

**ELECTRICAL PRACTICE IN  
COLLIERIES: A MANUAL FOR  
COLLIERY MANAGERS, UNDER-  
MANAGERS, ENGINEERS, AND  
MINING STUDENTS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649569700

Electrical Practice in Collieries: A Manual for Colliery Managers, Under-Managers, Engineers, and Mining Students by Daniel Burns

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)

**DANIEL BURNS**

**ELECTRICAL PRACTICE IN  
COLLIERIES: A MANUAL FOR  
COLLIERY MANAGERS, UNDER-  
MANAGERS, ENGINEERS, AND  
MINING STUDENTS**



**ELECTRICAL PRACTICE IN COLLIERIES.**

**WORKS BY PROF. A. JAMIESON,**  
M. INST. C.E., F.R.S.E., M. INST. E.E.

**MAGNETISM AND ELECTRICITY.** Specially arranged for Elementary or First-Year Students. With Examination Questions. FIFTH EDITION. 3s. 6d.

**STEAM AND STEAM ENGINES (A Text-Book on).** With numerous Illustrations, Plates, and many Examination Questions. FOURTEENTH EDITION. 3s. 6d.

**STEAM AND THE STEAM ENGINE (An Elementary Manual on),** forming an Introduction to the Larger Work. NINTH EDITION. Cloth. 3s. 6d.

**APPLIED MECHANICS (An Elementary Manual on).** With Examination Questions. FIFTH EDITION. With numerous Diagrams. 3s. 6d.

**APPLIED MECHANICS (An advanced Text-Book on.** Vol. I.—Comprising Part I.: The Principle of Work and its Applications; Part II.: Gearing. THIRD EDITION. 7s. 6d.

Vol. II.—Comprising Parts III. to IV.: Motion and Energy; Strength of Materials Hydraulics and Hydraulic Machinery. SECOND EDITION. 3s. 6d.

**POCKET-BOOK OF ELECTRICAL RULES AND TABLES.** By J. MURRO and Prof. A. JAMIESON. SIXTEENTH EDITION. Leather, Gilt, 8s. 6d.

In Large 8vo. Handsome Cloth. Profusely Illustrated with Plates, Diagrams, and Figures. Price 24s. net.

**CENTRAL ELECTRICAL STATIONS:**

*Their Design, Organisation, and Management, including the Generation and Distribution of Electrical Energy.*

By CHAS. H. WORDINGHAM, A.K.C., M.I.C.E., M.I.M.E.,  
Late Member of the Council of the Institute of Electrical Engineers, and Electrical Engineer to the City of Manchester.

"The Author furnishes elaborate particulars as to the General Organisation of a Central Station. . . . A work of EXCEPTIONAL COMPLETENESS."—*The Scotsman*.

**ORE AND STONE MINING.** By C. LE NEVE FOSTER, D.Sc., F.R.S.,  
Professor of Mining, Royal College of Science. FOURTH EDITION, Thoroughly Revised. 34s.

**COAL MINING.** For the Use of Colliery Managers and others engaged in Coal Mining. By H. W. HUGHES, Assoc. Royal School of Mines, F.G.S. With very numerous Illustrations. FOURTH EDITION, Revised and greatly Enlarged. 24s. net.

**MINE-SURVEYING.** For the Use of Managers of Mines and Collieries, &c. By BENNETT H. BROUGH, F.I.C., F.G.S., formerly Instructor of Mine Surveying, Royal School of Mines. NINTH EDITION, Revised. 7s. 6d.

**PRACTICAL COAL MINING.** For those employed in and about Collieries. With special reference to Scotch Practice. By G. L. KERR, M.E., M.Inst.M.E. Very fully illustrated. SECOND EDITION, Revised. 12s. 6d.

**ELEMENTARY COAL MINING.** By G. L. KERR, M.E. With 200 Illustrations. 3s. 6d.

**BLASTING.** A Handbook, for the Use of Engineers and others engaged in Mining, Tunnelling, Quarrying, &c. By OSCAR GUTTMAN, Assoc. M.Inst.C.E. 10s. 6d.

**MINE ACCOUNTS AND MINING BOOK-KEEPING.** With Numerous Examples from Actual Practice. By JAMES G. LAWN, Assoc. E.S.M., Prof. of Mining at the South African School of Mines. Edited by Prof. LE NEVE FOSTER. SECOND EDITION. 10s. 6d.

