

Book Reviews

Batteries on Ships

By Norman E Bagshaw, published by Research Studies Press (a Division of John Wiley and Sons Ltd), 1983, 203 pp , price £23 75

This book is No 1 in *The Battery Applications Book Series* of which M Barak is the series editor. The aim of these books is to give "specific details of the battery types used in each field of application, as well as their performance" and "to provide texts for the specialist in the form of workshop manuals, as well as for the less well-informed practitioner, in all practical aspects of the broad and active field of battery applications."

Batteries on Ships is a very demanding subject since almost every type of primary and secondary battery is used in some shipborne application. This is acknowledged by the author in his Introduction in which he states that, to avoid writing a full length book, he has "included only short descriptions of the design and electro-chemistry of some of the more commonly used types and forms of battery covering the more exotic batteries in greater detail." Further, since the book has been written from the applications point of view he has "tended to concentrate on aspects such as the method of installation, the effect of discharge conditions on performance, correct methods of charging to obtain maximum performance and life, and the necessary maintenance and care which should be accorded to batteries in operation."

The author has approached his subject by dividing the book into four parts. The first part, General Purpose Batteries on Ships, consists of three chapters. In the first there is a brief historical introduction to batteries and their use in ships, followed by short descriptions of the battery requirements of yachts, of emergency power in commercial passenger cargo ships, and the different approach to the problem of emergency battery power in naval vessels. The chapter concludes with a brief mention of battery propelled boats.

The next two chapters deal with alkaline nickel-cadmium and lead-acid batteries, respectively, in the size range tens of ampere hours to several hundred, required by the applications described in the opening chapter. The basic electro-chemistry of the cells is outlined, and this is followed by details of cell design and construction, discharge performance, charging characteristics, life, methods of installation in commercial and naval ships, and maintenance requirements. These two chapters amount to only 26 pages but by the use of a considerable number of illustrations and a concise text a satisfactory coverage of these batteries has been obtained which is quite adequate for the stated purpose of the book.

The second part of the book is entitled Small, Special Purpose Batteries for Ships. In this part separate chapters are given to Sealed Pocket-type

Nickel-Cadmium Batteries, Sealed Lead-Acid Batteries, Dry Manganese Dioxide-Zinc cells, Mercuric Oxide-Zinc cells, Small Sea-water Activated Batteries, and Thermal Batteries

The treatment given to each of these types of battery is similar to that afforded to the nickel-cadmium and lead-acid batteries in the first part of the book, but with a list of applications, or potential applications, for the particular type of battery at the end of each chapter. There is little information on the construction and installation of batteries to meet the requirements of the listed applications. Performance details are a little meagre for some of the primary batteries; *e.g.*, one would have liked to see information on the behaviour on long time, low-current discharge and on high current pulsed discharge, while further information on the performance of mercury cells, and the low temperature variation of them, at temperatures below 20 °C is obviously desirable. There is no mention of lithium batteries and this omission is rather surprising in view of the discussion of lithium primary batteries, and in particular the lithium-thionyl chloride battery, for torpedo propulsion in Part 4 of the book.

The two last parts, which comprise the bulk of the book, deal with Submarine Propulsion Batteries and Torpedo Propulsion Batteries, respectively. Both parts have a brief, interesting historical introduction to the subject followed by general details of the particular propulsion requirements. They then follow very different courses in describing how these requirements have been approached. In the case of submarine propulsion, this is almost entirely the slow, patient improvement of the lead-acid battery over a period of nearly one hundred years, while in the case of the torpedo battery many different types have been developed over a period of about 50 years, and the author has done an excellent job in describing the development progress and performance of batteries for these two different requirements.

For submarine batteries, in addition to actual performance details and maintenance, such important matters as grid alloys, cell cooling, electrolyte agitation, and shock resistance are also described. Silver oxide-zinc batteries, which have also been used for submarine propulsion, although on a limited scale, are described in considerable detail. Finally, alternative types of battery which might be developed in the future as submarine propulsion batteries are considered; these include not only aqueous systems but also high temperature and fuel cell systems.

Part 4, Torpedo Propulsion Batteries, is also remarkable for the detail it gives of the performance obtained with the several types of battery successfully put into production. It is also a description of the development, engineering, and production of a series of batteries of ever increasing power and energy density, which have to meet stringent safety and storage life requirements, in addition to the discharge ones. This part also concludes with a consideration of possible future types of battery.

It may be debatable whether this book has achieved the stated aims for the *Battery Applications Book Series*, but there is no doubt that it is of outstanding value as a source of information on advanced types of primary and

secondary batteries which have been produced in quantity. As such it is, therefore, of interest not only to persons engaged in work on submarine and torpedo batteries, but to all persons who have an interest in large batteries of advanced design for any application

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Modern Batteries An Introduction to Electrochemical Power Sources

By Colin A Vincent, with Franco Bonino, Mario Lazzari and Bruno Scrosati, published by Edward Arnold (Publishers) Ltd, 41 Maddox Street, London W 1, May 1984, 264 pp, price £14 50

This is a neat little book. According to its sub-title, it is an introduction to electrochemical power sources and it achieves this and a little more. It has eight chapters, all of which, with the exception of the first — the Introduction — have been written by one, and in some cases two, of the named authors.

The anonymous Introduction starts, inevitably, with Volta, but then rapidly chronicles the events leading to the development of the battery industry. This is followed by a brief, but useful section on nomenclature which is amplified by a Glossary at the end of the book. A short account of the circumstances leading to the demand for new battery systems is then given and the chapter closes with a survey of the more common types of battery and their applications, ranging from miniature batteries to batteries for load levelling.

The second chapter, Theoretical Background, starts from a simple electrode process and proceeds, through considerations of the double layer and interfacial potentials, to the thermodynamics of cells. The major portion of the chapter, dealing with current flow in an electrochemical cell, then follows, and the chapter concludes with a section on battery characteristics and performance criteria. This chapter gives a straightforward and readily understandable approach to the basis of cell operation, but at the same time it is made clear that the problems of developing new cells are complex and time consuming.

The following chapters are concerned with practical, or near practical, cells. Primary aqueous electrolyte cells are the first to be considered, starting with the Leclanché cell which is discussed in considerable detail, and continuing with alkaline manganese dioxide cells, zinc-mercuric oxide and zinc-silver oxide cells, metal-air batteries and magnesium-silver chloride batteries.

The next chapter deals with secondary aqueous electrolyte cells, and is concerned mainly with lead-acid and cadmium-nickel oxide cells which are treated, quite adequately, in the more-or-less standard manner, but iron-nickel oxide, zinc-nickel oxide, zinc-silver oxide and cadmium-silver oxide cells are also included.

There follows a chapter on normal temperature lithium-liquid electrolyte primary and secondary cells, which introduces the reader to the really