LOCKS, SAFES, AND SECURITY

ABOUT THE AUTHOR

Marc Weber Tobias has authored four law enforcement textbooks for Charles C Thomas • Publisher, dealing with criminal law, police communications, and security. Tobias received a Bachelor's Degree in 1970 from the University of Nebraska-Omaha, and a Juris Doctor Degree from Creighton Law School (Omaha, Nebraska) in 1973. He is an attorney in Sioux Falls, South Dakota, with Investigative Law Offices, P.C. As part of his practice, he routinely conducts technical fraud investigations and consults with corporations and government agencies throughout the world regarding the bypass of locks, analysis of design defects, and security liability issues. The author has been granted two United States patents and several foreign derivative patents for bypass tools relating to locks. He is a member of the Associated Locksmiths of America (ALOA), Safe and Vault Technicians Association (SAVTA), American Society for Industrial Security (ASIS), American Academy of Forensic Sciences (AAFS), International Association for Identification (IAI), American Polygraph Association (APA), and American Association of Police Polygraphers (AAPP). He is also a technical advisor to the Association of Firearms and Tool Marks Examiners (AFTE). Tobias has provided technical support and investigative services involving surveillance, covert entry, interrogation, polygraph, and crime scene documentation to many law enforcement agencies throughout the world.

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Second Edition

LOCKS, SAFES AND SECURITY

An International Police Reference

By

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To Manual, Dora, Nathan and Ida, for their wonderful gift of life, and without whom, this work would not exist.

FOREWORD BY BROCKMAN C. SELF

Twenty-eight years ago when I was beginning my career as a Special Agent of the FBI, I read the first edition of this book and attended a class that the author taught on lock picking and impressioning. Since that time, I have maintained close contact with the author. Until my retirement in 1999, I have had an occasion to work many cases involving the theft of physical assets and information. The compromise of locks, safes, and security systems was always a concern, especially when involving classified information or theft of critical components.

A veil of secrecy has always cloaked information regarding covert methods of entry involving locks and safes. The locksmith community jealously guards their techniques, even to law enforcement. Manufacturers likewise will rarely disclose design defects that permit their products to be bypassed – especially high security devices. Yet, there is a real need for this knowledge by criminal investigators, forensic examiners, and intelligence agencies so that they may perform their tasks competently. Many high-level investigations involve the surreptitious compromise of security hardware. Without a detailed understanding of locks and safes, anyone that is charged with the responsibility of reaching a valid case solution is hampered in their efforts.

The detailed treatment by the author in the second edition of *Locks, Safes, and Security* offers an unprecedented insight into these subjects. Marc Tobias describes all of the primary locking mechanisms: why they work and how they are bypassed. I found particularly valuable the forensics section that describes the analysis of locks, safes, and security systems for bypass. The detailed checklists that are presented will prove essential for use during any investigation regarding potential surreptitious entry. The chapters dealing with picking, impressioning, and decoding tools and techniques provide a global perspective of the incredible array of tools and techniques that are now available for compromise of the highest security locks and safes.

In many respects, the information should cause a great deal of concern for anyone that is responsible for security, because the author documents the ease with which many of the best locks in the world can be covertly bypassed without any trace whatsoever. Armed with this knowledge, security experts can intelligently add levels of protection as deemed necessary. The author's expertise in law enforcement, the law, and as a technician provides the required perspective to cover the subject in

depth. He has woven together the essential elements of many subjects and made detailed technical information understandable to divergent audiences.

I highly recommend this book to the law enforcement community, and I suspect that it will be equally well received by professional locksmiths and safe technicians. It is rich with the kind of information that has only been available in a fragmented form in many publications, if at all. The author has created a unique international treatise that is supplemented by reference to the most significant patents that have been issued during the past two hundred years in England and the United States, combined with excellent graphics.

