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BY

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PREFACE

This volume is a register of the most important works that have been written, not only on the subject of cryptography, but also on its manifestations in related fields. Hence, the items presented will be seen to vary considerably in nature and content: some are scientific and technical treatises dealing with the application of cryptography to military, diplomatic, and commercial uses; others dwell on the more popular and more limited manifestations of this science, and appear in a variety of disparate forms,—in that of cuneiform, runic, and other kinds of hieroglyphic writings, in literary anagrams and acrostics, in symbolism of colors, gem, emblems, and insignia, in the jargon of children as well as that of thieves, in various types of universal languages and stenographic systems, in tramps' signs and semaphoric signals, and also in the crude devices and ingenious stratagems which were employed during primitive ages as a means of concealing and conveying thought and information.

The material of the volume was gleaned and collected from quite varied sources. For the early fundamental exploratory work of the project, full utilization was made of the facilities offered by the libraries conveniently accessible in the area of Chicago,—Deering Library of Northwestern University, Harper Memorial Library of the University of Chicago, the John Crerar Library, and the Newberry Library. Then a preliminary survey was made in some twenty representative universities in different sections of the country in order to ascertain the extent of the cryptographic material which they contained. As a result of these investigations, valuable clues and indications were disclosed which made necessary for their solution the procurement of microfilm and photostat reproductions of special works contained only in distant institutions. Then thanks to research grants accorded by Northwestern University, two trips of six or seven weeks each were made possible during the summers of 1942 and 1943 to a number of Eastern institutions which the survey showed possessed substantial amounts of the needed material. Although each and all of these depositories contributed a due share of items to our quest, in all justice it should be stated that the most extensive contributions were derived from the Fabyan Collection of the Rare Book Section of the Library of Congress, the Mendelsohn Collection of the University of Pennsylvania, the New York Public Library and the Widener Library of Harvard University.

The number of works consulted and utilized in this quest for cryptographic references and material was quite considerable and, if given in

entirety, would make up an extensive and imposing list. However, it is hoped that an adequate idea of the extent and scope of our researches may be gained if only the most important and essential ones are named. For the purpose of clarification, these may be conveniently grouped into five classifications, as follows: (a) General works of reference; (b) Periodical indices and catalogues; (c) Works of biography; (d) Catalogues of rare books; (e) Special works on cryptography containing bibliographical lists or indications:

(a) *Encyclopedia Americana*; *Encyclopaedia Britannica*; *International Encyclopaedia*; *Catholic Encyclopedia*; *Jewish Encyclopedia*; *La Grande Encyclopédie*; *Encyclopédie ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers*; Brockhaus: *Die Grosse Enzyklopädie*; Boccardo: *Enciclopedia Italiana*; *Enciclopedia Italiana di Scienze, Lettere ed Arti*; Espasa: *Enciclopedia Universal Ilustrada Europeo-Americana*.

(b) *Poole's Index to Periodical Literature*; *Readers' Guide to Periodical Literature*; *International Index to Periodicals*; *Subject Index to Periodicals*; Peddie: *Subject-index of Books*; Watt: *Bibliotheca Britannica*; *International Military Digest, Annual*; *Répertoire Bibliographique des Principales Revues Françaises*; Lorenz: *Catalogue de la Librairie Française*; *Bibliographie der Deutschen Zeitschriftenliteratur*; *Bibliographie der Fremdsprachigen Zeitschriftenliteratur*; *Internationale Bibliographie der Zeitschriftenliteratur*; *Biblioteca della Camera dei Deputati*; *Provveditorato Generale dello Stato*.

(c) *Dictionary of National Biography*; Michaud: *Biographie Universelle Ancienne et Moderne*; *Nouvelle Biographie Générale Depuis les Temps les plus Reculés jusqu'à nos Jours*; *Allgemeine Deutsche Biographie*.

(d) Brunet: *Manuel du Libraire*; Graesse: *Trésor de Livres Rares*; *British Museum: Catalogue of Printed Books*; *Catalogue Générale des Livres Imprimés de la Bibliothèque Nationale*; *Gesamtkatalog der Preussischen Bibliotheken*.

(e) Bailey, J. E.: "Works on cryptography," *Notes and Queries*, Sept. 1, 1877, pp. 169-171. [Contains 40 items on cryptography]; Carmona, J. G.: *Tratado de criptografía*, Madrid, 1894. [Bibliographical list, pp. 173-179]; Dröscher, Ernst: *Die Methoden der Geheimschriften*, Leipzig, 1921. [Bibliographical list, pp. ix-xi]; Figl, Andreas: *Systeme des Chiffrierens*, Graz, 1926. [Contains 90 items on cryptography]; Friedman, W. F.: *Synoptic tables . . . and a bibliography of cipher literature*, Geneva, Ill., 1918. [Bibliographical list, pp. 14-16]; Gioppi, Luigi, di Türkheim: *La crittografia diplomatica, militare et commerciale*, Milano, 1897. [Bibliographical list, pp. 171-174]; Hughes, W. L.: "Works on cryptography," *Notes and Queries*, Oct. 20, 1877. [Contains 40 additions to the Bailey list]; Klüber, Johann Ludwig: *Kryptographik*, Tübingen, 1809. [Bibliographical list of 19 pages];

