A NEW TREATISE ON STEAM ENGINEERING, PHYSICAL PROPERTIES OF PERMANENT GASES, AND OF DIFFERENT KINDS OF VAPOR

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A new treatise on steam engineering, physical properties of permanent gases, and of different kinds of vapor by John W. Nystrom

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BY

JOHN W. NYSTROM, C.E.

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PREFACE.

THE object of this treatise is to furnish a variety of matters pertaining to STEAM ENGINEERING which appear to be wanting in that profession, and which have heretofore not been published.

The authors consulted for this work are eminent experimenters, such as Regnault and Rudberg on steam and gases, Faraday, Pelouze and Andrews on carbonic acid, Favre and Silberman on heat of combustion, Kopp on volume of water, Fairbairn and Tate on volume of steam. None of these savans, however, are responsible for the formulas and tables herein deduced from their experiments.

Where physical sciences are not sufficiently developed to establish a law of action mathematically, experiments are made for the purpose of guiding us to the law; but it can rarely ever be expected that experiments alone can give perfect results, but they give an approximation to the law of variation, which must finally be adjusted and established by the aid of mathematics. This is what has been attempted in the present work.

It was at first not intended to include in this work the steam-tables which are published in the author's *Pocket-Book*, but after having carefully investigated the Fairbairn experiments and formula for volume of steam and concluding that they could not be relied upon, it was therefore decided to calculate new steam-tables and extend them to a pressure of 1000 pounds to the square inch.

The relation between temperature and pressure of steam is also slightly altered in the new steam-tables so as to conform to a uniform curve or law, because the average curve adopted by Regnault does not follow a regular law, and therefore indicates that there must have been some inexactness in his experiments.

When the author worked out the first steam-table in the Navy Department under the direction of Chief-engineer Isherwood, the irregularity of the Regnault curve was then demonstrated with attempts

to correct it, but the Chief would not allow any deviation from that curve. The difference is, however, within probable experimental errors, and so small that it is not of much importance in practice.

The author believes that the relation between temperature, pressure and volume of steam, as given in these new tables, is nearest right. The old steam-tables are, however, referred to and used in the body of this work for the reason that many readers may have more faith in them than in the new tables, which are equally applicable to the examples.

Many mathematical proofs have been omitted in this work in order to avoid extensive algebraical demonstrations, which are objectionable to the general reader who only needs the resulting formulas for the insertion of his given numerical values.

The principal formulas are accompanied with examples and also tables ranging between practical limits, showing at a glance the relation between and proportion of the operating elements.

The calculus has been resorted to in only a few cases of necessity where the result could not otherwise be reached.

The numbers of the examples are arranged to correspond with the numbers of the formulas, and therefore do not run in order.

Profound and high-sounding terms, like "potential and kinetic energy," etc., are not used in this work, which limits itself to simple terms such as are used in the shop, and which express the true meaning of the respective cases.

The appendix on "Mechanical Terms" is added to this work to furnish an idea of the unsettled condition of that subject.

Similar discussions have been published in pamphlet form and distributed gratis to institutions of learning.

ALPHABETICAL INDEX.