

SRH-321

REPORT OF CODE COMPILATION SECTION

GENERAL HEADQUARTERS

AMERICAN EXPEDITIONARY FORCES

DECEMBER 1917 - NOVEMBER 1918

DECLASSIFIED per E. O. 11652
by Director, NSA

4 Date: 21 November 1973

Confidential

Register No. 130

WAR DEPARTMENT
OFFICE OF THE CHIEF SIGNAL OFFICER
WASHINGTON

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TECHNICAL PAPER
OF THE
SIGNAL INTELLIGENCE SECTION
WAR PLANS AND TRAINING DIVISION



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1935

Page (ii) blank and unnumbered
in original copy

FOREWORD

The report contained herein was prepared by Capt. Howard R. Barnes, S.C., in March 1919, when he was Chief of the Code Compilation Section, which was under the Chief Signal Officer, American Expeditionary Forces. No changes, additions, or deletions have been made therein. This report merits careful study by signal intelligence personnel.

WILLIAM F. FRIEDMAN, *Cryptanalyst,*
Chief of Signal Intelligence Section,
War Plans and Training Division,
Office of the Chief Signal Officer.

JUNE 25, 1934.

AMERICAN EXPEDITIONARY FORCES,

April 1, 1919.

From: Capt. H. R. Barnes, S.C.

To: Chief Signal Officer, American E. F.

Subject: Report of Code Compilation Section for the period December 1917 to November 1918.

1. The accompanying report represents the result of notes taken in this Section during the period of hostilities and is an earnest endeavor to set forth the mistakes made by this Section as well as by the Army in the construction and use of codes.

2. It further represents certain notes on code work in the British, French, and German Armies.

3. In its conclusion it sets forth suggestions and recommendations for the general betterment of the service, and it is earnestly recommended that careful consideration be given to the errors made in order that the future may profit by the experience of the past.

4. This report has been seen in its rough draft by Colonel Hitt, Colonel Truesdell, Colonel Cowan, Lieutenant Colonel Sanger, and Lieutenant Colonel Albright.

5. The work of the Section since the armistice has not been touched upon but is covered by a supplementary report of April 1.

H. R. BARNES,
Captain, Signal Corps.

REPORT OF THE CODE COMPILATION SECTION, GENERAL HEADQUARTERS, AMERICAN EXPEDITIONARY FORCES, FRANCE

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INTRODUCTION

Codes and ciphers are used in an army for the purpose of affording a secret means of communication between the various units which constitute an army and between these units and headquarters. It is an established fact that all codes and ciphers can be kept secret but for a certain length of time. Therefore, it is imperative that the men actually using the codes should follow closely the rules and regulations prescribed for the handling of messages in code.

Two methods of compiling codes presented themselves: First, to construct a code book containing words and phrases in common use and supplement it by a series of distorted alphabets and cipher keys which could be rapidly distributed to organizations in the event of the capture of a code book; second, to take away from the front area and place upon General Headquarters the burden of distortion and substitution by the printing and distributing of new code books at frequent intervals.

The first method imposes upon the front-line code men the double duty of putting up a message in code and changing it by the use of a cipher table. In view of the fact that code work is frequently done under heavy bombardment and gas or in the critical moments of an advance, it does not seem advisable to add any additional burdens to code operators.

The second method, by avoiding the use of the cipher tables, does away with this double encipherment and puts upon Headquarters the work of double encipherment which is accomplished by the reissuance of editions of code books compiled in the comparative quiet of the back area under more or less normal conditions.

The trench codes used during the War required but one operation—that is, the location of the word or phrase under its alphabetical arrangement and the setting down of the letter or number equivalent. The process of receiving consisted simply in the reverse of this operation and the location of the group in the decoding section which gave its word or phrase equivalent.

Throughout the War the French adhered to their original system of double encipherment. The Germans modified their codes from time to time in view of their own experience or by adopt

ing suggestions of value from captured enemy codes. The next issue of the German trench code appearing after the capture of an American code contained certain modifications of plan which they had adapted to their own use, and on another occasion they made further modifications after capturing another. The English, who adhered to their original plan until the appearance of the American codes, at the time of the armistice were completing plans to change over entirely from the double ciphering to the American method of reprinting entire books. It would seem, therefore, that the American method was well received by the armies engaged and was, moreover, sound in principle.

It must be borne in mind that at the commencement of the war no permanent experienced organization existed in the American Army either for the building up or the breaking down of codes. For some time after the opening of hostilities it was generally believed that the use of a cipher key rendered a code message very difficult of decipherment by the enemy. For that reason all armies used that system as a base for their codes. Later it was discovered that the system was very weak and rapid in solution.

One safe method of protecting the secrecy of messages seems to consist in the repeated changing of the cipher tables in the same message but this method makes for much confusion both in sending and receiving because of its complexity and the inexperience of code men. This inexperience is sufficient to nullify the best of code systems by the errors which occur at critical times due to excitement or incompetency.

The best and most practicable method seems to lie in providing a system which is simple of operation, comprehensive enough to provide a good working vocabulary, and changed entirely in its code equivalents at frequent intervals. It was upon this basis that the codes for the American Army were constructed.

When the Code Compilation Section was organized in December 1917, it consisted of a captain, three second lieutenants, and one corporal. These men were assigned to duty at General Headquarters, American Expeditionary Forces, and began the task of compiling codes for the Army in the field.

Organization.—The data on the subject of codes was most limited in scope. Previous to this war the United States Army had never had a "code book", properly so-called, for field service, and had had recourse to the cipher disk or short-lived emergency codes. Moreover, the Army was confronted with a foe who had profited not only by their own experiences of three years but the mistakes of the Allies which they had observed through their interception of wireless messages and the information gained from captured code books. At first the British and French were rather reluctant to disclose the systems which they had adopted for their codes, but eventually copies of obsolete editions were turned over to this section for reference and study. With this meager data the compilation of a front-line code was begun. The fundamental principle upon which the books were founded was a complexity sufficient to delay solution with a simplicity sufficient to afford ease of operation.

First American Trench Code.—The first American Trench Code, a small book consisting of some 1,600 words and phrases, was intended for distribution down to and including companies actually in line. Accompanying it were certain tables containing a distorted alphabet. It was proposed to change these tables at frequent intervals and thus delay the solution of intercepted messages. This trench code was never in fact actually delivered to the front line, and went no further down than regimental headquarters because of the danger of capture. An edition of 1,000 was printed. This book was about 4½" by 7" and could easily be slipped into a breast pocket. The 3-letter group system was adopted with an alternative 4-number series. Following is a sample page:

27-Z

- 01 AB..... Was not
- 02 AC..... Watch
- 03 AD..... Water
- 04 AF..... Wave (s)
- 05 AG..... Way
- 06 AK..... We
- 07 AL..... We are about to advance, lengthen range
- 08 AM..... We are held up
- 09 AN..... We are in need of
- 10 AP..... We are losing heavily
- 11 AR..... We are surrounded
- 12 AS..... We attack
- 13 AT..... We cannot
- 14 AV..... We have withdrawn
- 15 AW..... We hold the line
- 16 AZ..... Weak
- 17 EB..... Wear
- 18 EC..... Weather
- 19 ED..... Weather conditions
- 20 EF..... Well
- 21 EG..... Went
- 22 EH..... Were
- 23 EK..... Were not
- 24 EL..... West
- 25 EM..... Westerly
- 26 EN..... Wet
- 27 EP..... What
- 28 ER..... What is the approximate velocity of wind?
- 29 ES..... What is exact range of objective?
- 30 ET..... What is position (of)?
- 31 EV..... What is the situation (at)?
- 32 EW..... When
- 33 EZ..... When shall we be relieved?
- 34 IB..... When will barrage begin?
- 35 IC..... Where
- 36 ID..... Where is your headquarters?
- 37 IF..... Whether
- 38 IG..... Which
- 39 IH..... While
- 40 IK..... White
- 41 IL..... Who
- 42 IM..... Whole
- 43 IN..... Why
- 44 IP..... Wide
- 45 IR..... Width
- 46 IS..... Will
- 47 IT..... Will be
- 48 IV..... Will have
- 49 IW..... Will he
- 50 IZ..... Will I

It will be noted that the numbers and letters precede the word or phrase as:

"(27)01 (Z)AB.....Was not"

It was believed that this method would facilitate operation but later when longer phrases began to creep in the code group was added to the word or phrase as:

"Abandon second line.....CIC"

It was found that the mind received a more indelible impression in this way than by reverting to the beginning of the line. This was a matter of opinion and the system was not adopted by the British or French. It also made it difficult if not impossible to adopt the French system be of using both figure and number groups as was so frequently suggested.

In the margin of alternate pages, for convenience in spelling, the syllables "ed", "ing", "ly", and "ment" were printed. The book was arranged with 50 lines to a page. The master letter and number appeared at the top of each page. Thus the phrase "activity of artillery" would be coded "CIV" or "1348" depending upon whether letters or numbers were used.

Distorted alphabets.—As an additional aid to security, a distorted alphabet or cipher was provided on a separate card. These ciphers were subject to frequent change. The following copy indicates the style of distortion:

~~SECRET~~

13-a-

**THIS TABLE MUST NOT FALL INTO THE HANDS OF
THE ENEMY.**

1. If destroyed to prevent capture, report will be made to the office to which its return is ordered.

2. This table will be used from 3 a. m.-----
to 3 a. m.-----, after which it will be re-
turned in sealed envelope to -----

ENCIPHER

A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	R	S	T	U	V	W	Y	Z
g	k	h	w	a	o	z	n	t	f	i	l	y	b	e	s	r	d	p	c	v	u	m

DECIPHER

a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	r	s	t	u	v	w	y	z
E	O	V	T	P	K	A	C	L	B	M	Z	H	F	U	S	R	I	Y	W	D	N	G

Key word.....

Service message.....

Private message.....

By the use of this table the phrase "activity of artillery" would be enciphered as follows:

"C I V"
h t c or "htc"

The person receiving this message, by reverting to the deciphering table, would decipher:

"h t c"
C I V

and find the phrase-equivalent to be "activity of artillery." Thirty different distortion tables were issued.

Front Line Code.—To provide for the needs of the firing line, a smaller code book was prepared for emergency use and issued down to companies. This code contained about 500 carefully selected words and phrases. Before compilation, an officer of this Section spent some time at the front in an effort to obtain some first-hand information as to the specific needs of the front line.

An edition of 3,000 copies was issued.

This code book, known as the "Front Line Code", was about 3" by 6" and could be carried in an inner pocket. Two-letter groups were assigned to each word and phrase arranged alphabetically beginning with "AB" and ending with "ZZ." A few blanks were left at the end for emergency use.

In this book were inserted a number of nulls by the use of the parenthetical phrase, "This group means nothing."

To facilitate operation in the use of the two codes it was so arranged that the same distortion cards could be used with the Front Line and Trench Codes.

Before these codes had become widely distributed or much used, it was seen that the effort to provide a quick-operating, simple code had proved a failure by reason of its very simplicity. (The original plan had been adopted because of the unfamiliarity of American officers with code work.) It was obvious that any information sent in this code would be quickly known to the enemy. The books were thereupon withdrawn and a code, constructed upon the "chance" plan and provided with encoding and decoding sections, was adopted.

The encoding section consisted of an arrangement in alphabetical sequence of words and phrases and the assignment of code groups to them.

The decoding section consisted simply of the code groups in logical sequence with their plain-text equivalents. This process doubled the size of the book but by doing away with the cipher tables simplified the operation of coded messages. Recognizing the danger of repetition of particular groups two or more equivalents or variants were provided for the most commonly used words and phrases.

Potomac Code.—In June 1918 the first issue of the new series was published, and 2,000 copies were turned over to G-2 for distribution.

This code book, known as the "Potomac Code", the first of the so-called "River Series", contained approximately 1,800 words and phrases, and with the decoding section made a pamphlet of forty-seven pages. It was approximately 7½" by 9¾" and printed in typewriter type, a type selected for its good legibility under the poor lighting conditions of the field.

Each page contained two columns of fifty lines each, or one hundred lines to the page. At the margin of each column were printed in a small block a null and the following spelling combinations:

ed, en, er, es, ing, ion, ll, ly, nd, re, s, st, th

Thirty-five different nulls were provided and the instructions were that one at least should be used with every ten groups and invariably between groups used to spell out words.

The "Potomac Code" marked the inauguration of the policy of taking away from the front line all possible extra work in connection with coding and decoding and putting upon headquarters the burden of affording security by replacing and reprinting the books. The reissuance of code books provided the necessary secrecy since no particular code was intended to be in service for a great length of time, and therefore the amount of intercepted messages would be comparatively small.

Distribution.—In accordance with the plans of G-2, who distributed the code books, one edition was to be distributed down to regiments; another edition sent down to Army Headquarters; and a third edition held in reserve at General Headquarters. That this plan was well conceived was demonstrated by the fact that when this particular book was captured, one month after publication, the two sets were ready in reserve and were reissued to the entire Army organization within two days.

Suwanee Code.—The "Potomac" was followed on July 15 by the "Suwanee" in an edition of 2,500 copies. No radical change was made.

Wabash Code.—The "Wabash" followed on July 31 in an edition of 2,700 copies. This code followed the same general plan but was slightly smaller.

Mohawk.—The "Mohawk" followed on August 3 in an edition of 3,200 copies. This code was the first one with 4-number code equivalents, running from 2,500 to 5,000, making a total of approximately 2,500 groups provided for some 1,600 words and phrases. This book was captured in October.

Allegheny.—The "Allegheny" followed on August 12 with 3,200 copies, and the number groups were selected from numbers ranging from 1,500 to 5,000. Fifty blanks for the emergency use of organizations were also provided. This book was captured in October, making the third to be put out of commission in this manner.

