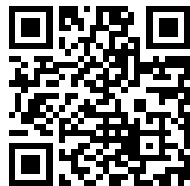


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# UNITED STATES ARMY

TRAINING MANUAL No. 29

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## TELEGRAPH OPERATOR

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INSTRUCTORS GUIDE  
FOR ALL ARMS

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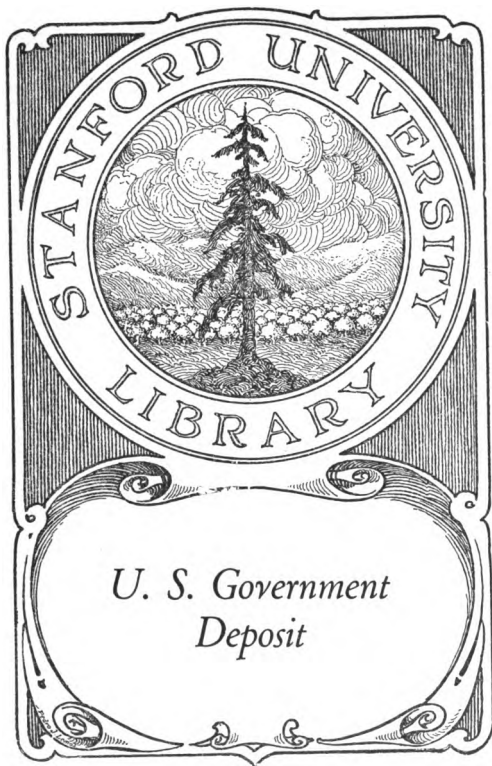
PREPARED UNDER THE DIRECTION OF THE  
CHIEF SIGNAL OFFICER

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1925



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1926









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## TELEGRAPH OPERATOR

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**CERTIFICATE:** By direction of the Secretary of War, the matter contained herein is published as administrative information and is required for the proper transaction of the public business.

**344462**

WAR DEPARTMENT,

WASHINGTON, *June 25, 1925.*

Manuals for training in the Army are to be prepared and revised from time to time by the branches of the service concerned and when approved published by The Adjutant General of the Army as training manuals.

In accordance with this plan there has been prepared by the Signal Corps a group of training manuals relating to signal communication specialists.

The training manuals in this series, relating to the training of telegraph operators, include the following:

Training Manual No. 20—Basic Signal Communication, Students Manual.

Training Manual No. 21—Basic Signal Communication, Instructors Guide.

Training Manual No. 28—Telegraph Operator, Students Manual.

Training Manual No. 29—Telegraph Operator, Instructors Guide.

This manual is published for the information and guidance of all concerned.

[A. G. 062.11 (6-25-25).]

BY ORDER OF THE SECRETARY OF WAR:

J. L. HINES,

*Major General,*

*Chief of Staff.*

OFFICIAL:

ROBERT C. DAVIS,

*Major General,*

*The Adjutant General*





# TELEGRAPH OPERATOR INSTRUCTORS GUIDE FOR ALL ARMS

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# TELEGRAPH OPERATOR INSTRUCTORS GUIDE

## INTRODUCTION

### PART I—CODE PRACTICE

#### 1. General principles underlying instruction in code.

This manual has been written with the idea of training Morse operators to fulfill successfully the duties required of them at the headquarters of tactical units in the field and in telegraph offices working with offices of the commercial telegraph companies.

No matter what type of training is to be given, the success of that training will depend to a very great extent on the industry and ability of the instructor. The development of accuracy and speed, both in transmitting and receiving, by operators is almost entirely dependent on the instructor. The good code instructor must be in accord with his students and teach them clearly and smoothly the course which has been prescribed.

In order that an instructor may intelligently pursue the method prescribed in this Manual for teaching students to become proficient Morse operators, it should be clearly understood at the beginning that this is a distinct method of giving instruction, consisting of—

- a.* The division of the letters, numerals, and the most frequently used marks of punctuation among the first six Unit Operations for the purpose of teaching the characters only. Following Unit Operation No. 6, all characters appear in each Unit Operation with the exception of a few special Unit Operations intended to give practice in the use of additional marks of punctuation, in numerals, and in message forms.
- b.* The teaching of the characters by sound only.
- c.* The teaching of the sound of the characters as they are heard when 20 words per minute are being sent.
- d.* The assignment of a major portion of the practice to code groups.
- e.* The sending of a greater number of words per minute than the student can actually receive, consequently compelling the student to reach out and obtain a greater receiving speed.
- f.* The attainment of ability to recognize the sounds of the characters before sending practice begins.

These items comprise a method which may be used to teach a group of students by a trained instructor without the assistance of any mechanical aid other than the usual standard code practice



equipment. There is, however, a mechanical device that may be used to advantage with the above method. This is the Ediphone code transmitter. This device takes the place of the instructor transmitting to the class and permits him to spend the major portion of his time in actual supervision. This auxiliary device may be used with the method herein described, both for transmission and for reception. The instructor should be careful not to consider the Ediphone code transmitter as a method of instruction, but rather as an aid to the method which has been outlined above and described more fully in following pages of this Manual.

In teaching the characters by sound it is naturally impossible to teach all of them at once; consequently the letters, numerals, and most commonly used marks of punctuation have been divided into six groups of seven characters each. A different group is taken up in each of the first six Unit Operations.

The terms "dot" and "dash" must never be used in code-practice instruction. Each character will always be referred to by its name, such as "A," "comma," etc.

The foregoing discussion involves the method of teaching the student to recognize the characters by sound, but nothing has been said as to how quickly he should recognize them. An arbitrary degree of proficiency has been adopted by stating that the student will receive instruction on a given group of characters until he is able to recognize all of those characters when sent at the rate of 25 per minute. Therefore after the student has received instruction on all of the groups of characters he should be able to recognize each character when sent with others at the rate of 25 per minute. This gives a starting point for further instruction of the student. Five characters are assumed to comprise the average word, so that after the preliminary instruction has ended the student should be rated as a 5-word per minute receiving operator. It is the purpose of this Manual to make him a 20-word per minute operator. For instructional purposes, the space between 5 and 20 words per minute must be divided into several classes or speeds. Based on the rapidity with which the average student progresses at the various stages of his training, the following speed classes have been chosen, namely: 5, 7, 9, 12, 15, 18, and 20 words per minute. The Unit Operations of this Manual are based on the above speed classes, the first six Unit Operations being required to bring the student up to the first class, 5 words, only.

The type of subject matter sent to the student for his receiving practice has a very important influence on the results obtained. Since one of the purposes of this training is to produce Morse telegraph operators for tactical units of an army operating in the field,

the subject matter transmitted for instruction should correspond as much as possible to the messages used in the field. Many messages sent under the above conditions are in code form; that is, they are arranged in groups of characters which have no English meaning of their own and which must be "decoded" before the message is intelligible. For this reason and for the additional reason that practice in properly arranged code groups has been found to develop operators rapidly, "copy" sent to the student for practice in these Unit Operations is composed of code groups. This method is continued until the student is more than a 15-word operator, at which point a change is made and a portion of the time is devoted to "press" or ordinary reading matter, and to message forms and Telegraph Procedure.

In code messages the meaning of each group is usually dependent upon the correctness of *all* of the characters forming the group; that is to say, one or more of the characters can not be wrong or missing, if the meaning of the group is to be understood with certainty. In "press" the misspelling or omission of a letter does not ordinarily make the meaning wrong or misleading. It is therefore very important in code messages to have absolute accuracy both of reception and of transmission. The accuracy of reception and of transmission will depend upon the training of the operators.

However, after a copy has been received its accuracy is of no value unless it is so copied that anyone can ordinarily read it without error. It is to obtain this result that all Morse telegraph operators trained according to this Manual are required to take a course in penmanship and typewriting.

The sound of a character depends to a great extent upon the speed at which it is sent. Since the final object is to make the student a 20-word operator, it has been found that from the very beginning all characters should be sent as though the entire transmission were at the rate of 20 words per minute. This means that the student is required to learn the sound of the characters only once and not for four or five different speeds.

The expert operator in copying press will be writing down his copy 4 or 5 words behind what is being sent. This means that the message coming to him in the form of Morse signals impresses him as words and not as individual letters or characters. The ability to copy behind is not so easily obtained when the subject matter consists of code groups, but even in this case it should be practiced. In order to train the student to copy behind, the following rule must be followed by the instructor: *In addition to sending each character as though the entire transmission were at the rate of 20 words per minute, send each code group at a speed halfway between the speed at which the student is practicing and 20 words per minute.*

In order to be able to follow out the above rule, all copies sent for practice to the 5-word operator must consist of 2-character code groups. Thus his practice will consist of a short group sent very rapidly and then a very long space before the next group is sent. It is readily seen that in following the above rule the only way to make the average speed of a transmission less than 20 words per minute is to increase the space between groups. It is during these long spaces between the groups that the operator is expected to write the group. On progressing to the 9-word class the student is sent 3-character code groups. Naturally, receiving the 3-character groups is more difficult due to the greater number of characters, and in addition the spaces between groups are shorter. At 12 words per minute 4-character groups are sent, and at 15 words, 5-character groups are sent.

In order that the methods of instruction given in this Manual may be successful, it is necessary that each instructor have only a small number of students in his section. About 12 students is considered the maximum number for one instructor to handle in code practice when instruction is given manually. With a larger number than this the students will not receive the individual instruction and help which are so essential. When the Ediphone is used, an instructor can take care of a much larger class, and if necessary one instructor can take care of two classes. Particularly in code practice it is important that the work given to a student be fitted to his needs; this can not be accomplished with too large a class. The instructor must know exactly the progress and the retardation points of each student in order that the proper steps may be taken to help the student along.

## **2. Specific directions regarding instruction.**

The duties of an instructor in code practice are to handle his students so that they become proficient operators in the shortest possible time, and to study the methods of instruction which he uses in order to constantly improve them. The course in code practice laid down in this Manual is believed to fulfill the first duty in the best possible way known at the present time, and should be followed carefully by instructors. The second duty of the instructor is fulfilled by a careful and intelligent study of the results of the tests which he gives the students and the records of the tests which are kept for further study. These tests and records will be discussed in a later paragraph. However, the instructor must not feel that he has accomplished his mission when he merely follows the Unit Operations as herein given. Unless he takes an active interest in his work and in the progress of each student, the results obtained will fall far short of those which might be possible.

The instructor who has become familiar with the different Unit Operations will note that they naturally divide themselves into three groups, namely, Unit Operations Nos. 1 to 6, which teach the student the telegraph alphabet and make him a 5-word operator; Unit Operations Nos. 13 to 16, which take him from 5 to 15 words per minute in the copying of code groups; and Unit Operations Nos. 17 to 18, which increase his speed to 20 words per minute and also give him practice in copying press.

Unit Operations Nos. 7 to 12, inclusive, for practice in marks of punctuation, in words having similar sounds, and in message forms, are used in conjunction with Unit Operations Nos. 17 and 18.

In Unit Operations Nos. 1 to 6 the instructor has two distinct things to teach, namely, receiving and penmanship. In addition to this, special instruction in penmanship and in typewriting should be given during periods allotted to these subjects exclusively. On taking up any one of the first six Unit Operations the first step is penmanship. This is due to the fact that good penmanship is desired before the student makes a record of his copy. The actual practice in penmanship should be concurrent with the student's receiving practice. Each Unit Operation gives the several steps into which both the sending and receiving practice of the student is divided. The instructor must necessarily follow the Unit Operations, and require the student to pass the proficiency tests given, before allowing him to progress. If this is not done, the value of the entire system of instruction will be nullified.

In Unit Operations Nos. 13 to 16 the task of the instructor is slightly different. When these operations are taken up, the student should know all the characters and be ready to develop some good speed in copying. The instructor will find it very difficult to have his assistants send the characters at 20 words per minute unless the Ediphone is used, but this rule must be absolutely followed or the development of speed by the students will be slow. It is not desirable to state definitely that the student must copy behind, but one of the objects in sending the code groups rapidly is to develop a tendency to copy behind and to force the student to read the entire group before or during the process of writing it. With Unit Operation No. 14, practice in transmission is taken up for the first time.

In Unit Operations Nos. 17 and 18 the training started in the previous operations is continued, with the addition of the copying of press and commercial messages. Unit Operations Nos. 7 to 12 should be studied concurrently with 17 and 18 to give the student practice in punctuation and message forms. Single-line practice should be given during one-third of the time devoted to receiving practice, by connecting two students on a single circuit and requiring them to handle

commercial messages with each other, the messages to be prepared in correct form by the instructor. In addition, if possible, the students' positions should be connected to a commercial wire for the purpose of copying and becoming familiar with the regular run of commercial business.

Some students are found to progress slowly. These must be given individual help and encouraged in all possible ways. It may sometimes be found that only one condition is retarding a student's progress. When this condition is found, the instructor must change that student's instruction so that the fault will be corrected. Often the lack of progress by a student may be traced to conditions existing outside of the code room. Even though the condition is due to something for which the instructor is not responsible, he should make every effort to correct it.

Mention has previously been made of sending practice, but there is an additional point which must be called to the attention of the instructor. Working the key by using *only* the muscles of the fingers must be absolutely prohibited. The correct motion of the wrist must be acquired; without this correct wrist motion the student will never become a proficient and rapid sender.

### 3. Progress tests—General.

Due to the unusual method of code-practice instruction prescribed in this Manual, no distinction should be made between instruction tests and progress tests. Owing to the great desirability of advancing the student as rapidly as possible in code practice, progress tests will be given at short intervals.

Progress tests in reception will be given at the end of every three hours of instruction. The test will consist of copying a three-minute transmission from the code record or table from which instruction is being given, and sent at the same speed as that at which the class is practicing.

Progress tests in transmission will be given at the end of every 12 hours of instruction and whenever students are advanced in reception from one Unit Operation to the next. The test will consist of a one-minute transmission by the student, taken from the code table corresponding to the speed at which he is being tested.

### 4. How progress tests are conducted.

*a. Without the use of the Ediphone code transmitter.*—(1) *A progress test in reception* will consist of copying a three-minute transmission of the instructor. The transmission will be taken from the table of the Unit Operation being studied. The characters will be sent at the same speed as that at which the class is practicing. Each student will copy this test by writing it down, as later described. He will then write "Reception" and his name on the top of his copy and turn it in for correction.



(2) For a progress test in transmission two instructors should be assigned to positions outside of the regular code practice room, but connected with the code practice room switchboard. A schedule of transmission for all students undergoing the test should be arranged in advance. Each student will be required to transmit from the table given him by the instructor. As soon as one student has completed his transmission the next should begin, and so on. Each transmission should last for a period of one minute. Each student is told to transmit as many characters as he believes he can send clearly and distinctly in that period of time. The two instructors in the adjacent room are directed to copy each student's transmission and to write "Transmission" across the top of each copy. As each student completes his transmission the head instructor will collect all of the receptions taken down by his two assistants, writing across the top of each paper the name of the student who transmitted.

b. With the Ediphone Code Transmitter.—(1) A progress test in reception will consist of copying a three-minute transmission from the record with which instruction is being given. The transmitter will be adjusted so that the characters will be sent at the same speed as that at which the class is practicing. Each student will copy this test by writing it down, as later described. He will then write "Reception" and his name across the-top of his copy and will turn it in for correction.

(2) With an Ediphone Code Transmitter available, it is generally found simpler and more advisable to determine for each Unit Operation a student's combined ability to receive and transmit rather than just his ability to transmit. Consequently, a combined *transmission-reception* progress test is given in such cases, as follows: Each student will be required to transmit from the table given him by the instructor, this table corresponding to the Unit Operation on which he is being tested, and being from the contents of the record used for instruction in that Unit Operation. Each transmission should last for a period of one minute. Each student is told to transmit as many characters as he believes he can send clearly and distinctly in that period of time. This transmission will be recorded on a wax record, by means of the Ediphone, and will then be transmitted by means of the Ediphone back to the same student, who will be required to copy his original transmission without reference to the table from which he originally transmitted. The student will then write "Transmission and Reception" across the top of his copy and turn it in for correction.

(3) However, if it is still desired to determine a student's transmitting ability the method described in *a* (2) can be employed, or the method described in *b* (2), except that the instructor rather than the student will copy the student's transmission as recorded on the wax record.

### 5. Scoring progress tests and determining progress.

*a. Scoring.*—The student's written copy of a transmission given for a receiving test, or the instructor's written copy of a student's transmission when a transmission test is conducted, or the student's written copy of his own transmission when a combined transmission-reception test is conducted *with* the aid of the Ediphone code transmitter and a wax record, will be compared with the instructor's copy or table showing what was or should have been transmitted, and will be scored by means of this copy, as follows:

- (1) Incorrect characters will have a circle drawn around them.
- (2) Characters omitted will be indicated by drawing circles at places where omitted.
- (3) The total number of circles will then be counted; this is the *number of errors* the student made, and is referred to as such.
- (4) The greatest consecutive number of correct characters will be counted next, and will be referred to as the *number consecutive* (abbreviated as "no. consec.").
- (5) Then if the student has himself made the copy being scored his penmanship on this copy will be compared with the penmanship scale and will be scored in accordance with it. (See Information, U. O. Nos. 1 to 6.)
- (6) For a progress test in reception or transmission, or in a combined transmission-reception progress test, the number of characters (errors included) transmitted by or to a student will be counted. This number will be divided first by the number of minutes the transmission continued, and then by 5, to obtain the speed of transmission of the test in words per minute. This figure, of course, does *not* indicate an ability to receive or to transmit that number of words per minute *correctly*. (See par. 5-c.)

*b. Progress indices.*—A number called a *progress index* is determined for the receiving (operating) ability or transmitting ability or both (operating) of each student, at the end of each Unit Operation or Code Practice, for the purpose of determining whether or not he will be allowed to advance, in receiving, from that Unit Operation to the next; or whether or not he will be allowed to transmit at a higher speed. The numerical value of each progress index of a student is inversely proportional to the student's ability to receive or transmit, or do both, as the case may be. As a result of this inverse proportion, the better the operator the smaller the progress index will be for any given progress test. A progress index of a student in reception or transmission or both (operating), for the speed taught in any Unit Operation, is determined from scores obtained as a result of a progress test in reception or transmission or both (operating), at that speed, on that Unit Operation.

