

**LESSONS AND PRACTICAL NOTES  
ON STEAM, THE STEAM ENGINE,  
PROPELLERS, ETC., ETC., FOR  
YOUNG ENGINEERS, STUDENTS,  
AND OTHERS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649630028

Lessons and Practical Notes on Steam, the Steam Engine, Propellers, Etc., Etc., for Young Engineers, Students, and Others by W. H. King

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.  
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

[www.triestepublishing.com](http://www.triestepublishing.com)

**W. H. KING**

**LESSONS AND PRACTICAL NOTES  
ON STEAM, THE STEAM ENGINE,  
PROPELLERS, ETC., ETC., FOR  
YOUNG ENGINEERS,  
STUDENTS, AND OTHERS**



Detroit-Mich.  
March 30<sup>th</sup> 1924

That the students of  
steam engineering may  
compare present-day  
instructions with that of  
the old school, this book  
is presented to Dean  
M. E. Cooley of the University  
of Ann Arbor Mich. by  
F. H. M. Cracker of  
"M. E. Cooley Association # 7.  
National Association of Stationary  
Engineers. Detroit-Mich.



LESSONS AND PRACTICAL NOTES

ON

STEAM,

THE STEAM ENGINE, PROPELLERS,  
ETC., ETC.,

FOR

Young Engineers, Students, and Others.

BY THE LATE

W. H. KING, U. S. N.

REVISED BY

CHIEF ENGINEER J. W. KING, U. S. N.

[THIRTIETH EDITION, ENLARGED.]

New York:

D. VAN NOSTRAND, Publisher,  
23 MURRAY STREET & 27 WARREN STREET.

1870.

**Engineering  
Library**

Entered, according to Act of Congress, in the year 1880,

BY J. W. KING,

In the Clerk's Office of the District Court of the United States for the Southern District of  
New York.



# CONTENTS.

## INTRODUCTION, PAGE 5.

### CHAPTER I.

#### STEAM.

Steam, 7. Mechanical Effect, 9. Expansion of Steam, 12. Table of Hyperbolic Logarithms, 14. Back Pressure, 16. Gain by Expanded Steam, 18.

#### EXPANSION VALVES.

Stokol's, 10. Stevens', 22. Allen & Wells', 23.

#### SLIDE CUT-OFFS.

Explanation, 24. Gridiron Valve, 26. Wash Valve, 29.

#### OTHER KINDS OF VALVES.

Double Poppet, 30. Single Poppet, 31. Hornblower's, 32. Box Valve, 33. Equilibrium Slide, 34. Double Slide Valve, 34. Piston Valve, 35. Long D Slide, 36. Short D Slide, 37. Worthington Pump Valve, 38. Pittsburg Cam, 39.

### CHAPTER II.

#### THE INDICATOR AND INDICATOR DIAGRAMS.

The Indicator, 41. Cylinder Diagrams, 44. Air-pump Diagrams, 56. Power Required to Work the Air-pump, 60.

### CHAPTER III.

#### THE HYDROMETER.

The Hydrometer, 62. Loss by Blowing-off, 64. Gain by the Use of Heaters, 68. Injection Water, 71. Evaporation, 72. Steam and Vacuum Gauges, 75.

## CHAPTER IV.

## CAUSALTIES, ETC.

Broken Eccentric, 79. Leaking Vessel, 79. Irregular Feed, 80. Foaming, 81. Hot Condenser, 83. Getting Under Way, 83. Coming into Port, 86. Sealing Boilers, 88. On Coming to Anchor, etc., 89. Management of Fires, 90. Patching Boilers, 93. Sweeping Flues, 95. Ash Pits, 95. Smoke-pipe Stays, 96. Grate Bars, &c., 96. Broken Air-pump, 97. Broken Cylinder-head, 98. Selection of Coal, 98. Safety Valve, 99.

## CHAPTER V.

## MISCELLANEOUS.

Theory of the Paddle Wheel, 101. Centre of Pressure, 114. Screw Propeller, 118. Altering the Pitch, 132. Parallel Motion, 133. Strength of Materials, 136. Surface Condensers, &c. Cylindrical Boilers, 145. Boiler Explosions, 148. Horse Power, 150. Vibration of Beams, 152. Marine Economy, 154. Limit to Expansion, 155. The Proper Lift for a Valve, 156. Temperature of Condenser, 166.

## CHAPTER VI.

## WESTERN RIVER BOAT ENGINE.

Western River High-Pressure Engine, 153. Side Elevation, 153. End View, 160. Explanations of Diagrams, 160. Hartup's Lifter, 165. Stern Wheel Boats, 167. Dimensions and Proportions of the Magnolia, 169.

## CHAPTER VII.

## BOILERS, ETC.

Water-Tube Boiler, 172. Horizontal Fire Tube, 173. Extracts from Report of Experiments made to Determine the Relative Efficiency of the Two Boilers, 174. Western River Boilers, 179. Boiler Flues, 184. Riveting, 186. Superheated Steam, 189. Draft, 191.

## APPENDIX.

## MATERIALS.

How to Test Iron, 194. Cast Iron, 195. Malleable Iron, 198. Steel, 203. Tenacity of Metals, 208. Transverse Strength, 205. Resistance to Torsion, 207. Results of Repeated Heating Bar Iron, 207. Strength of Joints of Boiler Plates, 209.

## THE ELEMENTS OF MACHINERY.

Motion, 211. Application of Power, 212. The Lever, 218. Inclined Plane, 217. Wheel and Axle, 219. Pulley, 219. Screw, 223. Wedge, 224. Centre of Gravity, 226. Centre of Pressure, 226. Gravity, 225. Displacement of Fluids, 227. Table of Pressure, Temperature, and Volume of Steam, 228.

## INTRODUCTION.

WRITING a book and then apologizing for having written it, is hardly in accordance with our convictions; but considering, nevertheless, the eminent talent which has preceded us upon the subject we have taken up, a few remarks of explanation may not be out of place. Books heretofore appearing on the steam engine, have been of two classes, or the work itself has been divided into two parts—the one for the theorist, the other for the practical man. In the one case long mathematical formulas have been produced, and in the other nothing but simple rules. The practical man, therefore, who has not had the advantage of a mathematical education, has nothing presented to him but the bare rules, which he is compelled wholly to reject, or take entirely upon trust. Besides, these works extend over numerous volumes, the study of which involve much time, labor, and expense, and which usually disheartens the practical man before he has made much progress. Having had many of these difficulties to surmount in our earlier studies of the steam engine, we were led to the course of keeping a Steam Journal, in which we noted, from time to time, as we progressed, whatever we thought important, and was made clear to our mind; and this course we would also recommend the young student; for, however well