

Cambridge University Press & Assessment
978-1-108-82854-3 – Imperial Science: Cable Telegraphy and Electrical Physics
in the Victorian British Empire
Bruce J. Hunt
Frontmatter
[More Information](#)

Imperial Science

In the second half of the nineteenth century, British firms and engineers built, laid, and ran a vast global network of submarine telegraph cables. For the first time, cities around the world were put into almost instantaneous contact, with profound effects on commerce, international affairs, and the dissemination of news. Science, too, was strongly affected, as cable telegraphy exposed electrical researchers to important new phenomena while also providing a new and vastly larger market for their expertise. By examining the deep ties that linked the cable industry to work in electrical physics in the nineteenth century – culminating in James Clerk Maxwell’s formulation of his theory of the electromagnetic field – Bruce J. Hunt sheds new light both on the history of the Victorian British Empire and on the relationship between science and technology.

Bruce J. Hunt is an Associate Professor of History at the University of Texas at Austin.

Cambridge University Press & Assessment
978-1-108-82854-3 — Imperial Science: Cable Telegraphy and Electrical Physics
in the Victorian British Empire
Bruce J. Hunt
Frontmatter
[More Information](#)

SCIENCE IN HISTORY

Series Editors

Simon J. Schaffer, University of Cambridge

James A. Secord, University of Cambridge

Science in History is a major series of ambitious books on the history of the sciences from the mid-eighteenth century through the mid-twentieth century, highlighting work that interprets the sciences from perspectives drawn from across the discipline of history. The focus on the major epoch of global economic, industrial and social transformations is intended to encourage the use of sophisticated historical models to make sense of the ways in which the sciences have developed and changed. The series encourages the exploration of a wide range of scientific traditions and the interrelations between them. It particularly welcomes work that takes seriously the material practices of the sciences and is broad in geographical scope.

Cambridge University Press & Assessment
978-1-108-82854-3 — Imperial Science: Cable Telegraphy and Electrical Physics
in the Victorian British Empire
Bruce J. Hunt
Frontmatter
[More Information](#)

Imperial Science

*Cable Telegraphy and Electrical Physics
in the Victorian British Empire*

Bruce J. Hunt

University of Texas at Austin



CAMBRIDGE
UNIVERSITY PRESS

Cambridge University Press & Assessment
978-1-108-82854-3 — Imperial Science: Cable Telegraphy and Electrical Physics
in the Victorian British Empire
Bruce J. Hunt
Frontmatter
[More Information](#)



Shaftesbury Road, Cambridge CB2 8EA, United Kingdom
One Liberty Plaza, 20th Floor, New York, NY 10006, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India
103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment,
a department of the University of Cambridge.

We share the University's mission to contribute to society through the pursuit of
education, learning and research at the highest international levels of excellence.

www.cambridge.org

Information on this title: www.cambridge.org/9781108828543

DOI: 10.1017/9781108902700

© Bruce J. Hunt 2021

This publication is in copyright. Subject to statutory exception and to the provisions
of relevant collective licensing agreements, no reproduction of any part may take
place without the written permission of Cambridge University Press & Assessment.

First published 2021

First paperback edition 2022

A catalogue record for this publication is available from the British Library

Library of Congress Cataloging-in-Publication data

Names: Hunt, Bruce J., author.

Title: Imperial science : cable telegraphy and electrical physics in the Victorian
British empire / professor Bruce J. Hunt, University of Texas, Austin.

Description: Cambridge, United Kingdom ; New York, NY, USA : Cambridge
University Press, 2021. | Series: Science in history | Includes bibliographical
references and index.

Identifiers: LCCN 2020047668 (print) | LCCN 2020047669 (ebook) |

ISBN 9781108830669 (hardback) | ISBN 9781108902700 (ebook)

Subjects: LCSH: Telegraph – Great Britain – History – 19th century. |

Electromagnetism – Research – Great Britain – History – 19th century.

Classification: LCC TK5157 .H86 2021 (print) | LCC TK5157 (ebook) |

DDC 621.3830941/09034–dc23

LC record available at <https://lcn.loc.gov/2020047668>

LC ebook record available at <https://lcn.loc.gov/2020047669>

ISBN 978-1-108-83066-9 Hardback

ISBN 978-1-108-82854-3 Paperback

Cambridge University Press & Assessment has no responsibility for the persistence
or accuracy of URLs for external or third-party internet websites referred to in this
publication and does not guarantee that any content on such websites is, or will
remain, accurate or appropriate.