Hudson.—The "Hudson" followed on September 2 with 3,200 copies; also a number-group code. In this code a group of five different nulls was printed on the margin of each fifty lines with a view to encouraging their use by making them conspicuous. With the object of providing a group for transmission from memory in the event of the loss of a code book, the group "2222" was printed in red ink on the outside cover of the book where it might be readily and often seen.

Colorado.—The "Colorado" followed on September 24 with 3,200 copies, using letter groups instead of numbers. The code books had been slightly reduced in size from time to time but this issue marked the last reduction. Without reducing the legibility of the type the lines were closed up and the outside margin reduced to 5½" by 7½" as against the 7¼" by 9¾" of the first issue. For the first time spelling combinations were printed at the bottom of each page, sixteen in all being provided, with two or more variants for each combination. On the cover the group "DAM" was printed to be memorized and used if the code were lost.

Different series for First and Second Armies—Champlain.—It was believed that the issuance of the large number of copies necessary to supply both the First and Second Armies would needlessly jeopardize the code, and it was decided to issue different series to the two armies. Accordingly, the "Lake Series" of codes was begun, commencing with the "Champlain" on October 7, and an edition of 2,500 copies of each code was put out. To accentuate the difference in the series the cover printing on the "Lake Series" was in red ink and that of the "River Series" in black ink. The River codes were issued to the First Army and the Lake codes to the Second Army.

Descriptive code groups for designating codes.—Instructions were issued directing that all messages sent in these codes should be preceded by a 3-letter code combination which would

indicate the particular code used. Thus a "Hudson" message was preceded by HUD; the "Colorado" by COL; the "Osage" by OSA, etc.

Huron.—After the "Champlain" came the "Huron" on October 15, the second of the Lake series. This book differed from its predecessors in that it contained in the front the "Emergency Code List" which was also issued separately down to companies for emergency use. In the back of this code there appeared a double receipt, easily detachable, for the convenience of officers receiving and delivering the code books.

The instructions were so altered as to include the telephone alphabet which was intended to simplify the transmission of code messages by telephone.

Osage.—The "Huron" was followed by the "Osage" on October 28. The changes consisted in the additional printing on the cover of the order to:

"Precede every message in this code by OSA"

and:

"NOTE: The * indicates new word or phrase."

This last direction was added in order that officers might have their attention quickly directed to new words or phrases which previously they had been spelling letter by letter.

Seneca.—After the "Osage" came the "Seneca" on November 6. This code differed only on the first page of the encoding section where on the margins were printed the variants for "minutes", "o'clock", "battalion", "regiment", etc., and the ordinals from first to tenth inclusive; and the printing of the initial letters of each word or phrase in small letters rather than in capitals. This last change was made as an aid to the eye in constructing sentences.

This book contained nearly 1,900 words and phrases as against 1,750 in the early issues of trench codes. Many changes had been made in phraseology, however, and of the original list of words and phrases 1,045 alone remained unchanged.

Niagara, Michigan, Rio Grande.—At the time of the armistice this Section had in press the "Niagara" code, and the "Michigan" and "Rio Grande" in manuscript. Thus, during the Armies' operations, fifteen codes were actually compiled in the trench code series. To be more exact, fourteen codes were prepared in the period of five months from June to November 1918, nearly three per month.

In the ten months of active operations the Section completed and printed more than 80,000 code books and pamphlets, all numbered, recorded, issued, and receipted for when issued. The record is complete, no copy being missing.

War Department Code Supplement.—In March 1918 an addenda sheet was compiled in order to provide code equivalents for a number of words omitted from the "War Department Code" and in addition to provide code groups for transports and a number of French cities and towns. One thousand copies of this Supplement were issued.

Telephone codes.—In March 1918 what was called a "Telephone Code" (sometimes called the "Female Code") was prepared for disguising the names of organizations and commanding officers. Originally intended for use over the telephone, it was principally used in messages to conceal organizations. Its code equivalents were the first and last names of women, and it was so arranged that the names, "Mary Brown", for example, might mean the "Chief Signal Officer of the First Army." Five hundred copies of this code were printed on a single sheet of letter-sized paper and turned over to G-3 for distribution. In October 1918 this code was reissued with the addition of a decoding section.

Telegraph codes.—In June 1918 a short 3-letter-group code was prepared for use in certain principal telegraph offices in order to conceal troop movements.

In July 1918 a more complete code of some 1,300 words and phrases was issued to replace the former edition. These codes were photostated and distributed to six telegraph offices.

~~SECRET~~

For Official Use of Officers to Whom Entrusted

CODE FOR DESIGNATING ORGANIZATIONS, COMMANDERS AND STAFF OFFICERS.

1. This code will be used when it is necessary to conceal the true designation of organizations, commanders and staff officers in letters, telegrams or telephone conversation.
2. An organization is designated by a single christian name. Example: 33rd Division—"MARIAN."
3. A commander is designated by two names. Example: C. G., 33rd Division—"MARIAN SNOW."
4. A staff officer is designated in the same way by two names.
5. THIS CODE MUST NOT BE USED FOR TELEGRAPHIC ADDRESSES OR TELEPHONE CALLS.
(The operators are not furnished with the code.)

ORGANIZATIONS.

- G. H. Q. Ida
- 1st Army. Bertha
- 2nd Army. Dolly
- 3rd Army. Kate
- 4th Army. Vera
- 5th Army. Maude
- 6th Army. Alma
- 7th Army. Kitty
- 8th Army. Florence

- 1st Corps. Agnes
- 2nd Corps. Grace
- 3rd Corps. Winifred
- 4th Corps. Ruth
- 5th Corps. Daisy
- 6th Corps. Carrie
- 7th Corps. Violet
- 8th Corps. Gabriella
- 9th Corps. Alice
- 10th Corps. Helen
- 11th Corps. Wilhelmina
- 12th Corps. Peggy
- 13th Corps. Ursula
- 14th Corps. Clara
- 15th Corps. Gladys
- 16th Corps. Anna

- 1st Division. Della
- 2nd Division. Joan
- 3rd Division. Frances
- 4th Division. Olive
- 5th Division. Sadie
- 6th Division. Maggie
- 7th Division. Tilly
- 8th Division. Irene
- 9th Division. Blanche
- 10th Division. Julia
- 11th Division. Laura
- 12th Division. Effie
- 13th Division. Claire
- 14th Division. Lois
- 15th Division. Irma
- 16th Division. Victoria
- 17th Division. Tina
- 18th Division. Agatha
- 19th Division. Hazel
- 20th Division. Jane
- 21st Division. Dot
- 22nd Division. Lydia
- 23rd Division. Sarah
- 24th Division. Molly
- 25th Division. Pearl
- 26th Division. Theresa
- 27th Division. Rachel
- 28th Division. Jennie
- 29th Division. Elsie

- 30th Division. Eva
- 31st Division. Kathryn
- 32nd Division. Neil
- 33rd Division. Marian
- 34th Division. Sylvia
- 35th Division. Rose
- 36th Division. Georgia
- 37th Division. Letty
- 38th Division. Jessie
- 39th Division. Mary
- 40th Division. Ellen
- 41st Division. Stella
- 42nd Division. Mabel
- 43rd Division. Virginia
- 44th Division. Mildred
- 45th Division. Belle
- 46th Division. Gwendolyn
- 47th Division. Leona
- 48th Division. Enid
- 49th Division. Martha
- 50th Division. Prudence
- 76th Division. Beatrice
- 77th Division. Imogen
- 78th Division. Margaret
- 79th Division. Priscilla
- 80th Division. Nora
- 81st Division. Alexandra
- 82nd Division. Caroffine
- 83rd Division. Genevieve
- 84th Division. Iris
- 85th Division. Lucille
- 86th Division. Naomi
- 87th Division. Rebecca
- 88th Division. Betty
- 89th Division. Rhoda
- 90th Division. Hortense
- 91st Division. Cornelia
- 92nd Division. Fanny
- 93rd Division. Bessie
- 94th Division. Edith
- 95th Division. Rosalind
- 96th Division. Theodora
- 97th Division. Christine
- 98th Division. Eloise
- 99th Division. Ernestine
- 100th Division. Constance
- 101st Division. Dorothy
- 102nd Division. Jocelyn
- 103rd Division. Drusilla
- 104th Division. Evangeline
- 105th Division. Lucy
- 106th Division. Zora
- 107th Division. Clemantine
- 108th Division. Yetta
- 109th Division. Yvonne
- 110th Division. Emelia

- 111th Division. Ray
- 112th Division. Susan
- 113th Division. Ethel
- 114th Division. Edna
- 115th Division. Marcia
- 116th Division. Sybil
- 117th Division. Beulah
- 118th Division. Eliza
- 119th Division. Harriet
- 120th Division. Louise
- 121st Division. Jerusha
- 122nd Division. Miranda
- 123rd Division. Pauline
- 124th Division. Emma
- 125th Division. Audrey

- H. O. S. O. S. Zenobia
- A. S. S. O. S. Tilda
- I. S. S. O. S. Carmen
- Base Sec. No. 1. Barbara
- Base Sec. No. 2. Josephine
- Base Sec. No. 3. Elizabeth
- Base Sec. No. 4. Charlotte
- Base Sec. No. 5. Henrietta
- Base Sec. No. 6. Annabelle
- Base Sec. No. 7. Mattie

TITLES OF OFFICERS.

- C.-in-C. or C. G. Snow
- C. of S. Dow
- Deputy C. of S. Jones
- A. C. of S. G-1. Fuller
- A. C. of S. G-2. King
- A. C. of S. G-3. Burns
- A. C. of S. G-4. Wells
- A. C. of S. G-5. Kelly
- Chief of Cavalry. Wise
- Chief of Infantry. Rush
- Chief of Artillery. White
- Chief of T. C. Dick
- A. G. Long
- I. G. Smith
- J. A. Black
- C. O. M. Adams
- C. S. Greene
- C. E. O. Brown
- C. O. O. Pratt
- C. S. O. Hart
- C. A. S. Fry
- C. C. W. S. Brady
- P. M. G. or P. M. Page
- Chief of M. T. C. Hand
- D. G. T. Silver

ORGANIZATIONS.

Agatha.....18th Division	Iris.....84th Division	Virginia.....43rd Division
Agnes.....1st Corps	Irma.....15th Division	Wilhelmina..11th Corps
Alexandra...81st Division	Jane.....20th Division	Winifred.....3rd Corps
Alice.....9th Corps	Jennie.....28th Division	Yetta.....108th Division
Alma.....6th Army	Jerusha.....121st Division	Yvonne.....109th Division
Anna.....16th Corps	Jessie.....38th Division	Zenobia.....Headquarters S.O.S.
Annabelle...Base Section No. 6.	Joan.....2nd Division	Zora.....106th Division
Audrey.....125th Division	Jocelyn....102nd Division	
Barbara....Base Section No. 1.	Josephine...Base Section No. 2.	
Beatrice....76th Division	Julia.....10th Division	
Belle.....45th Division	Kate.....3rd Army	
Bertha.....1st Army	Kathryn....31st Division	
Bessie.....93rd Division	Kitty.....7th Army	
Betty.....88th Division	Laura.....11th Division	
Beulah.....117th Division	Leona.....47th Division	
Blanche....9th Division	Letty.....37th Division	
Carmen....Int. Sec. S. O. S.	Lois.....14th Division	
Caroline....82nd Division	Louise.....120th Division	
Carrie.....6th Corps	Lucille....85th Division	
Charlotte...Base Section No. 4.	Lucy.....105th Division	
Christine...97th Division	Lydia.....22nd Division	
Claire.....13th Division	Mabel.....42nd Division	
Clara.....14th Corps	Maggie.....6th Division	
Clemantine..107th Division	Marcia.....115th Division	
Constance...100th Division	Margaret...78th Division	
Cornella....91st Division	Marian.....33rd Division	
Daisy.....5th Corps	Martha....49th Division	
Della.....1st Division	Mary.....39th Division	
Dolly.....2nd Army	Mattie.....Base Section No. 7.	
Dorothy....101st Division	Maude.....5th Army	
Dot.....21st Division	Miranda....122nd Division	
Drusilla....103rd Division	Mildred....44th Division	
Edith.....94th Division	Molly.....24th Division	
Edna.....114th Division	Naomi.....86th Division	
Effie.....12th Division	Nell.....32nd Division	
Eliza.....118th Division	Nora.....80th Division	
Elizabeth...Base Section No. 3.	Olive.....4th Division	
Ellen.....40th Division	Pauline....123rd Division	
Eloise.....98th Division	Pearl.....25th Division	
Elsie.....29th Division	Peggy.....12th Corps	
Emelia.....110th Division	Priscilla...79th Division	
Emma.....124th Division	Prudence...50th Division	
Enid.....48th Division	Rachel.....27th Division	
Ernestine...99th Division	Ray.....111th Division	
Ethel.....113th Division	Rebecca....87th Division	
Eva.....30th Division	Rhoda.....89th Division	
Evangeline...104th Division	Rosalind...95th Division	
Fanny.....92nd Division	Rose.....35th Division	
Florence....8th Army	Ruth.....4th Corps	
Frances....3rd Division	Sadie.....5th Division	
Gabriella...8th Corps	Sarah.....23rd Division	
Genevieve...83rd Division	Stella.....41st Division	
Georgia....36th Division	Susan.....112th Division	
Gladys.....15th Corps	Sybil.....116th Division	
Grace.....2nd Corps	Sylvia.....34th Division	
Gwendolyn..46th Division	Theodora...96th Division	
Harriet....119th Division	Theresa.....26th Division	
Hazel.....19th Division	Tilda.....Adv. Sec. S. O. S.	
Helen.....10th Corps	Tilly.....7th Division	
Henrietta...Base Section No. 5.	Tina.....17th Division	
Hortense...90th Division	Ursula.....13th Corps	
Ida.....G. H. O.	Vera.....4th Army	
Imogen.....77th Division	Victoria...16th Division	
Irene.....8th Division	Violet.....7th Corps	

TITLES OF OFFICERS.