Each index is equal to the *number of errors* multiplied by the *number of characters* in the test, and this result divided by the *number consecutive*. Thus with a student making two errors in a progress test containing 80 characters and getting 40 consecutive characters correct, his index for this progress test would be 4, arrived at as follows:

$$\frac{2 \times 80}{40} = 4$$

With each progress test in reception, accompanying each Unit Operation in Code Practice, a standardized progress index in reception, for passing from one Unit Operation to another, has been supplied, based upon experience with large classes at the Signal School. A student is considered sufficiently *proficient in reception* to advance in reception to the next Unit Operation in Code Practice when he makes a reception progress index equal to or less than the standardized progress index in reception given for that Unit Operation as a prerequisite to progression to the next Unit Operation.

A student is considered sufficiently proficient in the speed of his transmission, to receive instruction at a higher speed, when the progress index for his transmission alone, or for his transmission and reception together (as determined from the copy which the instructor made of the student's transmission, or as determined from the copy the student made of his own transmission), is equal to or less than the passing index in reception, as given in the Unit Operation corresponding to the speed in words per minute at which he transmitted.

*c. Progress ratings in words per minute.*—(1) A student is rated as able to *receive* at the rate in words per minute taught in any Unit Operation in Code Practice when under the provisions of above paragraph 5-b he is deemed sufficiently proficient in reception to advance to the next Unit Operation.

(2) A student is rated as able to *transmit* at a certain rate in words per minute when on any progress test in transmission he has made a transmission index equal to or less than that required for passing in reception, in the Unit Operation which provides instruction at the same rate per minute that the student actually transmitted, including errors. The rating in transmission is generally made use of only when Ediphone code practice equipment is not available. (See par. 4-b (3).)

(3) A student is rated as able to *operate* (transmit and receive) at a certain rate in words per minute when on any progress test in combined transmission and reception he has made an index equal to or less than that required for passing in reception, in the Unit Operation which provides instruction at the same rate per minute



## INSTRUCTORS GUIDE FOR ALL ARMS

*d.* After "No. of Characters" enter the number of characters transmitted during the test.

*e.* After "Date" enter the date of the test.

*f.* Under "No. of Errors" enter for each student the number of errors he made on the test.

*g.* Under "No. Consec." enter the maximum number of consecutive characters he correctly copied or transmitted in the test.

*h.* Fill in under "Progress Index—Reception" the progress index number as calculated, in case this is the record of a progress test in reception; otherwise leave blank.

*i.* Fill in under "Progress Index—Transmission" the index number as calculated, in case this is the record of a progress test in transmission alone; otherwise leave blank.

*j.* Fill in under "Progress Index—Recep. of own Trans." the index number as calculated, in case this is a combined transmission-reception test, given by having the student copy his own transmission as recorded on a wax Ediphone record; otherwise leave blank.

*k.* Under "Rating in Words per Min." enter the rated speed of each student in words per minute, for reception, for transmission, or for both together (operating), depending upon whether the progress test was intended to determine speed in sending, receiving, or both together (operating). The heading of the column filled in under "Progress Index" will indicate to what the speed in words per minute refers. Draw a line through this space if any student did not receive the speed rating in words per minute as required in paragraph 5-*c*.

*l.* Under "Penmanship" fill in the number rating in penmanship on the test, as determined in accordance with paragraph 5-*a* (5). If the test involved no copy made by a student, this space is lined out.

*m.* After "Class Average" determine and enter for each column the class average for the item given in the heading of that column.

*n.* Above "Instructor in Charge" will be entered the signature of the instructor, which will indicate that the record sheet has been filled out in accordance with the above instructions.

## PART II—TELEGRAPH PROCEDURE

The common experience with student operators is that when they have completed the course in code practice and are able to send and receive at a sufficiently high rate of speed they find themselves unable to work a military or commercial wire. The reason for this is that not enough time has been given to the technique of handling messages, and usually the time that has been given is misapplied.

The formerly accepted method of teaching procedure by requiring the student to memorize a great number of rules without ever seeing



them put to practical use met with little success. It required too much of the student and has never yet been successful in producing an operator. The method contained herein aims to teach procedure in a natural way—the student learns by doing.

Procedure can not be taught successfully unless the instructor is familiar with his subject and is a practical operator of considerable experience. Given an instructor of this sort, the operations outlined in this course can be made to produce operators capable of actually taking charge of a military or commercial office and handling business.

To carry out this scheme properly, it is necessary to have a Morse line extending to several student offices. Each of these offices should have a name and an office call, and one of them should be designated as a relay office. In this way messages may be filed at any office for any place designated, and can be handled in a normal way. In addition, it is very desirable that the student have access to a working commercial wire, so that he may familiarize himself with the various types of senders and study their peculiarities.

This practice in procedure should be taken up when the student can send and receive at a speed of about 7 words per minute, and should be continued to the end of the course.

### PART III—TOUCH TYPEWRITING

By touch typewriting is meant the operation of the typewriter without watching the keyboard. In order to accomplish this, it is necessary that all of the fingers be used and that each finger be trained to strike certain keys without hesitation or error. Although at the first attempt this may prove difficult, in reality it is very easy, much easier in fact than operating the typewriter by looking at the keyboard. It is simply training the fingers to select automatically the proper keys, in much the same way that a pianist's fingers select the proper piano keys. It is easy to see how impossible it would be to play the piano if the pianist attempted to look for every key. The same principle applies to the operation of the typewriter.

Touch typewriting is a great aid to the telegraph operator, as it enables him to concentrate on the reception of messages, without the need for any particular thought being given to the operation of the typewriter. This makes his work a great deal less difficult and tiresome; in fact a good operator who practices touch typewriting would much prefer receiving to sending.

The course in typewriting as taught in this Manual is based upon practice periods of one hour each.

The object of the course is to train student Morse operators, in the use of the typewriter for the reception of telegraph messages.

The early part of the course in touch typewriting is devoted to drilling the student in the mechanics of touch typing, with the object of his acquiring a sufficient speed on the typewriter to enable him to use the touch system with confidence, when he has attained a telegraph receiving speed of 15 words per minute. Beginning with Exercise C of Unit Operation No. 28, sample messages are given to familiarize the student with the proper form of received messages.

While speed in typewriting is the object to be aimed at, it can not be attained without first gaining accuracy. Therefore accuracy is absolutely essential before any thought is given to increasing the typewriting speed. In fact, speed grows as accuracy is attained. For this reason students are graded in Unit Operations Nos. 23 to 26, inclusive, only on effort, position, neatness, and accuracy. Beginning with Unit Operation No. 27, speed in typewriting is given a weight.

The typewriting requirement for graduation in the telegraph course is ability to copy from a sounder, a message being transmitted at a speed of 20 words per minute. This is equivalent to a typewriting speed of approximately 30 words per minute, copying from dictation, the reason being that a small margin of speed must be at the disposal of the operator to enable him to catch up when, as it is sometimes necessary, he allows the sounder to gain a few words.

#### PART IV—EQUIPMENT

The Unit Operations in this Manual devoted to telegraph equipment have been prepared mainly from a practical viewpoint. Theory of operation has been given only where necessary in order to aid the student in understanding practical applications. The instructor should not attempt to go into the fundamentals of electricity and magnetism other than as outlined in the Unit Operations. Elementary principles of electricity are included in Basic Signal Communication Manual No. 20, which should be studied by the student before taking up the Telegraph Operators Course.

Included in the Instructors Guide section of the equipment part of this Manual, there are "Instruction Tests." These tests are extremely valuable to the student, and in addition, enable the instructor to obtain at frequent intervals data regarding the standing of a student. The student should be encouraged to regard these tests as a part of this training rather than as a definite check on his ability.

It will be noticed that the tests are arranged for the instructor, in a simple convenient form. This form is briefly outlined as follows:

##### INSTRUCTION TEST (PERFORMANCE)

1. Equipment necessary for conducting the test.
2. How test is conducted, including any special instructions.
3. Directions to the student, including body of the test.
4. Method of scoring the test.

## TELEGRAPH OPERATOR

### INSTRUCTION TEST (INFORMATION)

5. Short-answer type of questions covering the Unit Operation, to be answered by the student.

If possible, the instructor should have the parts for the student (Nos. 3 and 5 above) mimeographed or hectographed in sufficient quantity for the needs of the class. If no method of reproduction is available, the instructor should copy the test on the blackboard.

The information part of the instruction test is scored as follows:

a. Recognition questions (multiple choice questions): Allow one point for each correct answer.

b. True-false questions (plus or minus questions): The score for the true-false questions is obtained as follows: Add up the number of the questions which have been correctly answered; then add up the number of questions to which the wrong response has been given. Subtract the number wrong from the number right. This difference will be the net score. If the number wrong should be greater than the number right, call the difference *zero*; that is, do not assign a score of less than zero. Disregard omitted questions. For further explanations of this method of scoring, see the Instructors Guides; Training Manual No. 23, "Telephone Switchboard Operator," or Training Manual No. 25, "Message Center Specialist."

c. Completion questions: The score for the completion questions is obtained by allowing one point for each blank space which has been filled in with a word or number which makes sense and at the same time is technically correct. There is no additional penalty for omissions.

### SUMMARY

It is evident from the foregoing that there are four main essentials in which the student telegraph operator receives instruction and that code practice is the principal subject of the four. These essentials may be further subdivided as follows:

1. Code practice—
  - a. Penmanship (handwriting).
  - b. Sending.
  - c. Receiving.
2. Procedure—
  - a. Rules and methods of procedure.
  - b. Procedure practice in conjunction with code practice.
3. Typewriting—
  - a. Practice to obtain sufficient speed.
  - b. Practice in conjunction with code practice.
4. Equipment—
  - a. Principles of operation.
  - b. Practical applications.

As has been stated in previous parts of this Introduction, it is necessary to combine several of the subjects so that they are taught simultaneously. At the same time it is necessary to devote additional study to a few of those subjects.

In order to enable the instructor to have a clear picture of the various phases of this course, a table has been prepared showing the relationship between the subjects. This table is shown below. In the first column of the table are listed the five phases of training.

*Phase No. 1* takes up the study of receiving and penmanship. In conjunction with these subjects, during additional study periods, penmanship (if time is available) and typewriting are taken up. The material has been arranged in the Manual so that when the student completes Unit Operation No. 6—Code Practice, he completes also Unit Operation No. 24—Typewriting. However, this is only approximate, as the instructor may find that some classes will not complete these two Unit Operations at the same time. If this occurs in Phases Nos. 1 to 4, the instructor should continue on to the next Unit Operation in one subject, while completing the unfinished Unit Operation or Unit Operations of the other subject.

*Phase No. 2* is similar to *Phase No. 1* in the subjects studied.

In *Phase No. 3*—Code Practice sending is taken up for the first time. Additional practice in penmanship is discontinued in this phase.

The same subjects are continued in *Phase No. 4*. It will be noticed that the Unit Operations in typewriting as a separate subject end in this phase. It is important here that the students complete Unit Operations Nos. 15 and 16—Code Practice and No. 28—Typewriting before going on to the last phase. The study of equipment also begins in *Phase No. 4*.

In *Phase No. 5*—Procedure is taken up as an additional study. Also, the knowledge acquired by the student in Typewriting and Procedure is applied in the Code Practice instruction. Unit Operations Nos. 7 to 12 are studied in this phase. If the students complete any one subject before another in *Phase No. 5*, they should continue on with the unfinished subject, and additional practice should be given in the completed subject.

As an aid to the instructor in comparing relative values of the various subjects in the entire course as laid down in this Manual, the following percentage weights are given as a guide:

	Per cent		Per cent
Receiving-----	30	Typewriting-----	10
Sending-----	30	Procedure-----	10
Penmanship-----	10	Equipment-----	10

## TELEGRAPH OPERATOR

It is therefore evident that of all the elements entering into the proficiency of a telegraph operator, abilities to receive and send are by far the most important.

*Phases of training, showing relationship between the various subjects of the Telegraph Operators Course*

	Code Practice Unit Operation Subjects	Additional study periods			Equipment
		Penmanship (if time is available)	Procedure	Typewriting	
Phase No. 1.	U. O. Nos. 1-6: Receiving. Penmanship. I. T. No. 1.	U. O. No. 1 (code prac- tice).		U. O. Nos. 23, 24. I. T. Nos. 7-9.	
Phase No. 2.	U. O. No. 13: Receiving. Penmanship. I. T. No. 1.	U. O. No. 1 (code prac- tice).		U. O. No. 25. I. T. Nos. 7-9.	
Phase No. 3.	U. O. No. 14: Sending. Receiving. Penmanship.			U. O. Nos. 26, 27. I. T. Nos. 7-9.	
Phase No. 4.	U. O. Nos. 15, 16: Sending. Receiving. Penmanship.			U. O. No. 28. I. T. Nos. 7-9.	
Phase No. 5.	U. O. Nos. 17, 18, 7-12: Sending. Receiving. Typewriting. Procedure.		U. O. Nos. 19, 20, 21, 22. I. T. Nos. 2, 3, 4-6.		U. O. Nos. 29- 44.

NOTE.—Abbreviations: U. O.—Unit Operation; I. T.—Information Topic.

### APTITUDE TESTS

Experience has taught that in every class there are students who lack the ability to progress in the subject being taught them. This is particularly true of the radio and Morse telegraph students. Among this class of students are some men who have little or no interest in telegraphy, and there are others who do not possess the necessary mental capacity to learn the International and Morse codes. It is therefore evident that if an attempt is made to teach either of these types of men considerable expense and waste of time are the results.

In order to overcome this difficulty in a class, it is necessary to select the men who in all probability will progress at a standard rate, and to weed out the men who will fall below this standard.

As an aid in the proper selection of men for certain courses of instruction, there have been developed a series of tests called "Aptitude Tests." Two samples of this type of test—"Morse Operator's Aptitude Test" and "Typewriter's Aptitude Test"—appear on the

following pages. These tests have been tried and have met with success. It is suggested that the instructor give these two tests to the students at the beginning of the Telegraph Operators Course. When the course is completed, the scores made by the students in both tests (and whether the operator's test was given manually or by use of the Ediphone), together with the scores on the final proficiency tests given to the entire class, should be forwarded to the Chief Signal Officer of the Army. The data obtained will be correlated and compiled with the object of improving upon and standardizing these aptitude tests.

The instructor should bear in mind that these aptitude tests should be considered only as an aid in the proper selection of men for this course, and not as a final and definite method to the exclusion of all else. In other words, they at present should be treated as experiments designed to determine their value, and to provide data for their improvement and standardization.

#### MORSE OPERATOR'S APTITUDE TEST

##### Equipment.

Morse code room with complete code practice equipment.

1 Ediphone connected with code practice equipment (if available).

1 Ediphone Test Record A or 1 Test Table A.

1 Ediphone Test Record B or 1 Test Table B.

##### Information.

This aptitude test is presented with this manual to serve as a guide to instructors in selecting candidates for the Telegraph Operators Course. Failure to pass this test does not necessarily indicate that the student can not learn Morse code, but that he probably will not learn the code in a reasonable length of time. Experiment at the Signal School has indicated that average soldiers without previous code practice experience, who are able to copy correctly from 90 to 100 characters out of the 150 transmitted on any one of the three tests, may be expected to become Morse operators after a reasonable period of instruction.

Before the test and at least once during the test the instructor must time the speed of the Ediphone and if necessary adjust it so that each test record is transmitted in exactly six minutes.

When these test tables are transmitted *manually*, the instructor must send each separate character at the speed used in transmitting a message at 20 words per minute, but his spacing between characters must be such that (a) with Test Table A, 3 seconds is given to each character and its space, i. e., the table is sent at the rate of four words per minute, the whole table being sent in six minutes; (b) with Test Table B, two and four-fifth seconds is given to each

character and its space, i. e., the table is sent at the rate of five words per minute, the whole table being transmitted in six minutes.

The conventional representations of these foreign characters are as follows:

· · · — — — · · · — — — — — · · · — — — · · · — — —  
 Ä CH È Ñ Ö Ü

These are given only as an aid to the instructor. However, instructors must not refer to them other than by their sound when instructing students.

The instructor should give this test to each class at the beginning of the course, recording the score made by each student on each of the three mechanical transmissions of Record B, or on the three manual transmissions from Table B (if no Ediphone equipment is available), and also whether the method of transmission was by Ediphone or manually.

Part I

Directions to the instructor.

1. Assemble the class in the code practice room and assign a position to each student.
2. Supply each student with four sheets of paper and two pencils.
3. Impress upon the class the necessity for absolute silence while the test is being conducted.
4. Allow no talking by the students during test periods.
5. Conduct the test as follows:
  - a. Place Test Record A on the Ediphone (if Ediphone is available) and make all adjustments for transmitting the test.
  - b. Explain to the students that at their instruments they will hear groups of telegraph sounds which represent certain foreign letters. The first group of sounds will represent the German character "Ä"; this same group will be repeated five times. The second group will represent the German character "CH"; this group will also be repeated five times. In the same manner the student will hear the sounds representing the French character "È," the Spanish character "Ñ," the German character "Ö," and the German character "Ü," each repeated five times.
  - c. Direct the students to adjust their sounders and listen carefully to the first transmission from the record or table, but make no attempt to write the characters transmitted.
  - d. Start the transmission from Test Record A (or from Test Table A if no Ediphone is available), and just before each group of five transmissions of the same foreign character call out the name of that character, giving it the ordinary English pronunciation as though it had no accent or other distinguishing mark.

*e.* After the last character has been transmitted allow the students to rest for exactly three minutes. Allow no talking.

*f.* Repeat the transmission from Test Record A (or Test Table A), again calling the name of each character just before it is transmitted. This time direct the class to concentrate on the sound of each character, and to write the character as it is called, omitting the accent or other distinguishing marks above it.

*g.* After the last character has been transmitted again allow the students a rest period of three minutes, without conversation.

*h.* Repeat Directions *f* and *g* above.

## Part II

### Directions to the instructor.

1. In Part II, Test Record B (or Test Table B) is used in place of Test Record A (or Test Table A). Explain to the students that from the next record (or table) the same characters Ä, CH, E, Ñ, Ö, and Ü are again transmitted, *but in random order*.

2. Conduct Part II of the test as follows:

*a.* Direct each student to write his full name and the date at the top of a clean sheet of paper.

*b.* Direct the students to attempt during the next transmissions, to write down the letter representing each character transmitted, omitting the accent or other distinguishing marks above the letters. If a character is missed, the student must draw a short dash in place of the letter; for example, A - U O - E; otherwise the instructor will be unable to mark his paper correctly, and the student will obtain a lower score than otherwise.

*c.* Start the transmission from Test Record B (or from Test Table B).

*d.* After the last character has been transmitted, allow the students a rest period of exactly three minutes.