Lacroix, Paul: *La cryptographie, ou l'Art d'écrire en chiffres*, Paris, 1858. [Bibliographical list, pp. 242-251]; Locard, Edmond: *Les correspondances secrètes*, Lyon, 1936. ["Bibliographie cryptologique," pp. 905-931]; Gyldén, Yves: "Cryptologues italiens du XV^e et XVI^e siècles," *Revue Internationale de Criminalistique*, Lyon, 1932. [Bibliographical list of 16 items]; Lange, André et E.-A. Soudart: *Traité de cryptographie*, Paris, 1925. [Bibliographical list of about 100 items]; Meister, Aloys: *Die Geheimschrift im Dienste der päpstlichen Kurie*, Paderborn, 1906. [Contains bibliographical indications interspersed throughout the work]; Schneickert, Hans: *Die Geheimschriften im Dienste des Geschäfts- und Verkehrslebens*, Leipzig, 1905. [Contains bibliographical indications]; Volts, James D.: *Bibliography of cryptography*, Cincinnati, 1938. [Bibliographical list of 18 pages]; Wagner, F.: "Studien zu einer Lehre von der Geheimschrift," *Archivalische Zeitschrift*, München, 1886-1888, Vol. XI, pp. 156-189; Vol. XII, pp. 1-29; Vol. XIII, pp. 8-44. [Contains bibliographical indications interspersed throughout the studies.]

It was from these and many other sources that was extracted the material which was later organized into the items of this volume. It should be mentioned that in this work of organization, a definite effort was made in every instance to give the title of each work in its entirety, with date and place of publication, name of publisher, number of pages, and re-editions, if any. In a number of cases, as the titles were quite long and descriptive, it was felt that the necessity of adding copious explanatory comments was thereby lessened and in some instances precluded, since the descriptions by themselves permitted the reader to gain an adequate idea of the contents and even the value of the works. But in most cases there were added analytical commentaries,—commentaries which are of eclectic nature since they are in fact syntheses of widely gleaned bits of information contributed by many sources. And finally, in so far as it was possible, the analyses and commentaries were directed in such a manner that they should present mainly information which would be of the greatest value and interest to a cryptologist,—information concerning the technique and history of cryptography and its varied manifestations in the related fields.

The author of this volume wishes to take advantage of this opportunity to express his gratitude and appreciation to the many persons who have contributed to or aided in its growth and final completion: to President Franklyn Bliss Snyder of Northwestern University for his encouragement of the project; to the members of the staff of the Charles Deering Library of Northwestern University for their untiring aid in the procurement of needed material; to the staffs of the Rare Book Room of the Library of Congress and of the University of Pennsylvania for rendering their respective

collections, the Fabyan and the Mendelsohn, conveniently accessible, and for providing microfilm and photostat reproductions; to various colleagues at Northwestern University for verifying the orthographic accuracy of portions of the manuscript: Professors Joseph G. Fucilla, Frank X. Spiecker, and Joseph C. Murley; to Major Donald D. Millikin of New York University for his kindness in affording access to his bibliographical notes; to Professor John W. Spargo, Editor of the Northwestern University Studies, for his editorial suggestions and aid. To Colonel William F. Friedman I am especially grateful for his continued encouragement, counsel and general contributions.

Evanston, Illinois
December 7, 1944

J. S. G.

This volume is dedicated to
Lieutenant Colonel William F. Friedman,
Signal Reserve (Retired), Director of Communications Research,
Signal Security Agency, War Department,
as a token of appreciation for the many contributions
he has made to the science of cryptology.

A

- *A*. *Leichtfassliche Anleitung zur Geheim-Schreibekunst oder Anweisung, wie man auf ganz einfache Weise jemandem etwas schriftlich mittheilen kann, das jedem Dritten ganz und gar unverständlich ist.* Von *A*. 5. Aufl. Weissensee [1864]. pp. 7. In-8°.
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- Acme Code Co. *Acme commodity and phrase code*. San Francisco: Acme Code Co., 1923. pp. 902. In-4°.
- *Acme supplement; an addenda [sic!] to the Acme Commodity and Phrase Code, covering a modern list of banks, vessels, cities, countries, steamship lines, port tables, private code words.* . . . New York, San Francisco, 1932. pp. 112.
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- Aeneas the Tactician (Aeneas Tacticus, 4th century, B.C.). [According to Polybius, this Greek writer was the author of several treatises on the art of war; of these, the only one in existence deals with the best methods of a defense for a fortified city. In addition, it is valuable for the large number of historical illustrations which it contains. The work was published for the first time by Isaac Casaubon, in his edition of Polybius, Paris, 1609, in-fol. There are several French translations, of which the best known is that of Beausobre: *Commentaires sur la défense des places d'Aeneas le Tacticien* . . ., Amsterdam and Paris, 1757. Ch. XXXI gives information concerning processes of cipherment, besides interesting descriptions of the various stratagems employed in early days to attain secrecy of communication. In commenting on this work, Polybius says that Aeneas: "had collected together twenty different manners of writings, so as not to be understood by any but those in the secret; and that these methods were partly invented by himself and partly in use before his time." For additional information concerning Aeneas the Tactician and his works consult *Nouvelle Biographie Générale*, Vol. 1-2, p. 337, and (under Enée le Tacticien) *Biographie Universelle*, Vol. 12, pp. 459-460. See also Lange et Soudart, *Traité de cryptographie*, III, 17, 212; Locard, "Bibliographie cryptologique," p. 922.]