Adams.....Chief Quartermaster
Black.....Judge Advocate
Brady.....Chief Chemical Warfare Service
Brown.....Chief Engineer Officer
Burns.....Assistant Chief of Staff G-3
Dick.....Chief of Tank Corps
Dow.....Chief of Staff
Fry.....Chief of Air Service
Fuller.....Assistant Chief of Staff G-1
Greene.....Chief Surgeon
Hand.....Chief of Motor Transport Corps
Hart.....Chief Signal Officer
Jones.....Deputy Chief of Staff
Kelly.....Assistant Chief of Staff G-5
King.....Assistant Chief of Staff G-2
Long.....Adjutant General
Page.....Provost Marshal General or Provost Marshal
Pratt.....Chief Ordnance Officer
Rush.....Chief of Infantry
Silver.....Director General of Transportation
Smith.....Inspector General
Snow.....Commander-in-Chief or Commanding General
Wells.....Assistant Chief of Staff G-4
White.....Chief of Artillery
Wise.....Chief of Cavalry

G-3. G. H. Q.

MEMORANDUM:

I. The enclosed Code for designating Organizations, Commanders and Staff Officers, is furnished you for use, when necessary in communications between you and the following officers ONLY:

<u>G. H. Q.</u>	<u>HQ. S. O. S.</u>	<u>EACH ARMY</u>
C. in C.	C. G.	C. G.
C. of S.	C. of S.	C. of S.
Deputy C. of S.	A. C. of S. G-1	A. C. of S. G-1
A. C. of S. G-1	A. C. of S. G-2	A. C. of S. G-2
A. C. of S. G-2	A. C. of S. G-3	A. C. of S. G-3
A. C. of S. G-3	A. C. of S. G-4	A. C. of S. G-4
A. C. of S. G-4	C. Q. M.	C. G. Army Artillery
A. C. of S. G-5	Chief Surgeon	C. of S. Army Artillery
Chief of Infantry	C. E. O.	
Chief of Artillery	C. O. O.	<u>EACH CORPS</u>
Chief of Cavalry	C. S. O.	C. G.
Chief of Tank Corps	C. A. S.	C. of S.
A. G.	C. C. W. S.	A. C. of S. G-1
I. G.	P. M. G.	A. C. of S. G-2
J. A.	C. M. T. C.	A. C. of S. G-3
	D. G. T.	
	D. P. E. S.	

<u>SCHOOLS</u>
Commandant Army Schools
Commandant First Corps Schools.
Commandant Second Corps Schools
Commandant Third Corps Schools
Commandant Infantry Candidates Schools
Commandant Saumur Artillery School
Commandant Heavy Artillery School
Commandant Trench Artillery Center

<u>EACH SECTION</u>
S. O. S.
C. G.
C. of S.

<u>EACH DIVISION</u>	
C. G.	
C. of S.	
A. C. of S. G-1 G-2 G-3	
<hr/>	
Each Regulating Officer	
C. G., Troops in Paris	

"TELEGRAPH CODE"

ABC... A	AMC... Arm	AUW... Bassens
ABD... ab	AMG... Armentieres	AUX... Bassigny
ABF... Abainville	AMK... Arnouville	AWB... Bastide
ABG... ac	AMO... arr	AWC... bat
ABK... Acheux	AMP... art	AWE... bau
ABL... Acy-en-Multien	AMS... Artenges	AWG... Bavelincourt
ABM... ad	AMV... as	AWK... Bavin de Jaillon
ABO... af	AMX... at	AWO... bay
ABP... ag	AMY... au	AWP... Bayenghem
ABQ... ai	AND... aub	AWS... Bayonne
ABS... aie	ANF... Aubervilliers	AWX... baz
ABU... Aigny le Duc	ANG... Aucanne	AWY... Bazirval
ABV... Aillevillers	ANK... aug	AWZ... Bazoilles
ABW... Ailly Haut Clocher	ANL... Aulnat	AXB... Bazu la Guery
ABX... ain	ANO... Aulnois	AXF... bb
ABY... air	ANP... aun	AXG... be
ABZ... ais	ANS... aut	AXM... beau
ACF... ait	ANW... Auteuil	AXP... Beau Desert
ACK... aix	ANX... Autingues	AXV... Beaudricourt
.....		
ADK... all	APG... av	BAK... Belfort
ADM... Allerey	APJ... Avesves	BAM... Bellac
ADP... Alquines	APN... az	BAN... Bellamagny
ADV... am	APO... Azerailles	BAP... belle
ADY... Amanty	APU... B	BAR... Bellevue
AFA... Ambazac	APW... ba	BAT... ben
AFC... an	APX... bac	BAV... ber
AFD... and	APY... Baccarat	BAW... Bernieulles
AFG... Andelot	ASB... Bacouel	BAX... Bertangles
AFJ... ang	ASF... bad	BED... Bertrichamps
AFK... Angers	ASG... Badmenil	BEF... Besancon
AFM... Angres	ASK... Badonvillers	BEJ... bet
AFO... ann	ASM... Badricourt	BEK... beu
AFP... Anney	ASO... bag	BEN... Beulay
AFR... Annex	ASP... bai	BEP... bez
AFV... Anould	ASV... Bains-les-Bains	BES... Bezinghem
AFX... Ansauville	ASY... bal	BET... bi
AFZ... ant	AUB... ban	BEV... bie
AGE... ap	AUD... Ban de Laveline	BEW... Biercy
AGF... ar	AUF... bar	BFA... big
AGK... arc	AUG... Barcy	BFC... bil
AGL... Arches	AUJ... Bar-le-Duc	BFG... bis
AGN... Arc sous Montenont	AUK... Barnecourt	BFJ... bla
AGO... Ardy	AUM... Bar sur Aube	BFM... Blanc Mesnil
AGY... Argengosse	AUP... Bar sur Seine	BFO... ble
AMB... Arles	AUS... bas	

(See note at the bottom of page 27.—F. F. W.)

~~Secret~~

MUST NOT FALL
INTO HANDS OF
ENEMY

The
“POTOMAC”
CODE

GENERAL HEADQUARTERS
AMERICAN EXPEDITIONARY
FORCES

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"POTOMAC CODE"

Approach...QYP
 Approved...KSO
 Approximate...COK
 Approximately...LAN..MCA..JMC
 -ar...SKX
 Are...CFY..YJV..SAR
 Are having...GWU
 Are not...WXM
 Are they...BSU
 Are we...GMA
 Are you...DUM
 Are you all right...FBN
 Arm...NGP
 Armored...PWM
 Army...YPK
 Arrive...OWA
 Arrived...KXB..GBO..PET
 Artillery...FCO..VSO..NFP
 Artillery fire...BYA
 Artillery observer...JAM
 Artillery position...YPG
 Artillery preparation...FGN
 Artillery support...KMY
 -ary...FUG
 As...JYS..VYP..REK
 As far as...XBS
 As soon as...NWY..BKO
 Ascertain...PBX
 Ask...VBY
 Asphyxiate...XYG
 Assemble...BGU
 Assist...XAC
 Assistance...OVM
 At...GWM..XOW..GSX..RYP
 At close quarters...AMO
 At once...BAK..BPS
 At point...WXS
 -ate...AMV
 Attack...NBL..GYS..OWG
 Attacked...GXB
 Attacking...MSY
 Attempt...WJS
 Attention...ROS
 Austrian...GAN..WOP
 Automatic...ABV
 Automatic rifle...SUC
 Automatic rifle ammunition...NUV
 Available...OPJ
 Aviator...OWB
 Await...SWY

Null...YSO
 Ing...YUX..LGW
 Ion...SMO..VAT
 Ll...BWA
 Ly...GOD

Await instructions...VNP
 Away...NOB
 Axe (s)...VEP
 B...KVG..VSY..VXK
 Back...WOS
 Bad (ly)...WCX
 Badly damaged...GAS
 Badly wounded...CPL
 Bag (s)...FJM
 Balloon...FCW
 Barbed wire...FSA..YSB
 Barrage...JYK..ABP..BMS
 Barrage wanted...MJX
 Barricade...AWE
 Battalion...ABS..JFC..AND
 Battalion headquarters...EXY..SAW
 Battery...NPB..DEK..QYJ
 Battle (s)...DCV
 Bavarian...DCP
 Bay (s)...LUS
 Bayonet...DGB
 Be...MBA..PYW
 Be ready...RAG
 Be released...FLC
 Because...ONW
 Been...OPC..KBY
 Before...KEG
 Began...OVX
 Begin...DUW..OPV
 Begun...BWU
 Behind...RPJ
 Behind the lines...MOS
 Being...YON..VMX
 Being established...NSC
 Being held...YAC
 Being sent...PAN
 Being shelled...PNA
 Believe...WEF
 Belong...CFW
 Below...SUR
 Belt (s)...XGF
 Bengal lights...CSG
 Best...PLX
 Better...JXG
 Between...SNP..SXO
 Beyond...PYF
 Billet (s)...XMU
 Bivouac...SYF
 Black...GSO
 Block...JAB

Null...WPA
 Nd...WEJ..XWS
 Re...PUW..NOM
 S...MOP..LGS
 St...CBS..GNY
 Th...DYM..MXF

A-B

"HUDSON CODE"

Armored...5875		Barbed wire...2267..5318	
Army...4889		Barrage...2301..4261..2552..	
Army headquarters...3766..4038		Barrage wanted...3940	
Arrive...3074		Barricade...4669	
Arrived...2147..5732..4206		Battalion...4061..3944..3156	
Artillery...3721..3199..5428		Battalion headquarters...5216..4429	
Artillery fire...3211		Battery...2959..2459..2735	
Artillery observer...4320		Battle (s)...5479	
Artillery position...2220		Bavarian...5909	
Artillery preparation...2976		Bay (s)...5328	
Artillery support...2075		Bayonet...4793	
-ary...5048		Be...5672..2291	
As...2757..5844..4385		Be ready...2656	
As far as...4278	Nulls:	Be released...3082	
As soon as...3973..4706	5170	Because...3586	
Ascertain...3032	2498	Been...1983..4059	
Ask...2264	3265	Before...3202	
Asphyxiate...4021	5078	Began...5641	
Assemblée...3325	5637	Begin...4772..3409	
Assist...5677		Begun...2142	
Assistance...3268		Behind...2506	
At...3385..2765..2066..3108		Behind the lines...2998	
At close quarters...3832		Being...5505..3954	
At once...2336..2611		Being established...5478	Nulls:
At point...5254		Being sent...4041	1936
-ate...2486		Being shelled...2925	5389
Attack...1723..2462..4127		Believe...5975	5401
Attacked...2652		Belong...5740	5471
Attacking...2345		Below...1825	5939
Attempt...4077		Belt (s)...3445	
Attention...2263		Bengal flares...1644	
August...2531		-Best...2625	
Austrian...4976..2957		Better...4225	
Automatic...3400		Between...3468..4370	
Automatic rifle...4014		Beyond...5453	
Automatic rifle ammunition...5491		Billet (s)...3972	
Available...3411		Bivouac...2655	
Aviator...5560		Black...1739	
Await...5657		Block...5842	
Await instructions...2335		Blue...4428	
Away...1940		Blue rocket...2234	
Axe (s)...3096		Board...5274	
B...2371..5697..2082		Boche...3333	
Back...3193		Body...4419	
Bad (ly)...4852		Bomb...3813..5498..3283	
Badly damaged...5290		Bombard...2973	
Badly wounded...5537		Bombarded...5977..3338	
Bag (s)...4149		Bombardment...2903	
Balloon...2635		Bombing...4804	
Bank...4750		Bombing post...2378	

"HUDSON CODE"

2883...Medical	2967...Let
2884...31	2969...Objective
2886...Enemy light artillery	2971...No
2888...N	2972...Charge
2889...U	2973...Bombard
2890...Me	2974...Capture
2893...Progress	2976...Artillery preparation
2895...Within	2978...Remain
2896...Road	2982...Radio operator
2897...Searchlight	2984...It
2900...Movement	2985...Control
2901...I	2987...Annoy
2902...-ent	2990...Heavy
2903...Bombardment	2991...If
2904...Station	2993...Less
2906...Disorder	2994...Missing
2907...Send out patrols	2995...From the
2909...Your	2998...Behind the lines
2910...Send up ammunition	2999...How is everything
2911.....	3000...F
2912...Advancing	3002...Morale
2913...Wind favorable	3004...-re
2917...Look	3005...Supply
2919...Slightly wounded	3009...Zero hour has been postponed
2921...All	3010...Heavy loss
2923...Should be	3011...Watch
2925...Being shelled	3012...Loophole
2926...Infantry patrol	3013...To
2927...(Null)	3015...Other
2929...40	3018...Keep
2931...Z	3020...Whether
2932...This evening	3021...Scout
2933...Situation improving	3022...29
2934...In order	3023...Men wounded
2937...Enemy wiring party	3025...Step
2942...(Null)	3026...Sending up
2944...J	3031...10
2945...Figure	3032...Ascertain
2946...8	3035...Box
2947...Premature	3037...White rocket
2948...By	3038...Necessary
2949...I have	3039...All communications cut
2951...On the way	3048...Gassed
2953...2	3049...Exhausted
2955...Comma	3050...Could be
2957...Austrian	3053...Few
2958...Went	3054...Mean
2959...Battery	3057...On
2960...Gas battery	3058...Suffer
2965...Pick	3061...Weather

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~~SECRET~~

MUST NOT FALL
INTO HANDS OF
ENEMY

MEMORIZE THIS GROUP:
"DAM---Code Lost."

The
"SENECA"
TRENCH CODE

Precede every message in this code by
"SEN"

NOTE: The * indicates new word or phrase.

