Functions now available for consultation; (2) the assembly of information regarding known Errors in the tables recorded." The extensive character of this work is readily seen from the fact that there are 282 references to tables and graphs of $J_n(x)$ alone, and for all the functions one finds a total of 1,071 references.

Another service which this work supplies is to help in attaining some uniformity in the symbolism of the functions. Each enumeration of tables is preceded by an extensive account of the functions tabulated, together with a standard notation for them and some description of their origins. Although symbolism has improved in recent years by the publication of such well-known tables as those of the British Association for the Advancement of Science, the present "Guide" has given considerable support to the problem by agreeing "as far as possible with (the symbolism) used by English writers."

One particularly useful part of the work is the concluding section devoted to a summary of the literature on "Polynomial Approximations and Asymptotic Expansions," which was entirely the contribution of Professor Bateman. Much of the modern development of asymptotic series arose out of problems presented by Bessel functions, as one may infer from the fact that the perfection of the powerful saddle-point method, or method of steepest descents, is a product of the study of these functions. Computers and other statistical workers will be especially indebted to this section of the work.

From this it may be inferred that science has received a very useful addition to its tools in the publication of this "Guide," and it should prove to be an indispensable addition to standard works on the subject of Bessel functions.

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RADIO COMMUNICATIONS

Fundamentals of Radio Communications. By AUSTIN R. FREY. xii + 393 pp. Illustrated. New York: Longmans, Green and Company, Inc. 1944. $4.00.

WITH the large number of well-written texts on the subject of electronics and related fields, an author assumes a considerable responsibility in adding to the list. The author of this book, however, has not just written another book but has made a real contribution in offering a work which will prove of great value, not only to the student who desires to make a serious study of the field, but also to the practical engineer who may not be sufficiently interested in radio communications to maintain a complete library on the subject. The writer of this book struck a very effective balance between writing a text which is sufficiently complete and rigorous to satisfy every one and, at the same time, kept the mathematical treatments on a basis which stressed the physics of the problem rather than the mathematical niceties.

Obviously, the most important application of electronics to-day is in radio communication and this book properly stresses that application. However, a number of subjects which are not as important in communication as in other electronic applications are discussed in sufficient detail to make this book a valuable addition to the library of those not specifically interested in communications.

The treatment of the various subjects follows fairly conventional lines. The first chapter, devoted to a very complete discussion of resonant circuits, is especially effective. The next few chapters deal with thermionic emission and introduction to an elementary mathematics of the triode. Voltage amplifiers are discussed and this subject is brought up to date by a good discussion of the most recent developments in the field of ultra high frequency applications. Power amplifiers are then covered in a rather conventional manner. The chapter on oscillators is another one which the author treated rather better than the average. Not only is the theory worked out in a decidedly satisfactory manner, but many of the minor details which are important to an engineer are discussed. Chapters on modulation, demodulation and R.F. transmission lines follow with some emphasis on the more recent work on frequency modulation.

The last chapter in the book dealing with radiation is again one of the most satisfactory chapters in the book. In a rather brief but most effectively written chapter, the subject of radiation and antennas is discussed. Obviously, this discussion would not enable an engineer to design an antenna system, but a thorough reading of this chapter should enable any one to understand the basic principles of the subject. Most treatments of this important subject are so beclouded with mathematics that the results can only be dug out with considerable difficulty. In this chapter, the author began with a really simple equation for the instantaneous magnetic field at a distance r from a conductor. This equation, which he wisely does not attempt to derive but to which he gives adequate reference, is the starting point for all the subsequent discussion. By comparatively simple mathematical manipulation, the radiation field from a dipole and the other type of radiators follows.

For the benefit of those who would use this book in teaching classes, each chapter is followed by a number of selected problems of moderate difficulty. The usefulness of these problems, however, would be considerably increased if answers to at least some of them would be provided.

The book, as a whole, is very well written and is a good example of fine expository writing. A minor criticism of the book is that the drawings are definitely

not up to standards which we have come to expect from modern technical books. Some of the lettering is not clearly legible in the reduced scale of the drawings. It is hoped that in later editions this defect can be corrected. A few well-selected photographs might also have enhanced the attractiveness of this book. In conclusion, it can be stated that "Fundamentals of Radio Communications" is a well-written book which should be found in the library of every one seriously working in the field of electronics.