- Aesop (Greek fabulist, who lived in the 7th century B.C.) [According to La Fontaine: *La vie d'Ésope le phrygien* (édition Jouaust of *Les Fables*, Paris, 1842, pp. 24-25) Aesop was instrumental in revealing a treasure to his master, the philosopher Xantus, by giving him the explanation of a Greek inscription engraved on an old monument. The inscription was made up of the first letters of certain words selected in such a manner that they contained a triple meaning. For additional information concerning Aesop and his works, consult (under Ésope) *Biographie Universelle*, Vol. 13, pp. 41-42, and *Nouvelle Biographie Générale*, Vol. 15-16, pp. 392-394.
- African, Julius the (Africanus, Sextus Julius, died A.D. 232). [To this Greek historian has generally been attributed the authorship of a work of 24 books, usually known under its French title of *les Cestes*, dealing with agriculture, medicine, physics, and especially military art. The Bibliothèque Nationale, Paris, possesses a manuscript copy of the section dealing with the art of war. It was translated into French by Guischart in Vol. III of his *Mémoires critiques et historiques sur plusieurs points d'antiquités militaires*. Paris, 1774. 4 vol. In-4°. However, according to a number of modern authorities, the work is nothing more than a copy of *Commentaires sur la défense des places d'Aeneas le Tacicien*. For additional information concerning Julius the African and his works consult *Biographie Universelle*, Vol. 1, pp. 211-212, and *Nouvelle Biographie Générale*, Vol. 1-2, pp. 354-355. See also Lange et Soudart, *Traité de cryptographie*, III, 17.]
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- *Opusculi morali*. Venezia, 1568. [This work was translated into Italian and edited by Cosimo Bartoli. It contains a chapter, pp. 200-221, dealing with ciphers. See also item on Cosimo Bartoli in this volume.]
- *Alberti on deciphering*. [Translation by Charles J. Mendelsohn from Meister's *Die Geheimschrift im Dienste der päpstlichen Kurie* . . ., p. 127, line 9 to p. 133, line 21. It is contained in the Mendelsohn Collection of the University of Pennsylvania.]
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Barcelona: Por Mariano Soldevilla, 1742. pp. 443. [For biographical information consult (under Anghiera, Pietro Martire d'): *Biographie Universelle*, Vol. 1, pp. 697-698; Espasa: *Enciclopedia Universal Ilustrada*, Vol. 5, pp. 552; *Nouvelle Biographie Générale*, Vol. 1-2, pp. 654-655.]

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Anleitung zur Geheimschrift. Berlin, 1828. pp. 15. In-8°. [Contains processes of cipherment. See also Locard, "Bibliographie cryptologique," p. 911; Wagner, "Studien," Vol. XIII, p. 37.]

Anleitung, Kurze, zur Tachygraphie oder zu der Erlernung des Geschwindschreibens vermittelt einfacher Abkürzungen besonders für Studierende auf Universitäten. Mit einer Kupfertafel. Jena: Schreiber, 1814. pp. 14.

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Appier Hanzelet, Jean. *Recueil de plusieurs Machines militaires, et feux artificiels pour la guerre, & récréation; avec l'Alphabet de Trittemius, par laquelle (sic) chacun qui sçait écrire peut promptement composer congruëment en latin. Aussy le moyen d'écrire la nuit à son amy absent; de la diligence de Iean Appier, dit Hanzelet, chalcographe, et de François Thybovrel, chirurgien. Au Pont-à-Mousson, par Charles Marchant, 1620*. pet. in-4 fig. [Bound with, and immediately following the five parts which make up the *Recueil*, are the following two parts: *Methode pour écrire occultement à son amy par l'alphabet de Trittemius, par laquelle l'on peut écrire & composer congruëment en latin promptement*. . . . *Recueillie et mise en lumière par la diligence de François Thybovrel & Iean Appier, dit Hanzelet. Pont-à-Mousson: C. Marchant, 1620*.—*Methode pour écrire de nuit, à son amy absent, et luy faire concevoir son intention*. . . . *Chose tres-vtile à toutes personnes qui exercent l'art militaire: mise en lumiere, par la diligence & fraix de François Thybovrel . . . et Iean Appier, dit Hanzelet . . . Au Pont-à-Mousson, par Charles Marchant, imprimeur de son altesse, M.DC.XX*. The subjects treated in the five parts are: 1st, means of attack; 2d, means of defense; 3d, models of various war machines; 4th, "feux de guerre"; 5th, "feux de joie." Then follows the *Methode pour écrire occultement à son amy par l'alphabet de Trittemius*. . . . The method consists in the use of torches to which values of a letter have been given: thus for example, *A* is expressed by a single torch, *B* by two, *C* by three, etc. For biographical and bibliographical information concerning Appier Hanzelet and his work consult, under "Hanzelet", *Biographie Universelle*, Vol. 18, p. 426 and *Nouvelle Biographie Générale*, Vol. 23-24, pp. 315-317.]

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Argenti's work is invaluable for the study of papal ciphers. It deals with theories and processes of cipherment, methods of decipherment, and cipher keys. In summing up the value of Argenti's contributions, Meister says: "Die wichtigste von den Chiffrenarbeiten des Matteo Argenti ist unstreitig sein grosses Chiffrenbuch. Es sollte ein Familienbuch werden, aus dem spätere Mitglieder der Familie Argenti das gesamte Chiffrenwesen der Zeit Gianbattistas und besonders Matteos Argenti erkennen sollten. Das Schicksal wollte es, dass es heute einen grösseren Beruf erfüllen soll, nicht nur für Familienglieder der Argenti, sondern für uns alle ist es die wichtigste Quelle zur Erkenntnis des damaligen, besonders des päpstlichen Chiffrenwesens geworden."—*Op. cit.*, p. 65, ll. 3-10. See also Lange et Soudart, *Traité de cryptographie*, V, 34; Locard, "Bibliographie cryptologique," p. 907.]

