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US WAR DEPARTMENT

TECHNICAL MANUAL



INSTRUCTIONS FOR LEARNING
INTERNATIONAL MORSE
CHARACTERS

June 2, 1943



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WAR DEPARTMENT,
 WASHINGTON, June 2, 1943.

INSTRUCTIONS FOR LEARNING INTERNATIONAL MORSE CHARACTERS

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SECTION I

PURPOSE AND SCOPE

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1. Purpose.—This manual is provided as a text for students learning and acquiring skill in the use of International Morse characters. It may be used by students being taught the characters by either of two approved teaching methods. The *tape method* makes use of a recorded tape with associated equipment as a source of character sounds. The *record method* employs phonograph records and reproducing equipment as a source of character sounds.

2. Scope.—*a.* This manual contains instructional material for student use during his learning of the International Morse characters

*This manual supersedes TM 11-454 dated April 21, 1942, so far as that manual deals with the teaching of International Morse characters.

and for his practice in qualifying for higher sending and receiving speeds after he has learned the characters. The instructions apply primarily to recognition of the character sounds as heard by the student; brief instructions are included for sight recognition as used with blinker signals.

b. The appendixes contain a list of prosigns, the International Morse characters, touch typing instructions, instructions for transcription from tape, suggestions for instructors, army lettering instructions, and Morse characters of some other languages.

SECTION II

BASIC INSTRUCTIONS TO STUDENTS

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3. International Morse characters.—*a.* International Morse letters, numerals, and punctuation marks are represented by long and short sounds or combinations thereof. The sound(s) representing a character are known as a character sound and the individual parts of a character sound are known as elements. The long sound is *dah*. The short sound is *dit*. These characters may also be transmitted visually by flashing a lamp for long and short periods respectively, or, as in wig-wag, by positions of a flag to the left and right of the flagman as described in FM 24-5. The process of receiving consists of recognizing these combinations of dits and dahs and recording the characters they represent.

b. At operating speeds of 20 words per minute or higher, the dits, dahs, and spaces of International Morse characters have the following relative lengths:

- (1) A dit is used as the unit of duration.
- (2) A dah is equal to three units.
- (3) The space between elements of any character is one unit.
- (4) The space between any two characters is three units.
- (5) The space between words or code groups is seven units.

Figure 1 graphically illustrates the element and spacing lengths for speeds of 20 words per minute or higher.

c. At operating speeds below 20 words per minute the time lengths of the elements and spaces within characters are not increased. The

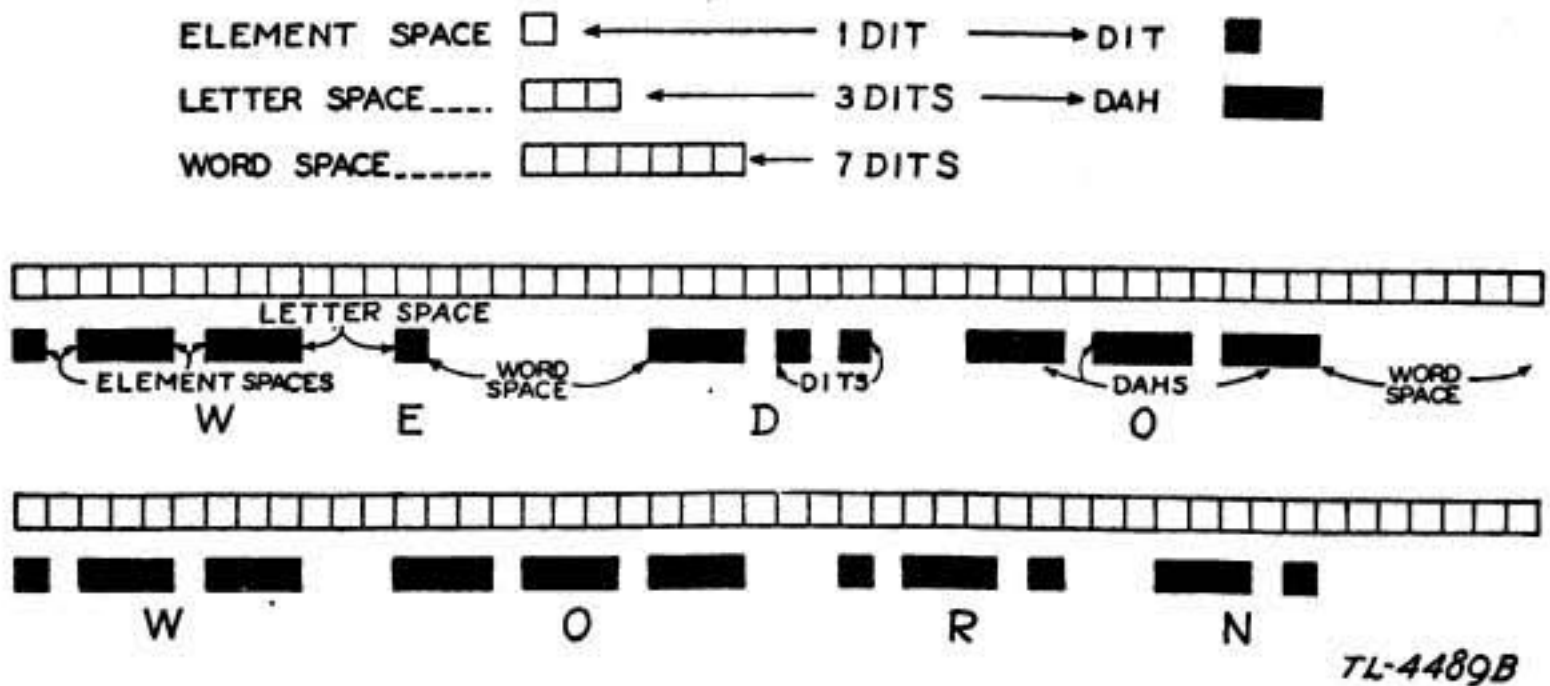


FIGURE 1.—Tape-recorded characters (correct spacing for speeds of 20 words per minute or higher).

“20-word character” is used with increased spaces between characters and words or groups. Failure to maintain the “20-word character” at these lower operating speeds will increase the student’s difficulty in raising his operating speed.

4. Suggestions for students.—The basic requirements in learning to receive are concentration, practice, confidence, and patience. For emphasis, these points will be covered in detail in paragraphs 5, 6, 7, and 8.

5. Concentration.—Concentration is of the utmost importance. When practicing, clear your mind of all outside thoughts and close your ears to all outside sounds. Acquisition of speed and proficiency will depend on your ability to do this. Practice constantly on concentration in this manner.

6. Practice.—Progress in reception will be directly proportional to the amount of practice you apply. You can help to develop your speed, spacings, and rhythm by whistling or sounding the characters by voice, or tapping them out. Listen to any available International Morse character transmissions and try to recognize and copy characters or words.

7. Confidence.—Resolve from the start that you are going to be a good operator. Do not allow slow progress to discourage you, for many good operators have had difficulties in learning the characters, and in increasing their speed.

8. Patience.—Don’t become impatient regarding the time it may take you to learn. You may reach certain speed limits above which you may find it difficult to progress. If this occurs don’t feel that you are lost. Keep plugging steadily and you will succeed. For many students there are certain speed levels where temporary “stagnation” occurs. You may find yourself at a standstill for as long as

1, 2, or 3 weeks on the higher speeds. Just be patient, apply yourself conscientiously, and you will later make up for the lost time.

9. Importance of phonic method of instruction.—*a.* This manual is based on the phonic method of instruction. This speeds up the mental process of learning and recognizing characters. You will recognize each signal as the character it represents. This is essentially a new language which you are learning to recognize and use. Soon you will be able to read it, write it, and by means of it, communicate with others.

b. At first, strive to get each letter on paper just as soon as possible after hearing it. Immediately upon recognizing the character, stop thinking of it as a sound; think of it then only as a letter or numeral to print or type. This leaves your mind free to grasp the next sound while you are printing or typing the previous character.

c. At all times think of each character as a sound. For example, *didah*—A; *dahdididit*—B, etc. Do not count the number of dits and dahs to determine the character. Think only of the sound. The elementary work of learning to recognize each character by sound is one of the most important phases in learning.

d. The faster you can print or type (as the case may be) the easier it will be for you to copy. When your mind does not have to struggle with the problem of typing or printing in addition to learning International Morse characters, full concentration on character sounds is possible. Therefore, it is urged that you make every effort to increase your ability to print or type.

e. When copying, if you miss a character, don't worry about it—go on to the next. Just as soon as you hear the first sound of the next character, stop trying to figure out what the missing character is. During periods of practice your aim should be to get down everything possible without worrying about missed characters. As your ability to copy increases you will miss fewer characters. The more alert you are, the faster you can get characters on paper after hearing them; and you will miss fewer, because you will have more time to think of the next signal.

10. Copying behind.—The real answer to the ability to copy at high speeds is development of the knack of *copying behind*. Instead of copying ahead—a *faulty and dangerous practice where you anticipate what is coming*—the ability to copy behind should be cultivated as soon as possible. *After you have thoroughly mastered the International Morse characters, you should start trying to carry two characters in your head before you record either on paper. As soon as you recognize the third character, put the first on paper, and so on. By constant*

practice you will find yourself able to carry several characters in your head at a time, and, in the case of plain language, you will carry whole words and simple phrases. When copying plain language, you must be especially careful not to be guided by the sense of what you are copying, as this will cause you to anticipate words that may not follow. It is correct to read what you are copying (in the case of plain language), but *you must not copy ahead.*

SECTION III

LEARNING INTERNATIONAL MORSE CHARACTERS—
TAPE METHOD

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General.....	11
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11. General.—*a.* Recording by hand (letter printing) and by use of the typewriter ("mill") are both important. The Army system of lettering is specified in the following lessons. Touch typing is covered in appendix III of this manual. Your practice in copying on the mill may be alternated with practice in copying by hand. You must first qualify on each lesson by hand before qualifying on the mill.

b. The combinations of letters used for the following lessons are based on the positions of typewriter keys and on the fingers used in typing the particular letters by the touch system. Other combinations may be made, to be used according to the method indicated.

c. Definitions.—(1) *Character*—a letter of the alphabet, a punctuation mark, or an Arabic numeral.

(2) *Character sound*—the sound, consisting of one or more elements, which represents a character.

(3) *Phonetic name*—the word spoken to represent a character so that it is certain to be understood.

12. Tape method receiving lesson 1.—*a. Objective.*—To teach the character sounds of the characters F, G, H, M, J, R, and U and the correct methods of recording them.

b. Information.—The elements of the character sound are short sounds (dit) and long sounds (dah). The dah is three times as long as the dit. The sounds making up a single character are separated by a silent space equal to the length of one short sound (dit). The

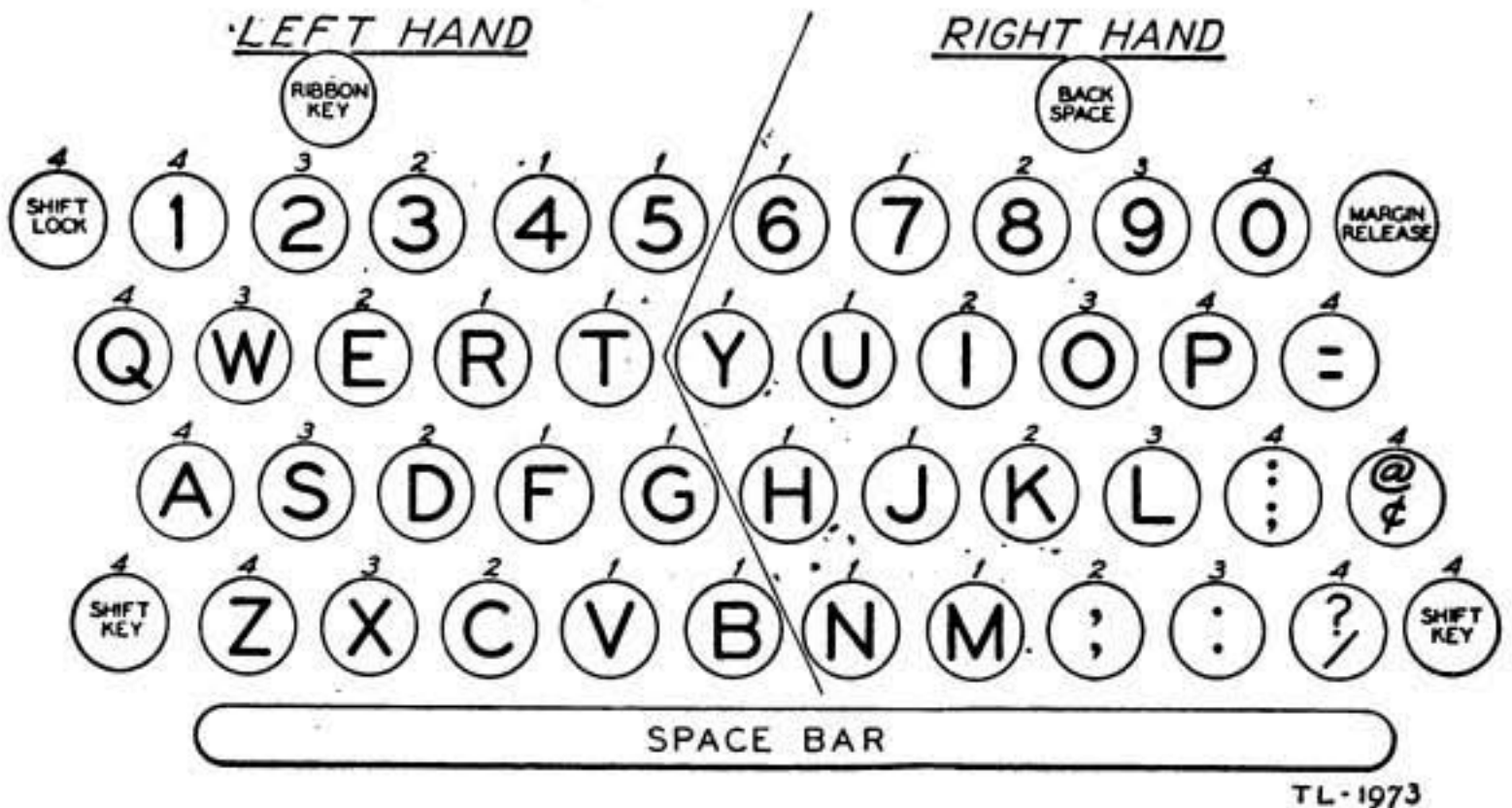
characters included in this lesson, together with the phonetic name, character sound, and army lettering of each are shown as follows:

Character	Phonetic name	Character sound	Army lettering
F	Fox	dididahdit	
G	George	dahdahdit	
H	How	didididit	
M	Mike	dahdah	
J	Jig	didahdahdah	
R	Roger	didahdit	
U	Uncle	dididah	

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c. *Directions.*—(1) Listen to the sounds and record the characters you recognize.

(2) If recording by lettering, letter each character as shown, making the strokes in the direction indicated and in the order in which they are numbered. Satisfactory copy consists of five 5-character groups per line correctly printed without write-overs.



TL-1973

FIGURE 2.—Keyboard chart for typewriter MC-88. (The small number above each key indicates the finger of the left or right hand to be used on that key. The typewriter MC-88 differs from standard business typewriters in two respects: all the characters of the alphabet print as capitals, and there is a separate key for the numeral "1." If a standard machine is used for International Morse character transcription, the student must learn merely to use the small letter "1" to indicate the numeral "1"; otherwise the finger positions are the same. The shift key is locked in the "cap" position, shifting to lower case for numerals.)

(3) If recording by typewriter, use only the *first* finger of each hand to type the characters of lesson 1 as shown on the keyboard chart in figure 2. Satisfactory copy consists of ten 5-character groups per line with two space-bar spaces between the fifth and sixth groups and no strike-overs.

(4) When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 2.

13. Tape method receiving lesson 2.—*a. Objective.*—To teach the character sounds of the characters B, D, K, N, T, V, and Y and the correct methods of recording them.

b. Information.

Character	Phonetic name	Character sound	Army lettering
B	Baker	dahdididit	
D	Dog	dahdidit	
K	King	dahdidah	
N	Nan	dahdit	
T	Tare	dah	
V	Victor	didididah	
Y	Yoke	dahdidahdah	

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c. Directions.—(1) Listen to the sounds and record the characters that you recognize.








(2) If recording by lettering, letter each character as illustrated, making the strokes in the directions indicated and in the order in which they are numbered. Satisfactory copy consists of five 5-character groups per line correctly printed without write-overs.

(3) If recording by typewriter, use only the *first* and *second* fingers of each hand for the characters of lesson 2 as shown on the keyboard chart in figure 2. Satisfactory copy consists of ten 5-character groups per line with two space-bar spaces between the fifth and sixth groups and no strike-overs.

(4) When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 3.

14. Tape method receiving lesson 3.—*a. Objective.*—To teach the character sounds of the characters C, E, I, L, O, S, and W and the correct methods of recording them.

b. Information.

<i>Character</i>	<i>Phonetic name</i>	<i>Character sound</i>	<i>Army lettering</i>
C	Charlie	dahdidahdit	
E	Easy	dit	
I	Item	didit	
L	Love	didahdidit	
O	Oboe	dahdahdah	
S	Sugar	dididit	
W	William	didahdah	

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c. Directions.—(1) Listen to the sounds and record the characters you recognize.




(2) If recording by lettering, letter each character as illustrated, making the strokes in the directions indicated and in the order in which they are numbered. Satisfactory copy consists of five 5-character groups per line correctly printed without write-overs.