Although this book will have taken the author seven years of intensive work to produce, it represents almost thirty years of experience, all the while gathering materials for this edition. We have discussed the rewrite many times during the past three decades: it was clearly worth the wait. I am certain that this text will be a standard reference within our profession for many years to come.

BROCKMAN C. SELF
FBI Special Agent (Retired), 1969-1999

FOREWORD BY DR. ILYA ZELDES

Many investigations involve the compromise of locks and safes. Although there are a few forensic locksmiths, most crime laboratories and investigators do not have the background or expertise to conduct such inquiries. There have been several publications on the subject of locks, safes, and their forensic examination. One of them was the first edition of *Locks, Safes, and Security* (1971). I read and used in my practice this book, which was called "the bible of lock examination" by forensic examiners.

For the last two decades, no comprehensive international treatise on locks and safes has been specifically written for law enforcement and government agencies until the second edition of *Locks, Safes, and Security*. This book is important for criminal investigators, forensic examiners, insurance agents, and security personnel in order to understand how locks work, how they can be compromised, and if they were bypassed.

Traditional tool mark examinations are routinely conducted by every crime laboratory. However, the expertise required in the evaluation of security hardware entails a comprehensive understanding of many levels of complexity of locks and locking systems that has been lacking. From my personal experience while working in both the former Soviet Union and the United States, certain criminal investigations would have been brought to a successful conclusion if a detailed analysis of locks and locking systems could have been competently performed at a crime scene. In most cases, this is not done because of lack of expertise of field investigators or forensic examiners.

I have known the author for the past quarter century. His unique experience as an attorney, prosecutor, criminal investigator and technician provides the necessary perspective to make this book a required international reference on the subject of locks, safes, and security for those charged with the investigation or prevention of crimes that involve a compromise in security.

DR. ILYA ZELDES, J.D., PH.D.
Director, South Dakota
State Forensic Laboratory (Retired), 1977-1993

PREFACE

The first edition of this book was published in 1970. At that time, high security had a very different meaning in terms of specifications, technology, and international standards. Today, the world of locks, safes, and security is indeed complicated, offering a wide array of products to meet virtually every requirement. The second edition brings together all of the disciplines that are encompassed and contemplated by the term security. Hopefully, it is a comprehensive work that will provide valuable reference information to its intended primary audience: the law enforcement and intelligence community.

The author has attempted to present extremely detailed theoretical and practical information in order to facilitate a thorough understanding of the complex subject matter. While the first edition covered many topics in summary fashion, this revised work examines each facet of the subject in extensive and, when required, intricate detail. Extensive supplementary materials have been provided in the *LSS+ CD/ROM*, and at *http://www.security.org.*, the web site maintained by the author.

The *CD/ROM* offers an extremely sophisticated index of topics, terms, and concepts in order to allow the reader to locate all available information regarding a specific topic and related subjects. The electronic version of this text is not simply a repeat of the information contained within the hardbound edition; it provides a rich and valuable multimedia supplement.

Any inquiries, questions, comments, or suggestions should be directed to the author at *mwtobias@security.org.* or to the publisher at *books@ccthomas.com.* Global toll-free telephone contact through http://www.security.org is also available. Also visit the publisher's web site at *www.ccthomas.com.*

MWT
JUNE 2000

INTRODUCTION

My intrigue with locks and their bypass began at age fifteen when I picked my first Schlage pin tumbler cylinder and had my first key cut by code. From the beginning, it has been a continuing fascination and learning process. After almost forty years, the challenge of understanding and opening locks, especially high-security locks, has developed into an intellectual exercise for me and an important part of my law practice for corporate and government clients. Locks are designed not to be opened covertly. Therefore, when they can be bypassed, important technical and legal issues arise.

