

TOP SECRET~~ULTRA~~

FOREWARD TO ENIGMA SERIES

CRYPTANALYTIC RESEARCH PAPERS

This series consists of original memoranda written by members of the cryptanalytic research section of the U.S. Naval Communications Intelligence Staff, and by others working with the research group. A brief description of the contents of each paper is given in the Index to each volume. While an effort toward completeness has been made, the reader is referred for greater detail to the various R.I.P.'s put out by the Atlantic Operations Department, especially R.I.P. 450. There he will also find polished techniques, which appear in this Series of their original form.

The name of the author and the date of the paper are also given in the Index, which lends an historical flavor to the Series. The Editor feels that there is considerable merit in an anthology of this sort, full of original ideas both good and bad, which supplements the finished publication. It should be further emphasized that R.I.P. 450 is concerned mainly with the techniques themselves, while this Series considers the cryptanalytic or mathematical theories which underly the techniques. On the other hand, machine research (from an engineering point of view) is not covered in this Series.

Some of the papers of this Series are expository, but most represent original work. It must always be borne in mind that we owe to the British the basic solution of the enigma, and many of the basic subsidiary techniques, together with the underlying mechanical and mathematical theories. Much of what we call "original" is only a retracing of steps previously taken by the British, and the Editor has striven to point this out in the Index. But there is also a great deal that extends or improves British methods, and some that strikes out in new directions.

It must be pointed out that the author of a paper may be entitled to credit only for his literary toil. Our group of eight or ten men worked as a team, and an assignment of "credit" would be as difficult as it is undersirable. In this line of endeavor, a chance remark may be worth a week's work.

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The E-Series consists of the following volumes, this one being marked by a star.

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PL-11

The E-Series consists of the following volumes, this one being marked by a star.

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Article 1. <u>Enigma Machine.</u> Greenwood, 13 November 1943.	1
An introduction to the principal features of the machine.	
○ Article 2. <u>Recovery of the Grundstellung.</u> Greenwood, 1 February 1943.	8
This paper describes the basic "click" process which is used to find the setting of a message from a short crib, when the Stecker is known. As an example, two messages are set, and then the Grundstellung is recovered by the same process from the resulting two four-letter cribs. For a brief account of the indicator system, of which the Grundstellung is a part, see Volume 2, Article 1.	
○ Article 3. <u>The Number of Stories Expected From the Click Process.</u> Howard & Clifford, 13 October 1942.	22
The click process is described in detail, and the number of chance answers is computed for every crib length up to ten. These answers are broken down according to the click pattern in poker-hand fashion. Mr. Turing of G.C.C.S., England, pointed out that these calculations could be simplified by means of a recursion formula, although the full poker-hand breakdown is lost (see Volume 6, Article 4-C).	
○ Article 4. <u>Click Probabilities at Correct Position.</u> Howard, October 1942.	45
The probability of each click pattern is given for a crib up to ten letters in correct position. Mr. Turing's remark holds here as well as for Article 3.	
Article 5. <u>Notes on "Click" Process.</u> Menzel, 27 February 1943.	53
A reversal of the usual process, which enables one to drag a crib through a message without having to reload the click board.	

Editor's Note: Frequently a good crib may exist for a message, but may occur anywhere in it. It must therefore be

tried at every possible position, which is very tedious using the ordinary click process. The British solution is embodied in their "Click Machine". The American solution is embodied in HYPO, which is based on a statistical solution, and is preferable for fairly long messages since no crib is needed (see Volume 3, Articles 2-5). Articles 5, 6, and 8 are concerned with methods for crib-dragging. Regarding Article 8, Medusa itself was not built, but it stimulated the construction of the Drag Grenade.

Article 6. Dragging a Certain Crib Through a Long Message Where Wheel Order and Stecker Are Known.

Ely & Cramer, Spring 1943. 58

The crib and cipher text are stripped through each of the 26 possible positions of the fast wheel, and compared for symmetry. This would be quite easy to do at the present time (1 June 1945) using either the NC-5 or Tessie (rigged for symmetric sequences); in fact the former is being used for such a job on the T-machine.

Article 7. Location of Basic Setting After Successful Bombe Solution.

Howard, 21 August 1942. 64

This article contains the original grenade idea, equivalent to the British "eel".

Article 8. Enigma Drag Machine (Medusa).

Moise, 11 October 1944. 67

This proposes a machine to try simultaneously, by means of two relay matrices, every possible position in a message for a four-letter crib with Stecker known.

