THE NEW STEAM TABLES, TOGETHER WITH THEIR DERIVATION AND APPLICATION

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PREFACE

THE following tables, together with the explanation of how the values have been calculated, are published in the hope that they will be of use to English engineers and students. The work has been based upon the researches of Professor H. L. Callendar, the importance of which does not seem to have been fully realised by engineers of this country and America. On the Continent Mollier has used it to compile tables in the metric system of units. Sir Alfred Ewing, in the latest edition of his book (1910), "The Steam Engine and Other Heat Engines," was the first English engineer to draw attention to the importance of Callendar's and Mollier's work. The authors gratefully acknowledge that the perusal of that new edition gave them the idea of going more fully into the subject. Although Mollier's values are given in that work, it was thought that more complete tables were needed.

It should be stated that these tables were calculated, originally, from Callendar's equations. Mollier's steam tables were not consulted until the final stage of proof correction. It was then suggested that the results should be checked against Mollier's, when it was possible to do so. (The values obtained by the authors had been checked several times, and appeared, by differences, to be reasonable.) On making comparisons with Mollier's tables—by translating the units—a few unimportant divergences were noted. In most cases the authors felt it right to bring their values into line with those of Mollier to avoid confusion of thought by anyone unable to appreciate the insignificance of the small divergences.

It is especially desired to thank Sir Alfred Ewing, K.C.B., for consenting to write the introduction to these tables, and for several suggestions which he has made. It is also desired to thank Professor Callendar for the trouble which he has taken, and for his uniform kindness.

It is only right to add that the Pound-Fahrenheit tables have been included because engineers still use them—not because the system is commended. It is to be sincerely hoped that all students will use the Pound-Centigrade tables, as there is no advantage, and several drawbacks, in using the Fahrenheit scale of temperature. It will undoubtedly gradually go out of use in this country.

At the end of the book will be found a chart representing the Total Heat of Steam on an entropy base. This graphical means of representing the properties of steam is due to Mollier and a reproduction of his diagram appears in Ewing's "The Steam Engine and Other Heat Engines." It already has an extensive use in connection with problems on steam turbines. It is here plotted in English Units.

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INTRODUCTION

By Sir J. Alfred Ewing, K.C.B., F.R.S.

Professor Smith has asked me to write a brief introduction to the Steam Tables which he and Mr. Warren have prepared, and I willingly do so because it may be expected that this publication will do something towards making engineers better acquainted with the important service which Callendar has rendered them in supplying materials for a new determination of the properties of steam, and towards facilitating the use of correct values in steam calculations.

As I have already pointed out, in the Third Edition of my book on "The Steam Engine and Other Heat Engines" (1910), the steam tables which have for many years been generally accepted contain serious errors and inconsistencies. Professor Callendar has shown how tables may be calculated which escape these inconsistencies and give figures that are in agreement with the best experimental data. To quote from the account of his work given in the Appendix to my book:—

"He assumed a characteristic equation connecting pressure, volume and temperature, applicable to water-vapour generally whether saturated or superheated. This equation involves certain constants, and he adjusted these to accord with well-established results of experiment. He proceeded to show that it was practicable to deduce from the characteristic equation, in the form assumed by him, by aid of relations depending only on the general principles of thermodynamics, expressions for all the important properties of steam, from which numerical values could be deduced within the range to which the characteristic equation might be held applicable, namely, for pressures such as correspond to saturation temperatures extending from 0° to 200° C. or so. Within this range the values so deduced are found