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in cifra): "Je ne crois pas qu'il existe nulle part un traité plus complet sur l'art d'écrire en chiffres ainsi qu'une histoire plus développée de cet art. Le second chapitre, composé de soixante-neuf feuillets, est une dissertation sur la science des chiffres pour les correspondances secrètes: c'est une sorte de *grammaire*. Le troisième porte le titre de *Polisteganografia*; le quatrième, *Apogriptografia*; le cinquième traite des *chiffres invisibles*; le sixième expose les chiffres inventés par l'auteur; le septième et le huitième fournissent des exemples et traitent de l'usage et emploi des clefs pour le déchiffrement." For additional information see Lange et Soudart, *Traité de cryptographie*, V, 34; Locard, "Bibliographie cryptologique," p. 906; Meister, *Die Anfänge der modernen diplomatischen Geheimschrift*, pp. 24-25; Meister, "Zur Kenntnis des venetianischen Chiffrenwesens," pp. 329-330; Pasini, *R. Archivio di Venezia*, 1873, p. 328; Wagner, "Studien," Vol. XII, p. 10.]

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———. *Clavis diplomatica, tradens specimen veterum scripturarum, nimirum alphabeta varia, compendia scribendi medii aevi, notariorum veterum signa nonnulla curiosa, una cum alphabeto instrumenti et ab-*

*breviaturis, singula Tabulis aeneis exhibita: quibus praemittuntur introductiones necessariae, subiiciuntur scriptores rei diplomaticae aliaque ad lectionem et intelligentiam veterum codicum, chartarum et diplomatum facientia, variis annotationibus historico-literariis hinc inde additis, studio et opera. Danielis Eberhardi Baringii. Hanoverae, sumptibus Haeredum B. Nic. Försteri et filii. MDCCXXXVII. pp. 195. [For information concerning the author and his works consult *Allgemeine Deutsche Biographie*, Vol. 2, pp. 65-66 and *Biographie Universelle*, Vol. 3, p. 100. See also Giry, *Manuel de diplomatique*, p. 66; Locard, "Bibliographie cryptologique," p. 924; Prou, *Manuel de paléographie latine et française*, pp. 6, 7.]*

——— *Danielis Eberhardi Baringii Clavis diplomatica, specimina veterum scripturarum tradens, alphabeta nimirum varia, medii aevi compendia scribendi, notariorum veterum signa perplura, cet. singula tabulis aeneis expressa. Praemissa est Bibliotheca scriptorum rei diplomaticae. Iterata hac editione sic ab auctore recognita, emendata ac locupletata, ut novvum opus videri possit. Hanoverae, svmt. haer. B. N. Foersteri et filii, 1754. pp. 616. In-4°. [Stresses processes of cipherment and bibliographical information. See also Locard, "Bibliographie cryptologique," p. 925.]*

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* "My article says Blair first published in 1802, and hence Gage's work could well be 1809."—William F. Friedman.

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Biographie Universelle, Vol. 8, p. 584 and *Nouvelle Biographie Générale*, Vol. 11-12, pp. 149-150. See also Carmona, *Tratado de criptografía*, pp. 81-82, 174; Dröscher, *Die Methoden der Geheimschriften* . . . , IX, 26; Klüber, *Kryptographik*, p. 15; Lange et Soudart, *Traité de cryptographie*, IV; Locard, "Bibliographie cryptologique," p. 906; Meister, *Die Geheimschrift im Dienste der päpstlichen Kurie* . . . , pp. 102, 107; Wagner, "Studien," Vol. XI, p. 173; Vol. XII, pp. 20-22.]

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of the University of Pennsylvania has a negative photostat reproduction of leaves 105-109 of the Library of Congress copy. These contain the portion dealing with ciphers. For biographical information concerning Fernández consult *Biographie Universelle*, Vol. 13, pp. 592-593 and *Nouvelle Biographie Générale*, Vol. 17-18, p. 473.]

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Ziffern, Noten, Punkte, mathematische und andere Figuren, Neb- und Stickwerk, Kräuter- und Blumenbüsche, Schildereien, Spielkarten, Fabnen, Feuer und Fackeln, Glocken und andere Stimmarten, selbst erdichtete Sprachen, verblümete Discourse, Augenwinken, unverdächtige Briefe, die etwas andere ausdrücklich als heimlich melden; auch sonsten durch gewisse zubereitete Säfte, und viel andere Dinge mehr, nabe und ferne, bei Tage und in der Nacht, seine Meinung gewissen Personen ganz verborgener Weise kann zu verstehen geben, entdecket von Johannes Balthasar Friderici Lipsiens. Hamburg, Gedruckt bei Georg Rebenlein in Verlegung des Autoris Anno 1685. pp. 280. In-4° [There appears to be considerable diversity of opinion concerning the date and place of publication of this work: Carmona gives both Amsterdam, 1680, and Hamburg, 1684; Gioppi, Kerckhoffs, and Riverbank list give Leipzig, 1685; Bailey indicates Hamburg, 1684; Klüber merely gives the date as 1684; and the Mendelsohn Collection of the University of Pennsylvania and the Fabyan Collection of the Library of Congress each has a copy indicating Hamburg, Georg Rebenlein, 1684 and 1685. Another edition appeared at Hamburg, 1735. pp. 280. In-4°. Friderici's work is especially important for its lists of the various processes of cipherment and information concerning the art of deciphering. "Ouvrage curieux et plus complet que tout ce qui avait été publié jusqu'alors sur les écritures secrètes. Quoiqu'il y ait encore quelques rêveries tirées des alphabets cabalistiques de Trithème, on y voit des procédés ingénieux et peu connus; mais la plupart de ceux qu'il indique sont trop compliqués. Il donne ensuite les vrais principes de l'art de déchiffrer, mais d'une manière trop peu développée. Breithaupt est le premier qui les ait donnés avec un détail satisfaisant, dans son *Ars deciffratoria*.—*Biographie Universelle*, Vol. 15, p. 190. See also Carmona, *Tratado de criptografía*, pp. 138, 175; Klüber, *Kryptographik*, pp. 5, 6; Lange et Soudart, *Traité de cryptographie*, VI, 41; Locard, "Bibliographie cryptologique," p. 909; Wagner, "Studien," Vol. XIII, p. 26.]