(3) If recording by typewriter, use only the *second* and *third* fingers of each hand for the characters of lesson 3 as shown on the keyboard chart in figure 2. Satisfactory copy consists of ten 5-character groups per line with two space-bar spaces between the fifth and sixth groups and no strike-overs.

(4) When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 4.

15. Tape method receiving lesson 4.—*a. Objective.*—To teach the character sounds of the characters A, P, Q, X, Z, 4, and 5 and the correct methods of recording them.

b. Information.

Character	Phonetic name	Character sound	Army lettering
A	Able	didah	
P	Peter	didahdahdit	
Q	Queen	dahdahdidah	
X	Xray	dahdididah	
Z	Zebra	dahdahdidit	
4	Fo-wer	dididididah	
5	Fi-yiv	dididididit	

TL-1972-4C

c. Directions.—(1) Listen to the sounds and record the characters you recognize.

(2) If recording by lettering, letter each character as illustrated, making the strokes in the directions indicated and in the order in which they are numbered. Satisfactory copy consists of five 5-character groups per line correctly printed without write-overs.

(3) If recording by typewriter use only the *first, third, and fourth* fingers of each hand for the characters of lesson 4 as shown on the keyboard chart in figure 2. Satisfactory copy consists of ten 5-character groups per line with two space-bar spaces between the fifth and sixth groups and no strike-overs.

(4) When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 5.

16. Tape method receiving lesson 5.—*a. Objective.*—To teach the character sounds of the characters 1, 2, 3, 6, 7, 8, 9, and 0 and the correct methods of recording them.

b. Information.

Character	Phonetic name	Character sound	Army lettering
1	Wun	didahdahdah	1
2	Too	dididahdah	2
3	Thuh-ree	dididahdah	3
6	Six	dahdididit	6
7	Seven	dahdahdidit	7
8	Ate	dahdahdidit	8
9	Niner	dahdahdahdit	9
0	Zero	dahdahdahdah	0

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c. Directions.—(1) Listen to the sounds and record the characters you recognize.

(2) If recording by lettering, letter each character as shown, making the strokes in the direction indicated and in the order in which they are numbered. Satisfactory copy consists of five 5-character groups per line correctly printed without write-overs.

(3) All fingers but the first finger of the left hand are used in typing these characters. Use the proper finger of the proper hand for each character as shown on the keyboard chart in figure 2. Satisfactory copy consists of ten 5-character groups per line with two space-bar spaces between the fifth and sixth groups and no strike-overs.

(4) When you have recorded satisfactorily 100 consecutive characters without error, you will be ready to start practice to increase your speed in receiving all International Morse characters. Your next lesson is in section IV.

SECTION IV

LEARNING INTERNATIONAL MORSE CHARACTERS—
RECORD METHOD

	Paragraph
General.....	17
Record method receiving lesson 1.....	18
Record method receiving lesson 2.....	19
Record method receiving lesson 3.....	20
Record method receiving lesson 4.....	21
Record method receiving lesson 5.....	22

17. **General.**—*a.* Recording by hand (letter printing) and by use of the typewriter are both important. The army system of lettering is specified in the following lessons. Touch typing is covered in appendix III of this manual. You will be required to qualify by hand before taking up the typewriter.

b. The combinations of letters used for the following lessons are based on the positions of typewriter keys and on the fingers used in typing the particular letters by the touch system. Other combinations may be made, to be used according to the method indicated.

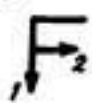

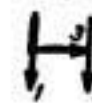




c. Definitions.—(1) *Character*—a letter of the alphabet, a punctuation mark, or an Arabic numeral.

(2) *Character sound*—the sound, consisting of one or more elements, which represents a character.

(3) *Phonetic name*—the word spoken to represent a character so that the character is certain to be understood.

18. **Record method receiving lesson 1.**—*a. Objective.*—To teach the character sounds of the characters F, G, H, M, J, R, and U and the correct methods of recording them.

b. Information.—The elements of the character sound are short sounds (dit) and long sounds (dah). The dah is three times as long as the dit. The elements making up a single character sound are separated by very short but uniform silent spaces. The characters included in this lesson, together with the phonetic name, character sound, and Army lettering of each are shown as follows:

<i>Character</i>	<i>Phonetic name</i>	<i>Character sound</i>	<i>Army lettering</i>
F	Fox	dididahdit	
G	George	dahdahdit	
H	How	didididit	
M	Mike	dahdah	
J	Jig	didahdahdah	
R	Roger	didahdit	
U	Uncle	dididah	

c. In the record method of learning International Morse characters you will first hear the character sound representing a character; then after a 3-second pause, a voice will announce its phonetic name. Since each lesson consists of only seven or eight characters, each

character is repeated many times during the lesson. Through this repetition you will learn to associate each character sound with its phonetic name.

d. Directions.—(1) Listen to the sounds and record the characters you recognize.

(2) Letter each character as shown, making the strokes in the direction indicated and in the order in which they are numbered.

(3) After you have heard the various character sounds several times you will be able to check to see how well you are learning your lesson. To obtain this check you will keep a box score on yourself. A portion of this box score form is here reproduced:

TL-5144-1

Use it in the following way:—When you hear a character sound, try to think what character it represents. If you identify it, print it in the upper left-hand square. Three seconds after the character sound is heard, a voice will announce its phonetic name. Let us suppose you thought the sound was Fox (dididahdit). You would print the letter F in your first square as shown:

F				

TL-5144-2

If the voice says, "Fox," you will know you correctly identified the sound, so you leave the space blank immediately below F.

Now you hear the next sound and you think it is George. Print G in the second space in the top row as shown:

F	G			

7L-5144-3

The voice, however, announces that the sound was not George, but Roger, So you print R underneath G as shown:

F	G			
	R			

7L-5144-5

Let us suppose that when the next sound is heard you are unable to identify it. You will then make a check mark in the third space as shown:

F	G	✓		
	R			

7L-5144-6

The voice announces that the sound was Roger, so you print R underneath your check mark as shown:

F	G	✓		
	R	R		

7L-5144-7

You think the next sound is Mike and print M in the fourth square. The voice says the sound was Mike, so you leave the fourth lower space blank and your box score looks like this:

F	G	✓	M	
	R	R		

TL-5144-8

You identify the next sound as Uncle and print U in the fifth upper square. The voice says the letter is Uncle, so you leave the lower space blank and your box score looks like this:





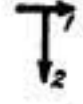


F	G	✓	M	U
	R	R		

TL-5144-4

Part of the time you will hear two character sounds grouped together such as dahdah didahdit (Mike Roger.) You will record them in your box score in the usual way, using an upper square for each character. Continue to fill out your score card until the lesson is finished. Then by looking at the lower row of squares you can tell which character sounds are giving you trouble. Practice these sounds by speaking them, using dits for short sounds and dahs for long sounds. When you are where you won't disturb anyone, practice whistling the sounds in a low tone. This is particularly good practice, since the whistle resembles the sound you will hear in your head phones when you begin copying radio messages. A similar check will be made after each lesson. When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 2.

19. Record method receiving lesson 2.—a. Objective.—To teach the character sounds of the characters B, D, K, N, T, V, and Y and the correct methods of recording them.

b. Information.

<i>Character</i>	<i>Phonetic name</i>	<i>Character sound</i>	<i>Army lettering</i>
B	Baker	dahdididit	
D	Dog	dahdidit	
K	King	dahdidah	
N	Nan	dahdit	
T	Tare	dah	
V	Victor	didididah	
Y	Yoke	dahdidahdah	

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c. Directions.—(1) Listen to the sounds and record the characters you recognize. The phonetic name of the character will be announced three seconds after you hear the character sound.

(2) Letter each character as shown, making the strokes in the directions indicated and in the order in which they are numbered. Use the box score method you used in lesson 1.

(3) When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 3.

20. Record method receiving lesson 3.—*a. Objective.*—To teach the character sounds of the characters C, E, I, L, O, S, and W and the correct method of recording them.

b. Information.

<i>Character</i>	<i>Phonetic name</i>	<i>Character sound</i>	<i>Army lettering</i>
C	Charlie	dahdidahdit	
E	Easy	dit	
I	Item	didit	
L	Love	didahdidit	
O	Oboe	dahdahdah	
S	Sugar	dididit	
W	William	didahdah	

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c. Directions.—(1) Listen to the sounds and record the characters you recognize. The phonetic name of the character will be announced three seconds after you hear the character sound.

(2) Letter each character as shown, making the strokes in the directions indicated and in the order in which they are numbered. Use the box score method you have used in previous lessons.

(3) When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 4.

21. Record method receiving lesson 4.—*a. Objective.*—To teach the character sounds of the characters A, P, Q, X, Z, 4, and 5 and the correct methods of recording them.

b. Information.

<i>Character</i>	<i>Phonetic name</i>	<i>Character sound</i>	<i>Army lettering</i>
A	Able	didah	
P	Peter	didahdahdit	
Q	Queen	dahdahdidah	
X	Xray	dahdididah	
Z	Zebra	dahdahdidit	
4	Fo-wer	dididididah	
5	Fi-yiv	dididididit	








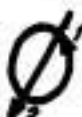
c. Directions.—(1) Listen to the sounds and record the characters you recognize. The phonetic name of the character will be announced three seconds after you hear the character sound.

(2) Letter each character as shown, making the strokes in the directions indicated and in the order in which they are numbered. Use the box score method you have used in previous lessons.

(3) When you have recorded satisfactorily 100 consecutive characters without error, you will be advanced to lesson 5.

22. Record method receiving lesson 5.—*a. Objective.*—To teach the character sound of the characters 1, 2, 3, 6, 7, 8, 9, and 0 and the correct methods of recording them.

b. Information.

<i>Character</i>	<i>Phonetic name</i>	<i>Character sound</i>	<i>Army lettering</i>
1	Wun	didahdahdah	
2	Too	dididahdah	
3	Thuh-ree	dididahdah	
6	Six	dahdididit	
7	Seven	dahdahdidit	
8	Ate	dahdahdidit	
9	Niner	dahdahdahdit	
0	Zero	dahdahdahdah	

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c. Directions.—(1) Listen to the sounds and record the characters you recognize. The phonetic name of the character will be announced three seconds after you hear the character sound.

(2) Letter each character as shown, making the strokes in the direction indicated and in the order in which they are numbered. Use the box score method you have used in previous lessons.

(3) When you have recorded satisfactorily 100 consecutive characters without error, you will be ready to proceed to section V, to practice to increase your speed.

SECTION V

PRACTICE TO INCREASE SPEED

	<i>Paragraph</i>
Speed qualifications.....	23
Visual signaling.....	24

23. Speed qualifications.—*a.* You will begin practice to attain speed after you have learned the characters and passed all lessons in section III or section IV. The character will still be the “20-word character” but the space between characters will be shorter than that used while you were learning them.

b. Copy 5 groups to the line if copying by hand, and 10 groups to the line with 2 space-bar spaces between the fifth and sixth groups if copying on the typewriter (“mill”).

c. Qualifying speeds are normally 5, 7, 10, 12, 15, 20, 25, 30, and 35 words per minute. At speeds 5 and 7 words per minute, the characters are normally evenly spaced. At 10 words per minute the characters are normally transmitted in groups of 5, to teach you to recognize the groups. At 12 words per minute and higher speeds, the copy will normally be in the form of messages, either tactical messages or War Department messages. Fixed station operators will use the War Department messages and all others will use the tactical messages.

d. To qualify at speeds up to and including 10 words per minute you must copy 100 consecutive characters without write-overs or strike-overs. As soon as you have qualified at a speed you will start copying at the next higher speed. You must qualify at 10 words by hand copying before you will be allowed to try to qualify with the typewriter.

e. Qualification requirements for speeds of 12 words per minute and higher require copying of the following without error, write-over or strike-over:

(1) Passing requirements for fixed-station operators:—

<i>Speed</i>	<i>Messages required</i>	<i>Total minimum number of text words or code groups</i>
15	3	45 or more
20	3	60 or more
25	3	75 or more
30	3	90 or more

(2) Passing requirements for high-speed and low-speed operators:

<i>Speed</i>	<i>Messages required</i>	<i>Total minimum number of text words or code groups</i>
15	3	45 or more
20	3	60 or more
25	3	75 or more

f. You will be required to copy traffic at 12, 15, 20, 25, 30, and 35 words per minute through interference composed of background noise and an interfering signal.

24. Visual signaling.—After passing twelve words per minute you will be given instructions in reading blinker signals. You will work in pairs, alternating between calling the letters as they are flashed from the blinker and writing them down as your partner reads them. You will continue practice until you are able to read the blinker at a speed of 10 words per minute.

SECTION VI

LEARNING TO SEND

	Paragraph
Information on sending.....	25
First sending exercise.....	26
Second sending exercise.....	27
Semiautomatic telegraph key.....	28

25. Information on sending.—*a.* Practice in transmitting with the telegraph key will begin either while you are working on lesson 1 or immediately after you have completed lesson 1. Approximately one-third of your time will be devoted to sending practice, with the object of bringing your sending speed to at least ten words per minute by the time you have passed the twelve word per minute receiving test. Sending practice will be arranged so that the slower student's work can be supervised by instructors or by students who are sufficiently proficient in *receiving* to recognize and correct transmitting errors. You should transmit at least once a week to a *recorder-reproducer* (if available) after you have reached a speed of five to seven words per minute, making a two-minute record of your transmission. To pass the test you must receive the transmission at the same speed without error.

b. Radio operators can receive well only if sending (transmitting) is properly accomplished. Hence, good sending is just as important as good receiving. Bad habits formed when learning to send will stick to you throughout your career. Thus, it is very important to begin your sending practice in a correct manner.

c. The key must be properly adjusted and the contacts correctly spaced before you begin to transmit. The spring tension (coiled spring) on any key must be adapted to the individual. The spring adjusting screw (fig. 3) controls this tension. If you have trouble in forming dits or dahs, change the spring tension until you are able to send both elements easily. Too much tension is usually indicated by dahs that are too short, irregular and long spacing between characters, and "dit skipping." Your sending will tend to be irregular if the spring tension is too weak. This will run your characters together, making dits too long and spacing of short and irregular duration. Sufficient adjustment is possible on any key so that anyone can make the action of the key suitable for his own use. Contacts which are spaced too closely together will have the same effect on the characters as insufficient spring tension. If the spacing is too great, an effect, the same as that of strong spring tension, may result. The contacts usually should be spaced approximately the thickness of a postcard. This spacing applies to everyone using a key. The screw for adjusting the gap

between the contact points is at the rear of the key lever, and is called the adjusting screw. The contacts must be alined properly and the key lever must be free to move, with no side play. The trunnion

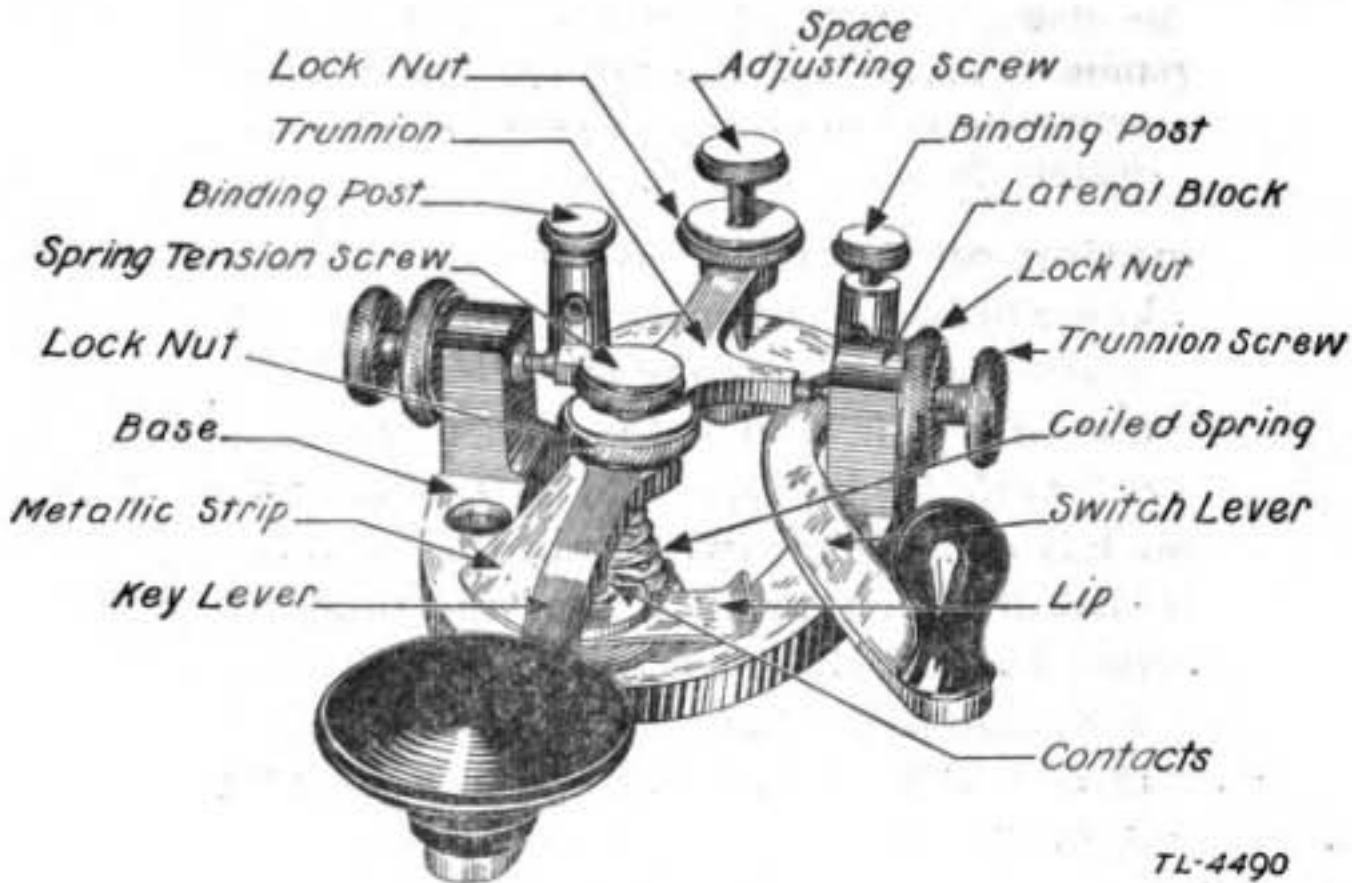


FIGURE 3.—Hand key.