*e.* Repeat the transmission from Test Record B (or from Test Table B) and again direct the students to write down, as before, the letter representing each character transmitted.

*f.* Allow a rest period of exactly three minutes.

*g.* Repeat Direction 2-*e* above.

### Directions for scoring.

1. Only Part II of the test is scored.

2. Compare with Test Table B each student's three copies of the transmissions from Test Record B (or Test Table B.) Draw a circle around each incorrect letter. Count the number of letters correctly received.



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3. Record at the top of each student's paper:
  - a. Total number of characters transmitted (150).
  - b. Total number of characters correctly received.
  - c. Total number of errors and missed characters.
4. A passing score is considered as between 90 and 100 characters received correctly out of the 150 sent.

### TYPIST APTITUDE TEST

This test is designed to measure the mental traits necessary for progress in touch typewriting, namely, the ability to memorize quickly, mental alertness, and ability to concentrate. It is presented primarily as an aid to the instructor in selecting students for the typewriting course, and should be used as a guide rather than as a means for final and strict determination.

Experience has shown that with an average group, if the score made by a student on this test is more than ten points below the median score of the group, he probably will not do satisfactory work in the typewriting course. If on succeeding tests, given at intervals of several days, that student approaches more nearly the median score of the group, he probably, with assistance in the difficult parts of the course, will do work of passing quality.

The median score of the class may be defined as the middle score when all the scores are arranged in the order of size. It is obtained as follows:

a. If the number of men in the class is even, and if their scores are arranged in order of size, then the median score is considered as the average of the two middle scores. For instance, if there were 100 in a class, and if the scores of the fiftieth and fifty-first men were 72 and 73, respectively, then the median score would be  $72\frac{1}{2}$ .

b. If the number of men in the class is odd, and if their scores are arranged in order of size, then the median score is the actual middle score. For example, if there are 99 in a class, and if the fiftieth man had a score of 76, then 76 would be the median score.

The instructor should give this test to all students three times at the beginning of the course. Intervals of six days each should be allowed between each succeeding test.

### TYPIST'S APTITUDE TEST

#### Directions to the instructor.

In giving this test lay the test paper face down on the student's desk. At the direction of the instructor all students will turn the paper over, fill in the name and date, and read the "Directions to the student." Make certain that all students understand what they are to do. The instructor should then direct "Ready, Begin," allowing an amount of time such that no student will complete the test, but

INSTRUCTORS GUIDE FOR ALL ARMS

such that the fastest student or students complete 90 or more substitutions. This time will be 1½ minutes for the first attempt; 1 minute and 15 seconds should be allowed for the second attempt, and 1 minute for the third attempt. Direct all students to stand up promptly when "Time" is called after each attempt. Watch carefully to see that no student skips around in making the substitutions, but takes the letters in order, completing each line before going to the next.

**Directions for scoring.**

The score in this test is obtained by subtracting the number of incorrect substitutions from the number of correct substitutions. In case the paper shows scattered blank spaces, which are evidence that the student has skipped around in making his substitutions, no credit will be given.

TYPIST'S APTITUDE TEST

----- (Name)	Attempt No.-----
----- (Date)	Number right.-----
	Number wrong.-----
	Score.-----

**Directions to the student.**—In the KEY below appear seven letters with a number under each letter. When the instructor directs "Begin," write below each letter in the TEST the number that appears under that letter in the KEY. Take the letters in the order they appear in the TEST from left to right, the top line first, without skipping any. Complete each line before starting the next. When the instructor calls "Time," cease writing immediately and stand up.

KEY

Y	Z	M	S	X	U	A
1	2	3	4	5	6	7

TEST

S	Z	A	M	Y	X	Z	U	Y	S
U	X	Z	A	M	U	Y	S	U	M
M	A	S	Z	X	M	U	Y	X	Z
X	M	A	S	U	Y	X	Z	A	S
Y	U	Z	A	M	X	S	Y	U	M
A	X	Y	U	Z	M	X	S	Y	A
Z	U	S	M	X	Y	A	Z	M	Y
A	X	Z	M	S	A	Y	U	X	A
Y	S	U	Z	X	M	Y	A	S	U
S	Z	A	M	U	Y	X	M	Z	S



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PART I  
CODE PRACTICE

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THE  
LIBRARY

# TELEGRAPH OPERATOR

## INSTRUCTORS GUIDE FOR ALL ARMS

### UNIT OPERATIONS

#### CODE PRACTICE

#### STUDY OF MORSE CHARACTERS AND PENMANSHIP

##### Equipment.

Ruled copy paper, two sharpened pencils, and an assigned position at the code practice table.

##### Information.

The purpose of Unit Operations Nos. 1-6 is to familiarize the student with the sounds of the Morse characters and to teach him a style of penmanship which has been found best suited to the work of a Morse operator. These two things are taught simultaneously. A group of 7 characters is taught in each Unit Operation, thus making six groups or Unit Operations to be studied in order to teach all 42 characters.

The Unit Operations and the characters studied in each are as follows:

Unit operation No.	Characters
1.....	D H C 9 X Z ?
2.....	<u>1</u> L or Ø S A M Q ,
3.....	<u>7</u> 0 or Ø 3 4 K P \$
4.....	E W Y 2 & U .
5.....	V R T S F I (.)
6.....	B N G 6 J 5 Paragraph

NOTE.—L and Ø (zero) are transmitted by the same Morse character. Ø (zero) is sometimes transmitted in place of the letter O, but the letter O is never transmitted in place of Ø (zero). (.) denotes the decimal point and is not identical with the period. In copying Ø and 1, the distinguishing lines through the zero and under the 1 will be omitted.

Figure 2 is a photograph of the "Penmanship Scale." Seven sample messages are shown; No. 1 is written practically perfect, whereas



No. 7 is illegible to a large extent. Nos. 2, 3, 4, 5, and 6 lie between the best and poorest and are arranged in their order of merit. The use of this scale is to furnish a definite check on the quality of the student's penmanship. This check is obtained in the following manner: The student's copy is placed on the penmanship scale and compared with the different samples until the one is found which it most nearly resembles. The number of this sample denotes the quality of the student's penmanship. If the only comparison which can be made is that the student's copy lies between two samples, its quality is then denoted by the number of the lower-grade sample, with the addition of the plus sign. For example, a student's copy is found to be better than sample No. 3, but is not as good as sample No. 4. The mark received will be 3+. This is explained here in order that the student may at any time grade his own penmanship if he so desires.

Code practice in each of the first six Unit Operations is divided into two parts. Part 1 covers the teaching of the sound of the characters being studied, while part 2 is devoted to practice in the reception and writing of these characters (and any previously studied) when sent at the rate of approximately 25 characters per minute.

#### Directions.

The following directions apply equally to any one of Unit Operations Nos. 1 to 6 and will be used with each operation as it is studied:

1. Pay close attention to the instructor as he explains the method of writing the seven characters being studied, and when told to do so, practice writing the characters.

2. When the instructor reads the characters and tells you to write them as they are read, use a sharp pencil and write them carefully and accurately on the ruled copy paper, taking care that your writing is evenly spaced on each line. As each letter is read write it first as a capital and next as a small letter.

3. *a.* Take your assigned position at the code practice table.

- b.* Each character in the Unit Operation being studied will be sent several times in the Morse code. For example, the seven characters D, H, C, 9, X, Z, and ? are studied in Unit Operation No. 1. Each of these characters will be sent five times, after which this same procedure will be repeated several times.

- c.* Listen carefully to the sound of each character as it is made and repeat its name to yourself.

- d.* When this practice has continued for some time, the instructor will direct the students to write each character as it is sent. Using the ruled copy paper and a sharp pencil, write each character every time it is certain that the character has been correctly heard, alternating capital and small letters.





*T.L.-330*



4. A  
the stu  
the sev  
and w  
viousl  
succes  
will be  
missio  
furnish  
Practi  
charac  
any ch  
out wh  
ones:  
on all  
each p  
5. E  
determ  
Specia

4. After completing the practice as outlined in Direction 3 above, the student should be able to recognize by sound and to write any of the seven characters studied. The next step is to be able to recognize and write these seven as well as any others which may have been previously studied when they are sent one after another in fairly rapid succession. In order that the student may do this, the characters will be sent at the rate of 25 per minute. Reception of this transmission (Record or Table B) should be written on the ruled copy paper furnished, with the usual care regarding accuracy, neatness, etc. Practice writing these characters in groups of 2, making the first character in each group a capital and the second a small letter. If any character is not recognized at once, do not stop and try to puzzle out which one it is, as to do so will mean the loss of several succeeding ones; leave a space and go ahead. Always place your name and date on all copies you make and turn it in to the instructor at the end of each period.

5. By means of certain tests which will be given the instructor will determine when a student may progress to the next Unit Operation. Special directions for these tests will be given by the instructor.

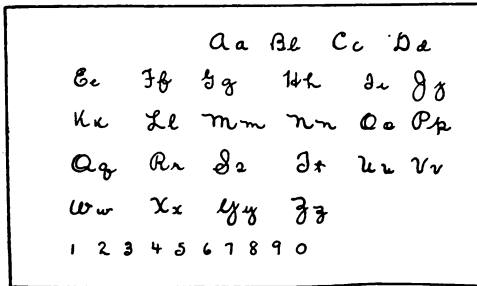


Fig. 1.—Penmanship chart



## SUGGESTIONS FOR THE INSTRUCTOR

### Equipment.

- Standard Morse code practice equipment.
- Ediphone code transmitter, if available.
- Records Nos. 1 A and B to 6 A and B, inclusive, if Ediphone is used.
- Tables Nos. 1 A and B to 6 A and B, inclusive.
- Supply of ruled copy paper and sharpened pencils.

### Information.

Counting the letters, numerals, and the most commonly used marks of punctuation, there is a total of 42 characters in the Morse code. They are taught in groups of 7. The student is required to receive the 7 characters being studied, also any previously studied, when sent at the rate of 25 per minute, before being allowed to study the next group.

The student will be required to write in longhand all received copy which he makes. In order to do this, he must be given instruction in writing the different characters. In addition a special course in penmanship may be given if the necessary time is available.

The course in Touch Typewriting contained in this Manual should be studied throughout the entire term.

### Directions.

The following steps will be taken up by the instructor in the order given, when teaching each of Unit Operations Nos. 1 to 6:

1. *Instruction in penmanship.*—*a.* Assemble the class and with the students studying Figure 1 of the Student's Manual go over carefully with them the formation of each of the 7 characters taken up in the Unit Operation. Direct the students to practice writing the characters of the Unit Operation, both capitals and small letters, being careful to follow the standard scale.

*b.* Read at the rate of 25 characters per minute from the code table containing only the characters given in the Unit Operation being studied. Require the students to write the characters as they are read. Continue this, with short rest intervals, for about 20 minutes. At the end of this time direct each student in turn to bring to the instructor the copy he has made, and using the penmanship scale (see Fig. 2 and Information Topic No. 13) go over it with him, pointing out his errors and making suggestions for improvement.

2. *a.* On completion of Direction 2 above, direct the students to take their assigned positions at the code practice tables. Explain to them that a character will be named, then sent several times in the Morse code, and that this will be repeated for each character

being studied. Tell the students to concentrate on the sound of the character and to attempt to associate that sound with that character.

b. If the Ediphone code transmitter is not available, name and then send manually five times from the "A" table of the corresponding Unit Operation each of the characters being studied. Make each character clearly at a rate of 25 characters per minute. Repeat the group of 7 characters in the same manner, three or four times, allowing a one or two minute rest period between repetitions. Then repeat the same group of characters three or four more times and require the students to write the characters as they are received, alternating capitals and small letters.

In case the Ediphone code transmitter is not available, and if the instructor has forgotten the Morse character for any mark of punctuation, the following is given so that he can refresh his memory:

— . . . — . — . — . . . — . . . — . . . — . . . — . . . Spell "Dot" — — — —  
? , \$ (.) Paragraph

It must be emphasized, however, that the student is to be taught each Morse character *by sound only*.

c. If the Ediphone code transmitter is available, place on the Ediphone the "A" record of the Unit Operation being studied, and run it over three or four times, with a one or two minute rest interval between repetitions. Then run the same record three or four more times and require the student to write the characters as they are received, alternating capitals and small letters.

3. On completion of Direction 2 above, the students should be able to recognize without hesitation the sound of any of the 7 characters studied. The next step is to give them practice on these characters (and others which may have been previously studied). This is done by using the "B" record or table of the Unit Operation which is being studied, as follows:

a. *Without the Ediphone.*—Transmit from the proper "B" table as given in Information Topic No. 1. For example, if Unit Operation No. 1 is being studied, transmit Table No. 1-B. Require the student to copy the transmission. Continue transmitting from the table until, from an inspection of the students' copy, it is certain that they can pass the test indicated below. Transmission of each of the first six "B" tables by Ediphone or manually should take exactly six minutes, when used for reception practice.

b. *With the Ediphone.*—Run the "B" record over and over and require the students to receive and write down its contents until, from an inspection of the students' copy, it is certain that most of them can pass the test indicated below.

4. *Progress test.*—Advance the student to the next Unit Operation if he makes an index of 5 or less on the progress test in reception (see Introduction) for the Unit Operation on which he has been working.

5. *Penmanship scale.*—The seven prints of the penmanship scale numbered “1 to 7” should be cut from this manual by the instructor and mounted in the proper order on a piece of stiff cardboard. The chart thus formed should be hung on the wall in the classroom within easy access of the students so that they can compare their penmanship with the chart. (See Information Topic No. 13.)

The students are expected to make a quality of 4 or better in penmanship, but on failure to do so will not be retarded in reception.





**PRACTICE IN RECEIVING MARKS OF PUNCTUATION, COMMERCIAL TELEGRAPH MESSAGES. AND WORDS HAVING SIMILAR SOUNDS**

**Equipment.**

- Ruled copy paper.
- 2 sharpened pencils.
- 1 typewriter.
- An assigned position at the code practice table.

**Information.**

These Unit Operations will not be taken up in their regular order, but will be practiced concurrently with Unit Operations Nos. 17 and 18.

The marks of punctuation in Table No. 7 should be practiced until they are thoroughly memorized.

The homonyms in Tables Nos. 8 and 9 should be studied carefully with a view to attaining skill in distinguishing between words of similar sound.

The message forms in Tables Nos. 10, 11, and 12 are given as guides to teach the proper way of transmitting the most commonly used message forms

**Directions.**

Specific directions for the student will be given by the instructor.

THE UNIVERSITY OF CHICAGO  
DEPARTMENT OF CHEMISTRY  
RESEARCH REPORT NO. 1000

BY  
J. H. GOLDSTEIN  
AND  
R. F. W. WILSON

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## SUGGESTIONS FOR THE INSTRUCTOR

### Equipment.

- Standard Morse code practice equipment.
- Ediphone code transmitter, if available.
- Records Nos. 7 to 12, inclusive, if Ediphone is used.
- Tables Nos. 7 to 12, inclusive.
- Necessary paper, sharpened pencils, typewriters, etc.

### Information.

These Unit Operations will be studied and practiced while the student is studying Unit Operations Nos. 17 and 18.

It is highly essential that the student become thoroughly familiar with the marks of punctuation given in Table No. 7; consequently he should not be hurried over this part of the work.

A sufficient amount of practice in receiving the homonyms in Tables Nos. 8 and 9 will be of great benefit to him when he begins to send and receive press and messages.

The message forms in Tables Nos. 10, 11, and 12 will show the student the proper way to send commercial messages.

### Directions.

1. Transmit Table No. 7 several times (by means of the Ediphone if available), allowing the student to consult the table of punctuations until he memorizes them. Thereafter transmit this table once or twice daily and require the student to copy it, using the typewriter. Continue this practice until the student can copy the entire record without error.
2. Transmit Tables Nos. 8 and 9 twice daily (by means of the Ediphone if available) until the student makes a perfect copy, using the typewriter.
3. Transmit Tables Nos. 10, 11, and 12 twice daily (by means of the Ediphone if available) until the student makes perfect copies.
4. Complete transmission of each table, by means of the Ediphone or manually, should take exactly six minutes.
5. As these Unit Operations are intended to assist the student in commercial work, he will be considered proficient in them when he has passed the proficiency test in Telegraph Procedure.



**RECEIVING PRACTICE IN TWO-CHARACTER CODE GROUPS  
SENT AT THE RATE OF FIVE TO SEVEN WORDS PER  
MINUTE**

**Equipment.**

Ruled copy paper, two sharpened pencils, and an assigned position at the code practice tables.

**Information.**

On completing Unit Operation No. 6 the student is proficient on receiving all characters when sent at the rate of 25 per minute. The purpose of this Unit Operation is to give the student his first training in the copying of code groups. The simplest possible group will be used, that is one composed of 2 characters. The student has noted that in all previous Unit Operations each character is sent very fast (about 20 words per minute) and that the slow speed used was obtained by leaving long intervals between characters. In this Unit Operation the same basic idea is carried out in the sending of groups—that is to say, each group is sent quite fast and the slower speed in words per minute obtained by leaving long intervals between groups.

The student will be given practice on groups composed of letters, numerals, and marks of punctuation, but in no case will any one group contain both a letter and a numeral. Numeral groups will be mixed in random order among the letter groups of the transmission.

The transmission on which the students receive practice in this Unit Operation will be at the rate of 5 words per minute at the beginning of the operation. Since a word is taken as 5 characters, 25 characters per minute will be sent. These 25 characters are divided into 2 character groups so that the student will actually receive approximately 12 groups per minute. In copying these groups the student should listen to the entire group, recognize each of the characters composing it, and then when the transmission of the group has been completed write the 2 characters recognized during the interval before the next group is sent. As the Unit Operation is studied, the speed is increased to 7 words per minute.

In writing his reception in this Unit Operation the student must be careful to write the same number of groups on each line and to have the groups on a line placed directly under those on the line above. The first letter in each group will be a capital, and the second a small letter.

**Directions.**

Specific directions for the student will be issued by the instructor. In general, the only directions needed by the student are given from time to time by the instructor.





### SUGGESTIONS FOR THE INSTRUCTOR

#### Equipment.

- Standard Morse code practice equipment.
- Ediphone code transmitter if available.
- Record No. 13-A if Ediphone is used.
- Tables Nos. 13-A and 13-B.
- Necessary ruled copy paper, sharpened pencils, etc.