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- De geheime schrijfkunst of briefwisseling, dat is, de kunst, om elkanderen alles, wat men wil, in allerhande taalen te schrijven, zonder dat een derde, al verstaat hij de kunst ook, ooit kan ontraadzelen, wat men elkanderen geschreeven heeft, nieuw uitgevenden, duidelijk ontvouwd en ten algemeenen nutte bekend gemaakt, door een geöeffend liefhebber*. Rotterdam: J. Bronkhorst, C. Van Wolfsbergen . . . n. d. pp. 60.
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& linguis clam, apertè; obscurè, & dilucidè scribere & respondere posse docetur, & demonstratur. In III. syntagma distributa in principum gratiam ac recreationem inuenta & in lucem edita. Felicibus auspicijs Leopoldi I. Rom. Imperat. semper Augusti. Romæ, ex typographia Varesij. MDCLXIII Superiorum permissu. Appendix apologetica ad Polygraphiam nouam in qua cryptologia trithemiana discutitur, & arcana paradoxa à trithemio proposita, ad veritatem examinata, partim approbantur, partim tanquam superstitionosa confutantur. pp. 148, 23. (Another edition appeared at Amsterdam, 1680. In-fol.). [The majority of authorities consider this work, which stresses processes of cipherment and codes, to be based more or less upon that of Trithem. Lange and Soudart detect an additional influence,—that of Vigenère. According to them Kircher "a transformé Vigenère en remplaçant les alphabets littéraux par des alphabets numériques . . . Inventeur d'un cryptographe: l'Arca glottotactica . . . Le système du Père Kircher est aujourd'hui abandonné." The work is summarised as follows in *Biographie Universelle*, Vol. 21, p. 645; "Cet ouvrage, fort curieux, est divisé en trois essais: le premier offre une pasigraphie, ou écriture universelle, que chacun peut lire dans sa langue. Le principe d'où il part est un dictionnaire numéroté, tel que Becher l'avait proposé sans l'exécuter. Kircher l'exécute en petit sur cinq langues (le latin, l'italien, le français, l'espagnol et l'allemand). Son vocabulaire a environ seize cents mots; les formes variables des noms et des verbes sont exprimées par des signes de convention. Le second essai donne une stéganographie plus ingénieuse que celle de Trithem; et le troisième, une boîte ou bureau stéganographique, pour écrire ou lire très-promptement un chiffre indéchiffrable." For additional information concerning Kircher and his works consult: *Allgemeine Deutsche Biographie*, Vol. 16, pp. 1-4; *Biographie Universelle*, Vol. 21, pp. 642-646; *Nouvelle Biographie Générale*, Vol. 27-28, pp. 769-776. Also see Carmona, *Tratado de criptografía*, pp. 62, 175; Dröscher, *Die Methoden der Geheimschriften*. . . ., IX, 33, 34; Lange et Soudart, *Traité de cryptographie*, VI, 47, 214, 245; Locard, "Bibliographie cryptologique," p. 909; Wagner, "Studien," Vol. XI, pp. 178-181; Vol. XIII, pp. 24-25.]

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in-fol; Estrasburgo, 1602; Argentorati, 1603, 1606. Dröschler gives 1616, n.p.) [This celebrated work is of encyclopedic nature. Book I deals with the cryptographic knowledge of the ancients; Book II gives 180 examples of the ciphers of his period; Book III is a treatise on deciphering. (Argenti states in his own treatise that he drew generously upon Porta's work.); Book IV contains very useful tables of various combinations of syllables and words. The importance and value of the contributions of this mathematician of Naples, inventor of the *camera obscura*, have been commented upon by many of the most noted workers in the field of cryptography: "Fondateur, avec Vigenère, de la cryptographie moderne. A perfectionné les systèmes de substitution simple et inventé la substitution double." — Lange et Soudart; "Le premier traité de cryptographie où il soit question de principes de déchiffrement est dû à Porta." — Kerckhoffs; "Portas Buch hat eine grosse Verbreitung und wiederholte Auflagen erlebt, ja sogar auch unberechtigter Nachdruck, ein offenkundiges Plagiat ist an ihm verübt worden, so sehr wurde es begehrt. Daraus ist der Einfluss Portas auf die Entwicklung der Kryptographie zu ermessen." — Meister. For additional information concerning Porta and his works consult: *Biographie Universelle*, Vol. 34, pp. 124-126; *Nouvelle Biographie Générale*, Vol. 39-40, pp. 842-843. See also Carmona, *Tratado de criptografía*, pp. 7, 59-60, 174; Dröschler, *Die Methoden der Geheimschriften*. . . , IX, 4, 10; Klüber, *Kryptographik*, p. 11; Lange et Soudart, *Traité de cryptographie*, V, 2, 19, 27-28, 213; Locard, "Bibliographie cryptologique," p. 906; Meister, *Die Geheimschrift im Dienste der päpstlichen Kurie*. . . , pp. 44-45; Pratt, *Secret and urgent*, pp. 118-119, 142, 164; Prou, *Manuel de paléographie latine et française*, p. 81; Wagner, "Studien," Vol. XI, p. 174; Vol. XII, pp. 14-18.]

