THE ELEMENTS OF PRACTICAL HYDRAULICS FOR THE USE OF STUDENTS IN ENGINEERING AND ARCHITECTURE. PART 1

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The elements of practical hydraulics for the use of students in engineering and architecture. Part 1 by Samuel Downing

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SAMUEL DOWNING

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Trieste

ELEMENTS

OF

PRACTICAL HYDRAULICS,

FOR THE USE OF

STUDENTS IN ENGINEERING AND ARCHITECTURE.

PART I.

WITH NUMEROUS WOODCUTS.

BY

SAMUEL DOWNING, LL.D.,

PROFESSOR OF CIVIL ENGINEERING IN THE UNIVERSITY OF DUBLIN;
HON. MEMBER OF THE INSTITUTE OF MECHANICAL ENGINEERS;
ASSOCIATE INSTITUTION OF CIVIL ENGINEERS.

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INTRODUCTION.

THE science of Hydraulics has for its object the knowledge of the phenomena of fluids in motion, and of the laws which regulate the production of these phenomena.

Applied as an art, its object is to render this knowledge available in the designs of the civil engineer, as in the determination of the dimensions of pipes for conveying water, gas, or air, and also in works for the collecting, conveying, and distributing the necessary supply of water, for mill-power, or for the summit-levels of canals; or for the supply of cities; and, generally, of all such works as depend for their suitable construction and proportions upon the result of calculations requiring a knowledge of the pressure and motion of fluids.

2. Fluids are defined to be bodies whose particles, by reason of their extreme mobility, yield to every the least force; they have, however, a certain degree of adherence

to the lb.; giving about 36 cubic feet to a ton, or 6 tons to a cubic fathom.

By a like approximation we have 6.25 imperial gallons to the cubic foot. These numbers give rise to many convenient practical rules, which are given in the "Practical Examples," for Chap. I.

The Imperial Bushel, which is the dry measure of capacity, is equal to eight gallons, or 1.29 cubic ft.

Throughout this work, the only units made use of are the foot and the cubic foot. We have in English works on Hydraulics a great variety of units: for volume, the gallon, the cubic foot, the ton, the cubic yard, and the hogshead; for length, the fathom, the yard, foot, and inch, which, coupled with the absence of decimal subdivisions in our weights and measures, is always perplexing to the reader.

As soon as the student has become familiar with the value of the inches in a foot expressed decimally, it is hoped that this arrangement will be found useful. Of the eleven decimal fractions for the inches in a foot, five are well known, namely, those for $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, and the rest may be readily remembered. It will be observed, also, that the eighth of an inch is very nearly 0.01 ft., and every other eighth has, in the place of hundredths, a corresponding figure, thus—

$\frac{2}{8}$ = 0.0208 ft., $\frac{3}{8}$ = 0.0312 ft., $\frac{4}{8}$ = 0.0416 ft., $\frac{5}{8}$ = 0.0521 ft., $\frac{6}{8}$ = 0.0625 ft., $\frac{7}{8}$ = 0.0729 ft.

Table showing the Decimal Values of the Inch.

Inches.	Fractions of a Foot.	Inches.	Fractions of a Foot.
1	$\frac{1}{12}$, 0.0833	7	$\frac{7}{12}$, 0.5833
2	$\frac{1}{6}$, 0.1666	8	$\frac{2}{3}$, 0.6666
3	$\frac{1}{4}$, 0.2500	9	$\frac{3}{4}$, 0.7500
4	$\frac{1}{3}$, 0.3333	10	$\frac{5}{6}$, 0.8333
5	$\frac{5}{12}$, 0.4166	11	$\frac{11}{12}$, 0.9166
6	$\frac{1}{2}$, 0.5000	12	$\frac{12}{12}$, 1.0000

The measure of the force of gravity is the velocity acquired in one second by a body falling freely from a state of rest, and is equal to 32.1948 feet per second, and always denoted by the letter *g*.

5. So many French works on Hydraulics, of great value, have been composed, that a notice of their weights and measures may here be useful.

The Mètre, adopted in France in 1798, as the unit of lineal measures, is supposed to be equal to the one ten millionth part of the quadrant of a Meridian of the earth; the accuracy of this is not, however, essential to the value of the system; expressed in English measures it is equal to 39.37079 inches, or 3.280899 ft.; which, in practice, may be taken, approximately, as 39.37 inches, and 3.281 feet. It is multiplied, decimally, into the Decameter, the Hectometer, and Kilometer, and is subdivided, decimally, into the Decimeter, the Centimeter, and the Millimeter; the Greek word being affixed for multiplication, and the Latin for division by ten.

The unit of weight is the Gramme, which is equal to