#### Information.

The subject matter contained on Record No. 13 or Tables Nos. 13-A and 13-B, used for instruction in this Unit Operation, consists of 2-character code groups sent at the rate of from 5 to 7 words per minute. The student is already a 5-word operator of single characters, so that the only new point in his instruction is the reception of groups consisting of more than 1 character. On listening to the record or either table it will be noted that each 2-character group is sent as though about 12 words per minute were being transmitted, then a longer interval is left before the next group is transmitted, thus reducing the overall speed to 5 words per minute. This method of sending is used for two reasons: First, it encourages the student to form the habit of listening to a group when sent at high speed and recognizing the groups as a whole before the completion of its printing; second, it allows a long interval between groups during which the student will have time to definitely decide what characters composed the group, and then to write those characters.

#### Directions.

1. At the beginning of instruction on this Unit Operation go over with the class the points given in the Information above and in the Information given in the Students Manual for this operation. See that the class clearly understands the manner in which the record or table is to be sent and what is to be expected of them.

2. Run the record on the Ediphone in the usual manner, if this is used; otherwise transmit from Table No. 13-A or 13-B at the speed and in the manner indicated under Information, above. Allow 1 or 2 minute rest intervals between each repetition of the record or table, with longer intervals about every 10 minutes.

3. At the end of each day's instruction give the usual three-minute test in reception. Collect the test papers, correct them, and enter the results on the proper form.

4. As the class becomes proficient, increase the speed at which the record is run or the table is sent, until seven words per minute is reached; this speed will be five and one-seventh minutes.

5. Progress the student to Unit Operation No. 14 when his reception index, as shown by the daily test at seven words per minute, reaches a value of 10 or less.





**RECEIVING PRACTICE IN THREE-CHARACTER CODE GROUPS  
SENT AT THE RATE OF SEVEN TO NINE WORDS PER MIN-  
UTE—PRELIMINARY SENDING PRACTICE**

**Equipment.**

Ruled copy paper, two sharpened pencils, and an assigned position at the code practice table.

A small brass or iron washer about  $\frac{1}{2}$  inch in diameter and  $\frac{1}{16}$  inch thick; (a penny will do.)

**Information.**

On completing Unit Operation No. 13 the student is rated as a seven-word receiving operator. This Unit Operation has two purposes: First, to make the student a nine-word receiving operator; and second, to start the student's instruction in sending and make of him a five-word sending operator.

The telegraph key used in sending is shown in Fig. 3. This figure also shows the correct method of holding and operating it. Ability to send will depend to a very great extent on the student acquiring the proper movement of his wrist and hand in operating the key. This movement can be best described in conjunction with Fig. 3. On this figure several arrows appear. Their explanation is as follows: When the key is closed, the hand executes a forward and downward rocking motion, and the wrist moves upward. On opening the key these two movements are reversed, the hand rocking backward and upward and the wrist moving downward. The importance of operating the key in this manner can not be overemphasized, and the student should make every effort to acquire this motion exactly as illustrated. It is important that the back of the hand and wrist be kept horizontal and not tilted.

In order to properly operate the telegraph key, it must be adjusted in a certain manner. Correct adjustment of the key is obtained as follows:

a. Adjust the two trunnion screws which form the pivot of the key lever. See that the lever moves freely up and down and with a very slight amount of side play. In adjusting these screws be sure that the upper contact of the key which is mounted on the key lever, is kept directly over the lower contact mounted on the base of the key. When the correct adjustment of the trunnion screws has been obtained, lock them by means of the locking nut on each screw.

b. Unlock the screw on the back end of the key lever and adjust it until the knob of the key moves up and down approximately one-sixteenth of an inch when the key is operating. Lock the screw in this adjustment.

c. Unlock the screw which passes through the key lever just in rear of the key contact and adjust it until the amount of pressure required to close the key is comfortable to the operator using the key. The exact adjustment of this screw will vary with different operators and must be determined by the operator to suit himself.

The student will be required to execute all sending practice given in this Unit Operation with a small washer or penny balanced on the back of his wrist where the wrist joins the hand. The purpose of this is to prevent the hand being turned to either side while the key is being operated. If, during the operation of the key, the washer falls off, the student should stop sending and replace the washer.

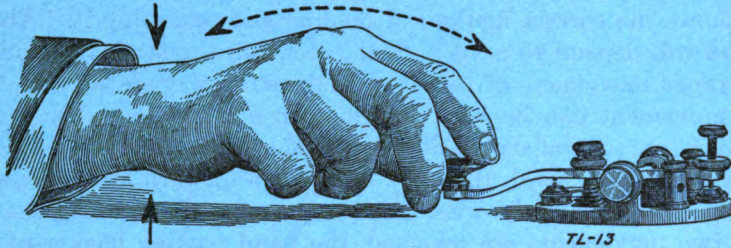


Fig. 3.—Correct position of hand at key

All receiving practice on this Unit Operation will consist of three-character groups, some groups being composed of letters and others of numerals and punctuations. These groups will be sent at the rate of from seven to nine words per minute. Receiving practice in these groups will be given along the same lines as the receiving practice of previous Unit Operations.

#### Directions.

1. RECEIVING PRACTICE.—Any directions needed by the student for the carrying out of the receiving practice required in this Unit Operation will be given by the instructor, as needed.

2. SENDING PRACTICE.—Approximately one-third of the total time devoted to the Unit Operation will be used for sending practice. Specific directions for the carrying out of the sending practice will be given by the instructor, as needed.

### SUGGESTIONS FOR THE INSTRUCTOR

#### Equipment.

Standard Morse code practice equipment.

Ediphone code transmitter if available.

Record No. 14-A if Ediphone is used.

Tables Nos. 1-A, 2-A, 3-A, 4-A, 5-A, 6-A, 6-B, 14-A, and 14-B.

Necessary ruled copy paper, sharpened pencils, etc.

A number of small brass or iron washers about  $\frac{1}{2}$  inch in diameter and  $\frac{1}{16}$  inch thick, sufficient to issue one to each member of the class.

#### Information.

Beginning with this Unit Operation *the class will receive instruction in sending*. The instructor must realize that this is quite important and must in no way be neglected. An operator who can receive but who can not transmit clearly and distinctly is worthless.

The ability of a student to transmit depends mainly on two things: First, he must know absolutely the correct sound of the character he is attempting to transmit, and second, the muscles of the wrist and forearm which manipulate the telegraph key must be flexible and under perfect control. With regard to the first point given above, it is pointed out that this sending practice should not be given until the student has qualified as a seven-word operator. He should, therefore, know absolutely the correct sound of each character. The attainment of the second point is purely one of muscular training and therefore will require continued and well directed practice.

The adjustments of the telegraph key are described in this operation of the Students Manual and will not be repeated here. However, the instructor must be constantly on the watch to see that the students have their keys properly adjusted, are holding them in the correct manner, and are manipulating them with the correct motion. The formation of characters should be for the present subordinated to the attainment of a correct method of operating the key.

For this Unit Operation one-third of the total instruction time each day will be devoted to sending practice. The time devoted to sending practice will be so divided and alternated with the time given to receiving practice that not over 20 minutes at any one time is used for sending.

The purpose of the receiving practice given during this Unit Operation is to make the student a nine-word operator. This practice is given with three-character mixed code groups sent at the rate of from seven to nine words per minute. In copying these groups the student should be required to make the first letter of each group a capital and the other a small letter.

SENDING PRACTICE

**Directions.**

1. Referring to the information contained in the Students Manual for this Unit Operation, go over with the class the correct adjustment and manipulation of the telegraph key. Inspect each member of the class to see that he has properly adjusted the key and has the correct idea of how to operate it.

2. Demonstrate to the class the use of the little iron washer provided and show them how to place this washer on the wrist. Remind them that all practice with the telegraph key, until further notice<sup>4</sup> will be with this washer on the wrist.

3. Instruct the class to practice sending the letter E, slowly at first and then with greater rapidity. Continue this practice for about five minutes and, while the class is engaged on it, go from one student to another and correct the errors that are being made in holding and operating the key.

4. Repeat 3 above, except that the class is told to practice sending the letter T.

5. Arrange the equipment provided so that the class may hear a transmission from the instructor or the Ediphone and at the same time be able to transmit with their own keys. Place Record No. 1-A on the Ediphone or send the characters of the operation in the order in which they are listed in Table No. 1-A, each separate character being repeated five times. Instruct the class to transmit with their keys exactly what they hear, attempting to make their own transmission sound as nearly as possible like that which they hear. Continue this for about 15 minutes.

6. Arrange the switchboard so that each student is operating individually, and instruct the class to practice sending the characters from Table No. 1-A, repeating each character five times. The class should practice on this a total of about one hour.

7. Alternate with the practice given in 6 above, practice in sending the letters E and T. This should continue for not over about five minutes at one time.

8. Repeat 5, 6, and 7 above, with the characters from Table No. 2-A.

9. Repeat 8 above successively for the characters from Tables Nos. 3-A, 4-A, 5-A, and 6-A.

10. Give progress test in sending, using Table No. 6-B. A student's index (*a*) for reception of his own transmission, if Ediphone was used, or (*b*) for his transmission alone if the test was given manually, should be 5 or less. Enter the results on the proper form. (See pars. 3 to 6, inclusive, in the Introduction, on Progress Tests.)

11. Run Record No. 14-A on the Ediphone or send from Tables Nos. 14-A or 14-B, in the usual manner for receiving practice, allowing the customary rest periods.

12. At the end of each day's instruction give a three-minute test in reception, on Record 14-A or on Tables 14-A or 14-B. Collect and correct the papers and enter the results on the proper form. (See pars. 3 to 6 in the Introduction.) When the record or either table is sent in five and one-third minutes the rate is nine words per minute.

13. Advance the student to the receiving practice of Unit Operation No. 15 when his receiving index at nine words per minute reaches a value of 20 or less.



**PRACTICE IN TRANSMISSION AND RECEPTION AT 12 AND 15  
WORDS PER MINUTE**

**Equipment.**

Ruled copy paper, pens, ink, and an assigned position at the code practice table.

**Information.**

On completing Unit Operation No. 14 the student is rated as a 9-word receiving operator and should be rated as a 5-word sending operator. These next two Unit Operations have two purposes: Unit Operation No. 15 endeavors to make the student a 12-word receiving operator and a 12-word sending operator; Unit Operation No. 16 endeavors to make the student a 15-word receiving operator and a 15-word sending operator.

Students must observe the exact method of holding and operating the telegraph key, as previously instructed in Unit Operation No. 14 for transmitting.

All the student's practice in Unit Operation No. 15 will consist of 4-character groups, some groups being composed of letters and others of numerals. These groups will be sent at the rate of from 9 to 12 words per minute. In Unit Operation No. 16, practice is given with 5-character groups sent at the rate of from 12 to 15 words per minute. Practice will be given along the same lines as the receiving practice in previous Unit Operations.

*Hereafter the pen will be used for reception in longhand, and the pencil will be discarded.*

**Directions.**

1. RECEIVING PRACTICE.—Any directions needed by the student for the carrying out of the receiving practice required in Unit Operations Nos. 15 and 16 will be given by the instructor as needed.

2. SENDING PRACTICE.—Approximately one-third of the total time devoted to Unit Operations Nos. 15 and 16 will be used for sending practice. Specific directions for the carrying out of the sending practice will be given by the instructor as needed.





### SUGGESTIONS FOR THE INSTRUCTOR

#### Equipment.

Standard Morse code practice equipment.  
Ediphone code transmitter if available.  
Records Nos. 14-A, 15-A, and 16-A if Ediphone is used.  
Tables Nos. 14-A, 14-B, 15-A, 15-B, 16-A, and 16-B.  
Necessary paper, pens, ink, etc.

#### Information.

For these Unit Operations approximately one-third of the time each day will be devoted to sending practice. The time devoted to sending practice will be so divided and alternated that not over 20 minutes at any one time is used for sending.

The purpose of the receiving practice given during these Unit Operations is to make the student a 12-word receiving operator after the completion of Unit Operation No. 15, and a 15-word receiving operator after the completion of Unit Operation No. 16. This practice is given in Unit Operation No. 15 with 4-character groups sent at the rate of from 9 to 12 words per minute; i. e., Record No. 15-A or Tables Nos. 15-A or 15-B, sent in from  $6\frac{2}{3}$  to 5 minutes. In Unit Operation No. 16 practice is given with 5-character groups sent at the rate of from 12 to 15 words per minute; i. e., Record No. 15-A or Tables Nos. 16-A or 16-B, sent in from  $6\frac{1}{2}$  to  $5\frac{1}{2}$  minutes,

#### Directions.

**SENDING PRACTICE.**—Divide the total time allotted to sending practice into three instruction periods. Alternate these three periods with receiving practice.

*First and second instruction periods.*—During the first two periods the instructor should devote the time to sending practice, utilizing the following plan:

Connect all the students of the class so that they are operating in groups of two. During the first period devote the time to sending. Have one student in each group send three-character mixed code groups from Tables Nos. 14-A or 14-B. The other student of each group will copy this transmission of the student with whom he is working. At the end of the first period the transmitter and receiver who are working together should consult with each other, attempting to point out and criticise errors in transmission. The second period is identical with the first, except that the men in each group reverse their operations.

*Third instruction period.*—Connect all students so that each one can operate singly. Tell the student to practice transmitting from Tables 14-A or 14-B, used in the first and second period.

The instructor then tests each student's ability to transmit, or to both transmit and receive, from Tables 14-A or 14-B, as described in paragraph 4-a (2) or paragraph 4-b (2) of Part I of the Introduction. He scores these tests, determines the progress index of each student, and records the results, as described in paragraphs 5 and 6 of Part I of the Introduction. At the end of these Unit Operations the student should become a 15-word sending operator.

**RECEIVING PRACTICE.**—For receiving practice in Unit Operation No. 15, use record No. 15-A on the Ediphone, or Tables Nos. 15-A or 15-B with the instructor sending manually in the manner usual for receiving practice. Allow the customary rest period.

Pencils will be discarded and pens used hereafter.

For Unit Operation No. 16 use Record No. 16-A on the Ediphone or Tables Nos. 16-A or 16-B, in the same manner as in Unit Operation No. 15.

At the end of each hour's instruction, give a three-minute test in reception, on Records or Tables Nos. 15 or 16, depending on the Unit Operation which is being used. Collect and score these tests and enter the results on the proper form, as given in the Introduction.

The student will be allowed to progress in receiving practice to Unit Operation No. 16 when his average index at 12 words per minute reaches the value of 25 or less. Record No. 15-A, or Tables Nos. 15-A or 15-B, must be sent in 5 minutes for this test.

He will be allowed to progress to receiving practice of Unit Operation No. 17 when his average index at 15 words per minute reaches the value of 30 or less. Record No. 16-A, or Tables Nos. 16-A or 16-B, must be sent in  $5\frac{1}{2}$  minutes for this test.

## PRACTICE IN TRANSMISSION AND RECEPTION AT 18 AND 20 WORDS PER MINUTE

### Equipment.

Paper, pens, ink, a typewriter, and an assigned position at the code practice table.

### Information.

On completing Unit Operation No. 16 the student is rated as a 15-word receiving operator, and should be rated as a 15-word sending operator. Unit Operation No. 17 endeavors to make the student an 18-word receiving operator and an 18-word sending operator. Unit Operation No. 18 endeavors to make the student a 20-word receiving operator and a 20-word sending operator.

*In Unit Operation No. 17 the student begins to use the typewriter.* He also begins to copy messages from a commercial wire, and he takes up the study and practice of Telegraph Procedure. In addition, he takes up the study of Unit Operations Nos. 7 to 12, inclusive. The purpose of these Unit Operations is to familiarize the student with additional punctuations, message forms and words having similar sounds.

The same care in sending and in the adjustment of the key, applies to these as well as previous Unit Operations.

All the student's code practice in these Unit Operations will consist of 5-character groups and 6-numeral groups. These groups will be sent at the rate of from 15 to 18 words per minute in Unit Operation No. 18. Practice in receiving these groups will be along the same lines as the receiving practice in previous Unit Operations.

### Directions.

1. RECEIVING PRACTICE.—Any directions needed by the student for carrying out the receiving practice required in Unit Operations Nos. 17 and 18 will be given by the instructor as needed.

2. SENDING PRACTICE.—Approximately one-third of the total time devoted to Unit Operations Nos. 17 and 18 will be used for sending practice. Specific directions for the carrying out of the sending practice will be given by the instructor as needed.

### Procedure.

One-third of the total time will be used for practice in Telegraph Procedure and in copying messages from a commercial wire.



RELATION IN TEACHING AND RESEARCH AT IS A.M.  
TODAY

It is a pleasure to have you here today, and I am sure that your presence will be a great help to us in our work.

The first part of the program will be devoted to a general discussion of the relation between teaching and research. This will be followed by a series of papers on specific aspects of this relation.

The second part of the program will be devoted to a discussion of the relation between teaching and research in the field of mathematics. This will be followed by a series of papers on specific aspects of this relation.

The third part of the program will be devoted to a discussion of the relation between teaching and research in the field of physics. This will be followed by a series of papers on specific aspects of this relation.

The fourth part of the program will be devoted to a discussion of the relation between teaching and research in the field of chemistry. This will be followed by a series of papers on specific aspects of this relation.

The fifth part of the program will be devoted to a discussion of the relation between teaching and research in the field of biology. This will be followed by a series of papers on specific aspects of this relation.

### SUGGESTIONS FOR THE INSTRUCTOR

#### Equipment.

- Standard Morse code practice equipment.
- Ediphone code transmitter if available.
- Records Nos. 17-A, 18-A, and 19, if Ediphone is used.
- Tables Nos. 17-A, 17-B, 18-A, and 18-B.
- Necessary paper, pencils, blank forms, typewriters, etc.

#### Information.

It has been found desirable when a student has reached the receiving speed of 15 words per minute to change the type of subject matter on which he is given receiving practice. Up to Unit Operation No. 17 all practice has been given on mixed code tables. These Unit Operations are designed so that the student may receive separate practice on tables containing all code groups composed of letters, and on tables with all code groups composed of numerals. Record No. 19 or Table No. 19 contains code groups composed of 6 numerals per group arranged to be sent at a speed of from 15 to 20 words per minute. This is used with both Unit Operations Nos. 17 and 18. Record No. 17-A or Table No. 17-A or 17-B, is for use with Unit Operation No. 17 and contains code groups composed of 5 letters each arranged to be sent at a speed of from 15 to 18 words per minute. Record No. 18-A, or Table No. 18-A or 18-B, is similar to No. 17 except that it should be sent at a speed of from 18 to 20 words per minute; this is used with Unit Operation No. 18.