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Edward Stafford in 1586; in all of which arbitrary marks are introduced." Consult the *Dictionary of National Biography*, Vol. XLVII, pp. 397-398 for biographical and bibliographical information concerning Rees. See also Lange et Soudart, *Traité de cryptographie*, VII; Locard, "Bibliographie cryptologique," p. 911; items in this volume under William Blair and Michael Gage; Wimsatt, "What Poe knew about cryptography," *Publications of the Modern Language Association of America*, New York, Sept. 1943, Vol. LVIII, No. 3, pp. 771-775.]

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Noribergense is: Resene Gibronte Runeclus Hanedi, and that he is known also by the name: Janus Hercules de Sunde. His work is valuable for the information it gives concerning the history of cryptography, processes of cipherment, methods of deciphering, and bibliographical indications. For information concerning Schwenter and his works consult *Allgemeine Deutsche Biographie*, Vol. 33, pp. 413-414. See also Carmona, *Tratado de criptografía*, p. 174; Dröscher, *Die Methoden der Geheimschriften . . .*, IX, 19, 45, 59; Klüber, *Kryptographik*, pp. 6-7, 14; Lange et Soudart, *Traité de cryptographie*, VI, 45; Locard, "Bibliographie cryptologique," p. 908; Wagner, "Studien," Vol. XIII, pp. 12-16.]

— *Steganologia & steganographia aucta. Geheime, magische, natürliche, Red und Schreibkunst; auff vielfältigs begehren guter Freunde, Auff neue revidirt, an etlichen orten corrigirt, was verborgen geschrieben detegirt, mit schönen und wunderlichen Künsten, der Steganologiae unnd Steganographiae zugethan, augirt und dann zum drittenmal in Truck verfertiget. Durch Janum Herculeum de Sunde, sonst Resene Gibronte Runeclusam Hanidem, der Magiae naturalis besondern Liebhabern. Nürnberg, In verlegung Jeremiae Duemlers. (ca. 1620). pp. 370. In-8°.*

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Davidis Solbrigii, soc. reg. scient. Boruss. Berlinens membri. Soltquellae vet. March. Typis Schusterianis a. MDCCXXVI. In-8°. [Wagner states in his "Studien," Vol. XIII, p. 42: "Davon erschien auch die pars II und eine deutsche Ausgabe noch in demselben Jahre." This work is likewise mentioned by Carmona (who however gives Frankfort as the place of publication), Klüber, Lacroix, and Lange et Soudart (who give the date as of 1756). See also Klüber, *Kryptographik*, p. 12.]

— *Allgemeine schrift, das ist: eine art durch ziffern zu schreiben, vermitteltst deren alle nationen bey welchen nur einige weise zu schreiben im gebrauch ist, ohne wissenschaft der sprachen, von allen dingen ihre meynungen einander mittheilen können. Der erste theil zum lesen, nebst nöthiger einleitung, exempeln und schlüssel, für die teutsche nation. Durch David Solbrig. . . Saltzwedel, druckts Christian Schuster, 1726.* 7 leaves, 55 [1], 236p., 1 leaf, 16p., 540 numb. col. [4]p. front. fold. table. ["Des allgemeinen A, B, C, teutscher schlüssel zum lesen, zum gebrauch der Allgemeinen schrift": 236p., 1 leaf. "Schlüssel des zweyten theils der Allgemeinen schrift, zum concipiren oder schreiben. Für die teutsche nation" (with separate t.-p.): 16 p. "Schlüssel der teutschen sprache zum concipiren der Allgemeinen schrift": 540 numb. cols. Some lists, as for example Carmona, Klüber and Lange et Soudart, give Coburg, 1736. In his "Studien," Vol. XIII, p. 42, Wagner states: "Es handelt sich aber in allen diesen Werken ausschliesslich um Pasi-graphie, nicht um Kryptographie."]

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March 27, 1500, the second, April 20 of the same year, "Dann war er bekanntlich in den Verdacht der Zauberei geraten, und so hatte er die Arbeit mit dem dritten Buche abgebrochen, das keinen Termin des Abschlusses mehr angibt . . .". The earliest date of publication is indicated by David Clément (*Bibl. cur.*, p. 94), who mentions the existence of two very rare volumes, in-8°, which appeared in 1531, in Lyon. This date is likewise given by Carmona, Larousse: *Grand Dictionnaire Universel, La Grande Encyclopédie*, etc. The *Encyclopaedia Britannica* mentions an edition, Lyon, 1551, but later refers to the 1606 edition; Carmona refers to an edition, London, 1603. Furthermore, a certain amount of confusion exists in some of the lists because of their failure to differentiate between the editions of the *Polygraphia* and those of the *Steganographia*; in fact, it is stated in some that the *Polygraphia* was reprinted under the title of *Steganographia*. For example, *La Grande Encyclopédie* indicates the following editions for the two works: 1518, 1531, 1550, 1564, 1571, 1600, 1606, 1613, etc. However, the editions generally indicated for the *Steganographia* are those of the 17th century: Frankfort, 1606, 1608; Darmstadt, 1606, 1621; Cologne, 1631, 1635. In addition, Todd cites an edition, Nuremberg, 1721. (It should be noted that copies of several of the early editions of the *Steganographia* are accessible in American libraries: 1606 Frankfort edition, in New York Public Library and University of Michigan Library; 1606 Darmstadt edition, in University of Chicago Library; 1608 Frankfort edition, in New York Public Library and Yale University Library; 1621 Darmstadt edition, in Cornell University Library; 1721 Nuremberg edition, in Johns Hopkins Library. The Library of Congress possesses the following editions: 1606 Darmstadt; 1606 Frankfort; 1621 Darmstadt; 1635 Cologne; 1721 Nuremberg.)

