Les cathodes chaudes

Theorie et pratique. Par Charles Biguenet. Pp. 183. (Paris: Éditions de la *Revue d'Optique théorique et instrumentale*, 1947.)

AMONG many recent books under the general heading of electronics, there has been until now no comprehensive account of the basis of the subject, the thermionic cathode. While it would not be true to say that the well-known books by Reimann, T. J. Jones or de Boer are out of date, there have been developments in the past ten years with which both the student and the technician should be familiar; none of these books was intended to appeal to the valve designer or to deal with the technique of preparing thermionic cathodes and persuading them to liberate electrons according to the mathematical formulæ. For these reasons any modern account of the theory and practice of such cathodes is to be welcomed.

In the present book there is a detailed account of those properties of tungsten relevant to its use as a thermionic cathode, which will be of considerable value to the technical reader, while the section on thoriated tungsten is almost as comprehensive. There is a discussion of the process of carburizing, which is welcome as there is little literature on this subject, while the theory of the thoriated filament is adequately covered. The section on oxide cathodes is well written, with a modern approach, and summarizes the earlier information in the light of the present ideas of the behaviour of semi-conductors. The practice of the preparation and application of coatings is described, and also their treatment; while the author presents his own theory of oxide coatings and the difference between pulsed and continuous operation. This may justify discussion elsewhere. The remainder of the book gives a short account of other types of cathode, and of associated techniques such as high-vacuum technique, eddy-current heating and the application of the electron microscope.

One statement which is surprising is (p. 70) that hydrogen raises the work function and lowers the emission from tungsten. The original observation to this effect by Langmuir was found erroneous, as discussed, for example, by Reimann ("Thermionic Emission", p. 178). There are statements where it would be helpful if an authority were quoted or if the evidence were indicated; for example (p. 100), "if the degree of carburising of a thoriated filament is less than 6%, the filament remains sensitive to traces of gas", and (p. 129) "the normal operating temperature of an oxide cathode is from 850° to 900° C.". An important omission occurs in discussing the relation between temperature and current in a thoriated filament, where no reference is made to the importance of the geometry of the filament.

These are points of detail. A general comment is that the value of the book would have been increased if further practical information had been included, possibly at the expense of the adaptations from de Boer's book on adsorption. For example, there is little actual information about the pulsed operation of oxide cathodes, and none about the pulsed operation of thoriated filaments, or of their use with high-anode voltages. There is no discussion of gettering techniques and their relation to emission development and maintenance. There is, in fact, no indication that, in practice, difficulties are frequently

encountered with cathodes of all types in obtaining or maintaining the theoretical performance. Thus we are not told whether thoriated filaments do in practice give the lives predicted by Langmuir's tables, while it may cause alarm and despondency among those concerned with valve manufacture and development to read that, after a prescribed treatment of an oxide cathode, "le tube est bon a couper et son émission électronique restera stable". The matter is not always so simple, especially with modern short-wave valves requiring high-current density.

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ICE CREAM

The Ice Cream Industry

By Grover Dean Turnbow, Prof. Paul Hubert Tracy and Lloyd Andrew Raffetto. Second edition. Pp. ix + 654. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1947.) 6 dollars.

IT is a commentary on the trend of life that a book of nearly 700 pages should be written on a comparatively small item of diet, an item which, until a few years ago, was either regarded as a luxury or as a special treat for small children. This one item has now become the basis of one of the big food industries, ice cream manufacture, and it must be admitted that ice cream is a useful and palatable method of inducing people to take more milk. Messrs. Turnbow, Tracy and Raffetto have in this revised edition brought their earlier work, of 1927, up to date; have added chapters and rewritten chapters, and the result is a very readable compendium of knowledge (there are a number of minor and several major errors particularly in the scientific parts) dealing with every aspect of ice-cream, from manufacture to salesmanship. It would be an interesting study to try to decide which author has been responsible for the various sections, for they are not all of one style, and one gets the feeling of a vision of patchwork quilt.

From the point of view of the chemist, the scientific portions are interesting; but one might question the desirability of including in a book of this nature explanations of some of the underlying scientific principles of physical chemistry. It must be remembered, however, that in the United States there are courses at universities and at technical colleges dealing with the manufacture of ice cream, and the authors state that their review of the physico-chemical properties is for the advanced student. One cannot but feel that the elementary mathematics included in the section dealing with control and standardization is a strange bed-fellow for the physico-chemical theories.

In these days of austerity in Great Britain, it is refreshing to know that on the other side of the Atlantic such a wide range of delectable sweetmeats is still to be had—plain ice creams, fruit ice creams, nut ice creams, confection ice creams, bisque ice creams, ice puddings, parfaits, mousses, and so on, to mention but a selection. To-day, in Britain, there is a welcome interest in food-borne infections, and therefore the statements regarding this danger are of particular import. One could wish that the advice given in the chapter on "Washing and Sanitizing" (!) could be brought to the notice of all manufacturers and purveyors of ice cream in this country.

Having watched children and adults in Britain eating ice cream, the following (p. 385) from the