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REPORTS

RECOMMENDATIONS OF THE INTERNATIONAL CONFERENCE ON PENICILLIN[1]

AN International Conference on Penicillin was called for the purpose, if possible, of establishing an International Standard for penicillin, and of setting the International Unit of penicillin in terms of this standard. Meetings were held in the apartments of the Royal Society, London, from October 16 to 19, with Sir Henry Dale in the chair. The conference succeeded in fulfilling its purpose, unanimous agreement being reached on all points. It is reported that the results achieved by various laboratories were remarkably concordant, and served as a foundation for the work of the conference. During the course of the deliberations, no essential point of disagreement arose, and eventually the following draft of resolutions was adopted.

In order to facilitate discussion the conference began by recognizing that the different penicillins known as I, II and III in Great Britain are respectively identical with those known as F, G and X in the United States. The recommendations of the conference are as follows:

(1) That, notwithstanding the existence of more than one penicillin, it is desirable and possible to select and adopt an International Penicillin Standard consisting of a specimen of the pure crystalline sodium salt of Penicillin II or G; and an International Penicillin Working Standard, the specific activity of which has been determined in relation to that of the International Standard.

(2) That the use of these Standard Preparations, for the time being, would meet the needs of practical standardization and render quantitative results obtained in different countries sufficiently comparable.

(3) That the offer of the representatives of the United States of America to prepare the material for the International Standard, from contributions generously supplied for the purpose by manufacturers in the United States and the United Kingdom be gratefully accepted, and that the individual contributions be brought into one solution and finally crystallized as one uniform preparation.

(4) That, with a view to the eventual replacement of this International Standard by a preparation of identical properties, the physical and chemical constants of the preparation now being adopted shall be accurately determined.

(5) That approximately 8 grams of the International Standard shall be prepared and a quantity regarded as adequate to satisfy international requirements shall be deposited with the Department of Biological Standards, the National Institute for Medical Research, Hampstead, London, N. W. 3, on behalf of the Health Organization of the League of Nations.

(6) That, on receipt at Hampstead, the International Standard shall be dispensed in suitable quantities into separate containers and after complete desiccation shall be sealed in these containers in pure dry nitrogen gas, by the method and technique hitherto adopted for other International Biological Standards and shall thereafter be maintained in cold storage pending supply to national control centers.

(7) That the International Penicillin Working Standard for general distribution shall, for the present, consist of a calcium salt of penicillin and that the offer of the Food and Drug Administration of the United States of America to supply such a preparation be gratefully accepted. As in the case of the International Standard, the International Penicillin Working Standard shall be deposited with the Department of Biological Standards, the National Institute for Medical Research, Hampstead, London, N. W. 3, on behalf of the Health Organization of the League of Nations. It shall be dispensed in suitable quantities, in the manner described above, and stored and distributed under the same conditions as other International Biological Standards.

(8) That the International Unit of Penicillin be defined as *the specific penicillin activity contained in 0.6 microgram of the International Penicillin Standard.*

The International Unit so defined is approximately equivalent to the unit originally adopted by Heatley and other collaborators of Florey (1941)[1] and commonly known as the "Oxford" unit.

(9) That 2.7 micrograms of the present International Penicillin Working Standard (see paragraph 7 above) be accepted as containing 1 International Unit of Penicillin.

(10) That for the determination, by a suitable method of comparative assay, of the specific activity of an unknown preparation of penicillin in terms of the International Standard it is necessary to use a suitable strain of *Staphylococcus aureus,* and that this strain must have practically equal sensitiveness to the inhibitory actions of Penicillin I, or F, and Penicillin II, or G. The two strains of *Staphylococcus aureus* which at present can be

[1] "Further Observations on Penicillin," Abraham, Chain, Fletcher, Florey, Gardner, Heatley, Jennings. *Lancet,* ii, p. 177, 1941.