In Large 8vo. Handsome Cloth. With Frontispiece, several Plates, and over 250 Illustrations. 21s.

**THE PRINCIPLES AND  
CONSTRUCTION OF PUMPING MACHINERY.**

*With Practical Illustrations of Engines and Pumps applied to Mining, Water Supply, Drainage, &c.*

By HENRY DAVEY, INST. C.E.M., INST. M.E.M.F.G.S., &c.

"By the one English Engineer who probably knows more about Pumping than any other."—*The Engineer*.

LONDON: CHARLES GRIFFIN & CO., LTD., EXETER STREET, STRAND.

# ELECTRICAL PRACTICE

IN

## COLLIERIES.

**A Manual**

*FOR COLLIERY MANAGERS, UNDER-MANAGERS,  
ENGINEERS, AND MINING STUDENTS.*

BY

**DANIEL BURNS, M.Inst.M.E.,**

CERTIFICATED COLLIERY MANAGER; LECTURER ON MINING AND GEOLOGY,  
THE GLASGOW AND WEST OF SCOTLAND TECHNICAL COLLEGE.

**With 142 Illustrations and Numerous Examples of the  
Calculations Involved.**

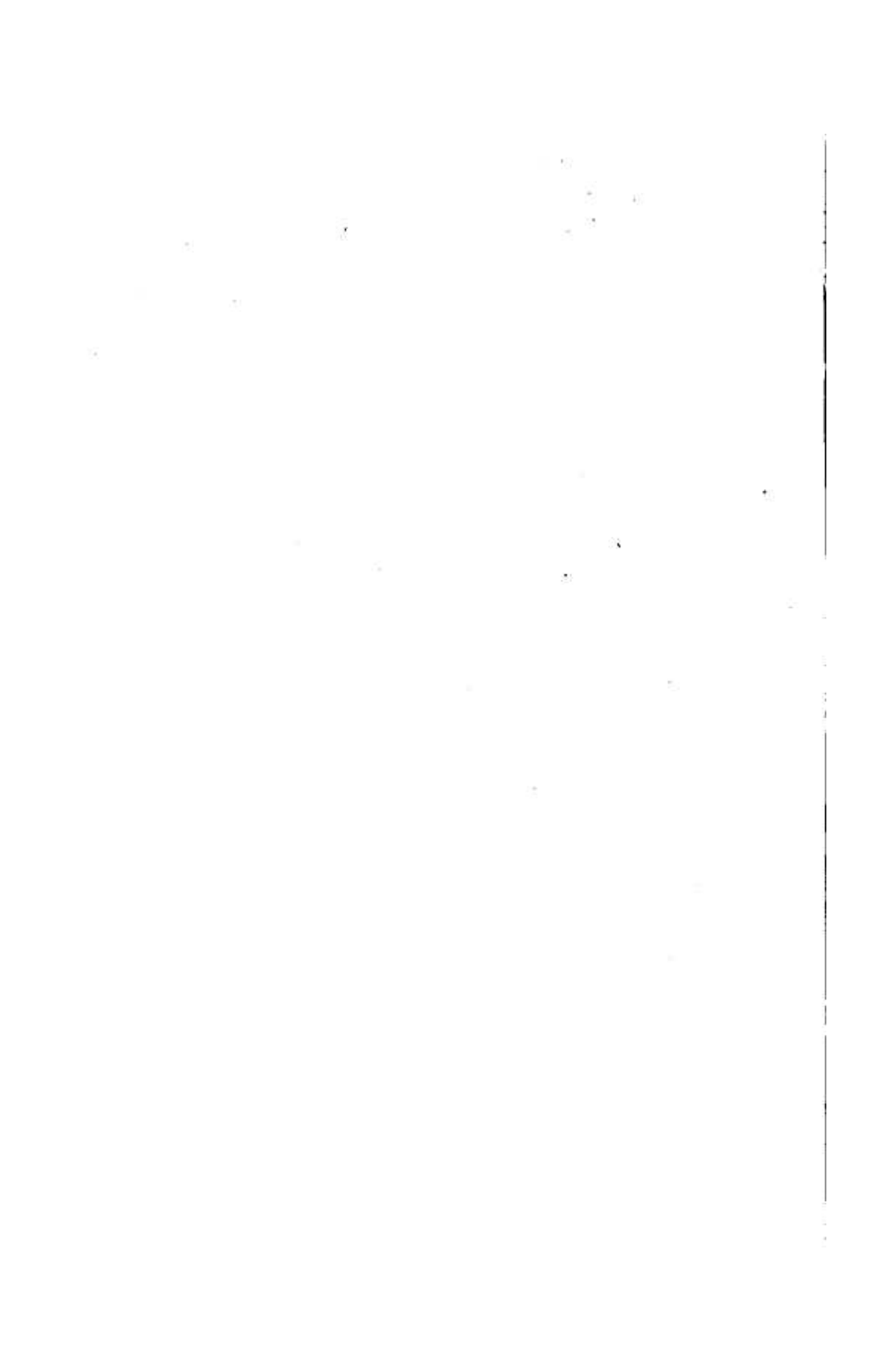


**LONDON:**

**CHARLES GRIFFIN & COMPANY, LIMITED;**

**EXETER STREET, STRAND.**

**1903.**





76946

MAR 9 1904

TN  
B93

6957533

## PREFACE.

DURING recent years the application of electric power in and about collieries has been extending rapidly, and at present few collieries of importance are without installations for the generation of electricity.

This little book is written with the intention of giving a short description of a few of the principal applications of this form of energy about collieries, and to serve as a guide to students who may be preparing for Certificates as Mine Managers, and who will, as time advances, be called upon to deal with questions and methods such as are here dealt with.

The ever-increasing demand for electric power in mines should form a sufficient reason for this attempt to put some information of a practical nature before that section of the public whose interests are largely bound up with recent developments and improvements in coal-working machinery. No attempt has been made to deal with the purely scientific aspects of the subject, but merely to include such technical details that the author has found to be of service in his own practice, and which, he hopes, will be of some service to Mining Students, Colliery Managers, and other responsible officials who may have to deal with the electrical equipment of collieries.