screws adjust this side play and aline the contact points. Particular care should be taken to see that the pivot points are clean and free from dust. Dirty pivot points will result in a scratchy signal.

d. Sending on the telegraph key is accomplished principally by the



View from above



Side view

TL-1974

FIGURE 4.—Correct position of fingers on key.

muscles of the forearm. The wrist and fingers should be *loose always*.

e. With the foregoing in mind at all times, place the elbow on the table at such a distance from the key that the fingers will curve as

illustrated in figure 4 (side view). Your first two fingers should rest on top of the key button as shown. Your thumb should be alongside the key button. Your third and fourth fingers should be allowed to curve under the palm of the hand without tension or rigidity. The palm of your hand should face the table. Your forearm, wrist, and fingers should be slightly arched, the fingers *curved, not straight*.

f. After the arm, wrist, and fingers have been placed as described above, check their positions. See that—

- (1) Your elbow (*not the forearm*) rests on the table.
- (2) There is space under your forearm and wrist.
- (3) Your fingers are curved and flexible, not straight or stiff.
- (4) The finger ends (pads) of your first and second fingers rest on *top* of the button near the back edge as shown in figure 4.
- (5) Your thumb is on the edge of the button, resting very lightly against it but *not grasping it*.

g. Now, with your fingers, wrist, and arm in the position described, press down the key button by a *straight downward* motion of the forearm. Your elbow stays in place. Your wrist acts as a hinge. Your fingers are flexed—*do not let them be stiff*. Now when the key has made contact, release the pressure on the button and let the spring bring the key back to the *up* position. Next, try making dits at the rate of one every second, making sure that the key goes down each time for a distinct dit. Do not allow your fingers to act independently. They merely take part in the coordinated actions of your forearm, wrist, and hand, most of the work being done by the larger muscles of the forearm and upper arm. Continuous independent use of the fingers in sending will cause muscular fatigue and will ultimately result in a “glass arm”—complete loss of muscular action in the arm concerned.

h. When sure that your key is adjusted properly, that your forearm is moving straight up and down, that your wrist is loose and operating like a hinge, and that fingers are flexible, begin your first exercise in sending.

26. First sending exercise.—Take the correct position for sending. Sit square with the table. Check your forearm, wrist, and fingers. Be sure they are flexible. Then begin making dits at the rate of about 100 per minute. Continue this during your sending period. *Do not make anything but dits*. Try making the dits faster as you *feel* your muscles limbering up. Do not permit your practice to be erratic—*send smoothly*. Constantly try to make the spaces between dits equal. If you go faster than you should, the results will check you, as your sending will be rough (unequal and not rhythmic) and your sending may “stutter.” Continue the first exercise until

you can send 30 dits in one group *smoothly* in about 10 seconds. Have your practice checked by an instructor before going to the second exercise.

27. Second sending exercise.—*a.* Make a few groups of 30 dits each to check your position. Then begin making the character *didididah*. Make the *dits* at the same rate you used at the end of the first exercise. Make the same space between the third *dit* and the following *dah* as you make between the preceding *dits*. Hold the key *down* for the *dah* a time *equal to three dits*. Begin making the character sound *didididah* at the rate of about 35 complete characters per minute. Remember to keep your wrist and fingers flexible; doing so will help you to become a good sending operator. Frequently lift your fingers from the keys and drop your wrist loosely back and forth 15 or 20 times, letting your fingers and wrist relax entirely during the exercise. Get the *feel* of this relaxed condition and maintain it when taking your position at the key. Continue sending V's until you can send 20 consecutive characters smoothly in 35 seconds. When this has been attained, ask the instructor to check your transmission. If it is satisfactory, you will be advanced to the practice of transmission of the material included in section VII.

b. Samples of recorded transmissions.—A study of the following samples of recorded transmissions should help you develop correct spacing.

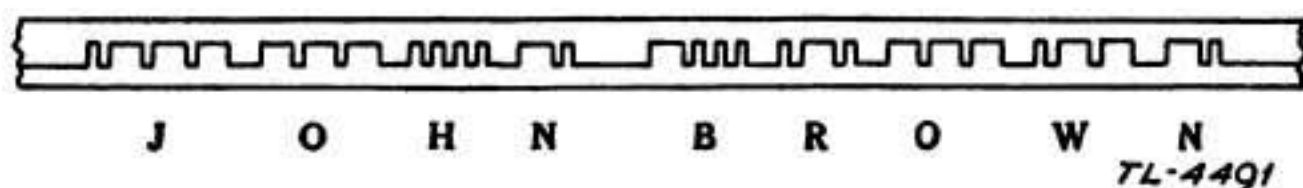


FIGURE 5.

(1) The transmission illustrated in figure 5 was made by machine. Notice the perfect relationship of dits and dahs, spacing between dits, dahs, letters, and words.

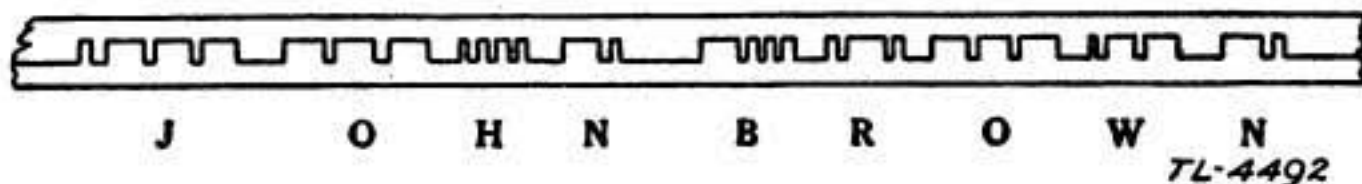


FIGURE 6.

(2) The transmission illustrated in figure 6 was made by an experienced operator using a regular hand key. Notice the near machine perfection.

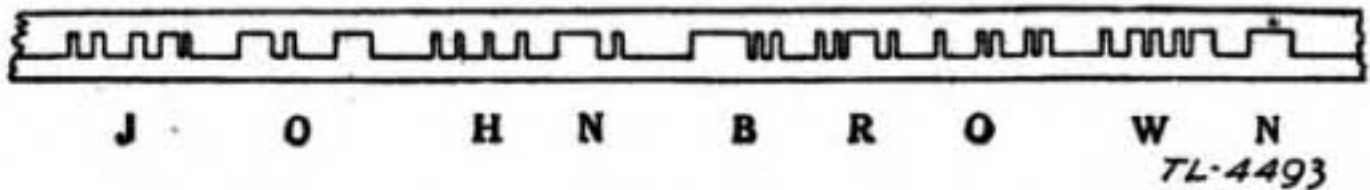


FIGURE 7.

(3) The transmission illustrated in figure 7 was made with a very small contact space and tight spring. Most of the characters are unreadable. The letters under the tape show what was intended to be transmitted.

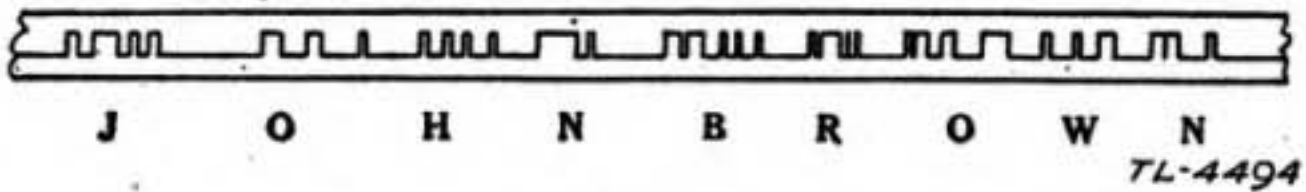


FIGURE 8.

(4) The transmission illustrated in figure 8 was made with a wide gap between contacts and with the use of normal spring pressure. The characters are unreadable. Notice how the dahs are split. This was caused by the key bouncing between contacts.

28. Semiautomatic telegraph key.—*a. Use.*—The semiautomatic telegraph key (commonly known to operators as a “bug”) is used chiefly in fixed stations where the operator is called upon for continuous sending over comparatively long periods of time.

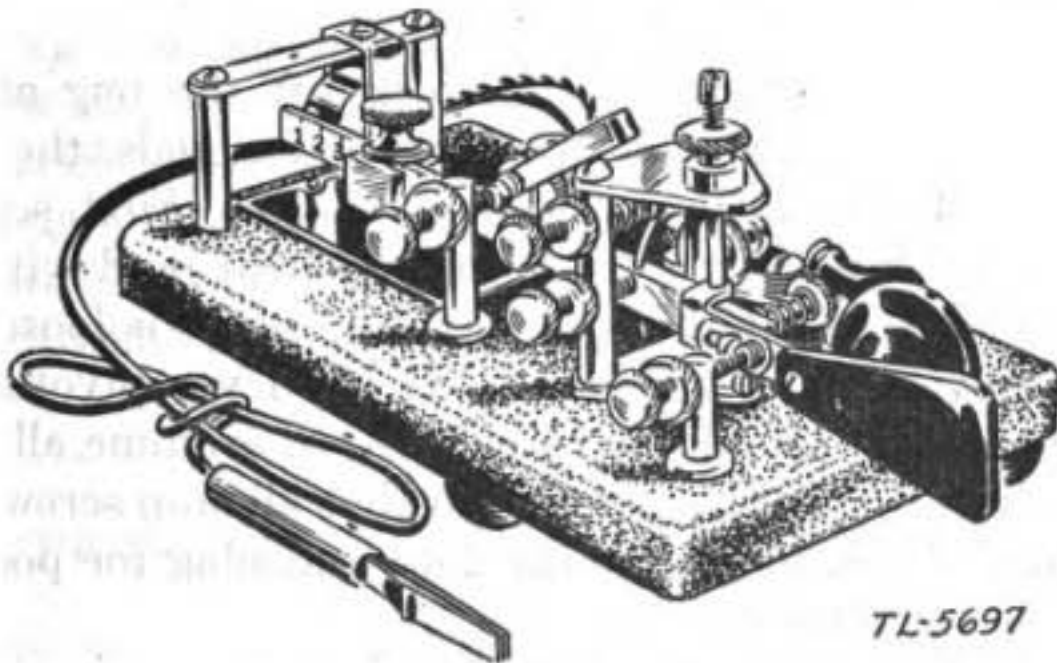


FIGURE 9.—Semiautomatic key (“bug”).

b. Operation.—In sending with the bug, the hand is placed in such a position that the thumb presses the dit paddle to the right and the index finger presses the knob to the left (right-handed operator). Dits are sent with the thumb against the paddle. As long as the paddle is held to the right the key sends dits. When the thumb pressure is released, the dits stop. Thus, one dit or many can be sent.

Dahs are sent by pressing the knob of the key to the left with the index finger. Each dah must be sent individually. Motion of the arm and hand in sending with the bug is horizontal, with the pivot at the wrist. Best operation is obtained when the key is adjusted for sending unbiased signals (dits and spaces of equal length). By observing the following instructions, a bug can be adjusted so that it will vibrate long enough to make 25 or more dits before stopping. The first 12 or 15 will be practically perfect (dits and spaces equal).

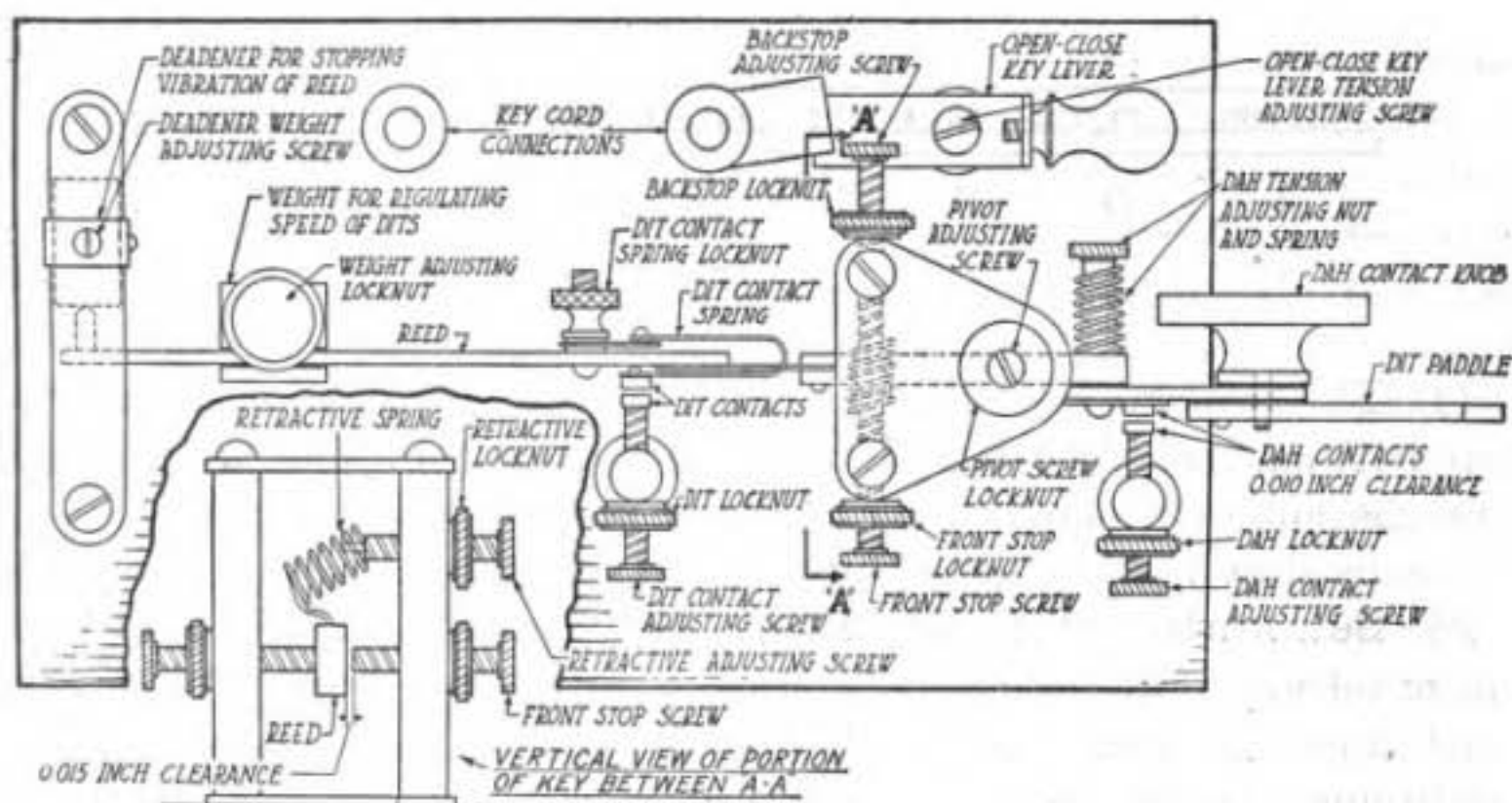


FIGURE 10.—Detail of semiautomatic telegraph key.

c. Inspection.—Before attempting to adjust the bug or when the receiving operator complains of unsatisfactory signals, the bug should be examined for mechanical or electrical defects. *First*, see that both the dit and dah contacts are clean, in alinement, and with the faces parallel. *Second*, see that the lever pivoting screw is loose enough to permit free movement of the lever. If the lever pivoting screw is too loose, signals will sound unsteady. *Third*, examine all supporting parts for rigidity. *Fourth*, make certain that all stop screws and locknuts are tight. *Fifth*, look over the cord and plug for possible short circuit or loose connections.

d. Adjustment.—After inspecting the key, adjust it in the following manner:

- (1) Place the key on a level surface.
- (2) Adjust the back stop screw until the reed lightly touches the *deadener*, and then tighten the locknut.
- (3) Adjust the front stop screw until the separation between the end of this screw and the lever is approximately 0.015 inch, and then

tighten the locknut. A separation greater than 0.015 inch is permissible if the operator prefers more lever movement.

(4) Operate the lever to the right. Carefully hold the lever in this position and stop the vibration of the reed. The next adjustment is very important and determines whether the dits will be too heavy, too light, or perfect. Adjust the dit contact, adjusting screw until the dit contacts just meet. It is necessary that this adjustment be made without flexing the contact spring. Without disturbing the adjustment, tighten the locknut on the dit contact adjusting screw. Recheck the adjustment.

(5) In case the dits are too fast, move the weight located on the reed in the direction of the deadener. If the dits are too slow, move the same weight in the opposite direction. Keys equipped with two weights should have one weight nearer the outer end of the reed.

(6) Adjust the dah contact adjusting screw to about 0.010-inch clearance.