In addition, *the use of the typewriter is taken up in all receiving practice and practice in Telegraph Procedure is commenced.* Unit Operations Nos. 7 to 12, inclusive, are studied concurrently with Unit Operations Nos. 17 and 18. Their purpose is to familiarize the student with *additional marks of punctuation, message forms, and words having similar sounds.*

#### Directions.

**SENDING PRACTICE.**—Divide the total time allotted to sending practice in these Unit Operations into three instruction periods. Alternate these three periods with receiving practice.

*First period.*—The instructor should connect the students of the class so that they operate in groups of two during this period, and devote the time to sending. Have one student in each group send from one of the five-character code-group tables, Tables Nos. 17-A, 17-B, 18-A, or 18-B. The remaining student of each group will copy the transmission of the student with whom he is working. At the end of the first instruction period the transmitter and receiver who are working together should consult each other and point out errors in transmission.

*Second instruction period.*—The second instruction period will be the same as the first with the exception that the men in each group reverse their operations.

*Third instruction period.*—Connect all the students so that each one will operate singly. Direct the student to practice transmitting from the tables used in the first period.

The instructor then tests each student's ability to transmit, or to both transmit and receive, from Tables Nos. 16-A, 16-B, 17-A, or 17-B, as described in paragraph 4-a (2) or paragraph 4-b (2) of Part I of the Introduction. He scores these tests, determines the progress index of each student, and records the results, as described in paragraphs 5 and 6 of Part I of the Introduction. At the end of these Unit Operations the student should become a 20-word sending operator.

**RECEIVING PRACTICE.**—Divide the time allotted to receiving practice into two equal periods.

During the first period, have the students practice receiving from the Ediphone records or from the instructor in the usual manner. For Unit Operation No. 17, spend three-fourths of the time of the first period on receiving from Record No. 17-A or from Tables Nos. 17-A or 17-B, at a speed of from 15 to 18 words per minute; and spend one-fourth of the time on Record or Table No. 19 at a speed of from 15 to 18 words per minute. This will be varied by practice on Unit Operations Nos. 7 to 12, inclusive.

During the second period (a) connect up the student to receive outside signals, preferably those from a commercial wire, so that the student may have an opportunity to listen to press and message transmission received on his own sounder; (b) take up Telegraph Procedure.

**NOTE.**—The class will be divided so as to alternate (a) and (b) daily.

For Unit Operation No. 18, spend three-fourths of the first period receiving from Record No. 18-A or Tables Nos. 18-A or 18-B at a speed of from 18 to 20 words per minute; and one-fourth of the time from Record or Table No. 19 at a speed of from 18 to 20 words per minute. Vary this by practice on Unit Operations Nos. 7 to 12, inclusive. During the second period, (a) devote to practice in receiving outside press and commercial messages, as in Unit Operation No. 17; (b) Telegraph Procedure.

**PROGRESS TEST.**—The student will be progressed to Unit Operation No. 18 when he is able to receive from Record No. 17-A or from Tables Nos. 17-A or 17-B, sent at a rate of 18 words per minute, with an index of 35 or less. In this case the speed of transmission of the record or table must be five and one-third minutes.

He will complete Unit Operation No. 18 when he is able to receive Record No. 18-A or from Tables Nos. 18-A or 18-B at a rate of 20 words per minute, with an index of 40 or less. In this case the speed of transmission of the record or table must be six minutes.

## CODE PRACTICE

### PROFICIENCY TEST NO. 1 (WITHOUT EDIPHONE)

When the Ediphone is not available, the proficiency test will consist of two parts.

The first part will be a three-minute transmission by the instructor from Tables Nos. 18-A or 18-B, at the rate of 20 words per minute, which the student must receive with a receiving index of 40 or less. The entire table must be transmitted in exactly six minutes.

The second part will consist of a three-minute transmission by the student from Tables Nos. 18-A or 18-B, at the rate of 20 or more words per minute. The instructor and two assistant instructors will copy this transmission, their copies being checked and the student's index calculated as prescribed in the Introduction. This transmitting index must also be 40 or less.

### PROFICIENCY TEST NO. 1 (WITH EDIPHONE)

The proficiency test in Code Practice with the Ediphone will consist of a three-minute transmission by the student from Tables Nos. 18-A or 18-B at the rate of 20 or more words per minute, this transmission being recorded on the Ediphone. The record made by the student will then be transmitted back to him at the same rate and he will be required to copy it. He must have an index of 40 or less on this received copy of his own transmission, to be considered proficient.

(See pars. Nos. 3 to 7, inclusive, of Part I of the Introduction.)





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**PART II**  
**TELEGRAPH PROCEDURE**

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PART II

TELEGRAPHIC PROCEDURE

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## TELEGRAPH PROCEDURE

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### ACCEPTING MESSAGES AT A TELEGRAPH OFFICE

#### Equipment.

- 1 tariff book of a commercial telegraph company.
- 1 rate sheet.
- 1 receiver's record sheet.
- 1 block of sending blanks.
- 2 sharpened pencils.

#### Information.

The object of this first Unit Operation on Telegraph Procedure is to familiarize the student with the methods of accepting messages to be sent by telegraph, and with the handling of them preparatory to transmission.

Consult Information Topics Nos. 2 and 3, the tariff book, the rate sheet, and the receiver's record sheet, before taking up this Unit Operation.

In general there are two types of procedure employed in accepting messages for transmission by telegraph.

The first type is employed for commercial messages, for messages accepted for transmission in part or wholly over commercial telegraph circuits, and for messages handled over military telegraph lines in the same manner as commercial messages.

The second type, a slight modification and simplification of the first, is employed in accepting from message centers, tactical messages to be handled over military field telegraph circuits.

The following method is prescribed for the first type of procedure in accepting messages at a telegraph office for transmission by telegraph, in situations in which commercial procedure is, in general, applicable:

a. Render all possible assistance to the sender in preparing his message. If he requests you to do so, you may write the message for him.

b. Read the message carefully; *carelessness causes errors and delay.*

c. If a word, code group, or cipher group is illegible, call the sender's attention to it. If he will not or can not make it legible, ascertain from him what it should be, and write or print it above that which is illegible; do not change or erase the illegible word.

d. If a word is misspelled, call the sender's attention to it. If he refuses to change it, accept it as written.

e. Note whether or not the sender has indicated the class of the message—day message, night message, day letter, night letter,

day press rate, night press rate, full-rate cable, deferred half-rate cable, cable letters, week-end cable letters, or priority (Government only). If not, ask him how he wants it sent and record in the proper place or places on the blank, the designation given. (Cable classification is placed just in front of the name and address of the addressee.)

f. See that the origin (the place it is from) is correctly entered.

g. See that the date is correct. It is not permissible to accept a message with an incorrect date, unless it is a message received by mail for transmission by telegraph, when it will show the date and the place from which it was mailed, with the addition of the date and the office where it is accepted for transmittal.

h. Examine the address, and if there are any apparent errors or omissions, call the sender's attention to them and have them corrected. In time of war, or under similar conditions, official telegrams for delivery in the theatre of operations, will be addressed to an office, or to an officer (giving his organization), but *not to a town or location*.

i. If the message contains obscene, profane, or libelous language, request the sender to rewrite the message omitting the objectionable words. If he refuses to do so, do not accept the message.

j. If the message is on official Government business, see that the appropriate certificate to that effect appears on the message, and that "Govt" appears in the check.

k. Call the sender's attention to any marks of punctuation in the message, and ask him if he wants them transmitted; and if so, they will be counted and charged for the same as words.

l. Call attention to any numbers or words which, as written by the sender, must be counted as two or more; and explain, if possible, how they could be rewritten so as to reduce the cost of the telegram.

m. If any message except a Government official message, lacks a signature, call the sender's attention to the omission. If he declines to sign the message, accept it, and then write in place of the signature the word "Unsigned."

n. Ask the sender for his full name and address, if he has not already indicated it, and either write it at the bottom of the blank, or request him to do this. Include telephone number, if any.

o. *Foreseen delays.*—

(1) If a message is offered when communication is known to be interrupted, inform the sender it can be accepted only subject to delay, for transmission as soon as circuits are restored. Write upon such a message "Subject to delay." Request the sender to initial this remark.

(2) If a message is offered, destined to an office the listing of which shows that it either has closed for the day, or that reasonable time is not allowed for transmission before the closing hour, so advise the sender, and indorse such message, "Sender advised of office hours at destination." Request the sender to initial this remark.

(3) If a message destined to an office, the office hours of which are not listed in the tariff book, is offered at a time when such an office is likely to be closed before the message can reach it, advise the sender of the uncertainty of getting the message to its destination the same day, and indorse the message "Subject to closing hours." Request the sender to initial this remark.

*p.* If the message is written on other than the prescribed form, paste it on a sending blank, leaving exposed the heading of the prescribed form.

*q.* If a "contract," "free," or "deadhead" message is offered ask the sender to produce proper identification and authority, and record same in the check.

*r.* If sender requests a repetition of his message, insert in the check the words "Repeat back." Add 2 to the count and charge for two extra words.

*s.* If the sender of a message requests a notice of its delivery, insert in the check the words "Report delivery." Add 2 to the count and charge for two extra words.

*t.* If the sender desires delivery personnel to inform addressee that an answer by telegraph is expected, insert "XU" in the check, but do not include it in the count, and do not charge for it.

*u.* If the charges on the message are to be paid by the addressee, insert in the check the word "Collect"; include in the count, but do not charge for it. Do not accept messages for transmittal "collect" if the customer has no collect card authorizing it, unless it is an answer to a prepaid message, or unless the customer deposits the full amount of the tolls as a guarantee. This deposit will be refunded after 24 hours if the notice of nonpayment of tolls has not been received. When applicable insert "Delivery guaranteed" in the check, add 2 to the count, and charge for two extra words. This indicates that addressee is expected to pay for delivery, but that sender will if addressee will not.

*v.* Count the words, code or cipher groups, extra words, etc., which are considered in the count and in determining charges, and enter this count at the beginning of the check in the heading. (See Information Topic No. 3.) When applicable, properly indicate in the check the double "count" and the number of extra words counted.

*w.* Consult the rate sheet and the tariff book for the proper charges. If prepaid, enter the word "Paid" and the amounts prepaid. If delivery charges are unknown, and are to be paid by sender, insert in check "Deliver and report charges"; add 4 to the count and charge for four words.

*x.* If the telegraph office accepting the message for transmission, or forwarding the message, is a branch of another telegraph office in the same place, insert the office call before the name of the place.

*y.* Insert after the name of the office of origin, the time filed at origin.





The following chart is given to illustrate the preceding rules for messages handled by commercial companies or under similar conditions by Government personnel, and in so far as they apply to what the counter clerk (or operator acting as counter clerk) writes down on a message he accepts from a sender.

The column at the left gives the order in which the information after any number in that column would be written on the blank. One item only after each such number or after a lettered subdivision of that number will be used for any one message. Omitted numbers will be used later to illustrate data put on the blank by the operator.

In the examples (except night press messages, day letters, and night letters) involving the count, each example is based on the sender or addressee having to pay for exactly 10 words; thus where there are extra words in the address, signature, or check the number in the body or text of the message is correspondingly reduced.

Item order	Subject	Examples, as written by counter clerk	References
1	(For operator)-----		
2	(For operator)-----		
3	The count-----	10 - 10/8 (when tolls on a 10-word message are pre-paid by sender). 11 - 11/9 (when tolls on a 10-word message are to be collected from addressee). (See No. 4 for use of "paid" and "collect" with "CAK" and "DH.")	
4	"Government official," "Contract," and "Dead-head" messages (if applicable). (See Government or commercial tariff books for additional information.)	Govt - CAK No. 389 - CAK answer - CAK No. 389 and CAK No. 275 - DH No. 83 - DH answer - DH No. 83 and DH No. 52 - CAK No. 386 and paid 30 - paid 30 and CAK No. 275 - CAK No. 386 and collect - Collect and CAK No. 275 DH No. 83 and paid 30 - paid 30 and DH No. 57 - DH No. 83 and collect - Collect and DH No. 57.	
5	Prepaid or collect-----	paid - collect. (See No. 4 for use with CAK and DH.)	
6	Class of message-----	nite - blue - nl - npr - dpr - cable p.	
7	Directions to operators for counting in body and code signature.	(a) dot ctd----- (b) period ctd----- (c) pctns ctd----- (d) cnt 6 pgs----- (e) sg ctd (in case of code signature)-----	
8	Money paid by sender, before transmission.	30 - 30 and 30 - 30 delivery 10 - 30 delivery \$1.00 - 30 sub free.	
9	Extra words counted-----	4 extra-----	



TELEGRAPH OPERATOR

Item order	Subject	Examples, as written by counter clerk	References
10	Charges on forwarded messages, to be paid by addressee	25 (where a message is received as "paid" but is forwarded as "collect") → 25 and 30 (where a "collect" message is forwarded).	
11	Special instructions for telegraph personnel (as many as applicable). (Count and charge for, except XU.)	(a) deliver and report charges (if to be paid by sender). (b) delivery guaranteed (if to be paid by addressee). (c) report delivery ----- (d) repeat back ----- (e) valued \$6000 ----- (f) personal (if to be delivered only to addressee). (g) XU ----- (h) RUSH ----- (i) (Any other special instructions applicable.)	
12	Office call of branch office at origin.	FX -----	
13	Name of city or town, and State, from which sent by sender. (See exceptions in tariff book.)	New York NY -----	
14	Filing time at point of origin	621A - 507P -----	
15	Original date filed by sender with telegraph office. (See exceptions in tariff book.)	(a) Oct 31 (if not a forwarded message). (b) 31 (if a back date on forwarding). (c) (omitted if forwarded on same date.) (See No. 18.)	
16	If a forwarded message. ---	via -----	
17	Office call of branch office forwarding message.	GY -----	
18	Name of city or town, and State, from which forwarded by intermediate telegraph office.	Troy NY -----	
19	Date forwarded (if forwarded).	Nov 1 -----	
20	Class of cable message (if other than a cable message) (counted and paid for).	clt, clp, lco, lcd, lcf, wlt, wlp --	
21	Add after body or text of unsigned messages which are not official Government messages.	unsigned -----	
22	Add where applicable, after signature of message; show to sender and have him initial same.	(a) subject to delay ----- (b) sender advised of office hours at destination. (c) subject to closing hours. -- (d) any other pertinent remark	
23	Ask sender if he authorizes company to state that he desired a telegraphic reply.	(See remark under No. 11 (g)).	
24	Number of messages to be delivered, when addressed for delivery to more than one person.	③-① -----	
25	Insert in upper right-hand corner of message the number assigned it on the Receiver's Record.	-----	

The following are examples of headings as written by counter clerks:

*At office of origin.* (Place and date may be written by sender.)

- (1) 10 PAID 30 NEW YORK NY 621A OCT 31 1925
- (2) 11/9 COLLECT NITE NEW YORK NY 507P OCT 31 1925
- (3) 10/8 GOVT PAID 30 AND 36 DELIVERY 10 NEW YORK NY  
621A OCT 31 1925
- (4) \*(100) COLLECT NPR NEW YORK NY 621P OCT 31 1925
- (5) 11 GOVT COLLECT NITE SG CTD 4 EXTRA VALUED \$60  
XU FX NEW YORK NY 507P OCT 31 1925
- (6) 50 PAID BLUE PCTNS CTD 60 AND 36 4 EXTRA DELIVERY  
GUARANTEED NEW YORK NY 220 P OCT 31 1925
- (7) 10 DH NO 83 AND PAID NITE DOT CTD 30 4 EXTRA  
REPORT DELIVERY CHARGES FX NEW YORK NY  
507P OCT 31 1925
- (8) 11/8 COLLECT AND CAK NO 275 PERIOD CTD 4 EXTRA  
DELIVERY GUARANTEED NEW YORK NY 621A OCT 31  
1925
- (9) \*(10) DH NO 83 NITE XU FX NEW YORK NY 507P OCT 31  
1925

*At office forwarding a message.*

- (10) 41 COLLECT NL CNT 1 PGH 5 EXTRA 35 DELIVERY GUAR-  
ANTEED NEW YORK NY VIA TROY NY OCT 31 1925
- (11) 11 COLLECT NITE PCTNS CNTD 4 EXTRA 25 AND 30  
REPEAT BACK REPORT DELIVERY FX NEW YORK NY  
31 VIA TROY NY NOV 1 1925

\*NOTE.—The count is inserted after, not before sending.

*In tactical units in the field* messages to be transmitted by telegraph generally reach the telegraph office through the message center. The message center may send to the telegraph office the message exactly as written by the writer, plus any additional notations, including the "Class," that may be required by message center procedure. In this case, the message may be written on a field message blank or on an approved blank for telegrams and other signal messages, or on a blank piece of paper. On the other hand, the message may have been encoded or enciphered on an approved blank at the message center, the address, body, and signature being encoded or enciphered. In this case the message center indicates to the telegraph office the station of destination as well as any special instructions, including "Class," that may concern the telegraph office.

A field message may have an address and a signature consisting only of the title of an officer and his organization. A field message also may contain a writer's number and a date and hour signed. All of this data must reach the addressee; consequently proper names as signatures may be lacking, and the operator must transmit the writer's number and the date and hour signed, in addition to any

information in the heading required to insure accurate transmission and to be able to trace errors.

The message center may indicate to an operator the maximum delay time allowed. If the message can not be transmitted within that time, the message center must be notified.

In the field, for reasons of secrecy, the transmission in clear (plain English) of names of places is frequently prohibited. In the field, telegraph offices are generally referred to by the headquarters with which they serve, rather than by the name of the place at which that headquarters happens to be at any particular time. The location of headquarters is generally known to the message center or to others concerned. Consequently in such cases operators will employ organization designations in place of names of places, in headings, addresses, and signatures of messages.

Message center personnel is supposed to have read through the message, and arranged with the writer (or code clerk) for corrections in case of poor legibility or incorrect form.

As there is no money value involved in such messages, the use of tariff books and rate sheets are dispensed with.

As the message center keeps an accurate check on the messages sent to the telegraph office, there is no necessity in the field for a "Receiver's Record."

As the time signed by the sender is a part of a field message, "Time filed" need not be transmitted in such cases.

Thus the previous procedure for commercial or semicommercial handling of messages is modified when employed over tactical circuits in the field, to include only the following:

a. Read the message carefully.

b. If a word, code group, or cipher group is illegible, call upon the message center for assistance in determining what it should be. Write above anything illegible the correct word, letters, or figures; do not change or erase the illegible portion.

c. Note whether or not the sender or message center has designated the class of the message (Routine, Priority, Urgent Priority). If no class is indicated, assume that it is a "Routine" message. (See Information Topic No. 2.)

d. If probable delay in transmitting is known in advance to be longer than that allowed by the message center, notify the message center, so that, if advisable, it can be transmitted by other means.

e. Count the words, code groups, etc., and enter in the "CHECK" in the heading.

f. Properly indicate any marks of punctuation which are to be sent, such as the decimals and the dash, in coordinates.