This book is a comprehensive international reference about locks, safes, and security. It is written primarily for law enforcement and intelligence agencies so that they might deal effectively with their various missions. The legendary Harry Miller once told me that critical information about locks and safes must be conveyed to law enforcement in such publications, because otherwise, they have no way to obtain the data. Most locksmiths are reluctant to share their trade secrets with outsiders. Thus, it is hoped that this book will achieve such a purpose. The material should prove equally useful to security management personnel, locksmiths, architects and lawyers. Each has specific responsibilities that are linked to one or more facets of security. Each is a professional, and must make critical decisions as to the proper hardware to protect people and assets, based upon a sound theoretical base.

The subject matter has been approached from many different perspectives in an attempt to anticipate the needs of the reader. In doing so, I have tried to strike a balance between theory and practicality. Many well-written trade works concentrate on individual locks and techniques. Those should be consulted when very specific data is required, as for example when a particular safe must be opened. Information in this book has been gathered from many sources. Locksmiths, manufacturers, instructors from recognized specialized entry schools, vendors, lock suppliers, designers, engineers, inventors, forensic examiners, and associates have provided invaluable assistance and a rich mixture of experiences and knowledge.

The subject of this book is very complicated, diverse, and global. As will be seen, the modern locksmith is a skilled professional who deals with its facets every day. In fact, in many countries, he is an engineer by trade. There is a great deal of history and technology incorporated within the modern lock, container, and security

system. The focus of this text is to put all that information into an understandable and useable format.

This book offers a detailed theoretical overview of locks, how and why they work, and what makes them secure. Extensive information is presented on how they can be bypassed. Some material has not been included for obvious reasons, but is available to authorized agencies in the multimedia **LSS+ CD/ROM** editions.

A concern is often voiced that this type of book should not be written, or its distribution should be severely restricted because the knowledge it offers will allow the compromise of security in sensitive installations. It is argued that acts of burglary, sabotage, or espionage may result from such publication. To commit a burglary or otherwise use the information in this book to break the law can subject the reader to severe penalties. In a free society, liberty means choice. If the reader chooses to utilize the data for unlawful purpose, that is his choice, with the attendant consequences.

The truth is, there is a vast amount of information in trade publications, multimedia, patent offices, and on the Internet about many of the topics covered within this text. The classic book written almost 150 years ago by George Price provided extremely detailed information on lock picking. So, the availability of such information is surely nothing new. The problem is that most locks can be bypassed, given the proper tools and knowledge. In the end analysis, that is a problem for the manufacturer to solve and not the responsibility of the author.

In some countries, such information is restricted. Britain, for example, considers the data contained in patents as secret. As a lawyer and technician, I have a different view. Many security issues can be remedied, if those responsible for decision-making have a thorough understanding of the technology underlying the problems relating to security, hardware, and software. Many manufacturers have conducted the requisite research and development to bring reliable and secure products to market. Others have not. If this book accomplishes nothing more, the exposure of poorly designed locks and safes will ultimately force a manufacturer to either produce a better product or lose market share. Most vendors will represent their products as secure. Many will not be telling the truth. I hope that the knowledge imparted to the reader will allow him to differentiate between the two.

The only way for the forensic examiner, security specialist, or special operations personnel to assess vulnerability is through a solid theoretical understanding of the subjects presented in this book. At least, that is the goal. With regard to products described or analyzed in this book, the author has no economic or contractual relation with any vendor or hardware manufacturer. There is no intent to sell or rate a specific vendor or product, unless specifically indicated. The opinions expressed with regard to security or compromise of a specific product is based upon data developed by the author or others, information known within the industry, or from tests on samples obtained directly from manufacturers.

A specific lock may be bypassed due to many reasons and may not necessarily be the result of a design defect. It may simply reflect errors in manufacturing tolerances that may or may not be common to all locks in the same class. The reader should draw his or her own conclusions as to the security and integrity of any product or

system.

Finally, organization of the material in certain parts of this book was extremely difficult, especially in the chapters dealing with forensic examination. This was because of the complex nature of the data presented and the often-overlapping disciplines. Any illogic in the presentation rests solely with the author. Suggestions for the next edition will be appreciated.