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"SENECA CODE"

ENCODING

00...BAT..GPL		50...QMV..JBX	
0...GWO..MEF..BAP		51...VYN	
1...VEN..OCM..GAP		52...JSX	
2...RGD..FJO..QYW		53...PWU	
3...CMB..DGS..NUM		54...XFW	
4...PJV..JAK..XMU		55...MYF	
5...KSP..PLY..WEF		56...GKO	
6...ORB..GPY..YMC		57...XBN	
7...ABG..DYL..MOS		58...BYN	
8...VPA..SPY..QVK		59...KGW	
9...OSC..JUW..XPJ		60...DAR..QJW	
10...CBP..NXP..PNU		61...NWU	
11...NSV..DSK..VSF		62...BGR	
12...RKY..GVO..AMY	0'clock:	63...NCS	
13...KMD..YFJ..CPB	OBK	64...JWA	Nulls:
14...SKX..BUT..NBA	GNA	65...WUP	DWS
15...VXK..JOP..DUW	PNR	66...COT	QAM
16...RWK..DWJ..PAG		67...FLY	BOP
17...SCW..MGV..LAN		68...MCB	YFG
18...YJA..DOG..KPS	Minutes:	69...OXA	XFY
19...PUX..VJB..FPO	DPL	70...SBP..WSO	
20...SON..FEK..OBL	NCV	71...YUJ	
21...GFS..ZVC..QPF	XUB	72...RFX	first...SPG..KGO
22...LBW..SYP..CSV		73...JPU	
23...SNG..JGL..BET		74...QAX	second...YPM..NAK
24...RYK..QEP..VMA		75...SXJ..APF	
25...ZOB..SUC		76...SMO	third...MGW..PBR
26...REL		77...XON	
27...BKS	Nulls:	78...DMA	fourth...VEF..MAT
28...YWX	BNA	79...YXG	
29...FON	NCJ	80...YOB..FCK	fifth...WXM..LOP
30...POV..JEX	NAG	81...XJC	
31...MJP	DEP	82...LYN	sixth...QPX..DAL
32...ZAS	REF	83...YAW	
33...VOL		84...AFO	seventh...VXG..KEG
34...JXM		85...JVN	
35...ONV	battalion	86...QXP	eighth...QEM..SOW
36...OVB	BYG..XAP..JSO	87...LUB	
37...WXO	brigade	88...MPO	ninth...GOC..BSC
38...CAN	SBN..OPS..CBG	89...NAM	
39...LET	corps	90...KBS..BWD	tenth...AWC..PWS
40...MUC..RUW	XJU..RKB	91...OLU	
41...GEX	division	92...WAX	
42...LGN	WNV..LBY	93...SPK	
43...WCO	regiment	94...FWP	
44...BLU	DWA..OSJ..ABY	95...GMA	
45...KVP		96...LOM	
46...MXS		97...GLX	
47...NOW		98...NPS	
48...DPB		99...XUN	
49...WOV		100...KXF..RMX..RPS..PFY	

"SENECA CODE"

are...XOB..QBS..CMK		back...QYB	
are not...ABX		back area...NFC	
are you...RWU		bad (ly)...DOT	
are you all right...KGF		badly damaged...RKO	
area...CUP		badly wounded...NOP	
army...FJC..SWX		balloon...FPY	
Army Headquarters...KXO..FXB		bank...SBA	
*arrange...LEF		barbed wire...ONG..JFB	
arrive...VSM		barrage...VAG..PNC..AMX	
arrived...MBW..JFY..WPN		barrage wanted...WAR	
Artillery...MXF..GFA..XUS		barricade...QMP	
artillery fire...MSA		Battalion...BYG..XAP..JSO	
artillery observer...DYV		Battalion Headquarters...DWB..	
artillery position...YUW		battery...KVX..GYM..YWU [XOW	
artillery preparation...OBW		battle (s)...LPD	
artillery support...BPG		Bavarian...JMS	
-ary...QVO		bay (s)...RAW	
as...OCW..BAF..RYV		bayonet...MSP	
as far as...ORM		be...BXS..SMK	
as soon as...CBS..SGB		be ready...OBA	
ascertain...POF		be released...ASV	Nulls:
ask...FLO		because...XYW	. BOP
assemble...ZAB		been...PJB..COW	XFM
assist...PCX		before...VNG	QAM
assistance...FPE		began...QEK	DWS
at...XYB..QAF..GOS..WXY		begin...DIS..WMV	YFG
at once...GWA..SPN	Nulls:	begin at...JPO	
at point...JUG	NAG	begun...FOX	
-ate...AUM	DEP	behind...SWJ	
attack...YPV..JYS	REF	behind the lines...KBV	
attacked...BNX	NCJ	being...FWO..QSM	
attacking...XSD	BNA	being established...LAG	
attempt...KSY..DAN		being sent...AXM	
attention...WMA		being shelled...RGF	
August...LGB		believe...MGO	
Austrian...DGK..SYM		belong...BWA	
automatic...LPW		below...SGO	
automatic rifle...GUW		belt (s)...NEW	
automatic rifle ammunition...YJX		Bengal flares...DYG	
available...MCS		best...RUM	
aviator...JMA		better...OGK	
await...VSD..MOF		between...FMB..VBO	
await instructions...FXY		beyond...PBY	
away...XJO		billet (s)...GUF	
	-B-	bivouac...WCS	
B...JGO..RBC..XPA..MSK		black...PXK	
-ion...PXF..WAV..GXV		-s...RFP..WNA..QMC..LOR	
-ly...WAM..NGS		-st...VCF..GYN..WJY..LGJ	
-nd...JUF..WBC..PCU		-th...PYB..BYW..PUF	
-re...YBJ..JXO		-un...NPJ...CMO	

"SENECA CODE"

DECODING

ABE...bombarde	APE...my
ABF...notice	APF...75
AEG...7	APJ...radio message
AEK...degree (s)	APN...come
AEM...ridge	APO...-ty
AEO...D	APU...foot
ABP...-non	APW.....
ABS...converge	APX...our artillery
ABV...take place	APY...all points
ABW...mistake	ASB...report
AEX...are not	ASF...heavy
ABY...Regiment	ASG...was not
AFC...-es	ASK...cross-road
AFD...sometime	ASM...should be
AFJ...S	ASO...-im
AFM...very	ASP...regulate
AFO...84	ASV...be released
AFR...Boche	ASX...Third Corps
AFV...sandbag	ASY...has destroyed
AFX...patrol schedule	AUB...storm
AFY...emplacement	AUF...A
AGB...we are in need of	AUG...large
AGE...hundred	AUK...were not
AGF...situation	AUM...-ate
AGK...aeroplane	AUP...on
AGL...understand	AUS...missing
AGN...question mark	AUW...enemy artillery
AGO...following	AUX...until
AGU...ward	AWB...general
AGY...send out patrols	AWC...tenth
AMC...complete	AWE...numbering
ANG...moving	AWG...(null)
AMK...permission	AWK...October
AMO...do	AWO...working party
AMP.....	AWP...is there any gas
AMS...incendiary	AWS...out of
AMV...station	AWX...comply
AMX...barrage	AWY...more
AMY...12	AXB...required
AND...weather conditions	AXF...has
ANF...enemy infantry	AXG...to be
ANG...mask	AXM...being sent
ANK...open	AXP...suffocate
ANO...H	AXS...him
ANP...British	AXV...relief
ANS...when shall we be relieved	AXW...detachment
ANW...millimeter (s)	AXY.....
ANX...force	BAD...new
ANY...why	BAF...as
APB...an	BAG...machine gun

The American Army in the field had no comprehensive code for headquarters work except the War Department Code which was intended primarily for cable work and not for active operations in a foreign country. The demand for a substitute was so insistent that a code was compiled primarily for communication within France.

The preliminary work covered a wide range of activities and required several months' study of confidential papers of organizations, replacements, operations, and military documents generally.

Staff Code.—In May 1918, the "Staff Code" went to press and was completed one month later. This code contained approximately 30,000 words and phrases. Among other things it embodied a list of several thousand French towns and villages and a complete list of the Army organizations up to May. It is believed that this is the largest and most comprehensive code book ever printed in the field. It contained both number and letter group equivalents. More than 50,000 telegraphic combinations were sent over an instrument in order, by selection, to reduce to a minimum the chances of error in transmission over the telegraph lines. One thousand copies of this code were printed and bound with a flexible cover.

This code differed from many others in that it was an alphabetical rather than a subject code. It was divided into what was known as a right-hand and left-hand column series. The left-hand series of code combinations differed in plan from the right-hand. This was done to confuse as much as possible enemy code experts. The complete Army organizations and all proper names appeared in this column, the right-hand column being reserved for the usual words and phrases of a code.

With this code were provided five different tables of distortion for G-1, G-2, G-3, G-4, and G-5. These gave a cipher combination to the original group and made an added security.

These distortion tables were prepared with an enciphering and a deciphering section. They consisted of certain selected 2-letter combinations from AB to ZY, arranged alphabetically with 2-letter equivalents selected at random.

For example, the code group FSNB might be distorted to read, VKXV. This was done simply by dividing the 4-letter group FSNB into two parts and distorting each part separately.

The decipherment consisted in the reversal of this process by consulting the table and translating VKXV to read FSNB.

Five different tables were provided for use with the Staff Code but there was no limit to the variety which could have been made under this system of distortion.

As will be noted from the accompanying memorandum a 4-letter code group was prepared and prefixed to each Staff Code message in order to identify the distortion table used.

~~SECRET~~

No 206

NOT TO BE TAKEN INTO
FRONT LINE TRENCHES

November 1, 1918.

MEMORANDUM No. 2.

1. The following is added to Par. 1, Memorandum No. 1, on Distribution of Staff Code and Distortion Tables:

	Distortion Table	Staff Code
Liaison Officer at Headquarters of Marshal Foch	SPE—	1

2. Par. 2, Memorandum No. 1, on Distribution of Staff Code and Distortion Tables, is amended to read as follows:

2. Messages of a "SECRET" nature will, after being properly encoded, be distorted by use of the special distortion table prepared by the Code Compilation Division, Signal Corps, and issued as "SECRET" documents by the A. G. O., American E. F., according to the above list. The following indicates the first words which will be used in messages prepared with distortion tables. The appropriate word appears on each distortion table:

Messages for C. G. and C. of S., SPEA, SPEB, SPEC, etc.

Messages for G-1 and G-4, SUPA, SUPB, SUPC, etc.

Messages for G-2, INTA, INTB, INTC, etc.

Messages for G-3, OPRA, OPRB, OPRC, etc.

Messages for all others, including G-5, COMA, COMB, COMC, etc.

In general, messages not to be transmitted by radio will be prepared without the use of distortion tables. The first word in this case will be NONA.

BY COMMAND OF GENERAL PERSHING:

ROBERT C. DAVIS,
Adjutant General.

ENCIPHERING TABLE

AB ap	BA gv	CA pv	DA za	EA ak	FA va	GA cj	IB yv	JA sk	KA bg	LA gy	MA xx	NA be	OB za	PA ov	RA fx	SA zj	UB fz	VA gi	WA ju	XA ep	YB pu	ZA sj
AC on	BC aa	CS ma	DB va	ED zl	FB ac	GS dg	ID gu	JB gz	KB de	LB lj	MB vs	NB xv	OC gx	PD fd	RB gj	SB cx	UC gk	VB cd	WB ve	XB nk	YC sd	ZB vf
AD lb	BD yz	CD vj	DC bo	EP ay	FC ep	GC vb	IF eg	JC zg	KC gf	LC dy	MC gb	NC ji	OD av	PC vg	RC nw	SC vd	UD nj	VC fx	WC cr	XC ga	YD wv	ZC xa
AF ro	BE gy	CE mn	DE ag	EE je	FD vl	GD on	IG xp	JD df	KD az	LD ck	MD ap	ND vx	OE bl	PD jc	RD ca	SD rs	UF cv	VD kl	WD in	XD jb	YF ja	ZD yj
AG vl	BF cu	CF yg	DF ep	EJ dx	FE ps	GE fg	IJ aj	JE rf	KE ji	LE zv	ME li	NE er	OG ev	PE ab	RE sv	SF al	UG by	VE uz	WE nu	XE wr	YK xd	ZE ao
AJ nd	BG di	CG gs	DG pa	EX pf	FG gd	GF po	IK pz	JF op	KI cb	LG vp	MG bd	NF gl	OJ xk	PF sa	RF bv	SG np	UJ pr	VF oa	WF kd	XF fn	YJ zw	ZF yk
AK gn	BI va	CJ ed	DI kx	EP rb	FI zl	GI kr	IL ud	JG pc	KJ jw	LI jy	MI vx	NG ay	OK cl	PG bp	RG zy	SI za	UK rw	VG yw	WG fj	XG ab	YK vi	ZG ur
AM zp	BJ of	CK lf	DJ zi	ER fu	FJ lv	GJ as	IM dk	JI lu	KL la	LJ bn	MJ vu	NI ar	OL up	PI cy	RJ kc	SJ fe	UL aj	VI iz	WI sz	XI pe	YL fe	ZI lg
AN ex	BK pd	CL kv	DK ix	ES kg	FX zc	GK ly	IN ki	JK cv	KM ry	LK fl	MK uj	NJ la	OM so	PJ xa	RK pj	SK dc	UM sc	VJ zu	WJ ac	XJ lc	YM os	ZJ kj
AP un	BL af	CM bs	DL ga	EY be	FL sa	GL jg	IP yw	JL zk	KH gr	LM sx	ML ef	NK ol	ON kn	PK ku	RL db	SL pe	UN xo	VK jr	WK py	XK wk	YN lv	ZK pi
AR xv	BM jp	CN ul	DM le	EW ld	FM da	GN yn	IS az	JM ax	KO fv	LO wj	MN ja	NM vy	OP ls	PL ag	RM jo	SN xg	UP dw	VL sf	WL ad	XL rl	YP es	ZL wd
AS fx	BN ka	CO fl	DW ew	EI ia	FN ax	GN xe	IV bo	JO fp	KP bj	LP pl	MO ng	NO ep	OR fa	PM zx	RN fb	SN gc	UR ez	VM ez	WN kb	XN yc	YR ba	ZM sr
AV dr	BO lx	CP zb	DO rx	EZ ge	FO ek	GO ub	IW ax	JP vg	KR no	LR vo	MP fo	NP lj	OS jz	PN vr	RO vz	SO dl	US fa	VN eb	WN es	XN af	YS sy	ZN xf
AW ie	BP od	CR ak	DP zo		FP na	GP rk	IX fs	JR av	KS uv	LS oc	MR zd	NR ko	OV wc	PO ds	RP oz	SP rd	UV jx	VO an	WO xc	XO rz	YV vc	ZO jf
AX yp	BR va	CS mn	DR ob		FR ja	GR ik	IZ jd	JS yb	KU dv	LV av	MU br	MU vw	OX ej	PS fr	RU ba	SU lk	UX ip	VR ve	WR dj	XR va	YX ry	ZR ye
AZ re	BS id	CU rj	DS br		FS vk	GS sv		JU sa	KV ox	LV av	MU br	MU vw	OX ej	PS fr	RU ba	SU lk	UX ip	VR ve	WR dj	XR va	YX ry	ZR ye
	BU xy	CV ar	DV ro		FU dn	GU sp		JV bl	KW cs	LW ug	MW ru	NW zr	OZ ra	PU rv	RV cf	SV og	UZ ca	VS co	WS lf	XS bx	YZ go	ZS du
	BV ra	CW do	DV jv		FV km	GV ze		JW kv	KX pb	LX xu	MW sg	NW rn		PV rn	RV xj	SV ad		VU pn	WU rg	XU zr		ZV ns
	BW yd	CX lb	DW sa		FW uc	GW eg		JX wf	KY au	LY ce	MX ky	NX pk		PW lp	RX yl	SX ip		VW sl	WV ow	XV nc		ZV yf
	BX sv	CY pg	DX za		FX ok	GX dp		JY dz	KZ xr		MY xi	NY be		PX jk	RY il	SY wo		VX uk	WV fc	XW su		ZW or
	BY vb		DY kz		FY wy	GY ni		JZ pw			MZ lv			PY oj		SZ aw		VY iw	WY bu	XY zi		ZX sb
			DZ va		FZ yz	GZ vn								PZ ur				VZ ar	WZ na	XZ da		ZY sa