*g.* If the message center or sender wants a message repeated back, insert "Repeat back" in the heading, and add 2 to the "count."

*h.* Indicate in the check any special directions to operating personnel for the handling of the message; where applicable, add to the count.

*i.* Where address of sender does not indicate the designation of the sending telegraph office (place or organization), see that the heading includes the designation of the telegraph office.

*j.* After accepting the message from the message center, enter on it the time filed, this being the time the message was accepted at the telegraph office. (This is not transmitted in field messages carrying the "Hour signed" of the writer.)

*k.* If date the message was signed is not the date filed, see that heading includes the date filed.

*l.* The message is now ready for transmission. If the operator himself did not handle the message up to this point, it is now sent to the operator's table for transmission.

*m.* The counter clerk should call the attention of the operator to any message which is classified as other than "Routine."

#### **Directions.**

The instructor will give to each student, messages of various types, including commercial messages as well as field messages in clear on field message blanks, and messages in code or cipher. On some of the messages there will be errors or matter which requires the special attention of the one accepting the message; handle each such case as described under Information, above.

1. Handle each message in the manner described above, depending upon which type of the two general types of messages each belongs.

2. Use the receiver's record for all messages which have not come through a message center.

3. Consider the instructor as the sender of all messages not received through a message center; and consider him as the message center in all cases where a message is supposed to have come through a message center.

4. At the end of the period turn in to the instructor all the messages accepted. The instructor will examine them for error, and return them.

5. In actual practice when the messages are turned over to the operator his attention is invited to any that are classified as other than "Routine."



### SUGGESTIONS FOR THE INSTRUCTOR

#### Equipment.

- 1 single Morse line with several telegraph offices, each office to be equipped as follows:
  - 1 Morse telegraph set.
  - 1 tariff book of a commercial telegraph company.
  - 1 rate sheet.
  - 1 receiver's record sheet.
  - 1 operator's number sheet.
  - 1 delivery register sheet
  - 1 typewriter
  - Sending blanks
  - Receiving blanks.
  - Carbon sheets.
  - Delivery sheets.
  - Delivery envelopes.
  - Pencils.

The above equipment includes everything necessary for instruction in accepting, transmitting, receiving, and delivering messages and will be the equipment for all Unit Operations in Telegraph Procedure.

#### Information.

The instructor should himself be familiar with the procedure for accepting messages, as laid down in the student's section of this Unit Operation.

If the students can be required to study the Unit Operation before coming to class, the instructor will have only to question them, to determine if they have a picture of the work to be done, and how to do it.

#### Directions.

1. Assemble the students and explain in detail the use of the tariff book, rate sheet, and receiver's register as applied to accepting messages.

2. Show them samples of the different representative classes of messages and instruct them in the proper procedure for accepting, checking, and recording those messages, as well as how to consult the rate sheets and tariff book, for information as to rates.

3. Drill the students thoroughly in the commercial and military classification of messages as contained in Information Topic No. 2.

4. Give each office a name and an office call, and assign a student to each. (See Information Topic No. 4.)

5. Designate one terminal office as a relay office and direct that all messages addressed to distant points be transmitted to this office.

6. File at each office messages of various types, including tactical messages on field-message blanks. Some of these messages will contain errors, such as misspelled words, improper address, no signature; and there will be code groups, words, or letters for which the check is unusual, etc.

7. Direct the students to accept these messages, as if they were accepting them at a regular telegraph office. Instruct them to consider the instructor as the writer of all messages not received through a message center, or as the message center, if received from a message center.

8. Assume for the purpose of this problem that all messages from a message center are delivered at a telegraph office of a tactical unit, and consequently that for such messages the Receiver's Record will not be used; and that other procedure will be modified for such messages, as given in the Information of this Unit Operation.

9. At the end of the period, all messages and forms will be collected, examined carefully for errors in procedure, and returned to the students with comments and suggestions.

10. As soon as practicable after correction of the papers, go over with the class the types of errors made.



## TRANSMITTING MESSAGES

### Equipment.

- 1 Morse telegraph set connected to a single Morse circuit.
- 1 tariff book of a commercial telegraph company.
- 1 operator's number sheet.
- 2 sharpened pencils.

### Information.

This Unit Operation is intended to familiarize the student with the routine of transmitting telegraph messages over a commercial circuit. The same general principles apply for transmission of tactical messages, with modifications, as indicated in the previous Unit Operation.

Consult, carefully, Information Topics Nos. 4, 5, and 6 before attempting to transmit messages.

So that a student will be able to properly receive what another student sends, Unit Operation No. 21 will be taken up concurrently with this Unit Operation.

The following rules are applicable to a telegraph operator who receives messages prepared as in the previous Unit Operation, for transmission by him:

*a.* The operator numbers serially, beginning after midnight, with number 1, each message sent to a particular telegraph office over a particular circuit. Similarly he numbers serially, beginning after midnight, with number 1, all messages received from any particular office over a particular circuit. Where there is more than one circuit between two offices, each such number is preceded by the letter designation of the circuit. Thus any two stations connected by two circuits will have four series of message numbers (two for messages sent, two for messages received), each preceded by one of two letters denoting the circuit over which handled.

*b.* Arrange the messages on file to be sent, in the order in which they are to be sent, with the oldest or most important on top. The one on top is then sent first.

*c.* Adjust the instruments to make sure that the line is not being used. Sometimes on a poor line a distant station sending is not always readily heard.

*d.* Do not "break in" on another sender unless very important business is on hand. Contention for the circuit is forbidden.

*e.* Call the station to which the message is to be sent. In calling, repeat the call letters of the other station several times, signing your own call at frequent intervals. Should the other station fail to answer, make a note on the back of your number sheet, stating the time you called.



f. When the other station answers, transmit a commercial message in the following order:

- (1) Circuit letter, if more than one circuit to receiving office.
- (2) Operator's message number.
- (3) Office call of sending office.
- (4) Check, including count and data for the information of the receiving office.
- (5) Office call of office of origin, if message originated at a branch office.
- (6) Place of origin of the message. (See previous Unit Operation and the tariff book.)
- (7) On day messages, day letters, day press matter, CAK messages, and cables, the time filed at the telegraph office of origin.
- (8) The date filed at telegraph office of origin.
- (9) Name to, address, and destination.
- (10) A period (not copied).
- (11) Body or text of the message.
- (12) A period (not copied).
- (13) SG (not copied).
- (14) Signature.
- (15) A period (not copied).

In sending a cable message designate the class by preceding the transmission with the word "Cable."

On messages originating on the lines of another telegraph company and transferred to your system, no filing time will be shown except when the message as transferred to your system shows the time when the message was filed at the point of origin, and in such cases the original filing time so shown will be transmitted.

When a message sent over the lines of your system is forwarded from the original point of destination to another point, the forwarding office will not show any filing time on the forwarded copy, but will date the message in accordance with rules in the previous Unit Operation.

NOTE.—In sending the date filed or date forwarded, only the day of the month will be sent, the name of the month and the year being omitted. Thus "June 10, 1922," would be sent "10." This is recognized as the date by its position in the heading.

g. While sending with one hand, mark the service on the message with the other, as fast as data therefor is received. This service is:

- The letter designation of the circuit, if more than two.
- The number of the message.
- The office call of the receiving office.
- The personal sign of the sending operator.

The personal sign of the receiving operator.

The time transmission was completed.

The date transmission was completed, if other than date filed at origin.

*h.* Should there be but one message for that office, transmit "NM" when transmission is completed, to indicate that there are no more messages.

*i.* When an acknowledgment has been received from the receiving station, complete the service on the message, and mark that number off on the number sheet. Do not consider the transmission of any message as completed until its receipt has been acknowledged by the usual signal. If several are sent in succession, the acknowledgment of the last may be considered as an acknowledgment for all. Should there be more than one message for that office, at the completion of the first message send "ANR" "WO," meaning, "I have another, who is receiving." When "OK" is received, resume sending and continue until all business is cleared.

*j.* Should the receiving operator be slow, the sending speed will be regulated accordingly. The inability of an inexperienced operator to receive rapidly will not be deemed a sufficient reason for failure to transmit to him.

*k.* To correct an error made in transmission, make an interrogation point. Then resume sending, commencing with the last word transmitted correctly.

*l.* Should the receiving operator question the check on a message, count the words in the copy of the message at the transmitting station. Should it be found that the check is wrong and the message originated at the station from which it is being sent, direct the receiving operator to correct it. Should it be found, on counting, that the check is correct, "letter" the message. That is, begin at the period after the address, and make the first letter of each word. The receiving operator can follow and by comparing these letters with the initials of the words in his copy can locate his error. When the error has been located resume that portion of the message where the error was made. If the check is wrong on a message which originated at a station, other than the one transmitting at the time the error was discovered, the message must be referred to the station of origin for correction. Corrections in the check can only be made by referring to the original copy written by the sender.

*m.* Should it be found that a message has been sent to the wrong destination, forward the message to the proper destination at once, as a new message, and notify the office to which it has been improperly sent, of the action taken.

*n.* When for any reason a message can not be transmitted promptly, make a note of the cause of the delay on the back of the message and report the facts to the chief operator. If for any reason a message can not be promptly completed or corrections made, the number will be erased and will be assigned to the next message transmitted. When corrections have been made a new number will be assigned and the message transmitted.

*o.* If to correct an error in a message or for any other reason a second transmission becomes necessary, the sending operator will send the word "Duplicate" or "DUP" immediately following the check. (This word is sent and copied but is not counted.) A new number will be given and new marks of transmission will be recorded thereon. In such cases the date of filing, as well as the date of duplication will be transmitted and copied. These rules do not apply to a message which is duplicated immediately at the request of the receiving operator, but to one when some time has elapsed and it is probable that the original has reached the delivery department, or may have been delivered to the addressee.

*p.* When a message is addressed to two or more persons, to be delivered to any one of the addresses but to only one, it will be sent as one message, the extra addresses to be included in the count, and paid for.

*q.* When a message is addressed to more than one person, for transmission and delivery to each, consider it as so many messages. If the receiving operator at the distant station is copying with a pen, send one message complete; then send the other addresses, assigning a message number to each address. If the receiving operator is copying with a typewriter, inform him how many copies there are to the message and thus permit him, by the use of carbon paper and additional message blanks, to make the desired number of copies. Transmit them as follows:

- (1) HR (*No. of*) CYS.
- (2) (Wait until receiving operator sends GA).
- (3) Office call of sending office.
- (4) Check, including count and data for information of receiving office.
- (5) Place of origin.
- (6) On day messages, day letters, day press matter, CAK messages, and cables, the time filed at telegraph office of origin.
- (7) The date filed at telegraph office of origin.
- (8) Period (not copied).
- (9) Body or text of message.

- (10) Period (not copied).
- (11) SG (not copied).
- (12) Signature.
- (13) HR NRS.
- (14) (Wait until receiving operator sends GA.)
- (15) Wire letter (if any), operator's number, name to and address of first message.
- (16) Period (not copied).
- (17) (Repeat 15 and 16 for each additional message.)

Send nothing in the service that would indicate to the addressees that copies of this message had been sent to other persons.

*r.* An office which does not keep open all night will clear all business before closing. A relay office will clear all business before closing. If for any reason any messages are left over until next morning, they will be transmitted before new business, under the original date of filing. The date will *not* be changed to that on which the business is forwarded. The date of forwarding will, however, be indicated.

*s.* Before filing, examine all sent messages for evidence of transmission. The utmost care must be taken to prevent unsent messages from being placed with those which have been sent.

*t.* Whenever duplicate numbers are discovered, a description of both messages will be wired to the distant office. The duplicate number will be made  $\frac{1}{2}$ . For example: If two messages bearing the number 50 are transmitted, and the fact is not discovered until some time afterwards, the last one sent will be made 50  $\frac{1}{2}$ . This is necessary, as there is always a possibility that the receiving office failed to get one of these messages.

*u.* When the last message has been sent and acknowledgment received therefor, mark all messages off on the number sheet and with the sign of the sending operator clearly indicated.

*v.* Canceled messages will be placed in an envelope or jacket labeled "Canceled" and filed with the day's business.

The following shows how an operator would actually transmit the headings given in the tabulation in Unit Operation No. 19, and in the order in which he would transmit any of those items:

*Information in headings, as transmitted by operators*

Item	As written by counter clerk	As transmitted by operator
1	(Inserted by operator)-----	A - B - C - etc.
2	(Inserted by operator)-----	3 - 30 - 300 - etc.
3	10 - 10/8 - 11 - 11/9, etc.-----	10 - 10/8 - 11 - 11/9 - etc.
4	Govt - CAK No. 389 - CAK answer - CAK No. 389 and CAK No. 275 - DH No. 83 - DH answer - DH No. 83 and DH No. 52 - CAK No. 386 and paid 30 - paid 30 and CAK No. 275 - CAK No. 386 and collect - Collect and CAK No. 275 - DH No. 83 and paid 30 - paid 30 and DH No. 57 - DH No. 83 and collect - Collect and DH No. 57-----	Govt - CAK - CAK - CAK and CAK DH - DH - DH and DH  CAK and paid - paid and CAK - CAK and collect - Collect and CAK - DH and paid - paid and DH -  DH and collect - Collect and DH ("paid" is not sent) - collect
5	paid - collect-----	nite - blue - nl - npr - dpr - cable - P
6	nite - blue - nl - npr - dpr - cable - P-----	dot ctd period ctd pctns ctd cnt 6 pgs sg ctd
7	(a) dot ctd----- (b) period ctd----- (c) pctns ctd----- (d) cnt 6 pgs----- (e) sg ctd-----	dot ctd period ctd pctns ctd cnt 6 pgs sg ctd
8	30 - 30 and 30 - 30 delivery 10 - 30 delivery \$1.00 - 30 sub free-----	("30" and "30 and 30" are not sent) - pd 10 - pd \$1.00 - sub free
9	4 extra-----	4 extra
10	25 - 25 and 30-----	25 - 25 and 30
11	(a) deliver and report charges----- (b) delivery guaranteed----- (c) report delivery----- (d) repeat back----- (e) valued \$6000----- (f) personal----- (g) XU----- (h) RUSH-----	dlr and report chgs dly gnteed report dly rpt back valued \$6000 personal XU RUSH
12	FX-----	FX
13	New York NY-----	New York NY
14	621A - 507P-----	621A - 507P
15	(a) Oct 31----- (b) 31-----	31 31
16	via-----	via
17	GY-----	GY
18	Troy NY-----	Troy NY
19	Nov 1-----	1

The examples of headings as given in Unit Operation No. 19 would be added to and transmitted by the operator as follows:

No.	As written by counter clerk	As added to and transmitted by operator
1	10 paid 30 New York NY 621A Oct 31 1925	E30 CK 10 FM NEW YORK NY 621A 31
2	11/9 collect nite New York NY 507P Oct 31 1925	25 CK 11/9 COLLECT NITE FM NEW YORK NY 31
3	10/8 govt paid 30 and 36 delivery 10 New York NY 621A Oct 31 1925	21 CK 10/8 GOVT PAID 10 FM NEW YORK NY 621A 31
4	*(100) collect npr New York NY 621P Oct 31 1925	B10 CK 100 COLLECT NPR FM NEW YORK NY 31
5	11 govt collect nite Sg ctd 4 extra valued \$60 XU FX New York NY 507P Oct 31 1925	C170 CK 11 GOVT COLLECT NITE SG CTD 4 EXTRA VALUED \$60 XU FM FX NEW YORK NY 31
6	50 paid blue pctns ctd 60 and 36 4 extra delivery guaranteed New York NY 220P Oct 31 1925	70 CK 50 BLUE PCTNS CTD 4 EXTRA DLY GNTTED FM NEW YORK NY 220P 31
7	10 DH No. 83 and paid nite dot ctd 30 4 extra report delivery charges FX New York NY 507P Oct 31 1925	51 CK 10 DH AND PAID NITE DOT CTD 4 EXTRA REPORT DLY CHGS FM FX NEW YORK NY 31
8	11/8 collect and CAK No 275 period ctd 4 extra delivery guaranteed New York NY 621A Oct 31 1925	84 CK 11/8 COLLECT AND CAK PERIOD CTD 4 EXTRA DLY GNTTED FM NEW YORK NY 621A 31
9	*(10) DH No. 83 nite XU FX New York NY 507P Oct 31 1925	C171 DH NITE XU FM FX NEW YORK NY 31
10	41 collect nl cnt 1 pgh 5 extra 35 delivery guaranteed New York NY via Troy NY Oct 31 1925	72 CK 41 COLLECT NL CNT 1 PGH 5 EXTRA 35 DLY GNTTED FM NEW YORK NY VIA TROY NY 31
11	11 collect nite pctns cntd 4 extra 25 and 30 repeat back report delivery FX New York NY 31 via Troy NY Nov 1 1925	A54 CK 11 COLLECT NITE PCTNS CTD 4 EXTRA 25 AND 30 RPT BACK REPORT DLY FM FX NEW YORK NY 31 VIA TROY NY 1

\*NOTE.—CK and FM are sent, but not written by either operator.

### Directions.

1. Take your places as in the previous Unit Operation.
2. This time the instructor will deliver to you messages such as you prepared for transmission in the previous Unit Operation. Transmit these messages in the same manner in which you would transmit them if you were handling actual messages over normal circuits.
3. Call upon the instructor for any help you need in determining exactly how to transmit your messages and to keep the number sheet.
4. Try for accuracy rather than speed in this Unit Operation until you have been over it several times.
5. Correct the receiving operator if he makes errors. In case of uncertainty as to who is wrong, consult the instructor.
6. At the close of the period compare with the student operators who received your messages to determine if they properly received what you sent.
7. Then turn in your messages and records to the instructor for correction.



**SUGGESTIONS FOR THE INSTRUCTOR**

**Equipment.**

Same as in Unit Operation No. 19.

**Information.**

This Unit Operation should be practiced in conjunction with Unit Operation No. 12.

**Directions.**

1. Assign students to the same telegraph office as in Unit Operation No. 19. This time they will act as operators.

2. Arrange a traffic load so that all students will have an equal number of messages to send and receive without undue interference.