Contents

<i>List of Figures</i>	page vi
<i>Acknowledgments</i>	viii
<i>List of Abbreviations</i>	x
Prologue: “An Imperial Science”	1
1 “An Ill-Understood Effect of Induction”: Telegraphy and Field Theory in Victorian Britain	3
2 Wildman Whitehouse, William Thomson, and the First Atlantic Cable	37
3 Redeeming Failure: The Joint Committee Investigation	97
4 Units and Standards: The Ohm Is Where the Art Is	144
5 The Ohm, the Speed of Light, and Maxwell’s Theory of the Electromagnetic Field	181
6 To Rule the Waves: Britain’s Cable Empire and the Making of “Maxwell’s Equations”	216
Epilogue: Full Circle	272
<i>Bibliography</i>	276
<i>Index</i>	299

Figures

1.1	<i>Goliath</i> laying the short-lived first Channel cable in 1850	page 11
1.2	The 1851 English Channel cable, as retrieved in 1859	12
1.3	Lines of force around wires carrying electric currents	19
1.4	William Thomson's curves showing how an electric current rises in a cable	35
2.1	Cyrus W. Field, John Watkins Brett, Charles Tilston Bright, and Wildman Whitehouse	39
2.2	The route of the 1858 Atlantic cable	42
2.3	Wildman Whitehouse's telegraphic recorder and marked paper tapes	49
2.4	William Thomson in 1852	51
2.5	Crewmen coiling the first Atlantic cable on the US warship <i>Niagara</i>	67
2.6	Wildman Whitehouse's magneto-electrometer	71
2.7	William Thomson's mirror galvanometer	79
2.8	William Thomson's marine galvanometer	82
2.9	A souvenir piece of the 1858 Atlantic cable, sold by Tiffany's	85
2.10	Theodor Linde's depiction of the Newfoundland cable station in 1858	88
2.11	Captain Frederic Brine's map of Valentia harbor, 1859	93
3.1	The routes of the Red Sea and India cables, 1859–60	115
3.2	Title page of the <i>Joint Committee Report</i> , 1861	126
3.3	William Thomson reading a letter from Fleeming Jenkin in 1859	130
3.4	Specimens of cable types	135
4.1	Latimer Clark and Cromwell Fleetwood Varley	147
4.2	Fleeming Jenkin's self-portrait, 1859	154
4.3	The British Association spinning coil resistance apparatus	171
4.4	A British Association resistance coil	172
5.1	Maxwell's vortex model of the ether	184
5.2	Maxwell's apparatus for measuring the ratio of units (ν)	210

Cambridge University Press & Assessment
978-1-108-82854-3 — Imperial Science: Cable Telegraphy and Electrical Physics
in the Victorian British Empire
Bruce J. Hunt
Frontmatter
[More Information](#)

List of Figures	vii
5.3 Portrait of Maxwell with the British Association spinning coil resistance apparatus	214
6.1 The <i>Great Eastern</i> grappling for the broken end of the Atlantic cable	225
6.2 “Awaiting the Reply” in 1866	229
6.3 <i>Vanity Fair</i> caricature of “cable king” John Pender	240
6.4 Plaque showing the vector form of “Maxwell’s equations”	257
6.5 Oliver Heaviside at his home in Devonshire in 1893	258
7.1 The global cable network, circa 1901	273

Acknowledgments

I have incurred many debts in writing this book, and I would like to thank the many people and institutions who have helped along the way. Like any historian, I relied heavily on libraries and archives and on the skilled staff who work in them. For access to the materials they hold and for assistance in my research, I would like to thank the staff and Syndics of Cambridge University Library, as well as the Science and Technology Facilities Council; the Archives of the Institution of Engineering and Technology; the PK Porthcurno Museum of Global Communications and the PK Trust; the Merseyside Maritime Museum of the National Museums Liverpool; the New York Public Library, particularly its Rare Book Collection (Astor, Lenox, and Tilden Foundations); and the libraries and special collections of Trinity College Dublin, University College London, and the University of Glasgow. I would also like to thank my own institution, the University of Texas at Austin, for maintaining its excellent library collections, including online access to the historical newspaper collections that I have found so invaluable, and for supporting my research over many years. I owe special thanks to Allan Green for the extended loan of his photocopy of the Atlantic Telegraph Company Minute Book (1856–58) and to Bill Burns for the remarkable collection of materials he has gathered on atlantic-cable.com and for the generous help he has offered me on many occasions, including the use of maps and images that were available nowhere else. Bill's website led me to the remarkable photograph of sailors on the *Niagara* that appears in Chapter 2, and I would also like to thank Page and Bryan Ginns for granting me permission to reproduce it. I would also like to thank Kyle Hedrick for giving me the map showing the route of the 1858 Atlantic cable; Beth Hedrick for the souvenir piece of that cable as well as the *Vanity Fair* print of John Pender; and Linda Henderson for the copy of Louis Figuier's *Merveilles de la Science*, from which I drew several illustrations. Lucy Rhymer, my editor at Cambridge University Press, has always been very patient and supportive; I would like to thank her, as well as Emily Sharp, Natasha Whelan, Anjana Karikal Cholan, and Judieth