DECIPHERING TABLE

ab XC	ba RU	ca UZ	da FM	eb VN	fa US	ga DL	ib CI	ja MN	ka BN	la NJ	na CS	na DW	ob DR	pa DG	ra OZ	sa JU	ub GO	va ZP	wa XR	xa PJ	yb JS	za OE
ac WJ	bc DC	cb KI	db RL	ed CJ	fb RN	gb MC	id BS	jb XD	kb WM	lb AD	ab VB	nb PE	oc LS	pb XI	rb EP	sb ZX	uc FW	vb GC	wb BY	xb CP	yc XM	zb CF
ad SW	bd MC	ed VB	dc SK	ef ML	fc WX	gc SN	if WS	jc PD	kc RJ	lc XJ	ac FB	nc XV	od BP	pc JG	rc AF	sc UM	ud IL	vc YV	wc OV	xc WO	yd BH	zc FK
af YW	be NY	ce LY	de KB	eg GW	fd PS	gd FG	ig FR	jd IZ	kd WF	ld EW	nd WL	nd TJ	of BJ	pd BK	rd SP	sd YC	uf PZ	vd SC	wd ZL	xd YG	yf ZV	zd MR
ag DE	bf MU	cf RV	df JD	ej OX	fe SJ	ge EZ	ij LB	je EG	kg ES	le EM	af XN	ne WC	og SV	pe SL	re AZ	sf VL	ug LN	ve WB	we VR	xe GN	yg CF	ze GV
aj LJ	bg KA	cg IP	dg GB	ek FO	fg GE	gf KC	ik GR	jr ZO	kl IN	lg ZI	ag PL	af BL	oj PY	pf EX	rf JE	sg KW	uj MY	vf ZB	wf JX	xf ZN	yj ZD	zf NY
ak CR	bl OF	cj GA	dl BC	ep NO	fl LK	gl VA	il RY	jg GL	kj ZJ	li MF	al XY	og MO	ok FX	pg CY	rg WU	sl ZY	uk VX	vg JP	wg PC	xg SM	yh ZF	zg JC
aa GJ	bj KP	ck LD	dj WR	er NE	fj WC	gj RB	ia EX	ji NC	kl VD	lj NP	aj UL	ni CY	ol NY	pi ZK	rj CU	sj ZA	ul CH	vi YK	wi UR	xi MY	yl RX	zi DJ
an VO	bk YR	cl OK	dk IM	es WN	fk RA	gk UC	in WD	jk PX	km FY	lk SU	ak EB	nj UD	oa VP	pj RK	rk GP	sk JA	ua NS	vj CD	wj LO	xj RK	yj IP	zj SA
ap MD	bl JV	cm RD	dl SO	ev OC	fl CO	gl NF	ip SX	jl KC	kn ON	lm XL	al SF	nk XB	on GD	pk NX	rl XL	sl VW	un AP	vk FS	wk XK	xk OJ	yh GM	zk JL
ar NI	bm EV	cn AC	dm XZ	en DN	fm OR	gn XC	is AR	ja YP	ko NR	lo WP	an CS	na FP	op JF	pl LP	ra BV	sa FL	up OL	vl AG	wl FD	xl FI	yp AX	zl ED
aa BC	bn LJ	co VS	dn FU	eo AN	fn XF	go AX	iv FJ	jo RM	kp SR	lp PW	ao ZE	no KR	or ZW	pa XI	ra NW	sa PF	ur ZG	va DZ	wb FA	xb ZC	yc ZR	zd SE
av LV	bo IV	cp DF	do CW	ez UR	fo MP	go YZ	iv VY	jp EM	kr GI	lr CK	ap AB	ap SG	os YM	pn VU	ro DU	so ON	us XP	vn GZ	wv DB	xv PY	yv IB	zv CE
aw JR	bp PC	cr WC	dp GZ		fp JO	gp FC	ix DK	jr VK	ks LU	ls OP	ar VZ	nr CV	ov PA	po CF	rp UX	sp GU	uv KS	vo LR	wo SY	xo UN	yv BO	zo DP
ax FN	br CS	ca KW	dr AV		fr PS	gr KN	iz VI	js FR	ku PK	lu JI	as YP	ns ZU	ow WV	pr UJ	rs SD	sr ZM	uw RS	vp LG	wv XA	xv IC	yv VG	zv AM
az KD	bs CM	cb BF	ds PO		fs LX	gs CG		ju WA	kv CL	lw MZ	au KY	nu WE	ox KV	ps FE	rt MV	su XH	ux MS	vt PN	wv XE	xv KZ	yz FZ	zv XU
	bu WY	cv UF	du ZS		fu ER	gv ID		jv DV	kw JW	lw YN	av GS	nv OO	oz RP	pu YB	rv PU	sv RE	uz VE	vs BI	wv MB	xv DX		zv DA
	bv RP	cw JK	dv KU		fv KO	gv LA		jw KJ	kx DI	lx BO	av SZ	nv RC		pv CA	rv UX	sv BX		vu BR	wv MJ	xv LX		zv VJ
	bw NA	cx SB	dv UP		fw YL	gv BA		jx UV	ky MX	ly GK	ax JM	nx IW		pw JZ	rx DO	sx LM		vw NU	wv YD	xv NE		zv LE
	bx ZS	cy PI	dx EJ		fx AS	gx OC		jy LI	kz DY		ay NG	ny EF		px VC	ry YX	sy YS		vz MI	wv MO	xv AP		zv YJ
	by UC		dy LC		fy KM	gy BE		jz OS			az IS			py WK	rz XO	sz RI		vy NM	wv FY	xv BU		zv PM
			dz JY		fz UB	gz JB								pz IX				vz RO	wv VM	xv MA		zv RC

"STAFF CODE"

200
B C

- 5-inch	- Abbreviate
20,000 ABAC__0	20,050 BCFG__A
20,001 ABAD__1	20,051 BCFK__ . certain amount
20,002 ABAF__2	20,052 BCFL__ . day ('s)
20,003 ABAG__3	20,053 BCFM__ . delay (of)
20,004 ABAJ__4	20,054 BCFP__ . direct hit
20,005 ABAK__5	20,055 BCFR__ . dispatch (from)
20,006 ABAM__6	20,056 BCFS__ . distance of
20,007 ABAN__7	20,057 BCFV__ . few
20,008 ABAP__8	20,058 BCFW__ hours
20,009 ABAS__9	20,059 BCFX__ miles
20,010 ABAV__1-horse	20,060 BCJB__ . front of
20,011 ABAW__1-inch	20,061 BCJF__ . height of
20,012 ABAX__1-mule	20,062 BCJK__ . large amount
20,013 ABAZ__1-pound	20,063 BCJL__ force
20,014 ABBA__1-ton	20,064 BCJM__ number (of)
20,015 ABBE__1½	20,065 BCJP__ . length of
20,016 ABBI__1½-ton	20,066 BCJS__ . little
20,017 ABBO__1.5-inch trench mortar (s)	20,067 BCJV__ . mile
20,018 ABBU__2-inch	20,068 BCJW__ . minute
20,019 ABBY__2-pound	20,069 BCJX__ . mistake
20,020 ABCA__2-ton	20,070 BCKC__ . misunderstanding
.....
20,026 ABDI__3-inch gun (s)	20,076 BCKS__ . reliable source
20,027 ABDQ__3-inch Stokes	20,077 BCKV__ . series of
20,028 ABDU__3-pounder	20,078 BCKW__ . shell
20,029 ABDY__3-ton truck (s)	20,079 BCKX__ . short distance
20,030 ABEB__3.2-inch	20,080 BCLB__ time
20,031 ABEF__3.2-inch Field Gun (s)	20,081 BCLC__ . shortage (of)
20,032 ABEG__3½-ton truck (s)	20,082 BCLJ__ . slope of
20,033 ABEJ__3.6-inch Field Gun (s)	20,083 BCLK__ . source (of)
20,034 ABEK__3.6-inch Field Mortar (s)	20,084 BCLM__ . strength of
20,035 ABEP__3.7-inch	20,085 BCLP__ . surplus
20,036 ABER__3.7-inch Trench Mortar (s)	20,086 BCLS__ . thorough investigation
20,037 ABES__4-cylinder	20,087 BCLV__ . total (of)
20,038 ABEV__4-inch	20,088 BCLW__ . week
20,039 ABEW__4-inch Stokes (heavy)	20,089 BCLX__ ago
20,040 ABEX__4-inch Stokes (light)	20,090 BCMC__ . year
20,041 ABEZ__4-pounder	20,091 BCMD__ . Abandon (s)
20,042 ABFA__4-ton truck (s)	20,092 BCMG__ first line
20,043 ABFE__4.2-inch	20,093 BCMJ__ the attempt
20,044 ABFI__4.5-inch	20,094 BCMK__ . Abandoned
20,045 ABFO__4.5-inch howitzer (s)	20,095 BCML__ . Abandoning
20,046 ABFU__4.7-inch	20,096 BCMP__ . Abandonment
20,047 ABFY__4.75mm.	20,097 BCMQ__ . Abate (s)
20,048 ABGA__5-inch	20,098 BCMV__ . Abated
20,049 ABGE__5-inch siege gun (s)	20,099 BCMX__ . Abbreviate (s)

(Note: The line of dots at the center of the page has here been inserted merely to indicate that several lines of text have been omitted in the attempt to make an exact reproduction of the original, which was too long for the present book.—H. F. F.)

Casualty code lists.—In May 1918 the following short code list for reporting casualties was prepared and printed. This list was printed later as a General Order:

Report following accidentally killed.....	AWL
Report following killed in action.....	BOX
Report following died of wounds.....	COW
Report following died of disease.....	DAY
Report following missing in action.....	END
Report following severely wounded.....	FEW
Report following slightly wounded.....	GAS
Drowned—Body recovered.....	INK
Drowned—Body not recovered.....	JAR
Death in line of duty.....	KIT
Death not in line of duty.....	LEG
Result of own misconduct.....	MOP
Not result of own misconduct.....	NAG
All in line of duty, not result of own misconduct.....	OAK
All entitled to wound chevron.....	PUN
Not entitled to wound chevron.....	RAM

Emergency code lists.—In September 1918 a short code of 2-letter combinations was prepared to meet in part the needs of the front line who had no access to the "trench codes" or other means of secret communication. Six thousand copies of this "Emergency" code were printed and distributed down to companies. It contained some fifty commonly used phrases with an encoding and decoding section. A new edition of these lists was put out to accompany each issue of trench codes. When the "Huron Code", the second of the "Lake Series", was issued on October 15, the list was printed in the front of the code book in order to provide a ready reference for communication between the users of the large codes and the front line who had but the small list.

This "Emergency" list was but in its infancy at the conclusion of the war and the experience gained by observation and criticism would no doubt have greatly improved it.

Radio Code.—Up to October 1918 the French Radio Code had been used by the American Army as a service code, but the difficulty in language was a constant source of trouble.

In October, therefore, a new American code was compiled, consisting of about 1,000 words and phrases, and has been in use up to the present moment.

As an emergency measure, all the work of compilation, printing, and delivery to the First Army was done in a period of six days. This code was known as "American Radio Service Code No. 1", and 2,000 copies were printed.

Although not, properly speaking, a function of the Code Compilation Section, the demands made upon it to determine what particular code was being used in the preparation of certain messages were so frequent that the need for centralization of code work was made conspicuous.

Miscellaneous codes.—At certain times messages were being sent by different organizations in "Playfair", "Hudson", and "Mohawk" Trench Codes; private organization codes regarding replacements; private casualty codes; ammunition codes; and in addition messages in plain containing such code groups as "Nellie Smith", and giving a location as "Windfall" or "Laredo."

