PREFACE

Were water a perfectly non-viscous, inelastic fluid, whose particles, when in motion, always followed sensibly parallel paths, Hydraulics would be one of the most exact of the sciences.

But water satisfies none of these conditions, and the result is that in the majority of cases brought before the engineer, motions and forces of such complexity are introduced as baffle all attempts at a rigorous solution.

This being so, the best that can be done is to discuss each phenomenon on the assumption that the fluid in motion is perfect, and to modify the results so obtained until they fit the results of experiment, by the introduction of some empirical constant which shall involve the effect of every disregarded factor.

It is worth while here impressing on the student of the science that, apart from these experimentally-deduced constants, his theoretical results are, at the best, only approximations to the truth, and may, if care be not taken in their interpretation, be actually misleading.

On the other hand, it may be well to answer the criticism of those who would cavil at such theoretical treatment, by pointing out that the results so obtained provide the only rational framework on which to erect the more complete structure of hydraulics.

In the following pages an attempt has been made to consider the science, and its application to the design of Hydraulic Machinery, in a manner suitable for a student who has some initial knowledge of mechanics.

While written primarily with the needs of a student in view, it is, however, hoped that the book may prove of value to such as are actively engaged in the practice and profession of Hydraulic Engineering. Although it has not been attempted to plumb the largely imaginary difficulties of a mathematical treatment involving some knowledge of the Differential and Integral Calculus, the knowledge of this subject which is necessary for a thorough grasp of the greater part of the book is very slight.

Where, as in some few paragraphs, a somewhat more extended
mathematical knowledge is required, the work is such as may safely be
left by all but the more advanced student of the subject.

In the section devoted to Hydraulic Machinery, it has not been
attempted to deal in any way exhaustively with the subject, and only
such machines have been illustrated or described as are typical of their
class, represent good modern design, and illustrate some definite principle
of construction. For many of these illustrations the Author is indebted
to the manufacturers, and while reference has been made to these in the
text, he would take this opportunity of thanking them collectively for the
help which they have so courteously tendered.

As was essential, reference has been freely made to the minutes of the
proceedings of the various English and American societies, and to the
English and German technical press as well as to standard works on
the subject. Of these the Author is particularly indebted to the Councils
of the Institution of Civil Engineers, the Institution of Mechanical
Engineers, the American Society of Civil Engineers, the Zeitschrift des
vereins deutscher Ingenieure, The Engineer, and Engineering.

The greatest debt of all is, however, owing to the teachings and pub-
lished papers of his old professor and friend Osbourne Reynolds. Old
students of the Professor will readily recognise to what extent any
slight merit which the book may possess is due, directly or indirectly,
to the influence of one to whom the science of Hydraulics owes so much.

In conclusion the Author would tender his thanks to Mr. S. Chapman,
to Mr. E. Magson, and to Mr. C. H. Lander and Mr. F. Pickford, of the
Manchester University, each of whom has revised a portion of the proofs
and to whose kindly criticism and suggestion the book owes much.

A. H. GIBSON.

Manchester,
February, 1903.
PREFACE TO SECOND EDITION

Since the first edition of this work appeared, a great deal of work has been done on the experimental side of Hydraulics, and as far as possible such work has been noted in the present edition.

The book has been practically rewritten. Much of the original matter has been re-arranged; some has been deleted; and considerable additions have been made to almost every section, particularly to those dealing with flow over weirs, through pipes, and in open channels; with methods of gauging such flows; and with the mechanical applications of Hydraulics. A chapter dealing with wave motion has been added, as have articles dealing, among other subjects, with the flow of fluids other than water, the admixture of fluids in pipes, and the interaction of passing vessels.

Such errors as have been noticed in the first edition have been corrected, and the Author would thank those readers whose kindness and courtesy in intimating these, has made their elimination largely possible.

DUNDEE,

October, 1912

A. H. GIBSON.