

**A HANDBOOK FOR STEAM USERS, BEING  
RULES FOR ENGINE DRIVERS AND BOILER  
ATTENDANTS WITH NOTES ON STEAM  
ENGINE AND BOILER MANAGEMENT  
AND STEAM BOILER EXPLOSIONS**

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A Handbook for Steam Users, Being Rules for Engine Drivers and Boiler Attendants with Notes on Steam Engine and Boiler Management and Steam Boiler Explosions by M. Powis Bale

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**RULES FOR ENGINE DRIVERS**

**&c.**

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WITH NOTES ON  
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AND STEAM BOILER EXPLOSIONS

BY  
M. POWIS BALE, M.I.M.E., A.M.I.C.E.

AUTHOR OF 'WOOD-WORKING MACHINERY' 'SAW MILLS'  
'STONE-WORKING MACHINERY' 'STEAM AND  
MACHINERY MANAGEMENT' ETC.

*FIFTH EDITION*

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1894

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PREFACE  
TO  
THE THIRD EDITION.



IT HAS BEEN a matter of gratification to the Author that a third edition of this little book should have been required within some eighteen months of its publication, it sufficiently proving that a plainly written treatise on Engine and Boiler Management was required. The Author has taken this opportunity of adding a few general notes on the selection of an engine and boiler, and of correcting one or two minor errors.

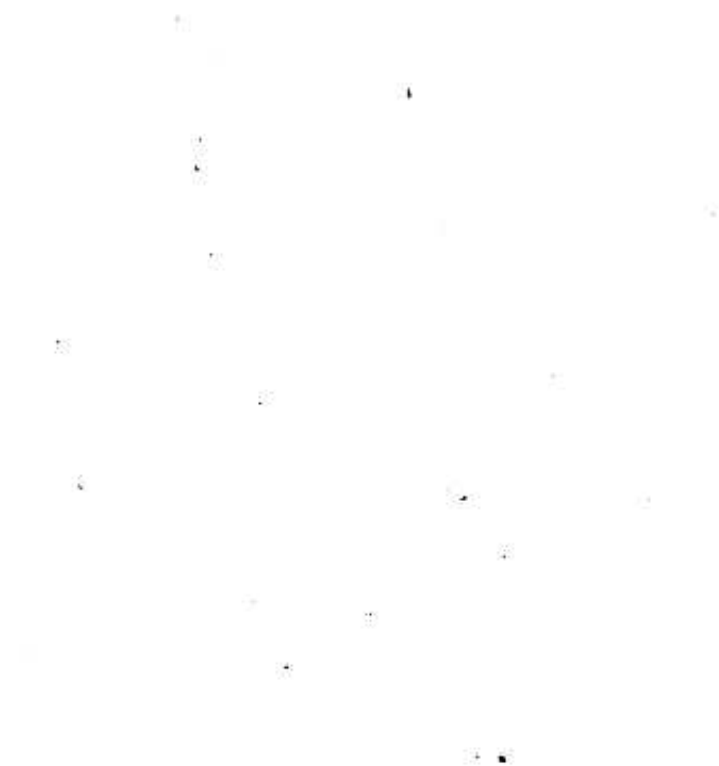


Figure 1. Relationship between the number of species (S) and the number of individuals (N).

The relationship between the number of species (S) and the number of individuals (N) is shown in Figure 1. The plot shows a positive correlation between S and N, with the rate of increase in S decreasing as N increases. This is characteristic of a species-area curve, which is often described by the power-law equation  $S = cN^z$ , where  $c$  is a constant and  $z$  is the slope of the curve. The value of  $z$  is typically between 0.1 and 0.2 for species-area relationships. The plot also shows that the number of species increases rapidly at first and then levels off as the number of individuals increases, which is consistent with the theory of species accumulation curves.



**PREFACE**  
TO  
**THE FIRST EDITION.**

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SOME YEARS AGO the Author published—chiefly for the use of his clients—a Chart of Rules for Engine-drivers to hang in engine-rooms. This has had a considerable circulation, proving that something of the kind was needed. Within the limits of a chart, however, it was impossible to include many things that might be of service to steam-users. The Author has therefore revised and added to these rules in the following pages, and embodied with them chapters on steam engine and boiler management, and steam-boiler explosions. The matter has been condensed as much as possible, and arranged in the form of paragraphs for easy reference.

The Author has for many years urged the necessity of a compulsory system of boiler inspection, and of granting certificates of competency to those having boilers under their charge, and his opinions in this respect have undergone no change—in fact, have rather been strengthened than otherwise. There is little doubt that many disastrous explosions have been clearly traced either to the gross ignorance of the attendants or the criminal carelessness of the owners. With an adequate system of compulsory inspection, the writer is of opinion we should hear much less of these ‘accidents.’

APPOLD STREET, LONDON, E.C.  
*October 1887.*

# CONTENTS.

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CHAPTER	PAGE
INTRODUCTION . . . . .	ix
I. RULES FOR ENGINE DRIVERS AND BOILER ATTENDANTS . . . . .	i
II. MANAGEMENT OF STEAM ENGINES AND BOILERS —BOILERS . . . . .	18
III. MANAGEMENT OF STEAM ENGINES AND BOILERS —ENGINES . . . . .	57
IV. EXPLOSION OF STEAM BOILERS . . . . .	69
INDEX . . . . .	97

# A

## HANDBOOK FOR STEAM USERS.

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### INTRODUCTORY.

#### *SELECTION OF AN ENGINE AND BOILER.*

It need hardly be said that the selection of an engine and boiler of a type exactly adapted to the nature of the duty it has to perform is a matter of critical importance to its satisfactory and economical working, and unless this selection is judiciously carried out, heavy loss and annoyance may result. No boiler or engine can be pronounced as the *best* for all duties, and each separate case should therefore be judged entirely on its merits and the surrounding circumstances. As these must of necessity vary largely, we cannot do more here than give a few general hints. An untechnical user would do well to take the advice of a competent engineer before deciding for himself. Passing first to the boiler, what is required is a steam generator which combines strength and durability with economy in working. Of late years the employment of higher pressures of steam has come into vogue, consequently the tendency has been to introduce the use of steel instead of iron, and otherwise improve the methods of manufacture.

In selecting a boiler, of whatever type, the chief points to consider are—(1) the quality of the feed-water, (2) the quality of the fuel, (3) the cost of the fuel. If the feed-