(7) Adjust the dit retractive and dah tension springs for the most comfortable operation.

e. Cautions.—Do not readjust the dit contact adjusting screw unless a complaint is received or unless you know definitely that your dits are too heavy or too light. When the bug is correctly adjusted, *never* change the back stop screw adjustment. It should not be necessary to change the front stop screw adjustment. If the locknut on the front stop screw should work loose, it will be necessary to readjust the dit contact adjusting screw. Do not have the dah contact adjusting screw so close that the dah contacts remain shorted.

f. Permissible changes.—The following permissible changes will *not* throw the bug out of proper adjustment: first, a change in the position of the weight for the speed of dits; second, a change in the tension of the retractive and dah springs to suit the individual's requirements

SECTION VII

PRACTICE MATERIAL FOR SENDING

	Paragraph
Code groups, exercises 1 to 54, inclusive.....	29
Clear English text, exercises 55 to 58, inclusive.....	30
Tactical net traffic, exercises 59 to 78, inclusive.....	31
War Department net traffic, exercises 79 to 87, inclusive.....	32

NOTES

1. Exercises 1 to 24, inclusive, furnish material for sending practice based upon receiving lessons 1 to 5.

2. Exercises 25 to 39, inclusive, furnish mixed code groups for sending practice at any desired speed.

3. Exercises 40 to 54, inclusive, furnish unmixed code groups for sending practice at any desired speed.

4. Exercises 55 to 58, inclusive, furnish clear text material, to be sent at any desired speed. Number of words per line and total number of words in exercise are indicated.

5. Exercises 59 to 78, inclusive, represent traffic handled in field radio nets. This traffic may be transmitted at any desired speed.

6. Exercises 79 to 87, inclusive, represent traffic handled in War Department nets.

29. Code groups, exercises (1 to 54, inclusive).—a. Exercises 1 to 3.—The 275 characters in exercise 1 consist of a gradually cumulated presentation of the seven characters in paragraphs 12 and 18, lesson 1. The 189 characters in each of the exercises 2 and 3 consist of nine sequences, each of which is made up of three sets of the seven characters in lesson 1 arranged in random order.

Exercise 1

FFFFF	GGGGG	FGFGF	FFGGF	FGGFG
HHHHH	FHFHF	GHGHG	GHHFG	GHHFF
GFFHG	JJJJJ	FJFJF	GJGJG	HJHJH
GFFHH	HJFHG	GHFGJ	HFGJJ	MMMMM
FMFMF	GMGMG	HMHMH	JMJMJ	MJFJG
MHHFM	GMGHF	GHJMJ	JHFFG	RRRRR
FRFRF	GRGRG	HRHRH	JRJRJ	MRMRM
RMMHF	JFGRJ	RRFGJ	GJGFH	FGMHR
MHHJM	UUUUU	FUFUF	GUGUG	HUHUH
JUJUJ	MUMUM	RURUR	FURJR	GGRHM
GUMHH	HJRJF	UJMHU	JFUMG	RFGMF

Exercise 2

RMGJH	JMGHF	MUHRG	JUFFU	RJGFU
HFMRG	RFJMM	HRJGU	UHFHF	MJRHJ
RUMHF	JGMUG	GRUJU	FGHHR	HUMMF
MGJRR	JUGFR	GMGMU	JUMJH	RGHFJ
HUFRF	MRGFU	FMMJH	HFGJR	UHUJR
GUJJH	FGGRM	RJMHG	UMFFH	URJHG
HRFUG	MMJRU	MJUFG	RFHJJ	MFMRB
GFGHM	UJGUH	URRH		

Exercise 3

HFHFM	GURGF	GRJUM	JRJUM	HJJUH
HGMFR	UMRRH	GFJGM	UFGFH	JGMUM
MJRUH	RJFRF	UGHHF	MURFM	HJRUF
GUMGH	JJGRJ	GHGUF	RJMRJ	FRMHM
UHFGU	UMJUF	MHRHR	RMHGF	GUJFG
JGJUG	RMMRU	HFMFH	JGRHU	FJJFG
FUFMJ	HMUHH	MRJGU	RGRFH	FUMJJ
FHGJU	GRRMJ	MRUH		

b. Exercises 4 to 6.—The 275 characters in exercise 4 consist of a gradually cumulated presentation of the seven characters in paragraphs 13 and 19, lesson 2. The 189 characters in each of exercises 5 and 6 consist of nine sequences, each of which is made up of three sets of the seven characters in lesson 2 arranged in random order.

Exercise 4

BBBBB	DDDDD	BDBDB	DBBDB	DBDBD
KKKKK	BKBKB	DKDKD	BDKBK	DKBKD
BKBDD	NNNNN	BNNNB	DNDND	KNKNK
DBNBK	BKNDK	BKKDN	NDBDN	TTTTT
BTBTB	DTDTD	KTCTK	NTNTN	KDTBK
NTNKT	BNTBN	NBDKD	KDDTB	VVVVV
BVBVB	DVDVD	KVKVK	NVNVN	TVTVT
NVNKN	KVDTK	VKTTB	KDTBD	TDBVD
BNBVN	YYYYY	BYBYB	DYDYD	KYKYK
NYNYN	TYTYT	VYVYV	YNTYK	VKDNY
KBYVN	YKVBN	DTDBK	TBTDB	TVNDV

Exercise 5

NYKTV	BTDKY	YVKTD	NDNBV	BKYYB
YVNKB	DTKBN	DVNTV	DTVTK	DBVVN
TBDKK	BYNTN	DYYBD	NYDYN	NBBKD
TTKVT	VVKYV	KDTVY	TDTYN	YKBKN
VBNDB	VBBKY	NYTDD	BNKKT	TYVVN
DTKKB	NTBYV	DVDND	NVBYK	YTBND
VYDTV	BTYDT	YKKNB	NKVDN	DBKTK
YVYVT	VNDBN	KBTY		

Exercise 6

YKBDV	BKTDN	YKBDV	NTYVN	TDVTT
BNBKB	VYNKV	KNDYT	YDVVB	DDYBK
TYKKN	TDVNY	BTNBB	YVDYK	VDNNV
KBTTN	YTDKY	YNTVK	TVDNY	NTKBB
KVDBD	DKNNV	TTYVB	BVVKN	BDKDY
TTTDK	NVDKY	YBNBB	TVKYV	NDYVB
KTDVB	NTBKV	NYDTY	DNKNB	NDVYT
BTVDK	DVKNY	BYTK		

c. Exercises 7 to 9.—The 210 characters in each exercise consist of five sequences, each of which is made up of three sets of the fourteen characters in lessons 1 and 2 arranged in random order.

Exercise 7

GUJUM	TMRKB	DYVNN	HYGNY	DBTHJ
MVFJR	RHDGK	VFUTK	BFKBB	YVDRF
JRBUR	UYNUY	TJFGH	JFHGM	MNVDN
TMTHG	DKVKV	NBGGF	HFKGT	RHNMT
RVUYU	HDUBD	MFKTV	MJKJD	YJBR Y
NGMHN	HDKFR	JYTUK	JVBBU	FVTKM
GDBDJ	NVYRT	FGNRU	YHMJT	JKBRN
BTHVK	YNKUM	UHVGD	DRGMD	FYMJR
NHFUF	TBVG Y			

Exercise 8

UBNFM	DHUNJ	HUTDM	GKGRF	KKRFT
DHBGB	VYMJJ	YRNVY	TVFBH	UFYNM
DFKUT	RBVRV	NYJTM	THMKV	BGGDU
YGJHR	KDJNB	RJGTH	UJJGR	HUTFF
NVKYB	RMKNB	VYDMN	FKYHD	TUMVD
GGVTH	FYBKD	MNUJY	RBVTH	MDUHT
NFURF	YMDKV	BKJJG	NRGRG	BDTGV
HFRFN	KDMTU	JYGHJ	BRVKN	HTMDB
KYNYM	UJFUV			

Exercise 9

UJMKD	HBRNY	GVJUR	TKUDV	MDYTH
RBJVF	MNTYB	NGGFF	KHFTY	BVUDD
NTFKJ	NBRHM	HNFKV	YRGJM	RTKGV
HYDUG	JUBMB	TYRKG	NDBGU	VHVUB
FYJFY	RNDGN	KDMFM	VHMJH	JKTTR
UGDRN	GHFMB	YNHRB	YFKUD	GHMUK
KDVTV	TUMJJ	FBNTV	JRYDN	VKTVG
DYVBG	HHRMB	RYGFJ	JUKKF	FMUNN
BTHJD	RYTMU			

d. Exercises 10 to 12.—The 275 characters in exercise 10 consist of a gradually cumulated presentation of the seven characters in paragraphs 14 and 20, lesson 3. The 189 characters in each of the exercises 11 and 12 consist of nine sequences, each of which is made up of three sets of the seven characters in lesson 3 arranged in random order.

Exercise 10

CCCCO	EEEEEE	CECEEC	CECEE	CECCE
IIIII	CICIC	EIEIE	EICEE	ICCEC
EICII	LLLLL	CLCLC	ELELE	ILILI
ELCIC	ICLEL	LICEI	ILECE	OOOOO
COCOC	EOEOE	IOIOI	LOLOL	ILOLL
ICILO	EIOCO	LEOCC	ECEOE	SSSSS
CSCSC	ESESE	ISISI	LSLSL	OSOSO
SCOIL	SIOLE	LCOSO	ECELC	IESIO
ISCLE	WWWWW	CWCWC	EWWEW	IWIWI
LWLWL	OWOWO	SWSWS	LIEWC	CIECI
OESWL	WSOEI	OWLES	LWCCO	ISLSO

Exercise 11

ILSCW	OIWOC	EWSIL	CSOLE	ECEOI
ESWIL	COSWS	WLIOC	ELWEL	LIECS
OWISE	IOWCL	OCSLE	OIOLW	COWIE
SWIEL	SCSCO	WLEIO	ISCLI	EWSWE
LCOCS	LEIWO	CWSLC	OSCEI	OWLIE
SSEOE	WOIIC	LELSW	IWCOS	CLSWC
CILWS	LWEOE	ECLIO	OSILC	SWIES
COWOE	LSEOW	CILII		

Exercise 12

LCSWL	OCIES	CIOWO	LWSEE	ILCOL
WICCI	SOISL	EWESW	EOCLI	LWCLS
OWSOI	WSECI	EOEIS	EWOLC	OSWWL
EESCI	ICOLW	LWISE	OLOCS	IOLCE
IWESC	IIOLW	WOLWE	ELOIS	SCCSE
CEWOS	OEILC	LSWES	CICOL	IWSCL
ICLOE	WISEW	SCWIO	OELCW	SCLWE
LOWOI	EIESC	LOSI		

e. Exercises 13 to 15.—The 189 characters in each exercise consist of three sequences, each of which is made up of three sets of the 21 characters in lessons 1, 2, and 3 arranged in random order.

Exercise 13

HEOEN	LSYEC	UTWFN	VKNIB	UKGCT
KBRGR	HCWOS	OIRJT	MSLFG	HVBYF
LDJYM	MJIUD	VDWOJ	YSDVE	GYJVG
NMCKE	LBBTN	IGMOS	TUNSW	WDLKI
MOCDH	HCFRY	VRJIT	RUUWB	LHFFE
KMJET	DCHOS	GMKTY	FEMVL	UIWIO
UYSHI	NENTV	CRJLS	GVHFN	DFCRO
KBJBK	DWLYB	UWRG		

Exercise 14

LVOJT	MVGNB	IGMLO	WCRBJ	BSRKY
UKUCS	HOUEK	TEWSV	IDYFT	WNLIO
HEJHF	YHDRW	GCFYJ	WMLJE	LJYSN
ECKND	FYOSC	KBBRG	TVICO	TRFBR
LKDHV	UVWDS	UHGHN	ITEOM	WUGIM
FJTOL	TEGVM	HYLJK	WYRKS	VFIBT
RBCJG	URLDN	UDHVW	DWHBS	ONFIE
IMNCS	UMCEF	GYKO		

Exercise 15

YMSBD	WLUFBR	SOVGN	GSNMC	MCFWG
VCERK	NTVDY	BHIHO	LIUFH	ILTBJ
KTUYE	JKOER	WJDTM	SJTIK	YESME
JVOLH	BMHCF	IUNGV	UKWJB	OYRHD
WEFNU	VIRLG	DWOSR	YKDFG	CBLNT
CDDNJ	STHKB	CGOSO	INUEY	NDJUT
LOYRE	RFLBI	WUYFV	GVGRF	MTEJC
IKWKB	SCMHL	HMVW		

f. Exercises 16 to 18.—The 275 characters in exercise 16 consist of a gradually cumulated presentation of the seven characters in paragraphs 15 and 21, lesson 4. The 189 characters in each of the exercises 17 and 18 consist of nine sequences, each of which is made up of three sets of the seven characters in lesson 4 arranged in random order.

Exercise 16

AAAAA	PPPPP	APAPA	APPAP	PAAPA
QQQQQ	AQAQA	PQPQP	APQPA	PQAPQ
APQAA	XXXXX	AXAXA	PXPXP	QXQXQ
XAQPX	PXQAP	APQXQ	APAQX	ZZZZZ
AZAZA	PZPZP	QZQZQ	XZXZX	PZAXQ
PXZAA	XZQPA	ZAZPX	QPQAX	44444
A4A4A	P4P4P	Q4Q4Q	X4X4X	Z4Z4Z
PA4QX	4PAXZ	AZAQA	ZQXP4	QP4ZQ
Z4XPX	55555	A5A5A	P5P5P	Q5Q5Q
X5X5X	Z5Z5Z	45454	5PXZ4	P5PX4
4ZAZP	5XQPA	AQ545	QAXQZ	Z4AXZ

Exercise 17

X4Q5P	4QZ54	Z5QPA	PAZXA	XXPZ4
AA5Q4	AZQZQ	PXP55	4XA45	QPZP4
ZXQ55	Z4PXX	QAAP4	QZZQA	A4XPA
4PQZ5	XX55Z	XPQA5	PQ4QZ	4ZAAP
455XX	54PXZ	4ZQP5	5A4QZ	XAQAP
XAPQX	PAZQX	Q45XZ	Z54PA	54AZX
5ZQPA	454AP	X45ZQ	QXPZA	XPAPQ
5QZA4	54QXZ	PX54		

Exercise 18

Z P A 5 Q	X 4 P A Q	P 5 X Z A	4 5 Z X 4	Q Q 4 P X
Z 5 5 4 P	4 Z X P A	A X Z A 5	Q Q P 5 4	5 P Z X Q
Z Q 5 Q X	A A X 4 A	P Z 4 A Z	Z A Q P 5	4 X 5 Z 4
P 4 Q X P	5 A X Q P	4 A X Q 5	Z P X 5 Q	5 Z P Q 4
Z A X 4 A	Z 5 Z 4 5	A Z P A P	X P X X Q	4 Q 5 Q 4
A Q A 4 X	Z Q 5 X P	P Z A Q 5	4 P 4 X A	5 Z 5 4 P
Z P Z Q A	Q 4 A 5 4	Z X Q X X	A 5 P 4 A	P 5 5 X Q
4 P A 4 X	5 P A Q Z	Z Z Q X		

g. Exercises 19 to 21.—The 252 characters in each exercise consist of three sequences, each of which is made up of three sets of the 28 characters in lessons 1, 2, 3, and 4 arranged in random order.

Exercise 19

C V C Q F	R X N I Y	U D A E D	X J Y H B	A H W 4 B
P 5 K D L	5 A P I J	S T V Z Y	O G 4 N Q	Q 5 U H 4
R E J L W	B S W K X	S N E I M	F U O C K	T T L G Z
F P Z M O	G R V M 5	S E N B R	C H Z I L	D K Q Z T
F Y B J L	P L U O W	Y W D 4 N	M C X O G	M P I Q W
F D K Q G	S V O T A	V 5 N A M	5 Y J E H	I G R U E
X R Z V T	S J H F B	P C 4 K 4	X A U C L	Y D X L 5
Z X S W U	S P L D V	J 5 U P N	T V I W G	T A Q M D
F H 4 5 B	F R A R Q	W G T C M	U A I J P	N F Z K H
N 4 Y X O	S 4 E G I	H O J E E	K O Y K V	Q B R M B
Z C				

Exercise 20

H N R Q I	N 4 H G U	N B V G T	A U 5 W X	Z C L P V
X M D L P	E E D O C	Y W J R O	I Q C 5 F	4 Y B R 4
M A K F Y	U W T S P	T V S X N	O S 5 Z J	Q E I G K
L B J K Z	F D H A W	R F W M Z	R F N K X	Q V L S B
F Y B U M	P S Y T E	A M J S N	A K X Z I	5 N C O 4
T H C K G	5 U I Y D	Q A R P D	E 4 Q H V	U Z O J X
5 4 E G W	G T C L O	V L I H D	B J P M I	D K Z M X
A U H V W	D A 5 R V	Y 4 S B O	M 5 K V H	N Y J S R
F N C P W	Q D L N B	5 X Q 4 U	Z B 4 T E	G Y F Z R
T K S H J	U A Q G L	E C O I F	P C O L E	G X I J P
W T				

Exercise 21

H B A S B	E P W G O	F Z E V A	X M 5 Y K	5 H G O E
V Z X Y D	F K R 5 Q	M N S T I	Q P N K W	Q I H R N
G C T C V	X 4 Z B P	C R J S 4	O D L A I	J Y U J F
U L U 4 W	M L T D K	F D Y X U	U W S J L	E T D N Q
O T P G F	B O N H C	5 R O V M	Q Y R I J	I Z P V A
M P T Q F	K U M R A	S C Z N 4	H D Y L E	X G S 4 W
L K W 5 H	E G C 5 X	B J V A I	Z 4 B R F	U A V P A
4 H 5 Q E	E S H C M	U L 4 B N	T O K Y G	D I J F Y
W X D V B	Q D M Y M	4 R T N F	K Q 5 C L	Z A B C G
I G U W N	S Z J T I	J O R P W	V L Z O S	P H 5 X X
E K				

h. Exercise 22 to 24.—The 355 characters in exercise 22 consist of a gradually cumulated presentation of the eight characters in paragraphs 16 and 22, lesson 5. The 216 characters in each of exercises 23 and 24 consist of nine sequences, each of which is made up of three sets of the eight characters in lesson 5 arranged in random order.