SECRET

EMERGENCY CODE LIST

To be used only with the "Seneca Code."

To be issued down to companies.

To be used only for communications within divisions.

To be completely destroyed, by burning, when in danger of capture or after a new code has been issued.

Precede every message in this code by "NA."

About to advance...AV
Ammunition exhausted...XA
Are advancing...CB
At...PO
Attack failed...CZ
Attack successful...ZB
Barrage wanted...XP
Be ready to attack...BF
Being relieved...AP
Captured...ZF
Casualties heavy...XG
Casualties light...FY
Center...RX
Enemy...CA
Enemy barrage commenced...AF
Enemy fire has destroyed...BY
Enemy machine gun fire serious...FZ
Enemy trenches...ZJ
Everything O. K....SB
Everything quiet...FA
Falling back...BS
Gas is being released...PX
Have broken through...PG
How is everything...AZ
Increase range...XY
Left...SZ
Look out for signal...FS
Machine gun ammunition needed...BD
Message not understood...SF
Message received...BM
Near...SA
Need water...CX
Not ready...PF
Objective reached...AX
Our...PM
Our artillery is shelling us...CM
Raiders have left...BP
Recall working party...ZP
Reinforcements needed...ZX
Relief being sent...SX
Relief completed...AB
Rifle ammunition needed...FM
Right...FB
Rush...CP
Situation improving...FC
Situation serious...AW
Stopped...AG
Stretcher bearers needed...XB
Strong attack...SP
Tank stuck...PB
Trenches...SM
Trenches have been occupied...PV
Troops...BJ
Using gas shells...FX
Using high explosive shells...XF
Wire entanglements destroyed...SC

AB...Relief completed
AF...Enemy barrage commenced
AG...Stopped
AP...Being relieved
AV...About to advance
AW...Situation serious
AX...Objective reached
AZ...How is everything
BD...Machine gun ammunition needed
BF...Be ready to attack
BJ...Troops
BM...Message received
BP...Raiders have left
BS...Falling back
BX...Center
BY...Enemy fire has destroyed
CA...Enemy
CB...Are advancing
CM...Our artillery is shelling us
CP...Rush
CX...Need water
CZ...Attack failed
FA...Everything quiet
FB...Right
FC...Situation improving
FM...Rifle ammunition needed
FS...Look out for signal
FX...Using gas shells
FY...Casualties light
FZ...Enemy machine gun fire serious
PB...Tank stuck
PF...Not ready
PG...Have broken through
PM...Our
PO...At
PV...Trenches have been occupied
PX...Gas is being released
SA...Near
SB...Everything O. K.
SC...Wire entanglements destroyed
SF...Message not understood
SM...Trenches
SP...Strong attack
SX...Relief being sent
SZ...Left
XA...Ammunition exhausted
XB...Stretcher bearers needed
XF...Using high explosive shells
XG...Casualties heavy
XP...Barrage wanted
XY...Increase range
ZB...Attack successful
ZF...Captured
ZJ...Enemy trenches
ZP...Recall working party
ZX...Reinforcements needed

The Code Compilation Section was never able to ascertain how many codes were in actual use at any one time; when they were put into service or withdrawn; or who issued these codes. Moreover, it did not know of any one office that did know. One instance of the confusion which naturally arose out of this multiplicity of codes is the case where a message was received at General Headquarters addressed to an officer in "London." After it had been put on the wire and forwarded to London, England, and a reply received that he was unknown, an investigation developed the fact that an organization in the field had assigned the code word "London" to an adjoining village but had not notified headquarters of its code list. This particular difficulty was straightened out, but not even Military Intelligence had a complete list of the codes in use. The confusion is manifesting itself at the present time in the tremendous task confronting the Historical Section in determining exactly where "Laredo", for example, was on September 5, knowing that probably ten days before or later the name was assigned to another place.

It is so vitally important that telegraph and telephone offices be kept constantly advised of all these codes, to say nothing of the other branches of the Army, that it seems imperative that the whole question of code preparation and distribution be centralized in order that there may always be some head or source of information thoroughly conversant with the whole situation.

There were far too many codes in use in the American Army, codes prepared to meet an emergency by men who had no special knowledge of such work. These codes must have presented no great difficulties to enemy code men and no doubt gave away much valuable information. A central office would materially have reduced these temporary codes and provided much safer vehicles of communication.

Printing of codes.—The codes compiled by the Code Compilation Section were printed at the printing office of the A.G.O. at General Headquarters.

By an arrangement with that office these codes were given preference over all matter except General Orders and Bulletins. In general this plan proved satisfactory but at times, owing to an unusual pressure of work, an issue of codes was considerably delayed. As a rule this delay was comparatively unimportant but there was always the danger that a code would be captured and a new issue needed at once to replace it. As a matter of practice two complete codes were always kept in stock for issue, except upon the occasion when three different series were in use on three different fronts at the same time. But the danger was too great to permit of this hazardous plan of control being long used. Frequently a code would be set on the linotype, carried through the composing room, proofread twice, printed and bound in about five or six days of normal work, but this only under the most favorable conditions. Under pressure, working three shifts of men during the twenty-four hours, the linotype could complete its work in forty-eight hours. However, upon occasions all work on codes was stopped for several days and this delay became too prevalent to make for the best results.

During the process of printing, the codes were under the constant supervision of an officer whose duty it was to destroy all spoiled sheets containing impressions even to the mats on the presses. All copies were counted and accounted for and the metal type melted down after the final impression. In many cases two or three officers were on duty in the printing office keeping the various operations in sight.

In future operations of this sort, I would recommend that this Section be given absolute control over a linotype machine and a small press, together with the necessary personnel to function, because in this way alone could the regular issuance of codes be insured. Inasmuch as the vital principle of the American system consisted of the rapid reissuance of the series of codes, too much value cannot be attached to the absolute control of printing facilities. The necessity for this became particularly evident upon the formation of the Third Army which called for a total issue of nine books a month instead of three as originally intended.

G-2.—During the entire period of the war this Section was cooperating closely with G-2 at General Headquarters. A careful study of the errors committed by the enemy was made, and later, when the American intercept stations were established, close examination was made, of the American messages, both by G-2 and by this section, to determine the common errors of commission and omission. When grave mistakes or violations of orders occurred, the attention of the offending officers was invited by G-2 to the danger of such practices, and helpful suggestions were given them for their better understanding.

Lieutenant Colonel Moorman was indefatigable in his endeavors to educate, encourage, and assist the code men of the Army—a task made the more difficult by the vast amount of “propaganda” necessary to popularize these codes. This work he assumed in addition to the already heavy burdens of enemy code destruction. To his unflinching courage of conviction and clearness of vision the Code Compilation Section is indebted for a large part of its achievements.

G-2 determined the number of each issue of trench codes and made the distribution to the Armies. The general policy of distribution and disposition was planned and carried out by that Section.

It seems to me of the highest importance that the Military Intelligence Section should work in the closest possible cooperation with a Code Compilation Section in order that that section may profit by the mistakes made by the enemy as well as those of our own army and by the improvements observed in enemy codes as they come to the knowledge of the Military Intelligence Section.

Distribution.—The problem of distribution was a difficult one to solve, inasmuch as the whole question was without precedent in the American Army and was changing from day to day by the peculiar conditions of the front and by the formation of the second and third Armies. In the main the centers of distribution were the officers of the G-2 section who had manifold other duties of equal importance to perform. This question has no doubt been covered by the report of G-2 at General Headquarters, so I shall attempt no general report of those activities.

Notes on the use and construction of codes.—The writer of this report has been engaged in code work for several years both as an operator and in the construction of codes. In the building up of these field codes efforts were made to consider not only the practical side of field operations but the psychology of the operators. The temperamentality of operators plays a very important part in the use of codes and the results of habit are perhaps more marked in this branch of service than in most others. The first result of familiarity with code work is the increased volume of code work. The result of this is the increased protection to the secret operations of the Army and a reduction in the actual business transmitted over the telephone and telegraph lines.

It is a point frequently overlooked but important that many times the use of codes reduces materially the volume of messages. This occurs for two reasons. First, because as a rule codes are so constructed that they permit the sending of several words or a sentence by an equivalent three- or four-letter group. Second, an officer familiar with code work will automatically shorten his message by boiling it down. As a corollary, it might be said that upon occasions many messages are not sent over the wires at all because of the so-called trouble of coding. This in itself is a gain inasmuch as they would undoubtedly have been coded had they been important enough to send.

A fact deduced from the study of the psychology of operators is the tendency to become familiar with certain set phrases and to endeavor to memorize certain code groups in order to speed up code work in general. This natural tendency was taken into account in the construction of codes and an effort made to avoid the use of such conspicuous combinations as “SOL”, “DOG”, “YOU”, etc., with words or phrases of frequent occurrence. This was done for the

reason that repetition affords the greatest assistance to the watchful enemy. On the contrary, the group "DAM" for "code lost" was assigned with the specific object of making the group easily committed to memory by its common use as an ejaculation.

Still another instance of this peculiar influence is found in the tendency of the operator to accept the first or most convenient one of a number of variants for a given phrase or word. Thus it was necessary in the placing of a series of "nulls" throughout the code book to arrange them in such manner that following this natural law of selection the operator would unconsciously choose different combinations by taking the nearest one to hand. This unconscious selection, the proverbial American short-cut, is one of the strongest arguments in favor of a short-lived code book because it reduces its safety in exact ratio to the years of its existence as operators become familiar with its plan of construction. When a change in book is made, the plan, if sound in principle, need not be altered, but it is the only method known of preventing operators from taking the line of least resistance.

Although it may seem a paradox, the most striking feature of the use of trench codes was the general inclination to avoid them whenever possible. This idea had its root in the proverbial inclination of the American for the before-mentioned short-cut. It received its nourishment either directly from commanding officers by orders to refrain from codes or indirectly through inattention or general lack of knowledge on the subject. Under this encouragement and on such fertile soil the idea grew so amazingly that even instructions from General Headquarters and the advice of code men were ignored or overlooked. As an instance of this, it is a matter of record that on one occasion a general in command in the field gave positive orders that prior to and during a certain important movement absolutely no code was to be used by his division.

On the other hand it was found that in actual practice the very men who might have been expected to shun codes were the ones who used them most. Thus it developed that the officers of the Signal Corps, whose primary duty it was merely to transmit the messages, were in many cases using the codes freely for the transaction of their own business, and moreover, in many instances, actually coding and decoding messages for the infantry, artillery, and other organizations. With but few exceptions it was from these officers that all the constructive criticism was received.

As a matter of fact, Signal Corps officers had received no more actual instructions in the use of trench codes than had the Infantry or Artillery officers, but the course of their instruction contained enough information on the general subject to remove the mystery from the word "code" and make it commonplace enough to be handled with impunity so that to them it had no terrors.

Perhaps the best example of the reverse of the Army's practice is the Navy, where every officer is trained in the use of codes from the beginning and regards them as equally essential in his profession with a knowledge of radio or navigation.

Lack of instruction in code work.—The fact next in prominence was the widespread lack of knowledge on the general subject of codes in the Army. At the commencement of the war, it is doubtful if a Regular Army officer had ever compiled a modern field code or assisted in compilation. Indeed, when this Section was organized its files did not contain a single copy of an American Army field code. The experienced Army code men were those who were familiar with the "breaking down" of codes rather than the "building up." Since, therefore, there were no code-construction experts in the Regular Army, it might have been expected that in the rush of preparation for hostilities this feature would be overlooked in the curriculum of instruction for officers. Up to July 1918, when the capture of an American trench code released that code from secrecy, no instruction was given on the subject in the Army Schools. After that date an effort was made to establish courses in certain schools. The result of the previous policy was that not only were the officers actually in the front line unfamiliar with code work, but all those officers going through the preparatory stages were uninstructed on this subject.

The Chief Signal Officer of the American Expeditionary Forces strongly urged upon General Headquarters the adoption of some thorough plan of instruction not only for officers but for enlisted men in order that a trained personnel might be available for emergency work.

Lack of instruction manifested itself not only in errors in code work and in the avoidance of code but in carelessness in handling the books themselves. As an instance, an officer upon one occasion certified that a certain copy of a code had been destroyed by him and forwarded certificate to that effect. Within a few days the "destroyed" code was forwarded among others to General Headquarters. Inasmuch as each code had its own distinctive number carefully checked and receipted for from its issuance, such an action might seem difficult to explain. As a matter of fact, code books were picked up in billets, at headquarters, and in the trenches. When it is recalled that the loss of a code book presupposes capture by the enemy and that even under the best of conditions at least two days are lost in the redistribution of between 2,500 and 3,000 copies, the result of such carelessness or ignorance is obvious. These cases also are in addition to the instances where, by the fortunes of war, books fall into enemy hands.

Construction of American codes.—The trench codes now in use are divided into two parts, which are known as the "encoding" and "decoding" sections. The encoding section is made up of words, numbers, and phrases arranged in a logical alphabetical sequence and not under a caption heading as is usually the case in commercial and military codes. Each word and phrase has an equivalent code group, three letters if a letter code, and four numbers if a number code. Two, three, or perhaps as many as five different groups, or variants, are provided for the various letters of the alphabet and for certain words and phrases in most common use. The reason for this lies in the protection afforded by avoiding the repetition of a particular group. In the preparation of messages, somewhat routine in character during normal conditions, when much care can be given to the work in hand, the life of any code may be greatly prolonged by choosing groups at random, where such choice is possible. When the code officer is under fire or in a gas attack or when great speed is necessary in the dispatch of a message, it is natural that despite all instructions to the contrary he will follow the line of least resistance. Therefore, the first group occurring will be the group used by him and, if occasion demands it, it will be used a second time. Herein lies the source of most danger to a code, for it is just such errors which make the opening for the entering wedge of the enemy code experts. Since it is very difficult to control or to prognosticate the actions of men under such unusual conditions, it is incumbent upon all code officers to take extraordinary precautions in normal times to offset in part the errors occurring under pressure.

