

# **ENERGY: WORK, HEAT AND TRANSFORMATIONS**

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Energy: Work, Heat and Transformations by Sidney A. Reeve

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**SIDNEY A. REEVE**

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# ENERGY

*WORK, HEAT AND  
TRANSFORMATIONS*

BY

SIDNEY A. REEVE, M.E.

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1909

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## PREFACE

The earlier chapters of this work are self-explanatory. The later ones justify some discussion of point of view.

The writer is not a physicist. Educated and trained as an engineer, his call to the teacher's chair led him to arrange his views as to natural principles with greater care than is common with engineers. The ideas promulgated in the following pages are in answer to questions received from bright-minded students a dozen years ago—questions which were sensibly asked, but which "stumped" the teacher for years for an adequate, equally sensible reply.

His efforts at the comprehension of thermodynamic action have led him to trespass, perhaps, upon the domain of the physicist. For the discussion of matters so intricate as molecular dynamics a thorough familiarity with experimental and mathematical physics might seem indispensable. No one can regret more than the writer his lack of this. His apologies for the consequent shortcomings of this little book are profuse in proportion.

Yet, should this situation arouse criticism or doubt, the answer is easy. Why have not the professional physicists long ago done this same thing, that it might have been done far better? The materials, opportunity and demand have long existed. Whatever question may arise as to the significance, or even the definition, of the more recent data of experimental physics, there can be none as to the long established principles of celestial mechanics. There is as little as to the only less venerable data as to thermal processes. For nearly a century there has been virtually no question as to the mechanical nature of heat. Yet these things cannot be accepted by any teacher of thermodynamics without enforcing conclusions substantially different from those now commonly taught. Therefore the writer cannot regard the concepts set forth in this little book as aught else than the indispensable premises for, rather than the remote conclusions from, experimental and mathematical physics.

The writer would never wilfully question the doctrine that accurate data are essential to progress. Scientific concepts cannot

advance without them. But what has been forgotten is that they are a means to an end, not an end in themselves; and that end is the better understanding of nature's ways. Science serves humanity only as it substitutes scientific concepts for superstitious guess-work. The accumulation of unending columns of figures and physical constants, even with religious accuracy, is as futile for the uplift of the race as is the accumulation of vast hoards of dollars, however conscientiously accounted to the last penny. Each *may* be turned to humanitarian ends. But until it is, like a prostrate ladder, it constitutes a trap for the feet of the unwary, rather than a pathway erected to higher things.

The book, therefore, is merely an attempt to fit together (1) the Newtonian mechanics, (2) the doctrine that heat is mode of motion, and (3) the dozen or so well known facts of thermal action, into a consistent whole which may serve as an engineer's idea of heat and heat-action. It was originally prepared for publication in the periodical press, and some of the earlier portions appeared, in preliminary form, in the columns of *The Engineer* (London). Some traces of this genesis may be noticed in the pages of the book.

The writer wishes to acknowledge his indebtedness to the Sheffield Scientific School, of Yale University, for helpful facilities for work.

NEW HAVEN, CONN., July, 1909.

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