ACKNOWLEDGMENTS

The second edition of this book will have taken more than five years to prepare and represents a total rewrite of the first edition. I have traveled throughout the world in an effort to gather the latest data about the truly global technology of locks, safes, and security. The book clearly took on a life of its own as the complexity of the subject became increasingly apparent, and more allied disciplines became relevant.

Along the way, a great many people, companies, and government agencies provided invaluable assistance to me. Some, of necessity, cannot be publicly thanked or acknowledged. But, they know of my sincere appreciation for their input. The list of those I acknowledge here is by no means all-inclusive. However, due to space limitations, those not mentioned will surely understand.

I wish to thank, first of all, Dr. Ilya Zeldes, Director (retired), and Rex Riis (Current Director), of the State of South Dakota Forensic Forensic Laboratory, for their continued encouragement and contribution in the analysis of evidence and photographic techniques utilized in this book.

The Attorney General of South Dakota, Mark Barnett, provided crime lab facilities for the preparation of certain exhibits and photo sessions and has been of real assistance.

Likewise, Special Agent Fred Devaney, South Dakota Division of Criminal Investigation, and his entire family have been most helpful. Special thanks to Mary Devaney for the many great meals during those times that I was engrossed in writing. Chuck Devaney, Fred's young son, edited many of the photographs and illustrations and in the process became competent in lock picking, much to the chagrin of his parents. His assistance is very much appreciated.

Under-Sheriff Dan Elston and Lt. Jeff Zanfes have provided valuable assistance for many years. Without the experiences gained through my association with the Minnehaha County Sheriff's Office (Sioux Falls), I would not have had access to certain laboratories and evidence used for this book.

A friend since college, Special Agent Brock Self, FBI, has assisted in editing since the first edition and has made countless suggestions, corrections, and additions to this book. I am very grateful to him for his friendship and professional assistance.

I would also like to express my gratitude to Governor William Janklow (South

Dakota), Gene Abdallah, Director of the Highway Patrol, Herman Solem (Warden, Retired, SDPEN), and Jim Severson (SDPEN and SD DCI) for their friendship and assistance during this project.

Beth Quarnstrom helped on some of the typing and preparation of the manuscript. She is a legal secretary without equal and is very much appreciated for her dedication.

Other friends that provided invaluable assistance along the way include Steve and Jay Dean Smith, Tom Gorgen, Lorin Pankratz (for his alleged good humor), and Mike Pellet, for his continuously interrupting late-night telephone calls.

In traveling and researching this book, there are many professional associates, manufacturers, and vendors who have provided assistance. These include, by country:

BULGARIA: Kostadin Bobev, Bulgarian Ministry of Internal Affairs and Forensic Science Institute.

CANADA: Nick Tyler.

DENMARK: Hans Mejlshade.

FINLAND: Heikki Majamma, Helsinki Crime Lab.

FRANCE: Aldo Silvera.

GERMANY: Ikon, Munchener Ruck Reinsurance (Munich), Wolfgang Steinke and the crime laboratory personnel at the BKA.

HONG KONG: Crime Laboratory.

IRELAND: Garda (National Police) Crime Laboratory, Dublin.

ISRAEL: Mul-T-Lock, and Moshe Tavor, Elliott Springer (Tool Mark Section) Israel National Police.

ITALY: Ezzio Chies (Silca).

NETHERLANDS: National Forensic Laboratory.

PAKISTAN: Inter-Service Intelligence (ISI).

UNITED KINGDOM: John Falle, Martin Newton, Horace Smith, Roy Saunders, Jim Wallbank. Special thanks to Debbie Hemstead, Rhonda Mitchell, Frank Post and Ray Sands (Chubb Safe Company), and the British Museum, London.

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USSR: General Vladimir Statkus, Ministry of Internal Affairs;

The following companies provided extraordinary technology assistance: **Polaroid** (photographic), **Olympus** (optics), **Silca** (keys), **HPC** (entry tools), **John Falle** (covert entry tools), **MBA, Iowa-American**, and **Sigma** (entry tools).