Exercise 22

11111	22222	12121	21121	21221
33333	13131	23232	23221	11321
31323	66666	16161	26262	36363
13636	26211	32616	12323	77777
17171	27272	37373	67676	62317
71632	17311	27762	63632	88888
18181	28282	38383	68686	78787
76323	21278	13167	61832	87286
67183	99999	19191	29292	39393
69696	79797	89898	36981	81273
62927	63817	86193	32917	62978
00000	10101	20202	30303	60606
70707	80808	90909	03832	13826
71826	90970	79928	61700	37616
19328				

Exercise 23

02176	16290	89713	38697	23809
23810	38962	86721	09167	73037
62967	23170	89398	16182	00182
19327	13008	97692	80663	71769
30791	07810	69382	83622	01928
60373	97016	32728	19689	82760
13736	01699	88072	13291	20183
81328	06779	72366	09012	86293
12779	38163	67800	9	

Exercise 24

03932	96318	07826	18172	06792
79621	18306	87839	30970	62163
20789	19836	27302	70961	81096
93971	67283	80328	61210	78690
70736	23299	12871	08316	26173
37869	18208	90316	27093	70876
03281	91067	26893	29167	03719
38681	70826	31920	29306	91083
79867	32281	20619	7	

i. Exercises 25 to 39.—The 216 characters in each exercise consist of two sequences, each of which is made up of three sets of the twenty-six letters and three sets of the ten numbers arranged together in random order.

If sent in 14 minutes 24 seconds, the speed is 3 WPM
 If sent in 10 minutes 48 seconds, the speed is 4 WPM
 If sent in 8 minutes 38 seconds, the speed is 5 WPM
 If sent in 7 minutes 12 seconds, the speed is 6 WPM
 If sent in 6 minutes 10 seconds, the speed is 7 WPM
 If sent in 5 minutes 24 seconds, the speed is 8 WPM
 If sent in 4 minutes 48 seconds, the speed is 9 WPM
 If sent in 4 minutes 19 seconds, the speed is 10 WPM
 If sent in 3 minutes 56 seconds, the speed is 11 WPM
 If sent in 3 minutes 36 seconds, the speed is 12 WPM
 If sent in 3 minutes 19 seconds, the speed is 13 WPM
 If sent in 3 minutes 5 seconds, the speed is 14 WPM
 If sent in 2 minutes 53 seconds, the speed is 15 WPM
 If sent in 2 minutes 42 seconds, the speed is 16 WPM
 If sent in 2 minutes 32 seconds, the speed is 17 WPM
 If sent in 2 minutes 24 seconds, the speed is 18 WPM
 If sent in 2 minutes 16 seconds, the speed is 19 WPM
 If sent in 2 minutes 10 seconds, the speed is 20 WPM
 If sent in 1 minute 44 seconds, the speed is 25 WPM
 If sent in 1 minute 26 seconds, the speed is 30 WPM

Exercise 25

P9JZ5	WOR7Y	C I 2 L Z	G14S B	V485 I
H8TYK	I3SEX	1PKVU	S QWDM	TQOV6
RRNX Y	BMD1L	C0J T2	0H87C	9WAF3
NNZH G	9X9J E	KFE37	0A6A F	G4Q56
OLUBU	2DMX7	UYZ8B	636A I	3UTS7
7YRPR	Q2I0M	DEU96	RP0G1	X9SHV
4TZ1W	JKXMV	5PVI F	DY9L5	E4OBT
2FO2G	8HLS8	BAQFQ	ANJKJ	CCLWZ
4HEM3	0DKWC	1NNG5	O	

Exercise 26

31H9J	VYV0A	NPBQS	7ZZQF	C4FZG
6H37T	K2HXY	G8OIR	W4UMM	0OUDG
8KXTW	2MOSA	UST59	JV1LC	8XEEJ
F6YPD	49CIA	B60KB	7NP5D	LEIRR
3WL21	N5Q2P	WB9O4	YAJQC	Y9BIU
GXE43	1TJQL	FURM3	NR7G9	8KXWS
6BD1H	JZH5A	LDONR	T0KSV	IGQ08
L5KMZ	6FZPT	5MP6I	01WXS	VCO2V
DE3EY	CA742	8H7FN	U	

Exercise 27

5Z7YP	OBUFH	92RXO	EMQ68	KZFN0
DK4L2	F4DCR	GDW85	6UEQO	JR0HH
GW1J3	JLMCA	MQX9V	PIT1V	YWGUI
CZ5NS	VSA81	496X7	2LNYS	P7TBI
B3ATE	K30AM	H8TN5	MYY0X	2P2DK
RV0T4	97NW0	5WSL7	3YCUN	SJIRE
HQMZO	C4312	KVCXF	LI8X5	T6ASE
JUDGA	4L6IO	RUBZ9	1BWH3	7FKDJ
609GG	VQ1PP	ZBEF8	Q	

Exercise 28

GUNIK	G6GXZ	R1P6Y	BQDL7	UE3Q1
731BT	59RXN	YIPEK	O2YQH	OTXW4
6IUFN	LA3TJ	PWZ4E	SSJ2A	V87CJ
0MH5F	H5C9M	C048B	SVZKO	WMVD9
FA2L0	D8R4N	E7QCE	FY936	SCLQO
ZT247	D1V7I	2UJDN	WWE0N	MY8H3
VXQ19	BALSZ	FCLP1	G4UXM	XH08R
HDGZP	09IKG	M5J6J	V8PS6	A3OWR
UFYBR	T55AB	TOIK2	K	

Exercise 29

XO5OP	FDLVI	RSU0G	WX911	M5M0Q
3A2PK	JUNZZ	XS9D7	3YU6M	RAVY9
KBLKO	61QN0	H2WA4	L7J63	TEVZF
JTDY5	W2IPH	SC8I4	GBEHE	TQCFG
7CN4R	B88B4	30QK6	D1WYO	2ASGJ
ZS89R	WOXA9	RM7UX	8UF05	HEMGH
B60OZ	LCB1N	2VDVI	IDPAT	TM72Y
4JEJW	X59KQ	NUCPK	THY7L	ILGPS
31C6Z	VF84E	FRSNQ	5	

Exercise 30

AWTWX	FSH0P	ZU5AG	XNUBC	O43KG
J9IO9	2QTVI	QMV8Z	GYD0C	IEPA3
U1KYR	1DCW2	BVJ7Z	7YDL6	SFER5
F084T	174HK	N36EQ	X28MJ	HLPSN
L65OB	9RMOG	EPYHI	FVOCW	81KH3
MCUTN	URLB5	IPHRB	4YPZD	9640M
G217F	J3GF5	AODK6	2A2TK	AXXVW
518QE	BCTVD	W9X4Z	0S8LS	6NQLJ
UZSJY	IMR0N	7E73Q	9	

Exercise 31

H6GRO	5Z05C	OM58H	L64B8	XNVFL
TCEVC	F1NH7	402S4	YW7ZK	XQU6Y
MYS2R	AX9AS	UPIPV	E3GFT	Q23TI
WB9BN	7LJKP	OWAQJ	9DD81	RMUDE
G31K1	JZIN3	DKMSK	SI581	JNW2H
AGWDC	YU9XX	D6MYG	UZPSK	ZEIWJ
V0HBU	FP30T	6VNPf	L7Y6C	23074
9O9LF	RQRRC	A4AVI	Q11EB	MXT5Q
7LJZT	58Z8O	OGBH4	E	

Exercise 32

40IRT	PICMT	8QJXD	1WBS0	6WXO4
UVS35	LDYHE	28NTE	FZ75C	RKIPB
QLCKZ	M01ZL	BEG9D	3Y2WH	6YOUJ
NSV59	U2G6Q	3GAFK	07V8A	4MA7R
NXP1F	JOHX4	67P1E	3VUOB	MQYU8
98J7E	2N9U3	GAWH0	RXTQG	3CWKP
0BL94	MRVJZ	LZ8JD	C7VSA	NFIPi
TYNZQ	W65A1	O1HID	SGFDC	K5BLK
420E5	YH2XR	OMTS6	F	

Exercise 33

HJPVU	2Y8GI	3U817	0FCZZ	W209O
XJQK3	S5O76	MTC66	JBAEG	UWI58
DY0LM	BEBNQ	MH61D	EK45V	DFRAQ
YIXV4	KRGN4	Z9ONF	P3SST	LLXA2
HW1TR	TP9QB	X9W06	USETA	NM176
AT5PQ	X1G4D	5CZYO	E2UJG	HYIIB
Z923H	SM33P	JK804	LPWK2	VLJFD
KR1V4	S9TH5	FX81C	BCAG0	WQY8N
OR7VL	NDFEZ	ROM6U	7	

Exercise 34

LU585	KY5QN	ATWPC	4Z03N	BIUTK
VASR8	FJMHL	B073Z	O6EUV	G3RCE
DE6NI	V91YC	4YAOJ	9M2S7	HXDQP
1PRZO	SDFJW	FG48M	G2KB0	WQIX9
X1L7H	2T6IW	W0C4R	B16QK	19D5A
J3RPW	VK8VY	OFEZ7	32VTO	EZL4Y
TJCDB	UXY08	X2GM6	LMDUA	T7IHQ
NBO95	65E1F	Q9GFH	PPKAL	I7H2S
UCJXN	SGNZ0	RS34M	8	

Exercise 35

73FTB	DE0AC	H9SES	K065N	F6C2K
4TUJR	4FL3H	QVGZA	LK990	LJ6QG
P83XJ	SXWIT	00BQA	VMMXZ	V1YYI
8C5EZ	RW85U	2G41P	ND7BW	B17PO
HMINY	2DUX4	8YMWX	JMLI0	S6MBK
471J8	GXE0C	B9ANC	VRPUD	TQWOF
35EFZ	PRDJT	3YIC9	FU7UQ	6AQAH
2KNVS	6LHI0	211KY	72PWV	5H8ZG
EB50L	3TDZS	9N4OG	R	

Exercise 36

MZ3EA	W6GQN	UIV60	VYP8E	NM301
94LZN	MVG7Q	KDTWA	XWLUB	C1B7Y
7GSRH	CRID0	LJZ92	YD595	SUC4P
XBFSO	245OX	80PRT	I2AES	1FQKJ
8KTHH	FJ6YH	87071	K5EV6	FHCYO
R8MT3	U9ROQ	GSML1	QJC2X	34NK5
NRLVE	U9D7G	FTDD5	LXPIH	4ZGWW
O28S0	3B1N9	PPTFJ	BAI4Z	X0EMC
IJKZA	WU2QB	6ASV6	Y	

Exercise 37

5TKX5	FOGQA	X8L41	H9853	JM7KW
J6XNT	VARLT	ZSNRJ	8S6VK	GI1M9
CP9C2	1FQUV	R0YY4	MA277	N6DZ0
U00DD	ZYHBI	33HUP	GCPSO	FLQEW
42WEB	BEIIK	0R91M	AG5YZ	97U82
YNITX	QAHN6	8205I	7YWVR	ZVRF5
KD6Q3	FJUBD	S1VOW	8L3T6	XGTEL
9LXSC	PZCM7	FGE4E	UPJS1	MOHHD
JB23K	NP0WC	B04AQ	4	

Exercise 38

RIBKS	4RGO1	FA7UD	Q14QF	L9X09
EKEDZ	ON0JT	V36SI	NCM84	JCBY7
E3WZT	GYDUF	BWP35	P5762	6ALHS
P9NQ8	JKI10	HVXX8	R0MAC	ZUW25
HTVGL	2YMJY	K3VV0	GBKX6	2SP4L
71QTM	EPP5W	LRH8M	06ECT	Z31I1
XO5UO	UBC8U	B7Z4Y	ANTV0	54AJ2
CJH6F	RFWMG	9GQ2N	Y7Z9D	KALIX
R8NOD	F9HQW	ID3SE	S	

Exercise 39

AØHM1	CPDGR	KQH7E	SI4VN	I UWØY
S J X2K	DF361	LRVBD	GKGZ9	XP2XE
663OT	C1TZQ	55FIF	JMRU4	5YT49
A3NUQ	BZLSØ	W8WC9	L8YPJ	87V2O
MB7HA	EONFW	1P9CE	CDZØS	QW15J
27S4T	6MH9D	MDOAI	GYXNV	GVHUR
GAQBØ	ZLE6O	FKTBO	5YIQC	WMJP9
4483S	KZ2U8	6R2NB	EFVPY	ØANXØ
H583K	L37LX	TRJ1I	U	

j. Exercises 40 to 54.—The 216 characters in each exercise consist of two sequences each of which was prepared in the following manner:—First, three sets of the 26 letters were arranged at random into five-letter groups. Next, three sets of the 10 numbers were arranged at random into five-number groups. Finally, the letter groups and the number groups were mixed together in random order to make up a sequence.

If sent in 14 minutes 24 seconds, the speed is	3 WPM
If sent in 10 minutes 48 seconds, the speed is	4 WPM
If sent in 8 minutes 38 seconds, the speed is	5 WPM
If sent in 7 minutes 12 seconds, the speed is	6 WPM
If sent in 6 minutes 10 seconds, the speed is	7 WPM
If sent in 5 minutes 24 seconds, the speed is	8 WPM
If sent in 4 minutes 48 seconds, the speed is	9 WPM
If sent in 4 minutes 19 seconds, the speed is	10 WPM
If sent in 3 minutes 56 seconds, the speed is	11 WPM
If sent in 3 minutes 36 seconds, the speed is	12 WPM
If sent in 3 minutes 19 seconds, the speed is	13 WPM
If sent in 3 minutes 5 seconds, the speed is	14 WPM
If sent in 2 minutes 53 seconds, the speed is	15 WPM
If sent in 2 minutes 42 seconds, the speed is	16 WPM
If sent in 2 minutes 32 seconds, the speed is	17 WPM
If sent in 2 minutes 24 seconds, the speed is	18 WPM
If sent in 2 minutes 16 seconds, the speed is	19 WPM
If sent in 2 minutes 10 seconds, the speed is	20 WPM
If sent in 1 minute 44 seconds, the speed is	25 WPM
If sent in 1 minute 26 seconds, the speed is	30 WPM

Exercise 40

JWRVP	WLTZU	69868	QVAGY	APNCB
DYOFH	QFXKN	53509	IVRFT	ZCRLE
ZWB JX	69134	MMJ UO	3Ø721	251Ø4
DEMIN	AIQSK	TGULS	GPOHS	72847
XCBYK	HEDST	XYLVR	WKVBA	65843
KXGYT	TIEMU	Ø9826	399Ø3	OCFAJ
HGH BX	PUOKU	DGMWR	NVIFZ	27812
DELQJ	QHZZR	ILBCP	NPAMY	CJEOQ
77511	NFS SD	54Ø46	W	

Exercise 41

PWNWF	24823	RARCX	HVVYS	MBRKL
53190	68106	CWQ EJ	DPOFE	UKMZQ
JITLS	NPVOD	DGYTG	58132	49740
HUBSY	ZEQBI	JZTHA	KFN LX	96775
CIGOA	MXUBM	VVRBG	05423	LLOXP
NGFQE	PWSPY	DOAEZ	TJ I JW	YXEAS
MOKUF	48179	ZHC U Q	I I Z DN	64899
RMTYR	80752	AWT J G	XCN Q H	31536
KHCKS	BLUFV	21067	D	

Exercise 42

GUGPL	YKTPB	95924	GADJV	JMHWR
18873	MUKDF	50476	22950	ES OCP
63468	ZZUYN	CELQR	YJCEX	01173
XNAHL	QKXR V	FMWWH	OAVBN	QOISB
ZSITT	FDIAB	VNZVL	63261	YXXTS
53424	MKEFK	RNVZW	TPNLM	DFGIR
DJICO	KCHJU	49071	SGQSE	JUUPA
93872	HDHEY	60588	ZQYBF	RWLOB
57901	XMPAO	WCGIT	Q	

Exercise 43

71714	FDLCQ	03621	ZHYMP	XVYGO
EKHWD	93865	73895	92604	ZBUHN
REFNP	58042	FUVSL	STGAA	BKWPW
IMDCA	XQJGL	JOMCR	IIKJV	TNRXS
YZQTE	UBODG	37960	INVKQ	OZNUB
PZLBD	JFILJ	VAJEG	HYMOC	08435
VPWER	61851	ISOME	ZSYWS	HXXPM
XWFQT	CUTLN	KCTAK	HQUGF	32729
59214	76840	YADRR	B	

Exercise 44

27952	85793	QVWNS	SOMDW	NXLZR
51349	FEC SA	UOIZX	46166	AALIO
GEJTK	WIREF	40870	CBHMK	NUBGP
CTJXH	RPHZP	28301	JKYVL	FGDVQ
MTYUB	DQYWN	HBZYM	61686	84357
LDKQZ	MLEOW	09202	JFGBW	SEJAT
RIVTR	32145	NLCJF	XSQAI	GTDCN
HZGOD	KYUSC	53097	KYHEI	18974
VFXAQ	OPMVP	XURUB	P	

Exercise 45

MXREV	JLMPW	HSNNV	10679	BFUWX
58990	COQDX	HCEAJ	PFOLJ	86231
84672	YTGSV	51523	PBSUQ	OZTYG
BQHKR	DGWIK	AUIMI	KRTLN	44370
YCFEZ	DAZZR	IVOCT	UJHDH	KIBOP
51889	FDYWS	JWLF R	15730	BNPYH
45932	62042	ZXLYE	COARX	86077
TGEMZ	NKMKD	AVNTL	PQIXC	QMQAS
96143	SWG GU	EJBVF	U	