3. Act as the counter clerk for all these offices. Change the "time filed" on the messages of the previous Unit Operation so that they will fit into the traffic load. Arrange the messages so that they can easily be turned over to the operators at the correct times. Give out the messages, at the proper times, to the various operators.

4. In connection with Unit Operation No. 21, direct the operators both to send the messages turned over to them for transmission, and to receive any messages that may be sent to them.

5. For practice in receiving, direct them to copy everything that goes over their circuit, whether or not for them.

6. See that the students use only the typewriter for receiving.

7. Circulate among the students and correct all errors that come to your attention.

8. At the end of the period collect all messages and records, correct and return when corrected.

9. At the next period go over with the class the principal errors of the previous period.

10. Return corrected, the messages and records turned in, giving comments and suggestions.





## RECEIVING MESSAGES

### Equipment.

- 1 Morse telegraph set connected to a single Morse line.
- 1 tariff book of a commercial telegraph company.
- 1 operator's number sheet.
- 1 typewriter.
- 1 pen and ink.
- 1 block of receiving blanks with carbons.

### Information.

This Unit Operation is intended to familiarize the student with the routine of receiving messages on a commercial circuit. It will be taken up at the same time as Unit Operation No. 20.

The tariff book will be consulted as to special rules in receiving messages, not covered in this Manual.

The following rules apply to a telegraph operator receiving messages:

*a.* So far as possible, always be ready to answer calls immediately. Have a supply of blanks ready, especially if it is customary to use carbon copies for the retained file. When the office is called, answer as soon as possible. If busy and unable to receive business at the moment, answer the call and advise the calling office of that fact. As soon as opportunity offers, call that office and tell him to go ahead.

*b.* When answering a call, look at the number sheet to see what the next number should be. Should the sender begin with a wrong number, break and get the number corrected before receiving any business.

*c.* Copy with a pen or typewriter. Pencils are not permitted.

*d.* Copy the message as follows:

Operator's message number.

Office call of sending office.

Personal sign of receiving operator.

Check.

Origin.

Time filed.

Date in full.

Addressee.

Address.

Body.

Signature.

Time reception was completed (to be written in the lower right-hand corner).

NOTE.—Although the sending operator omits the name of the month and the year, the receiving operator will enter the date in full, as Jan 17 – 1922. Sending operator must give the receiving operator time to write this.

*e.* While copying, count the number of words and verify the check. Should the number of words fail to agree with the check, break immediately and inform the sending operator how many words were received. Should the sending operator find his check correct and letter the message, compare the copy received with these letters. Should a discrepancy be discovered, break and ask for a repetition of that portion of the message.

*f.* Do not acknowledge receipt until the check has been corrected. Challenge all words that appear doubtful, and when confirmed by the sending operator underscore them.

*g.* If a word or more is missed, break and tell the sending operator to repeat, commencing with the last word correctly received. If the transmission is too fast, ask the sending operator to reduce his speed. Under no condition guess at the message being received.

*h.* When sure that the message has been correctly received, acknowledge receipt by giving the sending office an "OK" followed by the personal sign of the receiver.

*i.* Write the time reception was completed, in the lower right-hand corner of the message blank.

*j.* See that the received copy is legible and not likely to be misread.

*k.* If for any reason a message can not be completed promptly or correction made, the number will be erased and assigned to the next message received. Do not leave any blank or vacant numbers on the number sheet. In other words, have a message for every number and a number for every message. When the reception from any station is completed, mark the corresponding numbers off on the number sheet, with the personal sign plainly indicated.

*l.* When a message has been challenged and a serious error discovered, have the sending operator transmit the entire message again. When such a second transmission is made, the receiving operator will state in writing across the face of the first copy, what action has been taken. This first copy will then be filed with the day's work. When the first copy of the message is filed, as described in the preceding paragraph, the second copy will take the same number as the first. When the second transmission is made after the first copy has left the hands of the receiving operator, a new number will be assigned to this second copy. When the second copy takes a new number, it will be considered as a duplicate of the first and the word duplicate will be written plainly at the top of the message. When such a message bears a back date, enter both dates, that of origin as well as reception.

*m.* When a message is received addressed to any one of two or more persons, make but one copy for delivery.

n. When a message is received for more than one person and a copy is to be delivered to each addressee, make (besides the copy retained for record) one copy for each address, and each copy to be delivered will be given a separate number. Write nothing on any copy to indicate that the same message has been delivered to other addresses.

**Directions.**

1. Take your places as operators as in the previous Unit Operation.
2. Receive all messages sent to your office in accordance with the information in this Unit Operation.
3. Copy all traffic passing through your office.
4. Correct the sending operator if he makes errors. In case of uncertainty of either sending or receiving operator, consult the instructor.
5. At the close of the period, compare what you received with what the sending operator is supposed to have sent.
6. Turn in your messages and records to the instructor for correction.



**SUGGESTIONS FOR THE INSTRUCTOR**

**Equipment.**

The same as in Unit Operation No. 19.

**Information.**

This Unit Operation should be practiced as directed in suggestions for the instructor in Unit Operation No. 20.

**Directions.**

Same as for Unit Operation No. 20.



## DELIVERING MESSAGES

### Equipment.

- 1 tariff book of a commercial telegraph company.
- 1 delivery register sheet.
- Delivery envelopes.
- Delivery sheets.
- Pencils.

### Information.

This Unit Operation is intended to familiarize the student with the routine of preparing messages for delivery and recording them on the proper forms, also to familiarize him with the preparation of service messages.

Consult Information Topic No. 6, and the tariff book, for any needed information not contained in this Unit Operation.

The following rules apply for delivery of messages and for preparation of service messages in connection with them:

- a.* Enter all received messages on the delivery sheet and the delivery register.
- b.* Have the messages collected from the receiving positions and taken to the delivery department as frequently as possible.
- c.* See that there are two legible copies; one for delivery and one for the retained records.
- d.* Give each message to be delivered a delivery number, the first after midnight being number 1, the series to continue until the next midnight. This is a convenient method of keeping a delivery record. Enter the message on the delivery register as follows:
  - Delivery number of message.
  - Time delivered to messenger.
  - Address.
  - Charges.
  - Messenger.
- e.* Fold each message so that, when placed in an envelope, the address will show through the transparent front. In case envelopes without transparent fronts are used, both the address and delivery number will be plainly written on the front.
- f.* Write the delivery number and the charges in ink on the face of the envelope.
- g.* The message or messages will then be entered on the delivery sheet as follows:
  - Delivery number of message.
  - Address of message.
  - Time the messenger leaves the office to make delivery.
  - Charges.



*h.* Route the messengers so as to deliver messages by covering the shortest route possible.

*i.* The messenger will deliver messages only to the addressee or to some person authorized by the addressee to accept and sign for them.

*j.* The messenger should have each person to whom a message is delivered sign the receipt on the delivery sheet and enter the time of delivery. In the field tactical messages are all delivered to the message center.

*k.* Should it be impossible to deliver a message, the messenger should make a notation to that effect and the reason therefor on the back of the message envelope.

*l.* Upon returning to the office, the messenger should return all delivery sheets and undelivered messages to the delivery clerk.

*m.* When a messenger turns in a delivery sheet, examine it carefully to see that all messages were signed for and the time of delivery entered. If a message is undelivered, the cause will be entered on the delivery register under "Remarks."

*n.* Require an immediate explanation of the messenger for any omission.

*o.* Should there be undelivered messages, prepare, for immediate transmission, service messages to the offices where these messages originated stating they are undelivered, and giving the reasons therefor.

*p.* If delivery is accomplished later, notify the originating office of that fact by a brief service message.

*q.* There will be occasions when delivery by messenger will cause delay. At such times make delivery by telephone. Avoid delivery of "death" messages by telephone if possible. This practice is dangerous and in some States it is forbidden by law.

*r.* Messages delivered by telephone will be entered on the delivery sheet and the time of transmission, together with the name and rank of the person with the word "Telephone" indorsed in the proper place on the delivery sheet.

*s.* Copies of messages which have been telephoned will be held for future delivery, at which time the addressee or authorized person or representative will sign the delivery sheet.

*t.* Use great care in telephoning messages. Before sending the message ascertain the name of the person at the receiver, and never send the message to any person other than the addressee except when requested by him to do so. Upon completion of the transmission, the message should be repeated back to make certain that no errors have occurred.

*u.* If the addressee calls for the message while it is in the hands of the messenger, or if, at a later date, he applies for a copy of the mes-

sage, he may, if known or properly identified, make a copy thereof, but a receiving blank will under no circumstances be furnished nor will a second copy be made on a receiving blank by anyone connected with the service. Receipts will be taken for messages delivered in this manner.

*v.* File with the day's business any message which it has been impossible to deliver, with a notation showing cause of nondelivery.

*w.* Never destroy any message because of nondelivery, even though requested to do so by the office of origin.

**Directions.**

1. The instructor will turn over to you messages as received by operators. Prepare these messages for delivery in accordance with the foregoing "Information."

2. Act as the delivery boy, and deliver all messages to the instructor.

3. Return to your office and, as counter clerk, complete the records on the delivered messages.

4. If the instructor gives you information concerning the delivery or nondelivery of any message which requires a "service" message, prepare such service messages and show to the instructor for correction or comment.

5. At the end of the period turn in all messages and records to the instructor for correction.



**SUGGESTIONS FOR THE INSTRUCTOR**

**Equipment.**

The same as in Unit Operation No. 19.

**Information.**

The student should be required to study the tariff book carefully under the headings of "Delivery of messages" and "Service messages" and to familiarize himself with Information Topic No. 6.

He should be required to memorize the principal abbreviations used in the service messages.

At this time the student should have daily practice in accepting, transmitting, receiving, and delivering messages.

**Directions.**

1. Require the student to prepare all received messages for delivery, using the proper forms.

2. Return some of the above messages to the student with various notations, such as "Unknown," "Left town," "No such street number," "Unable to locate," etc., and require him to prepare service messages and file them for transmission. This work must be carefully supervised.

**PROFICIENCY TEST NO. 2**  
**TELEGRAPH PROCEDURE**

**Equipment.**

The same as for Unit Operation No. 19.

**Information.**

The student will be required to accept two messages, not to exceed 30 body words in both, record and transmit them after calling the proper offices, and to receive with typewriter two messages of approximately the same length from another office and prepare them for delivery, the four messages to be completely handled in 15 minutes.

No errors in the messages will be allowed.

Four errors in procedure will be allowed.

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**PART III**  
**TOUCH TYPEWRITING**

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## TOUCH TYPEWRITING

### GUIDE KEYS AND FIRST FINGERING EXERCISE

#### Information.

This Unit Operation is designed (1) to accustom the student to keep his fingers in position on the guide keys, this position sometimes being called the "home position"; (2) as a finger exercise; and (3) to acquaint him with the location of individual keys in the home position. Later the use of these keys as *guides* to other keys will be taught.



Fig. 4.—Correct position of body and arms at the typewriter

Note that the chair is squarely in front of the desk, body erect, both feet flat on the floor, forearms horizontal, elbows close to sides. No muscles are tense

A telegraph operator keeps his message blanks at the right of his machine and inserts the blank in the machine with his right hand. He removes the completed message from the machine with his left hand. This should be practiced from the very beginning so that it may become mechanical.

#### Directions.

1. Sit erect and have your chair squarely in front of your desk, so adjusted that your forearms are horizontal when the tips of the bent fingers rest on the second row of keys. Do not allow your elbows to stick out or your hands to touch the frame of the machine. Place



your feet squarely on the floor beneath the desk. Do not brace them against the desk nor allow them to assume any position in which there is the least tension or strain. Assume this position at all times when typewriting.

2. Adjust the paper guide of the typewriter so that when the paper is inserted with the left edge against the paper guide the same width margin will be secured at both the left and right side of the paper. Insert two sheets of paper in the machine.

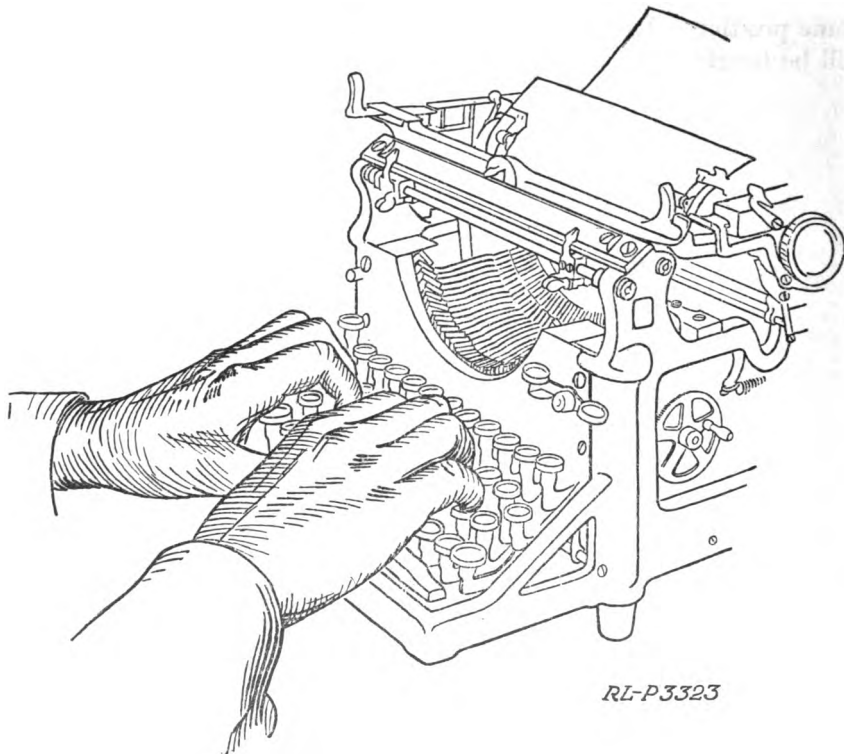


Fig. 5.— Correct position of hands and fingers

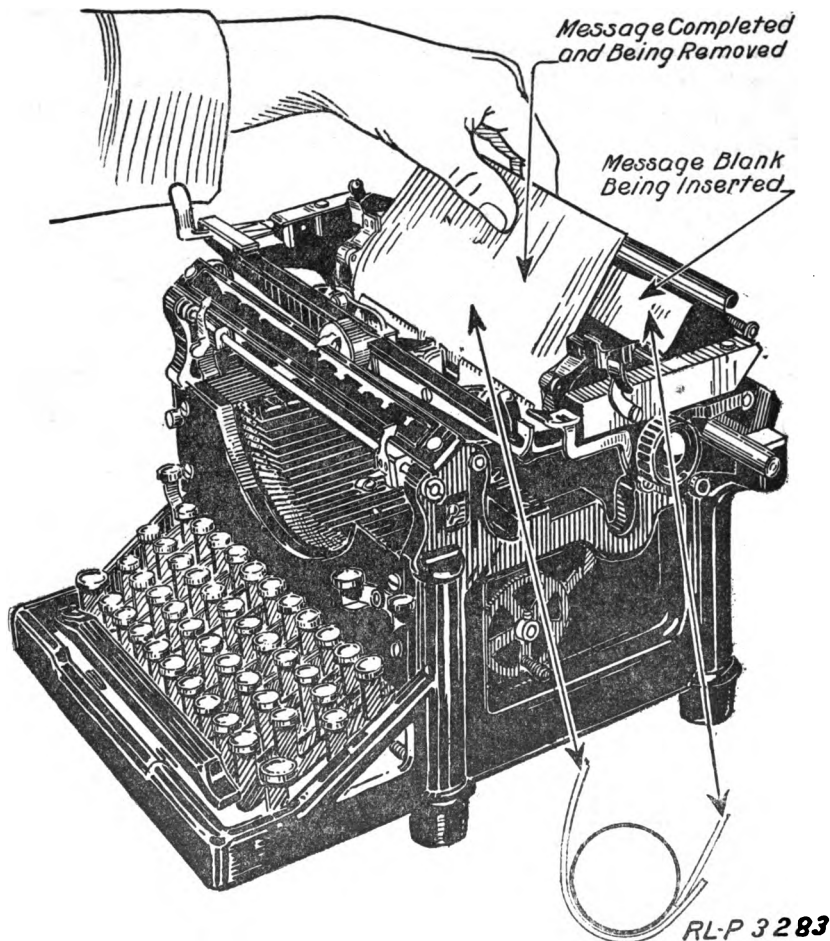
Note that the wrist is straight; tips of all eight fingers rest lightly on the guide keys

3. 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 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 L, K, and J. Use L K 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.



**Information.**

The student must keep his eyes on the chart and repeat the exercise many times. He must not try to write quickly, but to hit the keys at equal intervals of time, using a *light, quick, firm touch*. In his first attempts some of the letters will probably be very faint and others rather heavy. This is because his touch is not even. Some of his



**Fig. 7.—Removing message from typewriter**

The paper is grasped firmly by its upper edge and drawn from the typewriter with a steady pull fingers are not as strong as others. Continued practice will soon strengthen them. The student must *not glance at the keyboard*. A glance or two will undo the work of many hours. The student can learn to write by touch quicker than by sight, with the added advantages of greater accuracy and greater speed. To attain those results he must be prepared to follow the instructions in every detail.

**Directions.**

8. Write one line of each of the following words. *Do not allow the hands to touch the frame of the machine. Follow the fingering indicated on the chart, striking the keys at a regular rate. Do not look at the keyboard.*

**EXERCISE B**

asks;	all;	falls	half	halls
lad;	alas;	salad	lags	flags
fall	asks;	hall;	shall	galls
lass	flask	jags;	glass	glad:

9. Make three perfect copies of the above exercise.

**Information.**

The student may not be able to make a perfect copy on his first attempt. However, he should not let this discourage him, but should keep trying to get into the habit of hitting the right key.

**Questions.**

- (1) *Why must one guard against cramped, unnatural, or tensed positions when operating the typewriter?*
- (2) *Why should the operator learn to use one standard method of inserting and withdrawing paper from his machine?*
- (3) *Why is it necessary that the position of each key on the keyboard be memorized for rapid touch typewriting?*
- (4) *What would be the result if the forearm were held stiff and tense while typewriting?*
- (5) *Why do we say that one must form the habit of typewriting?*
- (6) *Give an example of automatic action as the result of habit.*
- (7) *Which shoe do you remove first when undressing?*
- (8) *Why is it advisable to have two thicknesses of paper in the machine at all times?*



### SUGGESTIONS FOR THE INSTRUCTOR

1. The classroom should be equipped with standard typewriter desks or solid tables with their tops 25 inches above the floor. The chairs should be adjustable if possible and without arms. Only universal keyboard machines should be used, all-capital machines if obtainable. Each student should be assigned a desk and a machine. He should be required to keep it clean and in good condition. The extra copies of the keyboard chart (Figs. 9 and 10) are to be pasted on cardboard and used by the students as constant references, so that there will be no temptation to look at the keys. Previous to the assembly of the class the instructor should have adjusted the marginal stops on all machines to give the proper length line, and set the line space lever for single spacing.