Book I contains a list of 31 kinds of ciphers, Book II, 24, while Book III is devoted to other matters. Tritheim suggests various ways in which secrecy may be attained, as for example, by making the first and last words meaningless, or in other cases by using the first, third, fifth, etc., or the second, fourth, etc. The remaining words result in a composition which will contain the desired concealed message.

The strange and bizarre terms and characters which Tritheim interspersed throughout the composition of the work soon caused him to be suspected of dealing in the black art. It is recorded that Charles de Bouelles came to this conclusion while examining the manuscript of the work, and that shortly afterwards he succeeded in influencing Frederick II, known as the Wise, to deliver over to the flames a copy which his library contained. This suspicion continued all during the course of the 16th century, as is evidenced by the many allusions to it in the writings of that period. However, a number of more judiciously-minded readers of the work now came to the belief that Tritheim had done nothing more serious than to use the conventionalised language of the magicians

in, as Meister aptly terms it, a spirit of *kindische Spielerei*, and they therefore undertook to vindicate the author of the charges. Among the more noted of these apologists of Tritheim are: Sigmund Dullinger, abbot of the monastery of Seon, in his *Trithemius sui ipsius vindex . . . Ingolstadii*, 1616; Gustavus Selenus, in his *Cryptomenytices . . . Lunæburgi*, 1624; Jean Caramuel, in his *Steganographiæ . . . Coloniae Agrippinæ*, 1635; Wolfgang Ernest Heidel, in his *Steganographiæ Trithemianæ vindicatio et illustratio . . . Norimbergæ*, 1721; Daniel Georg Morhof, in his *Polyhistor . . . Lubicæ*, 1688, etc.

For additional information concerning the life and works of Tritheim consult: *Allgemeine Deutsche Biographie*, Vol. 38, pp. 626-630; *Nouvelle Biographie Générale*, Vol. 45-46, pp. 644-647; *Biographie Universelle*, Vol. 42, pp. 178-183; Isidoro Silbernagel, *Johannes Trithemius, eine Monographie*; W. Schneegans, *Abt Johannes Trithemius und Kloster Spanheim*. See also Carmona, *Tratado de criptografía*, pp. 8, 58, 59, 60, 61 *et passim*, 173; Lange et Soudart, *Traité de cryptographie*, IV, 21, 24, 25, 71, 290-291; Locard, "Bibliographie cryptologique," p. 907; Meister, *Die Geheimschrift im Dienste der päpstlichen Kurie . . .*, pp. 38-39; Pratt, *Secret and urgent*, pp. 43, 61-62, 121; Wagner, "Studien," Vol. XI, pp. 160-170.]

——— *Polygraphiæ libri sex, Ioannis Trithemii abbatis Peapolitani, quondam Spanheimensis, ad Maximilianvm Caesarem. Impressum aere ac impensis integerrimi bibliopolæ Joannis Haselbergi de Aia Constantiensis dioecesis, anno MDXVIII Mense Iulio.* 300 leaves. petit in-folio. (Other editions: Frankfort, 1550; Cologne, 1564, 1571, 1671, 1676, 1721; Argentorati, 1613; Strassbourg, 1600, 1613, 1621, 1637. Copies of several of the early editions of the *Polygraphia* are accessible in American libraries: 1550 Frankfort edition, in New York Public Library; 1564 Cologne edition, in Newberry Library, University of Chicago Library, and University of Michigan Library; 1600 Argentorati edition, in Yale University Library; 1613 Argentorati edition, in New York Public Library. The Library of Congress possesses the following editions: 1518 Oppenheim; 1550 Frankfort; 1564 Cologne; 1571 Cologne; 1600 Argentorati.) There is considerable disagreement concerning the date of the first edition: Bailey, in the *Encyclopaedia Britannica*, and Klüber, in his *Kryptographik*, p. 15, give 1500; Gioppi indicates Paris, 1508; Kerckhoffs gives 1508 "d'après la préface"; and Meister states in his *Die Geheimschrift im Dienste der päpstlichen Kurie . . .*, p. 38, that Tritheim had ceased his cryptographic studies on the *Steganographia* after being accused of dealing in magic, but "Nach einigen Jahren war er wieder auf seine kryptographischen Studien zurückgekommen und hatte im Jahre 1508 seine *Polygraphia* zum Abschluss gebracht . . ." But in view of the suspicion and charges which the composition of his earlier volume, the *Steganographia*, had occasioned, it is readily understandable that the author must have exerted every care and effort to

prevent any semblance of cabalistic tinge from creeping into the pages of his new work.

Book I of the *Polygraphia* consists of 382 alphabets of 24 Latin words each, corresponding to each of the letters of the alphabet, and Book II contains 306 similar alphabets. As the words composing each alphabet have approximately the same meaning: (1st alphabet) *Deus, creator, conditor*, etc.; (2d alphabet) *clemens, pius*, etc., by taking the appropriate one from each alphabet, a person could form a phrase or a sentence which would not arouse any suspicion in transmission. To obtain the secret meaning from the message, all the correspondent had to do was to take down the letters corresponding to each word used. For example, the phrase *conditor clemens discernens mundana* would be deciphered as the word *cave* (*conditor* being *c* of the 1st alphabet; *clemens*, *a* of the 2d alphabet; *discernens*, *v* of the 3d alphabet; and *mundana*, *e* of the 4th alphabet).* Book III contains 132 alphabets of words invented in such a way that a message written by means of them would give an uninitiated person the impression that it was in a foreign language. Book IV contains 118 alphabets of variously-invented words. Book V contains a number of alphabets, and deals with methods of enciphering by means of the transposition of letters. Book VI contains several alphabets of allegedly ancient writing characters which Tritheim offered as material for anyone who wished to create his own secret alphabet.