Exercise 46

FAPQF	57512	UVRHL	IIAFM	93396
CTGZT	JBNDP	KDUPO	NBHR Y	WXMQW
46138	48407	LKWUR	VOSXS	VOSDJ
CBGCQ	ZMIHY	XEKZG	67250	JLATE
82190	NEYBV	AUAZI	HDNQT	SVBMD
70925	VWFEC	TGHYI	OKRXW	54637
47513	SPRJS	86123	FCLLP	WHZQQ
OKMZE	GAXCG	81496	YOLMR	IFNUK
JETPU	YBNXJ	92008	D	

Exercise 47

46028	MKGHA	IFYBG	ZMZRX	76009
TI AHD	21983	57428	51653	GEP S V
RNCEO	LQBBE	FVKLD	TWOOT	XKHJD
XULJA	39417	QCWNN	CSZPV	UJIRW
PFUQS	MYYZU	STVWD	58154	PLDYJ
63069	ASGZM	88073	MKMPN	ROVUA
97941	HXWYJ	QIFTT	CBRLV	UEHBX
YIEFQ	OCRKX	23750	ACFEK	41622
WBGSG	ONJDI	PZLHN	Q	

Exercise 48

76739	SRC CZ	90535	PNGSX	KPOFL
OHQUB	39041	80822	IFYIV	BWHMY
PUQEV	AKZZT	17646	54218	VJCTD
SGDJK	ENQXB	UEDWT	XMLGA	WYLOH
FAMRJ	IRNFR	33859	DASPZ	TJXLY
RJBSF	DVEPU	47556	IEAIA	XWTNM
KWGLS	09082	67693	42472	ORBYI
XTZMP	NHLKO	CGECJ	CQYUQ	OFHMW
01118	VBZKH	VQGDU	N	

Exercise 49

Y C I E O	02061	12365	28867	Z P B H Y
Z M U G M	N A G W O	C W D L V	W R N C H	P X Y P A
Z S U I S	90718	V Q X R M	J L F Q K	49734
J X U D I	B J F H F	E R O T G	35549	K N S A T
K E Q B V	L T D M D	U D R G J	19079	C A V F U
C X S J F	Q Z T E C	H Q L W A	G R Y Y W	V L D S T
Z H R I B	46484	N V H P T	30702	S M Q K J
58252	97351	K F I K X	O G M N W	61638
B E L O A	U B P E X	I P O Z Y	N	

Exercise 50

15982	B F W C Y	43568	99843	U H C U T
57174	62100	D O Z I K	W L D Q J	E S O X U
T R Z Q F	M R P S S	X G Q N T	O F H A J	V A H M B
I V N W B	P Y I J Z	L X Y V M	G P L K E	03762
A G D R C	E N K H O	Q H D B U	A B J F I	Q H J N A
22835	M W M A L	E R O L S	81469	Z Y K T G
L W N Z P	25406	C K G W T	09170	V D T Q F
C K V I O	S J D U R	Y C B Z X	V G M Y Z	F E R P E
61385	47973	X S U P I	N	

Exercise 51

55916	B B V E M	D U R I N	Z T Y O I	D O Z Y X
W P Q L L	G N A R S	34319	Q J W V F	W S H X Y
87080	K P C H K	G K P F R	E M A O J	I C X D T
B S N U Q	61257	23496	28704	T Z A C H
J F M Y L	E U G D Y	H B U W N	X H J J Y	V Z N N V
94450	L F T A V	X E Z A P	G M J K B	11732
T S S R C	U C I F Y	B E K X A	59763	P Q Q I D
29858	63087	H R W R U	M O T W S	P D M G E
40261	L G O Z I	C F O Q L	K	

Exercise 52

67826	V Q K I Z	G U I O S	S K U A R	F M P H L
83033	J Y Z J H	B X H V Z	N L D V W	O N Y F I
T O E T C	45179	65205	Y G P D D	M T E R E
44289	L A B G R	09171	W C X Q X	W K F P M
N A U J S	Q C B E F	N P W W H	03542	G A C Q U
10183	77022	46658	Y M C I F	T R Y I V
C Q L M Y	J T U A H	O P Z N V	97941	X O B U X
A J F Q S	R D V H E	96385	B T S K Z	L K K E O
M X Z D N	R J L D S	G P I W B	G	

Exercise 53

OVX H J	ESRPO	19034	27385	51093
YFAGU	10654	ODATU	28787	KQKLI
JTHCP	96264	BIQKC	MRGIE	FSDXL
RB Y B Z	SGYQZ	VMPHE	NWTVX	FAUCM
NLZWD	JWNHP	CXUGY	KEZPM	LJXJB
QAEXT	47923	VCLKD	31154	NEZYC
79307	FOSBQ	RSANJ	56620	WDKRY
IHWIB	LSMDV	MUTNG	FOUQO	81288
45690	WVPRT	IHAGF	X	

Exercise 54

OCLGQ	HAYSE	PPWQL	KZGID	05335
82192	BAFEH	RMVEF	31709	OJYZC
WINJT	58426	46689	DOXAY	DMSPK
NJB UK	HZQSX	17704	XRWMU	LRNVT
CTBVI	GFULM	IYJQJ	RAVKT	PBCZO
GQTUB	63650	72541	15289	GRSZP
VL Y DI	CYWXO	99772	MNIRZ	AEMJV
FKHHC	NQFPU	AXEOF	EGHWD	DSWTN
LBKXU	03046	84831	S	

30. Clear English text, exercises 55 to 58, inclusive.

Exercise 55

EVERY ACTION IS A WISE OR UNWISE INVESTMENT FOR FUTURE	(10)
DIVIDENDS THE PAST IS GONE WHAT WE CALL THE PRESENT MOMENT	(11)
GOES OVER TO THE PAST EVEN WHILE WE ARE SAYING THE WORD LEAVING	(13)
ONLY THE FUTURE IN WHICH TO WORK AND ENJOY WHATEVER WE DO IS	(13)
DONE FOR AN EFFECT IN THAT FUTURE BE IT NEAR OR FAR A MINUTE	(14)
OR A YEAR CONSIDER WELL THEN THE EFFECT YOU ARE TRYING TO	(12)
PRODUCE	(1)

Total words (74)

Exercise 56

THE LOCAL INTERESTS OF A STATE OUGHT IN EVERY CASE	(10)
TO GIVE WAY TO THE INTERESTS OF THE UNION FOR WHEN A SACRIFICE	(13)
OF ONE OR THE OTHER IS NECESSARY THE FORMER BECOMES ONLY AN	(12)
APPARENT PARTIAL INTEREST AND SHOULD YIELD ON THE PRINCIPLE	(9)
THAT THE SMALL GOOD OUGHT NEVER TO OPPOSE THE GREAT ONE WHEN	(12)
YOU ASSEMBLE FROM YOUR SEVERAL COUNTRIES IN THE LEGISLATURE	(9)
WERE EVERY MEMBER TO BE GUIDED ONLY BY THE APPARENT INTERESTS	(11)
OF HIS COUNTRY GOVERNMENT WOULD BE IMPRACTICABLE	(7)

Total words (83)

Exercise 57

THESE ARE THE TIMES THAT TRY MENS SOULS THE SUMMER	(10)
SOLDIER AND THE SUNSHINE PATRIOT WILL IN THE CRISIS SHRINK	(10)
FROM THE SERVICE OF THEIR COUNTRY BUT HE THAT STANDS IT NOW	(12)
DESERVES THE LOVE AND THANKS OF MAN AND WOMAN TYRANNY LIKE	(11)
HELL IS NOT EASILY CONQUERED YET WE HAVE THIS CONSOLATION	(10)
WITH US THAT THE HARDER THE CONFLICT THE MORE GLORIOUS THE	(11)
TRIUMPH WHAT WE OBTAIN TOO CHEAP WE ESTEEM TOO LIGHTLY IT	(11)
IS DEARNESS ONLY THAT GIVES EVERYTHING ITS VALUE	(8)

Total words (83)

Exercise 58

IT IS REFRESHING TO KNOW THAT THERE ARE GREAT FORCES	(10)
FOR GOOD AT WORK IN THE BUSINESS WORLD THAT IMPROVEMENTS ARE	(11)
BUT THE NATURAL EXPRESSION OF UPLIFTED THOUGHT THAT EXAMPLE	(9)
PURER MOTIVES HIGHER IDEALS AND THE RIVALRY OF EXCELLENCE	(9)
ARE LEAVING THE WORLD THAT OPPRESSION IS DECREASING IN ORDER	(10)
THAT SPONTANEOUS EFFORT MAY BE UTILIZED THAT COURTESY AND	(9)
KINDNESS ARE GAINING RECOGNITION AS FACTORS OF SUCCESS AND	(9)
THAT MEN ARE LEARNING TO LOVE THEIR DAILY WORK BECAUSE THROUGH	(11)
IT THEY FEEL THE DIVINE IMPULSE	(6)

Total words (84)

31. Tactical net traffic,* exercises (59 to 78, inclusive). (See TM 11-454 for procedure).

*NOTE.—Throughout this paragraph “-” represents the separative sign ii. It is transmitted “didit ddit.”

Exercise 59

A2D V BF6 291812Z GR6 BT
EXPECT DEPART 1945Z ARRIVE CRANDLE 2348Z BT 291812Z K

Exercise 60

A2D 6F2 V BF6 NR7 NR6 140018Y GR20 BT
XQZNP YQZIM WQZZV VHSIE EISIE HSQWY QMKZW BINSE EHQDF HIQIT
WQZXZ QTFEJ QVABD XSREU CXMPB ICFOX WHEIP ZXXXE BEHII ZSHEQ BT 140018Y K

Exercise 61

A2D V PW6 NR13-F-A-BF6 132340B-W-A2D PW6 GR20 BT
PQKTY TWYTN ZXQWZ KECTW YTQMA EHRFD VANCD TYTWX ZQPLH FRDBY
QWJVU UWVHE TEKHZ VHPWS QZAVH HOPWJ LFLFF DRBHI PYQZM APYWE BT 132340B AR

Exercise 62

K49—N—A2D V BF6 190049Z GR6 BT
 INTERCOMMUNICATIONS UNCIRCUMSTANTIATED STOP COMMANDERS
 DISPROPORTIONABLENESS UNWARRANTED BT 190049Z K

Exercise 63

6F2 V BF6 NR18—D—T—MPQ—A—BF6 291450U 6F2—W—KFR MPQ GR26 BT
 WZXYR TRFLT QASLK QZVHS IVQPZ HYQMA PWJEL PTPTX ZLKNT JWTKT
 AWATH QZTHF FLOCK ZDNTA HTYKS YHZTH VELHF ERYR HONAY PARAE
 JTWEN EPHVS XOTUX DTXQM AFAEL AEIUV BT 291450U K

Exercise 64

6F2 V BF6 NR49—D—T—A—BF6 290250Z QSN—W—6F2—N—G94 GR9 BT
 (AILAE) 492/6 23784 19827 37820 28/90 43821 01643 73814 BT 290250Z K

Exercise 65

G94 MPQ V 6F2—D—A—BF6 280409Z 6F2—W—2SN—N—KFR GR22 BT
 OHMWZ MIZIT UHPWT PEGET JKTA ZOWAE MZODU HRXLV DXBUI TRAEQ
 TTAQZ EHYTW OEMIP ECYMT PANPZ MIXTU LRFDK HUSVC ETRCK VLRUO
 OMHOE TRXDT BT 280409Z K

Exercise 66

GF2 V BF6—P—T—A—BF6 140200Z G94 MPQ 6F2—W—KFR GR18 BT
 ONNER JEOWT ZTWES AERHN KTYOI UITVS TINEH OTMMT EGPAN AETTI
 SEINT TIDNE UEFIN GETNM NSEES JEOWT KTAYX ZMIGN BT 140200Z K

Exercise 67

A2D GF2 V BF6—O—OP—KFR—6F2—T—KFR MPQ—A—BF6 131110Z KFR—W—A2D MPQ 6F2 GR10 BT
LEDAL ZTDXT UCHNH VSTST NDETD NTEMT TENFS LHFPW ELTZM ITHQZ BT 131110Z K

Exercise 68

KFR V 6F2—P—A—BF6 191214Z A2D KFR PW6—W—6F2 GR20 BT
NEREA HRTTI ZMPWO XZTYW ADKLF RAEWA TQMAT WYZOM EHEET ISINE
YQMAW OIEST EEHQZ TTMIZ XXTUB ZNVNN CONNE TYTWT SMTEM XLDFG BT 191214Z AR

Exercise 69

6F2 V BF6—D—T—A—BF6 162222Z KFR QOR KFR QLE 2 GR20 BT
NSEIT MONNC WQTYW WRKLF ANNCY TWXTU RAEWA RTPEG MIXTU ZSPHI
YQMAW OIEST EEHQZ TTMIZ XXTUE ZNVEN CCNNE TYTWT XNTEM XLDFG BT 162222Z AR

Exercise 70

MPQ V 6F2—A—BF6 311516X MPQ GR20 BT
QTYRZ MIYTW EHGLS FATWE YTYWY MIMIZ EHRAE TTPIW EPSQH MOMTO
XZTUQ TKPOL TWTEH LKTAQ MAZMI TAIZL DAEFG LAIGM EGMEW QZSDG BT 311516X B K

Exercise 71

KFR V MPQ—A—BF6 230901S KFR MPQ GR20 BT
JQWTE ETHRL AIYTW KTUIS LEAIZ MTOWQ SFLFR VHUST NIVET LZMNN
COLLA ITERY KTETA JEWTH EXVTY QWPOY MOYQW JXTUR VNBED XZZMI BT 230901S K

Exercise 72

G94 V 6F2—A—PW6 040001B G94 GR20 BT
VLAIV VUSTR MAWJT EBRST VNDEB RKAIL MNQPZ OYWEL VNZSG HETGM
AIPZZ MIMIE HSRTS ELIHG IRWQZ POMQI AIRSZ VVSTH TTEE OONO AS AR

Exercise 73

G94 MPQ V 6F2—OP—1349Z BT
ARRIVE LEK 1415Z BT 1349Z AR (or, BT AR)

Exercise 74

G94 KFR V 6F2—O—BT
SUB SIGHTED 5 MILES NORTHEAST LE HAVRE DESTROYED SAME BT AR

Exercise 75

6F2 V BF6—O—T—MPQ—A—BF6 2015Z A2D MPQ 6F2 GR10 BT
XETUV URQZP JWEPA NTKEQ ZXYPM YRESK KRQWP GLTUX XTUMZ YTWSD BT 2015Z K

Exercise 76

KFR—O—A—BF6—2SN—N—G94 BT
CHARLIE ABLE NAN CHARLIE EASY LOVE BT AR

Exercise 77

—O—A—BF6—PW6—W—A2D 6F2 BT
DISPLAY STARBOARD LIGHTS WHEN SUB SIGHTED BT K

Exercise 78

A2D V BF6—OP—0020Z IX BT
ASSAULT POINT ZIP BT 0020C K

32. War department net traffic (exercises 79 to 87, inclusive).

Exercise 79

NR1 WXH CK 5 AGL FM
KETCHIKAN ALS SEPT 030811 TO

FORESTRY SERVICE

JUNEAU ALS $\overline{\text{BT}}$

RANGE DEPARTED FOR KETLAKATIA 022349 $\overline{\text{BT}}$

PARKS $\overline{\text{AR}}$

Exercise 80

NR2 WXH SVC TO

WXA JUNEAU ALS $\overline{\text{BT}}$

UNDLD YR 73 ACL 3RD SARVELA SINED FORESTRY STOP SEE OUR 5 AGL THIRD FORESTRY
SINED PARKS $\overline{\text{BT}}$

KETCHIKAN ALS SEPT 3 $\overline{\text{AR}}$

Exercise 81

NR3 WXE CK 18 YNT FM

ANCHORAGE ALS SEPT 030909 TO

SMALL

ALASKA RAILROAD CHICAGO ILL $\overline{\text{BT}}$

REQUEST ONE THOUSAND MENU CARDS CURRY ROAD HOUSE FIRST AVAILABLE STOP ADVISE CUNNING-
HAM AT TALKEETNA WHEN SHIPPED END $\overline{\text{BT}}$

MORGAN $\overline{\text{AR}}$

Exercise 82

NR4 WXC CK 20 WEA FM

SITKA ALS SEPT 030916 TO

AIRWAYS OBSERVER

DUTCHHARBOR ALS VIA ANCHORAGE $\overline{\text{BT}}$

NAVY METEOROLOGIST JAPONSKI ISLAND REQUESTS HOURLY OBSERVATIONS NEXT TWO
DAYS STOP THIS OFFICE CLOSED BETWEEN 2400 AND 0500 DAILY ADVISE $\overline{\text{BT}}$

OBSR $\overline{\text{AR}}$

Exercise 83

NR5 WAR CK 25 SSB FM
SOCIAL SECURITY BOARD

WASHN D C SEPT 10~~1111~~ TO

BALTIMORE MD BT

LAURITZ Z SMORGESKERT NUMBER THREE FOUR NINE SEVEN TWO SIX FOUR ONE CLAIMS
DEDUCTIONS PREVIOUSLY MADE TO INCLUDE UP TO AND INCLUDING AUGUST THIRTY
FIRST BT

WEYGERT AR

Exercise 84

NR6 WVT CK 13 CIV FM
CIVIL SERVICE COMMISSION

CHICAGO ILL OCT 11~~0914~~ TO

WASHINGTON DC BT

AVAILABLE CHAIRMEN REMAINING ON LIST SEVEN STOP NEXT FOR NOTIFICATION
JOSEPH W LEWIS BT

CIVIL SVC COMM AR

Exercise 85

NR7 WVP CK 22 WD FM
COM

GOVERNORSISLAND NY NOV 21~~1001~~ TO

HINGHAM MASS BT

SUBMIT WEEKLY RADIO REPORT EVERY FRIDAY GIVING PERCENT OF PROJECT COMPLETED STOP
EXPEDITE REPORT FOR LAST FRIDAY AND COMPLY IN FUTURE BT

GREEN AR

Exercise 86

NR6 WVY CK 17 RAH FM

SANFRANCISCO CALIF DEC 010809 TO

US ENGINEERS OFFICE

FEDERAL BLDG SEATTLE WASH BT

RE MCKINLEY L C TRANSITMAN WENATCHEE PROJECT STOP ADVISE IF WOULD ACCEPT PERMANENT
APPOINTMENT NEWORLEANS OFFICE EXPEDITE BT

MOULTON AR

Exercise 87

NR9 WVU CK 16 WD FM

OMAHA NEBR JAN 162315Z TO

ARMY RADIO STATION ANCHORAGE ALS BT

TWO THREE NAUGHT SIX Z 4180 CALIBRATES FOUR ONE SEVEN EIGHT DECIMAL TWO THREE SIX KC BT

OMAHA MONITORING STATION AR

APPENDIX I

PROSIGNS

Prescribed prosigns are listed below. Some of them have more than one meaning. In the tabulation each separate meaning is closed with a period. Prosigns consisting of two or three letters which are transmitted without pause between the letters are shown with a line over the letters. The International Morse character sound and the meaning of the prosign are shown opposite each in the list.