Finally, I would not have been able to complete this text without the encouragement of my parents and brother. They have never faltered in their support and belief that I could actually complete the second edition.

WAIVERS, CONDITIONS, AND DISCLAIMERS

This book describes certain locks and safes and how they may be bypassed. Specific techniques are disclosed regarding lock picking, impressioning, decoding, and manipulation. As such, the reader is cautioned that the misuse of such information may constitute a crime in certain jurisdictions.

This book is intended for use primarily by law enforcement, intelligence, and other government agencies, as well as professional locksmiths and safe technicians. It is not intended, nor shall it knowingly be distributed, to individuals who do not have a legitimate need-to-know the information contained herein.

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4. Bypass information is lock specific. A manufacturer may make changes to frustrate bypass techniques detailed herein which are unknown to the **AUTHOR**, or which have occurred since publication or in different models of the lock.
5. The use or misuse of any of the **INFORMATION** and techniques described within this book may be illegal by certain individuals in one or more jurisdictions. The **AUTHOR** assumes no liability for the use or misuse of any **INFORMATION** or procedures described herein, and in no way encourages the use of such information in cases where such may be unlawful.
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7. The **AUTHOR** makes no representation that he has tested every product of any specific manufacturer described herein. AUTHOR further makes no representation that any product so tested is representative of all other products of any manufacturer.

8. The bypass of any product described within this text may reflect manufacturing tolerance errors, which may or may not be common to all locks or other security devices. Because it is impossible to test all such devices, there is no way to determine if all such devices exhibit the same characteristics. The **READER** should therefore draw their own conclusions as to the security and integrity of any product.

TECHNOLOGY UTILIZED IN THE RESEARCH AND PRODUCTION OF THIS BOOK

The author produced this text utilizing a number of different technologies, which may be of interest to the reader.

Computers, CD-ROM Creation, Printers, and Scanners

A Compaq 400 Mhz with 192 MB Ram and 27 GB hard drive, together with an IBM 770, 233 Mhz Pentium II laptop were the primary processors. An HP 4C flatbed scanner and a Nikon LS-1000 high resolution (2750 x 2750 pixel) 35 mm scanner was utilized.

A Hewlett-Packard 4000 and an HP 4M LaserJet with 1200 dpi resolution were utilized for printing all images.

HP 4220I and 6220I CD-R recording technology, and the HP 7110 CD-RW multi-write system was used to capture and store all images on CD/ROM, together with Adaptec software.

Software

The author, for the production of this book, utilized the following software:

Microsoft Word 97
Microsoft Access 97
Adobe Photoshop
Adobe Premiere
Hijack Pro
Dragon Systems Naturally Speaking
MacroMedia Authorware
Omni-Page Pro scanner software
Adaptec CD Creator II

Word processing was done through the Dragon Systems speech recognition software and Microsoft Word 97.

The **LSS+ CD/ROM** was created with MacroMedia Authorware software.

Cameras and Imaging

A Minolta 9XI 35 mm, with 100 mm macro lens and ring strobe, were utilized for all macro photographs. They were first shot on film, then scanned at high resolution and edited using Adobe Software.

A Canon EOS-1 was also used for many of the photographs. A Crown Graphic 4x5, with various Polaroid Backs, was also utilized to produce many of the images, especially the photomicrographs.

Kodak 2415 recording film, as well as Kodak Royal Gold 100, Kodak Elite, Professional Ektachrome, and Polaroid Type 51, 55, and 59 were utilized throughout. In addition, the Polaroid 35 mm instant monochrome and color films were used for certain photographs in the field.

Photographs with the Olympus borescope were captured with a Minolta 35 mm 7000 camera, or a Sony 999 470-line CCD color camera.

