SCIENTIFIC BOOKS

THERMODYNAMICS

The Nature of Thermodynamics. By P. W. BRIDGMAN. xii + 229 pp. Cambridge, Mass.: Harvard University Press. 1941. $3.50.

ANY book dealing with the philosophic aspects of physics from the pen of Professor Bridgman is something which students of the subject may expect to read with profound interest. Thermodynamics is to many a confusing subject, a subject in which the student is apt to become familiar with the technique of manipulation of the formulae which lie in his own particular territory without any very clear concept of the fundamentals underlying the operations concerned. Mathematical physics frequently develops a kind of inertia of technique which enables really valuable discoveries to be made without the discoverer really knowing what he is doing. It is, therefore, refreshing occasionally to have the complacency of mathematical technique disturbed by an inquiry as to the significance of the assumptions involved and of the operations carried out. Professor Bridgman attempts such an inquiry in his book.

The book itself is divided into four chapters, the first entitled: "The First Law of Thermodynamics and the Concept of Energy"; the second, "The Second Law of Thermodynamics"; the third, "Miscellaneous Considerations," and the fourth, "Retrospect and Prospect." It is naturally impossible to review in detail the enormous number of points discussed. A general attempt is made to analyze the meaning of such concepts as the transportation of energy from place to place in terms of what the picture of the said energy might be supposed to be in terms of the matter which possesses it. The spirit of the inquiry is exemplified by such questions as Professor Bridgman asks in connection with heat regarded as a "thing." "The whole situation," writes Professor Bridgman, "with regard to flow is evidently embarrassed by strong verbal impulses: we find it difficult to say 'There is flux at this point' without wanting to say also 'Something is flowing at this point,' and if something, then there is velocity and a density. To what extent is the impulse verbal that demands a velocity if there is a 'thing'?"

In another place the unsophisticated will be disturbed to find flux of energy in the opposite direction to the motion of the matter which carries it. Again, in connection with the first law of thermodynamics a careful consideration is given of just what is meant by measurement of work and quantity of heat, and the conclusion well known to the more sophisticated, but coming as a surprise to the naive, is voiced in the insistence that the primary content of the first law is comprised in the statement that the sum of the differential elements of heat added to a system and work performed upon it form an exact differential of suitably chosen coordinates.

Many questions are raised as to the significance of the allocation of energy in different places and entities in physics. Thus Professor Bridgman writes: "I can not help feeling that in some places there is a trace of mysticism left in the verbal impulse to say, 'Matter and energy are *really* the same thing.'" The implications of the second law of thermodynamics are discussed in the same detailed manner. We have Maxwell's demon subjected to a closer scrutiny as regards his mental processes than he has been accustomed to receive, and the general question of the assumption of specialized conditions in thermodynamical proofs is discussed in its relation to the extent to which such idealizations may themselves be inconsistent with the requirements of the second law.

Naturally, any one who has thought along lines paralleling those discussed by Professor Bridgman would find many points in which he would be inclined to raise minor arguments, but any differences of opinion of this kind would naturally be on a high plane of sophistication. Again there are many other matters of analogous nature to those covered in Professor Bridgman's book which invite attention, but any one who has been accustomed to take thermodynamics at its face value and use it merely as a tool will have his horizon of understanding greatly enhanced by a consideration of even a few of the points raised in this most interesting volume.

PHYSICAL AND CHEMICAL CONSTANTS

Tables of Physical and Chemical Constants and Some Mathematical Functions. Ninth Edition. By G. W. C. KAYE and T. H. LABY. 181 pp. London, New York, Toronto: Longmans, Green and Company. 1941. $5.00.

THOSE who have been accustomed to use Kaye and Laby's "Tables of Physical and Chemical Constants" will welcome the appearance of this revised edition, which, while retaining the features which characterized the usefulness of the previous editions, is amplified so as to include data pertaining to modern researches—nuclear physics, etc.—as well as additional material pertaining to the older branches of physics.

The book is characterized by the ease with which it is possible to ascertain the exact meaning to be attached to the data given, and frequently a preliminary summary of the physical laws associated with the data is given in condensed form but with a completeness adequate to remind the reader of the exact significance of the data themselves. Indeed, there is quite a little physics contained in the Tables, but it is not allowed to dominate the situation in such fashion that one is unable to find the wood for the trees. So frequently