Prosigns	Character sound	Meaning
A	didah	Originator's sign
<u>AA</u>	didahdidah	Unknown station
AA	didah didah	All after
<u>AB</u>	didah dahdididit	All before
<u>AR</u>	didahdidahdit	End of transmission
<u>AS</u>	didahdididit	Wait
B	dahdididit	More to follow
<u>BT</u>	dahdidididah	Long break
C	dahdidahdit	Correct
D	dahdidit	Deferred
EEEEEEEE	dit dit dit dit dit dit dit dit	Error
F	dididahdit	Do not answer
G	dahdahdit	Repeat back
GR	dahdahdit didahdit	Group(s)
II	didit didit	Separative sign
<u>IMI</u>	dididahdahdidit	Repeat
<u>INT</u>	dididahdidah	Interrogatory
<u>IX</u>	dididahdididah	Execute to follow
<u>IX</u> (5-sec. dah)	dididahdididah daaah	Executive signal
J	didahdahdah	Verify and repeat
K	dahdidah	Go ahead
N	dahdit	Not received or Exempted
NR	dahdit didahdit	Station serial number
O	dahdahdah	Urgent
OP	dahdahdah didahdahdit	Operational priority
P	didahdahdit	Priority
R	didahdit	Received (also Routine)
T	dah	Transmit to
V	didididah	From
W	didahdah	For information to
WA	didahdah didah	Word after

APPENDIX II

INTERNATIONAL MORSE CHARACTERS

	Paragraph
General.....	1
Character sounds.....	2
Phonetic alphabet and numerals.....	3
Foreign Morse characters.....	4

1. General.—All army and navy transmissions by telegraphic systems are made by using International Morse characters. The dits, dahs, and spaces have the following relative lengths:

- a. A dit is used as the unit of duration.
- b. A dah is equal to three units.
- c. The space between elements of any character is one unit.
- d. The space between character sounds is three units.
- e. The space between words or code groups is seven units.

2. Character sounds.—The dit and dah character sounds for International Morse characters are as follows:

a. *Alphabet.*

A didah	J didahdahdah	S dididit
B dahdididit	K dahdidah	T dah
C dahdidahdit	L didahdidit	U dididah
D dahdidit	M dahdah	V didididah
E dit	N dahdit	W didahdah
F dididahdit	O dahdahdah	X dahdididah
G dahdahdit	P didahdahdit	Y dahdidahdah
H didididit	Q dahdahdidah	Z dahdahdidit
I didit	R didahdit	

b. *Numerals.*

1 didahdahdahdah	6 dahdidididit
2 dididahdahdah	7 dahdahdididit
3 didididahdah	8 dahdahdahdidit
4 dididididah	9 dahdahdahdahdit
5 dididididit	0 dahdahdahdahdah

c. *Punctuation marks used in plain language messages by U. S. Army.*

<u>AAA</u> didahdidahdidah	Period (.)
<u>DU</u> dahdididididah	Hyphen or dash (—)
<u>KK</u> dahdidahdahdidah	Parenthesis ()
<u>XE</u> dahdididahdit	Slant line (/)

d. \bar{P} .— \bar{P} is a special character transmitted “didahdahdidah.”

e. Additional characters for foreign letters.(1) *French.*

É dididahdit

(2) *German.*

Ä didahdidah

CH dahdahdah

Ö dahdahdhit

Ü dididahdah

(3) *Portuguese.*

Á didahdahdidah

Ñ dahdahdidahdah

(4) *Scandinavian.*

Å didahdahdidah

(5) *Spanish.*

Á didahdahdidah

CH dahdahdahdah

Ñ dahdahdidahdah

f. Special characters (used by commercial stations).

Period (.)	didahdidahdidah
Comma (,)	dahdahdididahdah
Colon (:)	dahdahdahdididit
Interrogation (?) or request to repeat	dididahdahdit
Apostrophe (')	didahdahdahdhit
Hyphen or dash (—)	dahdididididah
Wait	didahdididit
Fraction bar (/)	dahdididahdit
Brackets or parentheses ()	dahdidahdahdidah
Starting signal	dahdidahdidah
Underline (_____)	dididahdahdidah
Double dash (=)	dahdididididah
Understood	didididahdit
Error	dit dit dit dit dit dit dit dit dit
Cross or end (+)	didahdidahdit
Invitation to transmit	dahdidah
End of work	didididahdidah
Separation between whole number and fraction	didahdidididah
Is it correct?	dididahdidah

g. Distress and urgent signals (see General Radio Regulations annexed to the International Telecommunications Convention).

Distress call $\overline{\text{SOS}}$	dididahdahd ahdididit
Urgent signal XXX	dahdididah dahdididah dahdididah

3. Phonetic alphabet and numerals.

Able (Afirm)*	Jig	Sugar	Zero
Baker	King	Tare	Wun
Charlie	Love	Uncle	Too
Dog	Mike	Victor	Thuh-ree
Easy	Nan (Negat)*	William	Fo-wer
Fox	Oboe (Option)*	Xray	Fi-yiv
George	Peter (Prep)*	Yoke	Six
How	Queen	Zebra	Seven
Item (Interrogatory)*	Roger		Ate Niner

*Where the U. S. Navy General Signal Book is used, the names in parentheses will be used in lieu of those they accompany.

4. Foreign Morse characters.—Russian Morse characters, Japanese Morse characters, and Arabic Morse characters are listed in appendix VII.

APPENDIX III

TYPING

	Paragraph
General.....	1
Basic factors in typing.....	2
Keyboard operation.....	3
Basic home position exercises.....	4

1. General.—Students who are not familiar with the typewriter (often referred to by radio operators as the “mill”) will receive basic instruction in its use. The amount of time given to instruction will depend upon the course the student is taking. Fixed-station and high-speed operators will start learning to use the mill simultaneously with receiving lesson 1, alternating between copying by hand and with the mill. Each lesson must be passed by hand lettering before qualifying with the mill. Figure 2 is a chart showing the keyboard of typewriter MC-88.

2. Basic factors in typing.—Certain basic factors must be presented to every beginner in touch typing. Some of them are:—

a. An explanation of the various adjustments on the Underwood, Royal, Remington, and L. C. Smith makes of “all-cap” (all letters

capitals—no lower case) telegraph mill. Certain brands of typewriters may be preferred by some operators, but all operators should know how to use any make of typewriter. The adjustments that will be explained are: margin stops, margin release, carriage return, back spacer, line-feed regulator, space bar, lower- and upper-case shift, and the ribbon mechanism.

b. Instruction in the correct position of the body and arms at a typewriter. A brief summary of the correct position at a typewriter is:

- (1) The chair should be squarely in front of the desk.
- (2) The body should be erect.
- (3) Both feet should be flat on the floor.
- (4) The forearms should be horizontal.
- (5) The elbows should be close to the sides of the body.
- (6) The muscles in the body should be completely relaxed.

c. Instruction in feeding telegraph blanks to a typewriter. This instruction will cover the correct method of inserting telegraph blanks into a mill; the placing of unused blanks on the left-hand side of the machine; the dual operation of withdrawing a telegraph blank from the typewriter with the right hand while the left hand picks up an unused blank for insertion into the machine; the turning (or spinning) of the platen knob with the right hand, prior to pulling the carriage to the right with the right hand, to rotate the new message blank into its proper position.

d. A demonstration by the instructor of the correct manner contrasted to the incorrect manner of striking the keys. It will be demonstrated that the keys are struck with quick, sharp blows with the striking force at the wrist. In following this procedure the student will readily see that the fingers reach for the keys, and that the shoulders do *not* become involved in striking a key.

3. Keyboard operation.—*a.* After the basic instruction the student will be given instruction in the actual operation of the keyboard. A recommended procedure to be followed by the instructor in teaching *home position* (positions of the fingers over certain guide keys that are termed their "homes"), with practice exercises, follows:

b. Place the little finger of the left hand on the letter A. The other fingers should be placed in order on S, D, and F. These four letters, A, S, D, and F, are to be used as guide keys for the left hand. Allow the fingers to rest lightly on them all the time except when it is necessary to strike some other key. The little finger of the right hand should be placed on the semicolon. The other fingers should be placed in order on the L, K, and J. Use the ;, L, K, and J, as guide keys for the right hand, allowing the fingers to rest lightly on them all the time

except when striking some other key. Practice placing the fingers on the guide keys without looking at the keyboard or touching the frame of the machine.

c. In typing the exercises shown following, remember to strike the keys with quick, sharp blows, reaching with the fingers, but furnishing the striking force at the wrist. Use the thumb of the right hand for striking the space bar. At the end of each line, return the carriage to the right by striking the carriage lever with the fingers of the left hand, pushing it all the way to the right until stopped by the marginal stops. This same motion of the lever will turn the platen into position for the next line. Remember to keep your eyes on the copy while writing, and think where the keys are located. If you are unable to visualize where certain keys are located, refer to the typing chart mounted directly over your mill. Do not try to type quickly, but hit the keys at equal intervals of time, using a light, quick, firm touch. Do *not* look at the keyboard. One glance at the keyboard will undo the work of many hours.

d. Before starting the basic home position exercises the student should:

- (1) Place himself in the correct position at the typewriter.
- (2) Return the carriage to the extreme right.
- (3) Assume the basic home positions with the left and right hands.

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4. Basic home position exercises.—*a.* Strike the following keys in the order shown below. Fill each line all the way across the paper. (Notice that there are two space-bar spaces after every fifth group. Allow this spacing on every exercise. Also allow a double line-feed space between lines.)

ASDFG HJKL; ASDFG HJKL; ASDFG HJKL; ASDFG HJKL; ASDFG HJKL; ASDFG HJKL; ASDFG

ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK ASK

LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD LAD

ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL ALL

SAD SAD

GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS GAS

ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD ADD

FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL FALL

ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS ASKS

ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS ALAS

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b. The following letters will be heard in receiving lesson 1. Copy this exercise for practice. Attention is called again to the two space-bar spaces after the fifth group. In this exercise write only ten groups to a line with two space-bar spaces between the fifth and sixth groups. (Allow double line-feed space between lines).

FGHNJ RUF GH MJRUF GHMJR UFGHM JRUF GHMJRU FHJUG MRFGJ UMUGJ
MRMGU JHF MU GUJHF RMHRM HFRMG UJFU MGUJH FRUHG FHFRM GUGJ
FJGRH UMFJG RHUMF JGRHU MFJHR JUUF GHMJRM FJHRJ UUFMG UHGMJ
FURJM JHFU JMGHF RHUMF FUUGH FGGHG GGJMG MMGHR UHJGF FMRJG

c. When, in the instructor's opinion, satisfactory progress has been made on the basic home position exercises, the student will put on the headset and learn to coordinate his typing with the incoming character sounds. Students will advance through the five basic receiving lessons and subsequent speed increases as their ability and aptitude warrants.

APPENDIX IV

TAPE READING

	Paragraph
Transcription of slip.....	1
Example of message.....	2
Collation.....	3

1. Transcription of slip.—Where the speed of transmission is greater than the receiving operator's phonic translating ability, the signals are recorded on a narrow strip of tape. Tape recordings are often referred to as *slip*. Figure 5 is a sample of radio slip. In transcribing radio slip, the tape moves slowly in front of the eyes. The time required for a beginner to train his eyes to this moving copy varies with individual cases. Following are some of the factors governing progress in learning to read slip:

a. *Typing ability.*—A good typist seldom has trouble in learning to transcribe radio slip.

b. *Ability to read ahead of the copy.*—Reading ahead, which is necessary in transcribing slip, is not to be confused with reading ahead in phonic translation, which is forbidden. Reading ahead calls for the development of close coordination between the eyes and the fingers. For example, the operator transcribing tape may encounter the following phrase in a message: "TRANSFERRED AT A MEDITERRANEAN SEAPORT." etc. The receiving operator's fingers are typing "transferred" but the eyes are looking ahead to the spelling of a probable strange name after "A." In this manner, while the receiving operator is ready to type the word "MEDITERRANEAN" he does not have to stop the tape and strike the keys "letter for letter." The fingers will automatically transcribe the word "MEDITERRANEAN" as previously seen, while at the same time the eyes are looking ahead on the moving tape for other words in the message. The student must keep his tape moving, for only by so doing can he develop speed.

c. *Learning to count the number of words in a message while typing.*—An operator transcribing from radio slip should not find it necessary to look at his copy in order to count the number of words contained in the text of a message. Continually looking at each line to ascertain

whether there are ten words on the last line copied would slow up a receiving operator. The number of words contained on each line must be counted and kept account of in your head. The following method is an easy way for a beginner to learn how to count the number of words in a message: As you copy each word say to yourself, "One, two, three, four, five, two spaces, one two, three, four, five." Two counts of five have now been accounted for and will total ten words on that particular line. When this simple method of counting has been learned, the next counting step is to learn how to count straight through to ten without saying "two spaces." When the student has learned to place exactly ten words on each line without any effort, he should then start learning to count the total number of words in all messages up to and including 25-word lengths without starting over after each tenth word. A good operator should not find it difficult to keep track of messages up to and including 50-word lengths in one straight continuous count while typing from slip.

d. Learning to closely scrutinize the tape and avoid embarrassing errors.—Too much emphasis cannot be placed upon closely scrutinizing the tape. Errors are inevitable if the tape is not watched closely. An average reader may pass through paragraph after paragraph without noticing simple words being misspelled, so watch the tape as closely as if you were proofreading. If the word starts out "APPRO," do not relax the eyes and jump to the conclusion that it is "approximately"—it may be "appropriation." The only accurate way of knowing what word is on the tape is to keep the eyes on the tape constantly. Errors can be serious.

2. Example of message.—An illustration of the characters a receiving operator would encounter on the tape while receiving follows:—

a. Assume the following message is being transmitted:—

214WVN 5 RAH COLLECT

BOSTON MASS NOV 131619Z 1942

CG

2ND SERVICE COMMAND GOVERNORSISLAND NY
PROJECT 369 COMPLETED NOV 25

US ENGINEERS OFFICE

b. The tape as seen by the receiving operator would show the following characters:

214 WVN 5 RAH COLLECT BOSTON MASS NOV 131619Z CG \overline{AA}
2ND SVC COMD GOVERNORSISLAND NY \overline{BT} PROJECT 369 COM-
PLETED NOV 25
 \overline{BT} US ENGINEERS OFFICE \overline{AR} 214 369 \overline{AR} \overline{AR} (Next message etc.)

3. Collation.—At the end of each message a confirmation of difficult words and figure groups is transmitted. This is known as the collation. The collation begins at the end of the message and is terminated with a double \overline{AR} signal. The receiving tape operator should always check collations with the received copy. In order to develop the habit of watching collations, student operators while learning should write the collation on the bottom half of each message.

APPENDIX V

SUGGESTIONS FOR INSTRUCTORS

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General.....	1
Speed of character transmission.....	2
Radio operator's course.....	3
Training in International Morse characters—use of distributed practice....	4
Training in International Morse characters—use of self-check procedure....	5
Training in International Morse characters—proportioning time spent receiving and sending.....	6
Training in International Morse characters—attaining speed in receiving and sending.....	7
Radio procedure training.....	8
Auxiliary training.....	9

1. General.—In instructing radio operators it must be recognized that the mental processes and mental habits of a student play a very important part. Students will learn most rapidly when correct mental habits are developed by using proper mental processes. This section deals with the mental habits and mental processes of the student from the instructional point of view. Emphasis should be placed on proper class discipline and the wearing of proper uniform.

2. Speed of character transmission.—In order to prevent the student from learning characters by counting dits and dahs, these elements of the character sound are transmitted at a rate employed by operators when sending 20 words per minute. However, the space between character sounds is such that only five words are transmitted each minute on the tape method and less than this number on the record method. This comparatively high-speed transmission results in the student learning the characters by sound only. In so doing a reflex action is developed. This action of hearing a character and immediately recording it becomes automatic. The operator learns to hear the sound and immediately register the character without any mental effort. It is this effortless reflex action that makes a good radio operator.

3. Radio operator's course.—A radio operator's course should contain the following elements:—

a. Training in International Morse characters (radio, telegraph, and light signals).

b. Radio procedure training.

c. Auxiliary training.