The following points were considered in the actual construction of the trench codes:

1. *Clearness of type*, account being taken of the poor lighting facilities at the front;
2. *Simplicity of operation*, believing that the absence of complication would tend to reduce error in preparation and transmission and increase the number of coded messages;
3. *Size of the book*, in order to make it convenient to handle and preserve;
4. *Vocabulary*, large enough to provide a working basis for all ordinary conversation yet not too large to be easily handled;
5. *Paper*, of a quality sufficiently good to last for the short life of the book yet poor enough to permit of rapid destruction if necessary to prevent capture;
6. *Variants*, to provide safeguards to avoid repetitions as much as possible of common expressions; and
7. Certain accentuated features to call particular attention to things to be remembered or to make them conspicuous.

It will be found difficult to bear in mind under extraordinary conditions all the minute directions which may be laid down for the use of a code, yet a slight deviation from those directions may give to the enemy who has intercepted the message the clue not only to that particular mes-

sage but to many others. In other operations of an army in the field, an error in judgment or of carelessness may rebound upon the unfortunate officer to his rapid undoing, but an error in code operation may not be apparent at once; may not in any way affect the responsible officer, but may wreak havoc upon the plans of the supporting troops adjoining. This might be the immediate result of such error. The late result might be that his mistake had provided the key which could unlock messages hitherto undecipherable, and such messages as might be sent until the notice of error was disseminated. When it is remembered that the secret correspondence of the entire army may be jeopardized and delayed by one man's carelessness or failure to carry out instructions, officers should treat the preparation of code messages with the seriousness which the gravity of the situation demands. These remarks are apropos of what may seem to be errors of small magnitude, but are made emphatic because they might otherwise be considered of small moment.

Referring to the "Secret Instructions" for the use of Army codes, the following practices are expressly forbidden:

- (a) To use plain language in the same message with code or cipher.
- (b) To repeat a message in any code or cipher other than that in which first sent.
- (c) To repeat a code or cipher message in plain language.
- (d) To repeat a plain-language message in code or cipher.

Under section (a) it is so obvious that the use of a word in plain affords a ready clue to the adjoining words that no comment is necessary. Such words usually would be used to avoid the labor of spelling out letter by letter, and if nothing were lost save that particular message, no great harm would result. But the solution of a group by the enemy may mean not only the gain of that group, but be like the ever-widening circles in the water caused by the dropping of a stone.

Section (b) emphasizes the fact that repetition in another code may jeopardize the secrecy of the second code, inasmuch as the first may have been intercepted and deciphered.

Section (c) is almost axiomatic in its directions, since it is evident that such a procedure simply presents the enemy with just that many code groups, plus the ratio of the widening circle.

Section (d) is but the reversal of (c) and its importance is equally obvious.

A frequent error in code preparation arises in the spelling of words in messages. In order to provide a full list of words and phrases to cover all conditions and situations and to include all officers' vocabularies, a very large code book would be necessary. It is obviously impracticable to provide such a book. One, therefore, must be used which will include so far as possible all words in common use at the front, and such phrases as will be most frequently used in reports and orders. The reduction in size means the elimination of many important words. Much care has been given to a selection which will provide substitutes in large part for the omissions. Take, for example, the situation where the expression "Instruct him accordingly" was to be used. Upon reference to the code book the word "instruct" might not be found. The word, therefore, may either be spelled out letter by letter, or, a much shorter method, the word "tell" might be used instead. It was found in actual practice that at times certain alterations were made in the actual text of messages by operators to avoid the dangerous course of spelling out words.

It should be impressed upon all officers that the enemy has various channels of secret information, and that through all these channels back to their main headquarters flows a steady stream of information of all sorts. Much is merely piecemeal scraps of military movements, but the central organization sifts the material, carefully indexes it, and files it away for future reference. Accepting the fact of this central bureau of the enemy, the following points are set down to show how important even a small degree of carelessness becomes when augmented by the accumulated mass of material:

- (a) The date and time of day when messages are sent.
- (b) The approximate positions of the sending and receiving stations.
- (c) The system of call signs and wireless procedure.
- (d) The organization and disposition of our forces.
- (e) Name of commanding officers and units.
- (f) The constant lookout for answers to messages which they have intercepted and decoded, and the watch for repetition in clear of messages previously intercepted and decoded.

With one of our most active field signal battalions during the war, more than 80 percent of its messages were sent by radio. It has been estimated that 75 percent of all radio messages are intercepted; therefore, the enemy will necessarily have access to a great deal of information.

Operators have a tendency to send certain stereotyped report messages at stated hours each day. If this system of daily reporting is universal, the enemy, who is undoubtedly making similar routine reports, may make a very accurate conclusion as to our reports, and thereby identify certain code groups. This is one of the insecurities of the modern codes.

Errors.—A very strict rule was early laid down to men engaged in the actual transmission of messages. Upon one occasion a high officer prepared an important message and directed it to be sent "in plain." The danger of clear was so obvious that the receiving operator reported to his immediate superior his belief that it should be coded. The superior so informed the general who initiated the message and thereupon received prompt and precise orders to send it "in plain", which was done. However, the officer in charge of the station filed a report with higher authorities of the incident.

Upon another occasion within 12 minutes of zero hour, a regimental commander within a few hundred yards of the enemy's lines gave telephonic directions in plain language and received replies as to the forthcoming attack. As a result, within 2 minutes after this conversation the heaviest barrage that had ever confronted them was being laid down by the enemy, and 10 minutes later the organization went over the top on schedule time. How many lives were needlessly sacrificed by this indiscretion can never be computed, but the capture of an enemy amplifier in the front area on this attack emphasized the folly of such negligence.

At another time, when it was important that certain information should be obtained from the enemy, thanks to a similar telephone conversation, our raiding party penetrated the third-line enemy trenches without encountering a single person, and then returned through a very heavy barrage after an absolutely futile expedition. It developed later that the commanding officer, in order to make the directions clear, had repeated them three separate times over the telephone in plain language.

Carelessness in code work.—As an example of extreme carelessness in the preparation of a code message there may be cited the case of a message where the code group for "semicolon" was used fourteen times in one short message from the front. This repetition occurred despite the fact that several variants had been provided for this sign. It might also be said that there existed no valid reason why the punctuation should have been used at all in this message.

During an attack a certain code officer transmitted a message in which he had had occasion to spell out a word in which the letter "e" occurred. In order to be on the safe side, he used all five equivalents for the letter "e", one after the other, thus lengthening his message by four extra groups as well as affording a very valuable opening for enemy code men, in the event that the message was sent by radio and intercepted.

This officer had not read the instructions in his code book or this error could not have been committed.

Another officer took occasion during activities to end a message couched in very unusual language to say the least. His telegram read in part:

"An aeroplane was observed at crack of dawn."

In order to send the phrase "crack of dawn", it was necessary to spell out the word "c-r-a-c-k" which took 4 groups, and the word "d-a-w-n" taking 4 more groups. He had, therefore, used a total of 9 three-letter groups, or 27 characters, to send this expression.

A knowledge of the phraseology of his code book would have shown this officer that his book contained the words "break" and "day", an expression equally euphonious. This he could have sent in 3 groups—a saving of 18 characters on the wire.

Euphony, however, is not necessarily important in war times, and his message could have read "daylight", an identical meaning, and this could have been sent in one group. His message then would have been just 24 letters shorter; more to the point; and labor saving, both to code men and telegraph operators, sending and receiving; to say nothing of the decreased assistance to enemy code experts.

It would be difficult to find any justification for such a practice. This message consumed approximately 20 minutes more time than was necessary, and this in a time of intense activity when the wires were crowded with messages.

An error which through ignorance of its importance may well creep into frequent practice is that of combining plain language and code groups in a message. The following is an example:

"Following message sent C. G., 4th Division. Quote. Your division has been assigned to 1st Army. End quote. Smith. Division short of equipment and transportation. (2142) (1685) (1912) (4001). G. H. Q. says (5622) (2814) (1918) (2004)."

The first mistake occurred in sending the first part of this message in plain and the rest in code.

The second in sending information of this nature over the wire in plain language.

The third mistake, and this might be vital in many ways, occurred in quoting in plain language an important troop assignment message which presumably had been sent originally in code.

Not only did this second message give enemy code men full information in regard to this organization, but what might be more important gave them eight code groups intact as well as other preliminary and concluding groups of the original message. This information used with relation to other intercepted messages might be the means of solving problems hitherto secret.

All these serious consequences thus grew out of someone's disinclination to take the time to put the entire message into code.

An error, very like that in the "crack of dawn" message, frequently occurs through a lack of knowledge of the code-book phraseology. For example, in a message from the front, an officer used the expression "Tell Captain ——." The word "tell" was not in the current code book, so the word was spelled out "t-e-l-l", using four groups. In this particular message, although three different code equivalents had been provided for the letter "l", the same group was repeated, thus reducing by more than 50 percent the labors of the enemy code experts. To make matters worse, no blanks or "nulls" were used between the letters in spelling the word. The crowning error was seen in the fact that the word "Inform" which appeared in the code book, might have been used with equal force.

In another message the word "normal" was sent *twice*, in both cases spelled out letter by letter, using the same code equivalents. In addition to the lengthening of the message by spelling out "n-o-r-m-a-l", 6 code groups, or 12 including repetition, the serious error of repeating groups was made, although an attempt to alleviate this was made by the introduction of a "null" between two letters of the repetition.

This word could have been built up by using "no-r-m-al", 4 groups, or 8 including the repetition, a saving of 4 groups in the message.

As a further protection to the code, the first occurrence of this word might have been spelled out letter by letter, and the reoccurrence coded by being built up as indicated in preceding paragraph. As a matter of fact the phrase "as usual" conveys much the same meaning and might have been used with its code equivalents.

It is readily seen that in messages sent under trying battle conditions many errors in construction may occur, due to the necessity for speed and the psychological pressure of the moment, but familiarity with the code-book phraseology should have been acquired during periods of inaction.

German thoroughness.—As an example of German thoroughness and care the following instance is given. In answer to a telegram of inquiry regarding the location of a certain aerial the code man replied with a short message giving the location in one of the groups. However, he surrounded this group with *nine* "nulls" or meaningless groups to disguise his true meaning. The telegram of inquiry had been intercepted by our Intelligence and deciphered and the reply was eagerly awaited. The reply was intercepted, but, although some of the "nulls" were located, the message was not translated until after the capture of a German code book when the message was seen to read: "In the brickyard." The first operator had been a little careless in his construction and the second operator, recognizing this, had taken greater care to disguise his own message.

German carelessness.—It became evident early after the American entrance into the war that a great deal of care was being given to the course of instruction of enemy code men in the preparation and transmission of code messages. Many errors which would have been committed by inexperienced code men were noticeably absent. Yet, as appeared in several notable instances one of which the Military Intelligence sets forth at length, the greatest assistance to our code experts was derived from the careless repetition in plain of messages sent in code or some equally simple deviation from the rules laid down for the preparation and transmission of messages.

The following extracts from a captured German document bear repetition in view of the emphasis laid upon the dangers of carelessness in code work. It is headed:

"THE ENEMY IS LISTENING."

(It would be well if each American code man had this motto graven in his memory.)

"Messages in plain text are permitted only when the danger of interception is outweighed by the necessity of rapid transmission and the urgency of the moment."

* * * * *

"The most serious harm yet caused to the German front has without doubt been through imprudent telephone conversations."

* * * * *

"Details of a gas attack by the enemy had been discussed by telephone and intercepted by us. The intercepting operators repeated them word for word over the telephone to our P. C.'s. The enemy in turn intercepted these conversations, and, knowing us to be aware of his plans, changed the hour and point of attack and carried it out with full success. Thus the heedlessness of our operators was the direct cause of the death of many of their comrades."

* * * * *

"Enciphering processes must fulfill two requirements: 1. They must be as safe as possible. 2. As simple as possible. * * * The best safeguard lies in frequent change of key and the use of keys as short as possible. Even the best of methods may, however, be spoiled if incompletely employed, and a whole series of messages based on one key laid bare through a slight fault of a single operator even though previously used with skill by several. Some

methods have also been compromised by insignificant messages sent carelessly in moments of calm.

"Punctuation marks in cipher messages also endanger them. For example:

AWL RBG RBG RBG - ,

"The thrice-repeated group RBG is manifestly neither a word nor a letter, because these cannot be so often repeated in succession in German. They must, consequently, be numbers, which the punctuation also indicates, and in fact they can be nothing but hours.

"The surest protection against enemy intelligence service is the intelligent use of all liaison branches liable to be intercepted, avoiding above all plain-text messages even by telephone in the danger zone.

"Rigorous adherence to rules, which are to be repeatedly impressed on all liaison organizations and which must be enforced by surveillance, is a guarantee of the success of our undertakings and a protection of the lives of thousands of men."

German codes.—It is a significant fact that whereas the mistakes of the American officers in code work covered the entire field, those of the Germans were confined in the main to the mistakes of subordinate officers or radio operators. This evidenced a thorough drill and instruction in code work and a remarkable degree of similarity in the construction of code messages was noticed. This attention and knowledge made the task of solution by the Allied code experts far more difficult.

Criticism.—Throughout a large part of the Army a great deal of criticism was from time to time directed toward the trench codes, most of it destructive rather than constructive. This was natural, perhaps, in view of the extremely limited knowledge of codes and ciphers.

The G-2 section sent out a circular letter inviting criticism and requesting suggestions looking to improvement. In the main these suggestions were words and phrases to meet certain local conditions to be added to the vocabulary. Whenever these additions seemed broad enough to cover more than a local need they were added, oftentimes words or phrases being removed to make room for them. It must be borne in mind that the phraseology of war changes very rapidly and words and phrases quickly become obsolete. As an instance "rolling barrage" lived its day and passed out to make way for another phrase of the moment.