This celebrated work was translated into French by Gabriel de Collange under the title: *Polygraphie et universelle écriture cabalistique de M. I. TritHEME abbé. Paris, 1561*. In 1620, Dominique de Hottinga, a Frisian, perpetrated one of the world's most famous plagiarisms, by publishing Collange's work, likewise in French, but under his own name, and in addition with a preface in which he had the audacity to state how arduous the task of composing the work had been,—and he did not make any mention whatsoever of Collange or even of Tritheim.

It should be noted also that Tritheim was not only the first author to have written a comprehensive dissertation on cryptography, the *Polygraphia*, a work which became the basis upon which many later writers have worked, but in addition he possessed such a good knowledge of Tyronian notes that Dom Tassin and Dom Toustain, the authors of the *Nouveau Traité de Diplomatique* (T. 2, p. 126, and T. 3, p. 150) felt called upon to attribute to him the honor of having been the first to have published and to have interpreted some of these notes. For additional information concerning Tritheim and his works consult the list given under the *Steganographia* item, and in addition Klüber, *Kryptographik*, p. 15; Lange et Soudart, *Traité de cryptographie*, IV,

* "I haven't tried this myself but one of my associates, a Latin scholar, tried to compose a message of practical importance by this method and reported dismal failure!" —William F. Friedman.

- 21, 24; Locard, "Bibliographie cryptologique," p. 905; Prou, *Manuel de paléographie latine et française*, pp. 48, 81.]
- *Polygraphiæ libri sex, Ioannis Trithemii Abbatis Peapolitani, quondam Spanheimensis, ad Maximilianum Cæsarem. Accessit clavis Polygraphiæ liber unus eodem authore . . . Additæ sunt etiam aliquot Locorum Explicationes, eorum præsertim in quibus admirandi operis Steganographiæ principia latent, quæ ingeniosis occasionem præbent, longè maiora & subtiliora inueniendi. Per . . . Adolphum à Glavburg . . . Francoforti: ex officina Cyriaci Iacobi, 1550.* pp. 280. In-4°.
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- Uken, Melchias. *Anweisung zum Dechiffiren, oder die Kunst, verborgene Schriften aufzulösen*. Helmstädt: Bey Christian Friedrich Weygand, 1755. pp. 62. In-8°. [An interesting study dealing with methods of decipherment and the history of cryptography. Curiously, it has received various attributions of authorship in the different lists: anonymous, in the Klüber, Lange et Soudart, Locard and Wagner lists; a number of other lists attribute it to Johann Friedrich Hähn. See also Carmona, *Tratado de criptografia*, p. 177; Klüber, *Kryptographik*, p. 4; Lange et Soudart, *Traité de cryptographie*, XIV; Locard, "Bibliographie cryptologique," p. 910; Wagner, "Studien," Vol. XIII, p. 31.]
- *Steganometrographia; sive, Artificium novum et inauditum, quo quilibet, etiam latinae linguae et poëseos ignavus soliusque maternae linguae beneficio instructus, epistolam latino aut germanico et quidem elegiaco carmine scribere potest . . . , cum Geomantia metrica. Utrumque artificium spatio horae dimidia addisci potest. Authore Melchia Uken . . . Francofurti et Lipsiae, apud Joan. Frider. Gaum, bibliopol., Ulm., 1751. xx, 308p. In-8° (Another edition, Ulm, 1759.)* ["Steganometrographiae supplementum," pp. 89-214, and "Geomantia metrica," pp. 215-308, have separate title-pages with vignettes. This work was translated into German under the title: *Steganographie, Geheimschreibkundst in Versen . . . Ulm, 1759*. It deals especially with processes of cipherment. See also Carmona, *Tratado de criptografia*, pp. 176-177; Klüber, *Kryptographik*, p. 17; Lange et Soudart, *Traité de cryptographie*, XIV; Locard, "Bibliographie cryptologique," p. 910; Wagner, "Studien," Vol. XIII, p. 42.]
- . . . *Geheimschreibkundst in Versen, dadurch ein jeder, der auch die lateinische Sprache und Dichtkundst nicht versteht, allein durch Hilfe seiner Muttersprache einen lateinischen oder deutschen Brief, und zwar in einem elegiaschen Gedichte schreiben, und einem abwesenden die geheimen gedanken seines herzens . . . offenbaren kann . . . Nebst einer neuen Punctirkundst in Versen. In Ulm, Auf Kosten der Gaumischen Handlung, 1759. 31 leaves. In-8°.*
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- "Un initié. Mystères des sciences occultes." Paris, 1890, pp. 215-232. [Contains processes of cipherment. See also Locard, "Bibliographie cryptologique," p. 929.]
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- U. S. General Staff. *Manual of cryptography. Prepared by the General Staff, War Office . . .* London, 1914? pp. 96. ["List of works consulted," p. 2.]
- U. S. Signal Corps. Office of the Chief Signal Officer. *Signal Book, U. S. Army, 1912, 1914, 1916 . . .* [Signalling of various kinds, and chapter on telegraph code books and ciphers, cipher disk, operator's cipher, route cipher, etc.]
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* "Credit for the invention of the principle now known as the Wheatstone (where a sequence of n characters is slid against another sequence of $n + m$ characters) really belongs to an American, Decius Wadsworth, an associate of Eli Whitney. In 1819 Wadsworth constructed a beautiful model of a cryptograph based on this principle. The model belongs to the Hampden Historical Society of Hampden, Conn., and is now on temporary loan to the War Department."—Note by William F. Friedman.

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Author's Note.—The author regrets to state that he was unable to verify completely the bibliographical details in the items under: Ammon, Chanidzé, Kryha, Norway, Phillip, Robinson, Schmidt, and Wilmers.

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