4. Training in International Morse characters—use of distributed practice.—*a.* It is recommended that not more than three successive 50-minute periods be devoted to straight practice at any one time, and that only one 50-minute period at a time be so used until after the alphabet is mastered. A 10-minute recess at the end of each class hour is recommended.

b. Not less than two nor more than five periods a day should be devoted to practice on International Morse characters. Three or four periods a day probably will prove to be the most satisfactory.

c. If the minimum time of two periods a day is to be used, it is recommended that the practice period be separated by at least two periods devoted to other material, or that if the schedule requires International Morse character practice during the morning or afternoon only, both periods be given in the morning and separated by at least one period devoted to other material.

d. The division of practice suggested above should reduce monotony and at the same time provide periods of maximum lengths of time under which efficient training may be expected to take place.

5. Training in International Morse characters—use of self-check procedure.—All student responses, especially during the first phase of training, should be checked frequently so that no student will make the same error repeatedly. This is important, and it is necessary that instructors give personal attention to all students.

6. Training in International Morse characters—proportioning time spent receiving and sending.—*a.* While mastering the alphabet, the student's practice time should be devoted to receiving and practicing correct printing of characters, and familiarizing himself with the feel of the key.

b. While the students are working at speeds from six to eight words a minute, it is recommended that one-third of the time be devoted to sending practice. Students should be carefully supervised by the instructors to insure development of proper sending habits.

c. After the student is able to receive correctly seven words per minute, it is recommended that one-third to two-fifths of the sending practice should consist of sending back and forth with another student. Approximately one-third of this two-man net transmission should consist of extemporaneous conversation during which no recording is done with pencil or mill.

7. Training in International Morse characters—attaining speed in receiving and sending.—*a.* Speed in receiving and sending is acquired only by constant practice after the student has acquired

the proper mental habits. It is recommended that formal 2- or 3-minute tests be administered so the student will learn to work accurately under pressure

b. A progress chart showing receiving and sending speeds attained by each student should be posted in a prominent place. This chart should be changed as quickly as possible after a student has passed a test and progressed to his next assignment.

8. Radio procedure training.—Radio procedure training is presented in other training manuals (TM 11-454, FM 24-6, 24-9, and 24-10). The teaching of radio procedure and the introduction of prosigns into the International Morse character training program should be started as soon as the student has qualified at seven words per minute.

9. Auxiliary training.—Auxiliary training should consist of *a* to *g*, inclusive, below, and may include paragraphs *h* to *m*, inclusive, if time is available.

a. Appendixes I to IV, and VI.

b. Lettering practice.

c. Practice in taking poorly sent messages or messages sent through static and intentional interference should be introduced at 12 words per minute.

d. Operation, technique, and care of representative radio sets involved in field operation.

e. Operation and use of field telegraph set TG-5-(*).

f. Techniques of the location of stations and their concealment from the view of enemy aircraft and possible shell fire.

g. Training of operators to send and receive visual transmission at 10 words per minute. This training should begin after the student has qualified at 12 words per minute. In order to qualify for visual reception he must receive 100 consecutive characters sent at 10 words per minute without error, calling off each letter (using its phonetic name) to another student who records as directed.

h. Training in teletypewriter operation and procedure for those operators who are satisfactory typists.

i. Identification of enemy aircraft and tanks, and methods of defense.

j. Packing and removing radio equipment.

k. Reading maps and aerial photographs and sketching terrain features.

l. Elementary cryptography and message center procedure.

m. Use of other communication devices such as panels and pyrotechnics.

APPENDIX VI

ARMY LETTERING

1. Lettering style.—The accompanying army lettering chart shows the proper army method of printing letters and numerals by hand. Figure 11 illustrates the strokes used in army lettering and their order of use in lettering.

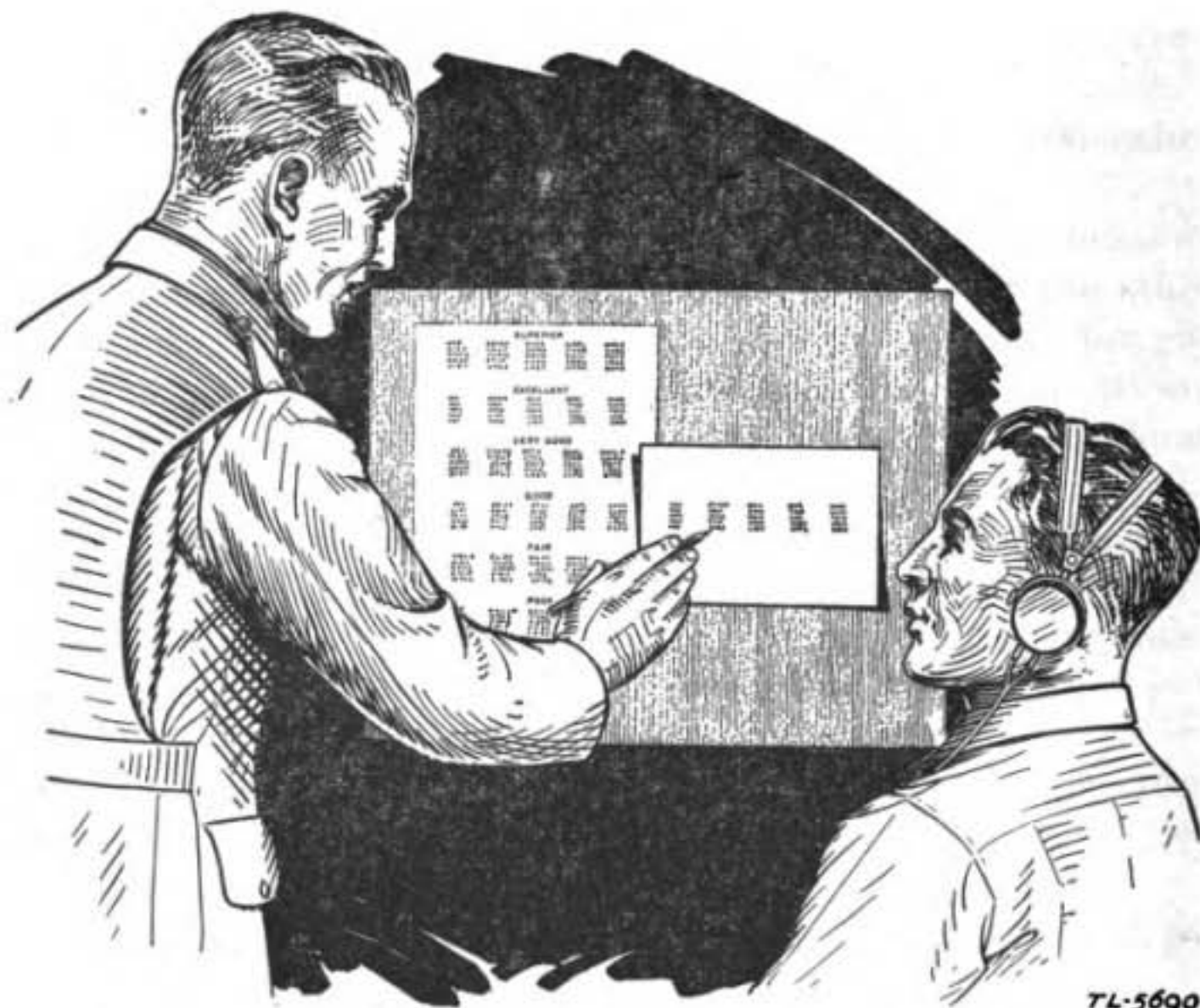
2. Neatness and legibility.—Neat and legible printing is of great importance in the duties of an efficient radio operator. As a means of determining progress in lettering, the student's copy is compared with a standard printing scale at frequent intervals. This standard scale consists of six printed charts which range from *superior* (upper chart) to *poor* (lower chart). The instructor places the student's copy alongside the standard charts in the manner shown in figure 12, and points out the quality of his lettering as compared to the standard scale. The student is given a grade ranging from superior to poor as determined by the chart (fig. 13) which his copy most closely resembles.

SIGNAL CORPS

A ¹ ₂	B ²	C	D ²	E	F ²
G ²	H ²	I	J ²	K ²	L
M	N	O	P ²	Q ²	R ²
S	T ²	U	V	W	X ²
Y ² ₁	Z ² ₁	1 ¹ ₂	2 ¹	3 ¹	4 ² ₁
5 ²	6	7 ¹	8	9	0 ² ₁

7L-4505A

FIGURE 11.—Lettering guide.



7L-5690

FIGURE 12.—Instructor showing student his progress by comparison with standard.



TL-5689

FIGURE 13.—Grading chart.

APPENDIX VII

JAPANESE MILITARY MORSE CHARACTERS, RUSSIAN MORSE CHARACTERS, AND ARABIC MORSE CHARACTERS

	Paragraph
Japanese Military Morse characters.....	1
Russian Morse characters.....	2
Arabic Morse characters.....	3

1. Japanese military Morse characters.—*a.* The following is a list of Japanese kana characters with Morse character equivalents. Those characters in columns 4 and 5 are not kana signals, but are used to change the initial consonant of certain kana from the values in column 3 to those of columns 4 or 5. They always follow the kana. For example: — . . . is ha, — is ba, and — — . is pa. If operators are trained in kana they copy the character sounds in kana; otherwise they copy the character sounds in English and submit the copied text to others for interpretation. (For purpose of brevity the dit dah combinations of character sounds are shown as follows: . for dit; — for dah).

(1) U. S. Opr. writes	(2) Morse	(3) Kana	(4) Nigori	(5) Hannigori
A	· —	i		
AA	· — · —	ro		
AR	· — · — ·	n		
AS	· — · · ·	o		
AU	· — · · —	wi		
AW	· — · — —	te	de	
B	— · · ·	ha	ba	pa
BT	— · · · —	me		
C	— · — ·	ni		
D	— · ·	ho	bo	po
DM	— · · — —	yu		
DN	— · · — ·	mo		
E	·	he	be	pe
F	· · — ·	ti (chi)	di (ji)	
G	— — ·	ri		
H	· · · ·	nu		
ID	· · — · ·	to	do	
J	· — — —	(w) o		
K	— · —	wa		
KA	— · · · —	sa	za	
KI	— · · · ·	ki	gi	
KM	— · — — —	e		
KN	— · — — ·	ru		
L	· — · ·	ka	ga	

LEARNING INTERNATIONAL MORSE CHARACTERS

(1) U. S. Opr. writes	(2) Morse	(3) Kana	(4) Nigori	(5) Hannigori
M	---	yo		
<u>MK</u>	-----	su	zu	
<u>MM</u>	-----	ko	go	
<u>MN</u>	-----	so	zo	
<u>MR</u>	-----	si (shi)	zi (ji)	
<u>MU</u>	-----	hi	bi	pi
<u>MW</u>	-----	a		
N	-. .	ta	da	
O	---	re		
P	. --- .	tu (tsu)	du (zu)	
Q	--- . -	ne		
R	. --- .	na		
S	. . .	ra		
T	- - -	mu		
U	. . -	u		
<u>UA</u>	. . ---	mi		
<u>UT</u>	. . ---	no		
V	. . . -	ku	gu	
W	. - - -	ya		
<u>WI</u>	. - - - .	(w) e		
<u>WN</u>	. - - - .	se	ze	
X	- . . -	ma		
Y	- . - -	ke	ge	
Z	- - . .	hu (fu)	bu	pu
I	. .	nigori		
<u>UN</u>	. . - - .	hannigori		

b. The following lists the Japanese Morse character equivalents of numerals. The normal and abbreviated signals, the romanized rendering of the Japanese sound occasionally used for number representation during communication, and the kana and Morse character equivalents are listed.

U. S. Oper. writes	Morse	Kana	Normal	Abbreviated	Romanization
N	-. .	ta—1	. - - - -	- . .	hi
Z	--- . . .	hu (fu)—2	. . - - -	--- . . .	hu (fu)
S	. . .	ra—3	. . . - -	. . .	mi
M	---	yo—4	. . . - -	---	yo
A	. -	i—5	. . . . .	. -	i
T	-	mu—6	-	-	mu
R	. - .	na—7	- - . . . .	. - .	na
W	. - - -	ya—8	- - - . . .	. - - -	ya
V	. . . -	ku—9	- - - - . .	. . . -	ku
O	- - - -	re—0	- - - - -	- - - -	re

SIGNAL CORPS

c. Following is a list of auxiliary signals used for punctuation, etc.:

Period.....	.....
Paragraph.....	.....
Parenthesis (open).....	.....
Parenthesis (closed).....	.....
Long sound.....	.....
End of message.....	.....
Code or abbreviated numerals.....	.....
Error—will correct.....	.....
End of part (interrogation).....	.....
End of transmission.....	.....

d. Following is a list of some of the abbreviations and procedure signals:—

U. S. Opr. writes	Morse	Kana	Meaning
<u>AHR</u>	· — · · · · · — ·	i nu na	Here is a message. (I shall continue transmission.)
<u>AS</u>	· · · · ·	o	Wait.
<u>ASMN</u>	· — · · · — — — ·	o so	Send slower.
<u>AWK</u>	· — · — — — · — ·	te wa	Switch to telephone.
<u>DQ</u>	— · · — — — · —	ho ne	Break sign. (Body of message follows.)
<u>EEEEEEEE</u>	· · · · · · · · ·		Error.
<u>EA</u>	· · —	he i	Close station.
<u>GT</u>	— — · —	ri mu	Government telegram.
<u>GW</u>	— — · · — —	ri ya	Will use abbreviations or code.
<u>AR</u>	· — · — ·	i na	No, negative.
<u>K</u>	— · —	wa	Go ahead.
<u>KAS</u>	— · — · — · · ·	sa ra	Repeat entire message. (Will repeat.)
<u>LAR</u>	· — · · · — · — ·	kan	Readability.
<u>LARM</u>	· — · · · — · — · — —	kan yo	Good readability, can read.
<u>LARMU</u>	· — · · · — · — · — —	kan hi	Poor readability, cannot read.
<u>LART</u>	· — · · · — · — · —	kan mu	Cannot hear.
<u>MMAR</u>	— — — — · — · — ·	kon	Jamming, interference, static.
<u>M</u>	— —	yo	Local.
<u>RWNI</u>	· — · · — — — · · ·	na se (na ze)	Why.
<u>R</u>	· — ·	na	Understood, received.
<u>MRMW</u>	— — · — · — — · — —	si a (shi a)	I have traffic.
<u>MRR</u>	— — · — · · — ·	si na (shi na)	I have no traffic.
<u>UR</u>	· · — · — ·	u na	Urgent.
<u>UY</u>	· · — — — · —	u ke	I have a message for you.
<u>UD</u>	· · — — · ·	u ho	Interrogation.

LEARNING INTERNATIONAL MORSE CHARACTERS

U. S. Opr. writes	Morse	Kana	Meaning
<u>UMM</u>	.. --- --- ---	u ko	Receiver.
<u>VE</u>	... ---	---	End of message.
<u>X</u>	--- ...	ma	Relay message..
<u>MMR</u>	--- --- ...	yo si (yo shi)	Yes, affirmative.
<u>ZW</u>	--- ... ---	hu ya (fu ya)	Transmission is not clear.
<u>ZZ</u>	--- ... ---	hu hu (fu fu)	Code signal is not clear.

2. Russian Morse characters.—

Russian letter		Transmitted by radio as:	Same signal in International Morse characters as:	Means in English*	Pronounced in English
Print	Script				
А	А	.-	A	A	ä (car)
Б	Б	---	B	B	b (bar)
В	В	...---	W	V	v (vice)
Г	Г	---..	G	G	g (get)
Д	Д	---..	D	D	d (day)
Е	Е	...---	E	E	yě (yet)
Ж	Ж	...---	V	ZH	zh, s (pleasure)
З	З	---..	Z	Z	z (zero)
И	И	..---	I	I	yē, ee (meet)
Й	Й	..---	J	I	y (boy)
К	К	---..	K	K	k (Kate)
Л	Л	---..	L	L	l (lamp)
М	М	---..	M	M	m (might)
Н	Н	---.	N	N	n (nine)
О	О	---..	O	O	ō (or) (never "oh")
П	П	---..	P	P	p (pipe)
Р	Р	---..	R	R	r (rose)
С	С	...---	S	S	s (site)
Т	Т	---..	T	T	t (time)
У	У	...---	U	U	oo (boot)
Ф	Ф	...---	F	F	f (fine)
Х	Х	...---	H	KH	h (hard)
Ц	Ц	...---	C	TS	z (German zu, or ts)
Ч	Ч	---..	OE	CH	ch (church)
Ш	Ш	---..	MM	SH	sh (short)
Щ	Щ	---..	Q	SH CH	sh (longer as if followed by y).
Ъ	Ъ	...---	AC	(*)	—(Hard sign, used after consonant to separate vowel).
Ы	Ы	---..	Y	I	i (writ)
Ь	Ь	---..	X	(*)	—(Soft sign, used after consonant to soften it as if using y after it).
Ю	Ю	...---	IM	YU	ū (use)
Я	Я	---..	AA	YA	yä (yard)
Э	Э	...---	UI	E	ě (met)

*Pronunciation sign only.

3. Arabic Morse characters.—

•—	ا ā	•	ع د	—•••	ب b	—	ت t
—•••	ث th	•—•—	ج j	••••	ح ḥ	—•—	خ kh
—••	ر d	—•••	ذ dh	•—•	ر r	—••••	ز z
•••	س s	—••••	ش sh	—•••—	ص ṣ	•••—	ص ḍ
••—	ط ṭ	—••—	ظ ḏ	•—•—	ع ʿ	—••	غ gh
••••	ف f	—••—	ق q	—•—	ك k	••••	ل l
—•—	م m	—•	ن n	•••••	ه h	••—	و w.ū
••	ي y.ī						

TL 5706

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[A. G. 062.11 (3-26-43).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

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(For explanation of symbols see FM 21-6.)