Sheeja, for their help in bringing this book to fruition. Some chapters of this book incorporate material that appeared in earlier forms in several journal articles: Bruce J. Hunt, “Michael Faraday, Cable Telegraphy, and the Rise of British Field Theory,” *History of Technology* (1991) 13: 1–19 (Chapter 1); Hunt, “Scientists, Engineers, and Wildman Whitehouse: Measurement and Credibility in Early Cable Telegraphy,” *British Journal for the History of Science* (1996) 29: 155–69 (Chapter 2); Hunt, “The Ohm Is Where the Art Is: British Telegraph Engineers and the Development of Electrical Standards,” *Osiris* (1994) 9: 48–63 (Chapter 4); and Hunt, “Maxwell, Measurement, and the Modes of Electromagnetic Theory,” *Historical Studies in the Natural Sciences* (2015) 45: 303–39 (Chapter 5). I would like to thank the editors and publishers of these journals for permission to include this material here.

Over the years, many friends and many audiences have heard me talk about the history of cable telegraphy and electrical physics, and I would like to thank them for their patience and support. On the British side, I would especially like to thank Simon Schaffer, Richard Noakes, Crosbie Smith, and Jim and Anne Secord, and on the American side Tom Hankins, Bob Kargon, Russell McCormach, Bob Rosenberg, Robert Smith, Bruce Hevly, and Megan Raby. My deepest thanks go of course to Beth, Peter, and Emma.

Abbreviations

ATC Minute Book	Minute Book of the Atlantic Telegraph Company, October 26, 1856, to April 9, 1858, BICC Archive, Merseyside Maritime Museum, Liverpool
<i>BA Report</i>	<i>Report of the Annual Meeting of the British Association for the Advancement of Science</i>
C&W	Cable and Wireless Archives, PK Porthcurno Museum of Global Communications
CUL	Cambridge University Library
CUL-RGO	Royal Greenwich Observatory Archives, Cambridge University Library
<i>Elec.</i>	<i>The Electrician</i>
<i>Further Corr. 269</i>	<i>Further Correspondence Respecting the Establishment of Telegraphic Communications in the Mediterranean and with India</i> , British Parliamentary Papers, 1860, LXII.269
<i>Further Corr. 461</i>	<i>Further Correspondence Respecting the Establishment of Telegraphic Communications in the Mediterranean and with India</i> , British Parliamentary Papers, 1860, LXII.461
Heaviside, <i>EP</i>	Oliver Heaviside, <i>Electrical Papers</i> , 2 vols. (London: Macmillan, 1892)
Heaviside, <i>EMT</i>	Oliver Heaviside, <i>Electromagnetic Theory</i> , 3 vols. (London: Electrician Co., 1893–1912)
IET	Institution of Engineering and Technology Archives, London
<i>Joint Committee Report</i>	<i>Report of the Joint Committee to Inquire into the Construction of Submarine Telegraph Cables</i> , British Parliamentary Papers, 1860, LXII.591
Maxwell, <i>SLP</i>	James Clerk Maxwell, <i>Scientific Letters and Papers of James Clerk Maxwell</i> , ed. P. M.

List of Abbreviations

xi

	Harman, 3 vols. (Cambridge: Cambridge University Press, 1990–2002)
Maxwell, <i>SP</i>	James Clerk Maxwell, <i>Scientific Papers of James Clerk Maxwell</i> , ed. W. D. Niven, 2 vols. (Cambridge: Cambridge University Press, 1890)
Maxwell, <i>Treatise</i>	James Clerk Maxwell, <i>Treatise on Electricity and Magnetism</i> , 2 vols. (Oxford: Clarendon Press, 1873)
ODNB	<i>Oxford Dictionary of National Biography</i>
<i>Phil. Mag.</i>	<i>Philosophical Magazine</i>
<i>Phil. Trans.</i>	<i>Philosophical Transactions of the Royal Society of London</i>
<i>Proc. ICE</i>	<i>Proceedings of the Institution of Civil Engineers</i>
<i>Proc. RS</i>	<i>Proceedings of the Royal Society of London</i>
<i>Red Sea Contract</i>	<i>Electric Telegraph Companies. Copies of All Correspondence between the Electric Telegraph Companies Under Contract with the Government Respecting the Failure to Lay Down or Keep in Working Order the Electric Wires</i> , British Parliamentary Papers, 1860, LXII.211
Smith, <i>Reports</i>	F. E. Smith, ed., <i>Reports of the Committee on Electrical Standards Appointed by the British Association for the Advancement of Science</i> (Cambridge: Cambridge University Press, 1913)
Thompson, <i>Kelvin</i>	Silvanus P. Thompson, <i>The Life of William Thomson, Baron Kelvin of Largs</i> , 2 vols. (London: Macmillan, 1910)
Thomson, <i>MPP</i>	William Thomson, <i>Mathematical and Physical Papers</i> , 6 vols. (Cambridge: Cambridge University Press, 1882–1911)
WC-NYPL	Wheeler Collection of Electricity and Magnetism, Rare Book Collection, New York Public Library