Number groups v. letter groups.—Another suggestion, or criticism, frequently made, was a comparison with the French and British code system. This usually was made by troops who were or had been serving with those forces. The French used groups of three numbers each and were limited therefore to 999, whereas the American codes had nearly twice that number.

Frequent requests were made to provide both letters and numbers for code groups but the peculiar construction of the American codes rendered this impracticable. However, to cover this need the pronouncing alphabet was printed in the instructions in each code book. A study of this would have made the transmission of code groups over the telephone simple and accurate, and it was to obtain this accuracy that numbers were desired.

The question of the relative values of letters and numbers for telegraphic transmission was made the subject of an exhaustive study. A large number of telegraph operators, radio operators, code men, and the two most experienced superior-officer code experts were consulted. The result was inconclusive inasmuch as opinion was almost equally divided even in each of the various classes.

So far as the actual coding of messages is concerned, I personally prefer numbers for the reason that the combination "2632" is clearer in my mind than the combination "ABZQ", for example.

Criticism.—To return to criticism, it should be said that every effort was made both by circular and by personal solicitation to obtain constructive criticism. Starting as the section did from

absolute zero it was realized that all possible assistance should be sought from the actual users of codes in the field with a view to affording them the maximum assistance. So well in fact was the criticism received that each issue of the trench codes was different from its predecessor in material content and in construction; clearness, rapidity in operation, scope, and ease of operation being constantly borne in mind. This is illustrated in one comparatively insignificant item by the constant diminution in size of the book itself to meet the wish for a more convenient volume to handle.

Further criticism was invited from the British code experts who first were given a number of messages in the new Trench Code and requested to "break them down" and then requested to point out faulty construction. Later, these same experts were furnished with a copy of the book and further suggestion as to faults was requested and given.

British codes.—Major Hay, of the British General Staff, after an exhaustive study, replied to Major Moorman of G-2:

"We have not been able to solve them or even to get any light. The security appears of a high order."¹

In his report he analyzes his views on the probable construction of the code and adds:

"I am of the opinion that this code when used with care could not be read by the enemy until he had collected a very large amount of material. * * * Under favorable conditions this code would be safe for at least two months * * * but it would be advisable to make a more frequent change. * * *"

This is interesting in view of the established principle of changing every 10 days.

The conclusions drawn by the British experts are not always favorable, although but few criticisms occur, but their deductions are interesting and for the emphasis which they, as well as the Germans, place upon errors and carelessness the reports are submitted herewith.

At the very time when the greatest number of flattering references to the superiority of the British system of double cipher were being made that Army had in contemplation a complete reversal of their system and the adoption of the American. They did indeed effect a partial change in plan before the cessation of hostilities. When I informed a British code expert that our codes could be compiled in 10 days he was completely dumbfounded, saying it would take them at least 30. This, I think, was the greatest obstacle they had to overcome in a change of system.

Another source of criticism was the method of distribution carried on by G-2, by which the "Mohawk" code, for example, might be withdrawn from a given organization and replaced by the "Hudson", whereas another unit with which the first-named organization was in communication was still using the "Mohawk."

At first some confusion resulted from this, but later all code messages were preceded by a code group which indicated the book used.

Requests were made to consolidate the alphabet, but the result of placing all the letters of the alphabet on one conspicuous page was found to be that a great deal of unnecessary spelling was done, whereas by scattering them throughout the book, various spelling combinations and words were found closely related to the individual letters. Thus, by making it slightly more difficult to code rapidly, the security of the system was greatly protected. Although spelling, letter by letter, frequently is made necessary, it affords the best possible opportunity to enemy code experts. For this reason every care should be taken to reduce this practice to a minimum.

Recommendations.—In connection with the question of distribution of trench codes reference should be made to the report of G-2 at General Headquarters, American E. F., on this subject.

¹ See appendix A.

In regard to the method and scope of instruction given in the use of trench codes, reference should be made to the report of the school at Gondrecourt, the Army Staff School at Langres, and the Army Signal School.

More authority should be vested in the officer in charge of the code-Compilation section in order that he might have access to all confidential documents of the various branches of the Army without question as to his right to such information. Possibly his assignment to the General Staff might aid him in establishing a closer liaison. The closest possible cooperation should exist between this Section and G-2 for their mutual benefit.

The officers composing this Section are all Reserve Corps men and cease to function at the end of the present emergency. There are no other officers of the Army who have had any experience in the compiling of trench codes, and but two or three who are familiar with the mistakes made in the compilation of the ones used during the war. I earnestly recommend that certain officers be detailed to study this report of errors made by this Section, as well as by our Allies and by the enemy, in order that these mistakes may be avoided in future work of this character.

It is earnestly recommended that the trench codes used in this war be made a part of the scholastic training of young officers not only at the War College but at Fort Leavenworth and West Point. The course of instruction need not be a long one or very comprehensive, but it is believed that even a slight familiarity with the construction and use of these codes would remove that disinclination to use them and carelessness in operation which seems inborn in all men and particularly in Americans. Even a slight knowledge of the dangers of carelessness, the many fatal consequences which follow upon neglect of rules, would tend to bring about a belief on the efficacy of codes in general and a tacit acceptance of their value to an army.

This course of instruction should cover the importance of the actual safeguarding of the code book upon all occasions, as well as the protecting of the method itself. A severe penalty should be provided for violation of the rules laid down for the use of codes.

If possible, a certain amount of instruction should be given to enlisted Signal Corps personnel in order that in emergency a trained force would be available. At the opening of the war the commercial field was combed for code operators, but the field is very limited and commercial codes differ greatly from Army codes both in principle and in operation.

Too much emphasis cannot be laid upon the necessity for care in code work and the British, French, and German experts' views coincide with our own experience that even the best system of code construction can be completely nullified by a few commonplace instances of error. It is for this reason that this exhaustive report has been prepared with the hope that the mistakes of the past may not be repeated in the future.

In the British Army an officer guilty of carelessness in code work is court-martialed and receives a severe sentence to which much publicity is given in the service.

In the German Army the penalties are even more rigorously inflicted.

In the American Army the question of actual losses of codes is not so important, these instances being rare, but the danger lies in the too-common practice of looking upon codes as a thing to be avoided whenever possible. This criticism is not directed at any officer in particular, and many are most scrupulous and conscientious in their code work, but the system which forces these officers to enter an area where code work is essential finds them unprepared by previous experience to cope with the situation.

For more than 10 years the writer has been engaged in the Government service, and during a large part of that time had occasion to send and code many Government telegrams. In the preparation of several comprehensive codes, reference and study has been given to thousands of official telegrams. Beyond question these messages were constructed without proper regard to

clearness or brevity. In one branch of the service so serious had this matter become that it was proposed to appoint a supervisory officer whose sole duty it should be to correct and edit official messages.

It is a practice peculiar to the Government service to deny to any subordinate authority to edit telegrams, presumably for the reason that a superior officer does not approve of changes in his phraseology. This is equally applicable to all branches of departmental service and by no means confined to the Army.

In code offices, as the writer knows from personal experience, on many occasions clearness of idea has been sacrificed, much additional code work entailed, and great cost incurred, solely because no authority was given to the code officer to deviate from or even to question the phraseology of a telegram.

In order to vest this authority in a reviewing officer it must be granted that he has more than the usual grasp of official business, but it would be of great assistance if he had power merely to question and make suggestions of changes to be in turn reviewed by the preparing officer. The importance of this rigid adherence to text has always seemed to me greatly exaggerated in view of the fact that in almost all instances official telegrams are prepared by subordinates and merely initialed by a superior officer.

The reviewing of all questioned telegrams might be done by an officer of rank and this process if systematized need not long delay transmission.

In one Department of the Government, which before the war gave considerable study to this question, it was estimated that the saving in cable tolls alone would more than pay the salary of a reviewing officer at \$5,000 a year.

It might incidentally be said that but few code officers care to accept this responsibility, and under pressure of war work but few have an opportunity to study telegrams passing through.

This question is raised at this time simply because unfamiliarity with codes has caused many errors of transmission and in many cases brought about a congestion of business on the telegraph lines which might have been avoided by a little coordination.

The Navy Department by its compulsory use of radio for the transmission of its messages was sometime ago compelled to give the subject of codes a great deal of consideration. As a result that Department has developed a very efficient bureau and organization which has gained much valuable experience during the war.

The Army has no bureau corresponding to "communications" and its code work is being handled by the code-compilation section at General Headquarters, by the War College, and perhaps by isolated officers throughout the service. This plan, or lack of it, does not make for the best results to the Army, because there is little coordination and the men who have been constructing codes in the field in many instances have been out of touch with the men who are most familiar with enemy codes.

It would seem that the most logical plan would be the organization of a central bureau at Washington where an officer of rank might be vested with the power to control all code compilation both in peace and in war, with enough latitude to inspect other systems and enough authority to acquire an intimate working knowledge of the Army's needs. This officer should have no other duties of a military character. His task should be the gathering together of all possible military information, to keep abreast of the times, to compile codes for emergency use, and possibly to assist in the instruction of junior officers throughout the military posts and schools of the United States.

This is an important office in its possibilities and the outbreak of another war would find the Army as prepared to meet the situation as it was unprepared in this war. There must be after the conclusion of peace a more thorough coordination of the War, Navy, and State Depart-

ments for their mutual benefit. The Navy already has their admirable organization; the State Department will revise its system; and the Army must not permit the lessons of this war to pass away unnoticed. It would seem that the present affords the best opportunity to institute this reformation before all the officers best acquainted with the work in the field have returned to civil life or been transferred to other fields of activity.

In conclusion I should like to express my appreciation of the valuable service rendered by Colonel Parker Hitt of the Signal Corps during this trying period. His broad knowledge of codes in general, his intimate knowledge of the Army and the General Staff, and his unflagging industry, added to a never-failing courtesy even under tremendous pressure of work, made my task far lighter in consequence. To him more than to any other officer of the American Army is due whatever success the American codes may have obtained.

H. R. BARNES,
Captain, Signal Corps.

APPENDIX A

M. I. 1. B., WAR OFFICE,

June 24, 1918.

Dear Major MOORMAN:

Many thanks for your encoded messages. We have not been able to solve them or even to get any light. The security appears of a high order.

I enclose a memorandum embodying my views on this code.

Yours sincerely,

M. V. HAY,
Major, General Staff.

Major MOORMAN, General Staff,
2d Section (G. 2.),

A.E.F., France.

Major MOORMAN:

The four specimen pages of the code adopted for Wireless Signalling purposes by the American Expeditionary Force have been examined in this office, and, in deference to your wishes, the following observations are submitted:

1. The trigrams employed in the four pages under consideration are composed of any three letters of the alphabet except H, I, and Z, with the further restrictions that E, T, and U do not occur as a first component, D, Q, and T as a second, or Q as a final component of any group.

2. No letter is repeated in any one trigram, so that groups like AGA, BBM, XPP do not occur.

3. If these conditions hold throughout, there are thus 20 different initial letters, 20 medial, and 22 final, making, when all the remaining combinations are used, a possible aggregate of 7,600 groups. Perhaps, however, the number should be 20, 21, and 22, respectively. This would provide a round total of 8,000 groups and a symmetrical arrangement of columns in the code-book.

4. 621 different trigrams are used in the total of 1,151 contained in the 41 messages submitted. Of these 621 trigrams 371 occur only once and 135 only twice. The average frequency for each group is less than two. The deduction is that many alternatives are employed.

5. The most frequent groups are XYF (16), RMS (15), JEW (15), NES (13), MOP (11), FPL (10), DCA (9), YOU (13), LGS (7).

6. The statement above that many alternatives are employed for these is borne out by the fact that there are hardly any recurrences of the same trigrams in juxtaposition or even in proximity to one another. JEW-XJU occur twice; BEW-RMS twice; NFW-RMS twice. MOP tends to occur near the beginning and end of messages, and suggests, therefore, an address or signature, or it might be a stop. Other groups that strike one as worth watching are: DCA, FCM, RMS, XJU, XOW, YFO, YOU.

7. If spelling is used to any extent it has not been detected (for the reason given in paragraph 6).

8. Both the code as a whole and the messages in particular would seem to have been composed with great precautions for safety; but from only 41 messages one is unable to form a definite opinion as to the possibility of solution. Appearances are certainly in favour of safety, but much would depend on the amount of traffic and the frequency with which the code was

changed. Also information under the following headings might prove of great value to any one attempting its solution. Moreover, most of this information would presumably be available to the enemy

- a. The date and time of day when the messages were sent.
- b. The approximate positions of the sending and receiving stations.
- c. The system of call signs, general wireless procedure, etc.
- d. The organization and disposition of the forces under the American Command.
- e. Names of commanders and designations of units (unless special code groups are used for these in every case).
- f. Intelligence derived from inferences based on actions which seem to follow the reception of certain messages or vice versa.
- g. Chance information gained through carelessness on the part of a subordinate officer or N.C.O., such as the interception by the enemy of the substance of a code message repeated in clear by telephone or power buzzer. This is no doubt strictly prohibited, but in the stress of battle such things may occur.

I am of the opinion that this code when used with care could not be read by the enemy until he had collected a very large amount of material.

One of the principal safeguards against discovery lies in the use of alternatives, and in practice this safeguard loses something of its value owing to the fact that encoders soon get into the habit of using the same common groups and of neglecting to use the alternatives. In fact the user of a code can only with great difficulty be prevented from clothing his meaning always in the same manner both with regard to the language used and the selection of groups for encoding. The length of time for which this code can be considered secure is therefore mainly dependent on the way in which it is handled.

Under favourable conditions this code would be safe for at least two months; but having regard to the probability of accidents I think it would be advisable to make a more frequent change and not at regular but rather at irregular intervals.

M. V. HAY,
Major, General Staff.

M. I. 1. B.
June 24, 1918.