Microscopes and Special Optics

The author utilizes an Olympus 10–40x zoom microscope for all photomicrosopy. A Polaroid MP-3 and MP-4 were used for the production of many exhibits. An Olympus 1.2 mm diameter rigid lens relay borescope, with a 15º viewing field, was employed to produce microphotographs within several locks.

Miscellaneous Materials

Kerr Impressioning material and FIMO casting clay was utilized for all impressioning of keys and locks. The HPC 1200 and Silca Quatracode key machines were utilized for the duplication and creation of keys. HPC, MBA, and John Falle supplied lock picking and decoding tools, as well as special micrometers for intricate measurement.

CONVENTIONS, REFERENCES, AND ORGANIZATIONAL DATA

LSS+ CD/ROMS will only be sold to purchasers of the bound edition of Locks, Safes, and Security. An authentication certificate, included with every book, must be supplied at the time of purchase.

References Cited Within This Text

Nomenclature for references has been standardized throughout this text for ease in research, to insure compatibility with the CD/ROM edition, and updates appearing on the web site.

Chapter Subheadings

Each major subheading has been numbered to enhance organization and understanding. In many cases, numbering sequences omit certain levels in order to reserve space for future editions. Numbering is consistent between printed and electronic editions.

Patents

Patent cites are indicated by a sequence of numbers enclosed within brackets. Thus, the following patent shown in parentheses (1234567) would cite U.S. patent, 1,234,567. Patents granted in Great Britain are prefaced with a heading of GB. Commas have been deleted to allow for consistency in searching within the CD/ROM.

The LSS+ and LSS+/ CD/ROM Editions*

Two multimedia editions of this text will be available on **CD/ROM**. **LSS+/*** will provide a supplement to **LSS+** and contain information regarding the bypass of high-security locks and safes. Release of this CD/ROM shall be to government

agencies only. **LSS+** will contain the entire text of the bound edition and will include many other enhancements, including:

• **Photographs**. Many of the photographs and illustrations were originally shot in color but reproduced in black and white in the book. They have been presented in color on the **CD/ROM** editions. In many of the exhibits, more photographs have been added to enhance understanding and clarity. In addition, zoom capability has been provided to show intricate components.

• **Patents**. Only patent references were provided in the bound edition due to space limitations and cost. Full text patents are available on the **CD/ROM** or by hyperlink to the web.

• **Standards**. A complete set of UL standards, as they apply to locks and safes, is contained in the **CD/ROM** editions.

• **Instructions for the use of Picking, Decoding, and Impressioning Tools**. Information and audio/video demonstrations of the use of specialized pick tools are provided.

• **Audio and Video Clips**. Audio and video material has been integrated into the text on both **CD/ROMS**. These multimedia presentations demonstrate certain bypass techniques by some of the most experienced technicians in the world. In **LSS+/***, highly sensitive information regarding the use of high-technology picking and decoding tools is presented. This **CD/ROM** is restricted to government agencies only.

• **Indexing and Hyperlinks**. Full literal string indexing has been incorporated into the **CD/ROM** editions for instant retrieval of information based upon key words in the text. Hyperlinks to the *www.security.org.* web site are also incorporated for the latest updates and expanded information.

• **Other Integrated References**. Two other works have been integrated into the **CD/ROM** editions. *Fire and Thief-Proof Depositories*, although 150 years old, is the most comprehensive reference in the world regarding locks and safes. It was written by George Price in 1850. The author has revised the original Price edition and integrated the text into *Locks, Safes, and Security.* Price's book provides rich detail about locks and safes from the perspective of one of the most famous locksmiths of the time.

The Art of Manipulation by Clyde Lentz and Bill Kenton has been updated and revised by the author and is included in **LSS+**. This manual, originally written in 1953, was the premier instructional piece on the manipulation and remains so to this day.

www.security.org.

Security.org. was created and maintained by the author to provide the most comprehensive reference data about locks and safes on the Internet. Detailed information for more than 150 manufacturers are available. Many hyperlinks are embedded in the **CD/ROM** editions.

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