Arithmetical examples have been included at the end of several of the Chapters for the benefit of those students who may peruse the book. The answers given to these examples are only correct to the nearest round number, having in most cases been obtained by the use of the slide rule. If any errors come under the observation of those using the book, the author would feel much obliged if they would point them out to him..

The author gratefully acknowledges his indebtedness to many of the Technical Journals for information included in the book, and has also to thank the General Electric Company, Messrs. Ernest Scott & Mountain, the British Thomson-Houston Company, Messrs. Mavor & Coulson, and the Grant Electric Drill Company for the loan of process blocks, and the Jeffrey and other Companies who supplied photographs of their manufactures.

He has also further to express his thanks to the publishers for the pains that have been taken both with the text and the illustrations.

D. B.

*Glasgow, January, 1903.*

# CONTENTS.

CHAPTER I.—UNITS OF MEASUREMENT, CONDUCTORS, &c.		PAGES
Units—The Volt—The Ohm—The Ampere—The Watt—Series Circuit—Parallel Circuit—Carrying Capacity of Cables—Lightning Arrester—Measuring Instruments—Shaft Cables—Clamps—Insulated Suspenders—Examples,		1-21
CHAPTER II.—THEORY OF THE DYNAMO.		
Magnets—Lines of Force—Solenoid—Direction of Current—Commutation—Distortion of Magnetic Field—Eddy Currents and Hysteresis—Series Winding—Shunt Winding—Compound Winding—Alternating Current—Alternating Current Dynamo—Polyphase Currents—Three-phase Generator,		22-36
CHAPTER III.—THE DYNAMO.		
Continuous Current Dynamos—Armatures—Formed Coils for Winding—Commutators—Brushes—Driving by Belts—Attending the Dynamo—Tests for Continuity—Insulation Test—Faults and Remedies—Faults in Armature—Faults in Commutator—Engines for Driving—Parson's Steam Turbine—Examples,		37-64
CHAPTER IV.—MOTORS.		
Transmission of Power—Construction of Motor—Back E. M. F.—Starting Switches—Stopping the Motor—Siemens' Starting Switch—Liquid Starters—Connections for Series Motor—Connections for Shunt Motor—Connections for Compound Motor—Efficiency—Multipolar Motor—Enclosed Motors—Alternate Current Motors—Three-phase Motor—Star Connection—Mesh Connections—Examples,		65-84
CHAPTER V.—LIGHTING.		
Advantages of Electric Light—Incandescent Lamps—Fuse Wires—Switches—Arc Lighting—Arc Lamps—Lamp Fittings—Anti-vibration Lamps—Light required for given Area—Size of Engine for Lighting—Examples,		85-104