2. Assemble the class before having them start work on this Unit Operation and illustrate to them the following points:

- a. Proper position of body, arms, and fingers at the machine.
- b. Proper method of inserting, adjusting, and removing the paper.
- c. Proper method of spacing for the line,
- d. Proper stroke.

3. The instructor should prescribe that there be always two sheets of paper in the machine. This will decrease mutilation of the cylinder and accustom the student to the proper weight of stroke necessary to secure clear impression. It should be shown that a quick sharp stroke of the key with prompt release will produce a clear impression, while a slow pressure of the key will produce little or no impression on the paper. Time should therefore be used in locating the key, but having located it the stroke should be sharp, with a prompt release.

4. The instructor should watch the students closely and caution them frequently in regard to those points during the first few attendances, to make certain that they form the proper habits.

5. In the early exercises the student should be instructed to allow his fingers to rest lightly on the guide keys all the time. This enables him to learn the location of the other keys by feeling for them while keeping his eyes on the chart. As soon, however, as he has learned the location of all the letters of the alphabet, he should practice keeping his fingers *close to the guide keys*, striking each letter with a *low lift of the hand*. This will insure the proper combination of wrist and finger movement. Too much importance can not be laid upon the oft-repeated advice "*Keep your eyes on the copy while writing and think where the keys are. Do not erase.*" The

tendency of a beginner to look "once in a while" will be greatly increased if he is allowed to use an eraser, as he will almost invariably look at the keys when making a correction.

6. The questions given at the end of the Unit Operation are designed to promote discussion of the typewriting course. They should be discussed in the assembled class along with any other questions which may occur to the instructor.

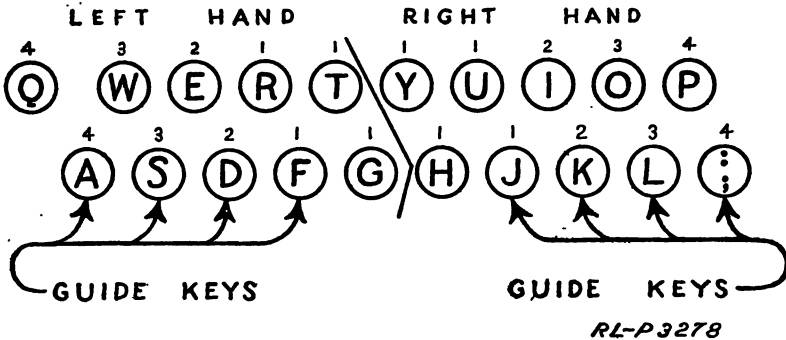
7. Students will be graded on the work done each period. For the first six Unit Operations, they will be checked on effort, position, neatness, and accuracy. In order to check the students on effort and position, it is necessary that the instructor watch their work very closely during the class period.

8. With beginners, the Unit Operations should be practiced in sequence and each should be mastered before allowing the student to proceed to the next. Care should be taken not to attempt to keep the class together on Unit Operations. Allow each student to progress according to his ability. The number of copies specified in the Directions under each Unit Operation must be required to insure the student sufficient practice on all parts of the keyboard.

**SECOND FINGERING EXERCISE**

**Information.**

The second fingering exercise is slightly harder than the first, and the tendency to look at the keyboard once in a while will be very great. The student, however, must not yield to this tendency, but must feel for the key, glancing at the chart for its location. Before commencing work on this Unit Operation he should reread the Directions given in Unit Operation No. 23.



**Fig. 8.—Keys of home row and upper letter row**

Numbers above individual keys refer to the fingers which strike those keys, 1 being the forefinger, 2 the middle finger, etc.

**Directions.**

1. Copy the following exercise, referring to Fig. 8 for the correct fingering:

**EXERCISE A**

awerqfa ;oiupj; awerqfa ;oiupj; awerqfa ;oiupj; awerqfa ;oiupj; awerqfa  
 awerqfa ;oiupj; awerqfa ;oiupj; awerqfa ;oiupj; awerqfa ;oiupj; awerqfa  
 teagrds pholkyi teagrds pholkyi teagrds pholkyi teagrds pholkyi teagrds  
 teagrds pholkyi teagrds pholkyi teagrds pholkyi teagrds pholkyi teagrds

**Information.**

In striking a capital on the right side of the keyboard, hold down the shift key firmly with the little finger of the left hand; in striking a capital on the left side of the keyboard, hold down the shift key firmly with the little finger of the right hand. Be very careful not to release the shift key until the proper letter has been struck. If the machine requires the use of the shift key for the period, be sure to hold it down firmly with the fourth, or little finger of the left hand until you have struck the period with the fourth finger of the right hand.



**Directions.**

2. Write one line of each of the words in the following exercise:

**EXERCISE B**

sails	jails	lakes	kodak	fields
sales	dirks	folds	fails	flukes
liked	doles	forks	awful	apples
julep	shift	flare	litre	quirks
Peter	Ruth	Delia	Lilly	Judith

3. Copy the following exercise:

**EXERCISE C**

Keep up the good work. Keep up the good work. Keep up the good work.

Good results are sure to follow. Good results are sure to follow.

He laughs last who works first. He laughs last who works first.

Real skill is the sure reward of wise efforts, says Harry K. Soper.

Speed will look after itself if you play your part well.

4. Make five perfect copies of each of the above three exercises.

**Questions.**

(1) *Why should the fingers be kept in the home position when not in use?*

(2) *How is efficiency in typewriting sacrificed when the typist looks at the keyboard while writing?*

(3) *Why is it important that the shift key be pressed down the entire distance before the type strikes the ribbon in capitalizing?*

(4) *Sometimes the bottom of a capital letter will be printed some distance above the writing point. What is the cause? How avoided?*

**SUGGESTIONS FOR THE INSTRUCTOR**

1. Before permitting the students to start work on this Unit Operation, assemble the class. Explain and demonstrate to the students the use of the following:

- a. The left and right marginal stops.
- b. The left and right marginal releases.
- c. The shift keys and the shift lock.

2. It should be explained that the left-hand marginal release should be used only when two or three letters are needed to finish the last word in the line. The right-hand marginal release will be used very little. Emphasis must be laid on the fact that in using the shift key the eyes should remain on the sheet being copied by the student.

3. The shift keys are a part of the keyboard and are to be located by touch in the same manner as the letter keys. Consequently it will be necessary to watch and correct all students who have a tendency to look at the keyboard when printing capitals.



### THIRD FINGERING EXERCISE

#### Information.

This Unit Operation involves the use of the three letter rows of keys. The student must refer to the chart (Figs. 9 or 10) for the fingering. The keys must be struck with a low lift of the hands and at a regular rate. Eyes must be kept on the chart or on this page. While working on this Unit Operation the hands must be brought back to the home position after each word and after each sentence.

#### Directions.

1. Make a perfect copy of the following exercise:

#### EXERCISE A

abcdefghijklmn; opqrstuvwxyz; abcdefghijklmn; opqrstuvwxyz;  
abcdefghijklmn; opqrstuvwxyz; abcdefghijklmn; opqrstuvwxyz;

I hope Peter will go on the Fourth of July. I hope Peter will go on  
I hope Peter will go on the Fourth of July. I hope Peter will go on

Ruth saw the swallow fly past the window of the Waldorf Hotel on Tues.  
Ruth saw the swallow fly past the window of the Waldorf Hotel on Tues.

Dear Sir: We have your letter of yesterday, but are unable at this time  
Dear Sir: We have your letter of yesterday, but are unable at this time

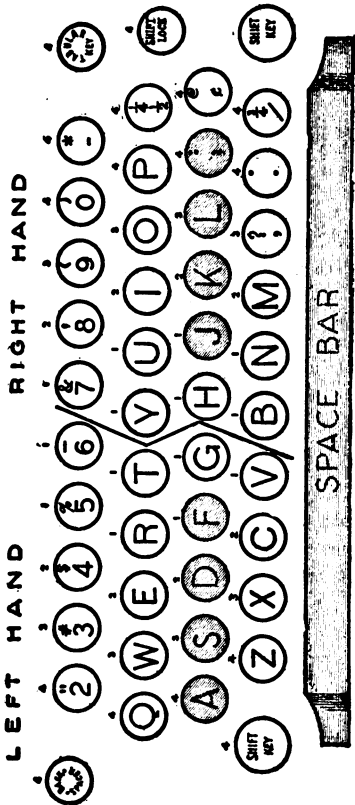
2. Write one line of each of the following words:

#### EXERCISE B

exceed	favor	delicious	wrinkles	shanks
major	quince	vexation	plaintiff	azalea
taxes	youths	grammar	buzzard	vampires
coiled	amethyst	juvenile	gambols	humbugs
hovels	axial	elastic	baptize	provoked

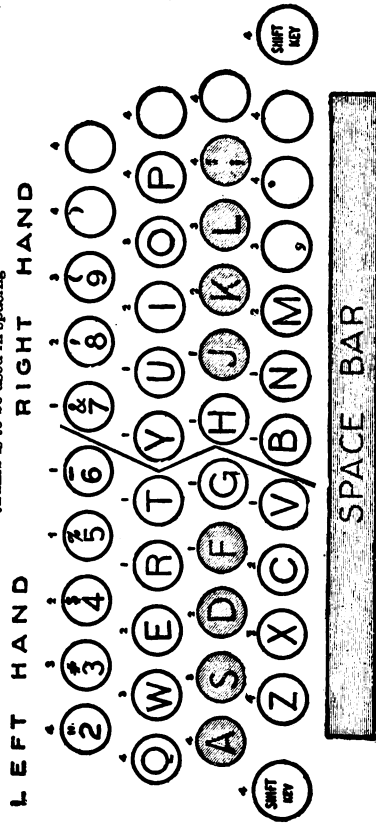
#### Questions.

- (1) *What is the usual cause of errors in typewriting?*
- (2) *How can errors best be avoided?*
- (3) *In striking a key the other fingers of the hand will frequently have a tendency to move along with the finger which is doing the striking. Why should this movement be eliminated?*
- (4) *Why can not speed be acquired in a short time?*
- (5) *Why should a beginner not try immediately for speed?*
- (6) *Why should the punctuation marks be struck more lightly than the letter keys?*



*RL-P 3315*

Fig. 9.—Practical touch typewriting chart for Underwood No. 5  
Numbers above individual keys refer to the fingers which strike those keys, the forefinger being No. 1, middle finger No. 2, etc. Shaded keys are guide keys. Only the right thumb is to be used in spacing



*RL-P 3316*

Fig. 10.—Practical touch typewriting chart for any standard keyboard  
Numbers above individual keys refer to the fingers which strike those keys, the forefinger being No. 1, middle finger No. 2, etc. Shaded keys are guide keys. The student should insert additional characters on the chart in accordance with the location of such characters on the keyboard. Only the right thumb will be used in spacing

### SUGGESTIONS FOR THE INSTRUCTOR

Before allowing the students to begin this Unit Operation, the instructor should explain and demonstrate to the class the use of the "*Line-space adjusting lever*," the "*Line-space release*," and the "*Variable line-space push button*." It should be pointed out that the release will be used to a great extent when filling out printed blanks, where each individual typewritten line must be adjusted to the printed line of which it forms a part, while the push button will be used when resuming work on a typewritten sheet which has been removed from the machine and it is desired to join accurately the new work with the old. The release should also be used when printing a figure which is to be raised or lowered from the regular line of print, as the cylinder may afterwards be restored accurately to its position for continuing on the same line.

The necessity of striking punctuation marks more lightly than letter keys must be impressed upon the students. This is to avoid punching holes in the paper.



## NUMERALS AND FIGURES

### Information.

The numeral 1 is made by striking the uncapitalized L. If the student is using an Underwood No. 4 machine, the naught is made by striking the letter O capitalized. The line for underscoring is made by striking the "6" key with the shift key depressed. The hyphen is made by striking the right-hand key of the upper row. Fractions not given as special characters on the keyboard are made by writing both the numerator and denominator on the same line, the diagonal stroke being used to separate them.

In underscoring, the word or words which are to be underscored should be written first, then the carriage moved back without turning the roller, and the underscoring put in.

### Directions.

1. Make two lines of each of the following groups, single space between lines of the same group, double space between lines of different groups.

#### EXERCISE A

11910. 32	"Robinson Crusoe"	left-hand.
3476. 19	Lyons & Co.	\$250 at 6%
\$4321. 80	5 - $\frac{1}{2}$ %	Burton & Co.
#67, 319	Leonard Valentine's house	1924 and 1925.
	(902.1)	<u>Expires in 1937.</u>

### Directions.

2. Write each sentence in the following exercise three times. Single space between like sentences, double space between groups of three sentences.

#### EXERCISE B

Wheat sold yesterday at 67- $\frac{3}{8}$  cents in St. Paul.

This battalion advanced today to the line (332.6 - 747.5) - (337.5 - 752.6).

Will deliver 100,000 rounds of 30 cal. ammunition to you at Hill 532 today at 12:30 P. M.

Trains marked with an asterisk (\*) run daily.

At 8:00 A. M. the 2nd Infantry will leave OCHILLE and march to your support.

Train #17 arrived 2- $\frac{3}{4}$  hours late.

Please ship us 100# World Beater flour at \$1.27, less 7%.

51st Signal Bn., Camp Alfred Vail, N. J., 12/12/24.

Mrs. Jenny Rives, 24 E. Charles St., Schenectady, N. Y.

Will meet you at 612 $\frac{1}{2}$  Madison Ave. at 2:30 P. M. tomorrow.

The "Mary Ann" will arrive at Boston at 4 o'clock today.





**SUGGESTIONS FOR THE INSTRUCTOR**

1. Before having the students start work on this Unit Operation the instructor should assemble the class and caution the students against looking at the keyboard when writing numbers and special characters. Due to the infrequency of use of these keys there is a tendency to relax when writing them. This should be guarded against especially while the typewriting habits of the student are in the formative stage.

2. The operation and use of the back-spacer and tabular keys should also be explained to the student. Since the telegraph operator will have very little use for the tabular accessories, it is unnecessary that he be especially practiced in their use. He should, however, know of the purpose of the various accessories so that he may use them when necessary.



## THE HAMMER STROKE

### Information.

The hammer stroke is an important aid to speedy touch typing and should be cultivated by the student. The following are easy words for practice of the hammer stroke. The hands should be kept just over the guide keys but must not rest upon them. The keys must be struck with a low lift of the hand. A sharp hammerlike blow should be used instead of trying to feel for the keys.

### Directions.

1. Practice 30 of these lines each day before copying Exercise B:

### EXERCISE A

the, and, of to, I, a, in, that, you, for, it, was, is, will, as, have,  
the, and, of to, I, a, in, that, you, for, it, was, is, will, as, have,  
the, and, of to, I, a, in, that, you, for, it, was, is, will, as, have,

that that that that that, you you you you you, for for for for for,  
that that that that that, you you you you you, for for for for for,  
that that that that that, you you you you you, for for for for for,

with with with with with, very very very very very, their their their  
with with with with with, very very very very very, their their their  
with with with with with, very very very very very, their their their

all, me, so, one, if, they, had, has, very, were, been, would, she, or,  
all, me, so, one, if, they, had, has, very, were, been, would, she, or,  
all, me, so, one, if, they, had, has, very, were, been, would, she, or,

may, letter, make, write, thing, think, truly, should, now, its, two,  
may, letter, make, write, thing, think, truly, should, now, its, two,  
may, letter, make, write, thing, think, truly, should, now, its, two,

thank, do, after, than, air, last, house, just, over, then, work, day,  
her, do, after, than, sir, thank, house, just, than, wire, radio, some,

then there there their their over over over then then their some some

over day work soldier sailor airship battleship private corporal sergeant  
memorandum memorandum memorandum memorandum memorandum

carbon carbon carbon carbon carbon carbon carbon carbon carbon carbon

dictation dictation dictation dictation dictation dictation dictation

manifolding manifolding manifolding manifolding manifolding manifolding

transcription transcription transcription transcription transcription

cablegram cablegram cablegram cablegram cablegram cablegram cablegram

telegram telegram telegram telegram telegram telegram telegram telegram

dexterity dexterity dexterity dexterity dexterity dexterity dexterity

statement statement statement statement statement statement statement

New York, New York, New York, New York, New York, New York, New York,  
Chicago, Chicago, Chicago, Chicago, Chicago, Chicago, Chicago, Chicago,

Philadelphia, Philadelphia, Philadelphia, Philadelphia, Philadelphia,  
St Louis; St Louis; St Louis; St Louis; St Louis; St Louis; St Louis;  
Washington; Washington; Washington; Washington; Washington; Washington;  
San Francisco. San Francisco. San Francisco. San Francisco. San Francisco.  
Cincinnati, Cincinnati, Cincinnati, Cincinnati, Cincinnati, Cincinnati,  
Boston Boston Boston Boston Boston Boston Boston Boston Boston Boston  
Cleveland; Cleveland; Cleveland; Cleveland; Cleveland; Cleveland; Cleveland;  
Detroit Detroit Detroit Detroit Detroit Detroit Detroit Detroit Detroit  
Battalion Battalion Battalion Battalion Battalion Battalion Battalion  
Division Division Division Division Division Division Division Division  
Regiment Regiment Regiment Regiment Regiment Regiment Regiment Regiment

**Directions.**

2. Prepare five perfect copies of the following exercise:

**EXERCISE B**

Every moment has its duty and its opportunity. Life is what we make it.  
Every moment has its duty and its opportunity. Life is what we make it.  
Every moment has its duty and its opportunity. Life is what we make it.

Are you marching or marking time? It takes about the same amount of motion.  
Are you marching or marking time? It takes about the same amount of motion.  
Are you marching or marking time? It takes about the same amount of motion.

It is important to live in an environment that stimulates one to effort.  
It is important to live in an environment that stimulates one to effort.  
It is important to live in an environment that stimulates one to effort.

For I may acquire dexterity in typing by judicious zeal and good hard work.  
For I may acquire dexterity in typing by judicious zeal and good hard work.  
For I may acquire dexterity in typing by judicious zeal and good hard work.

There is always room for the man who can be relied upon to deliver the goods.  
There is always room for the man who can be relied upon to deliver the goods.  
There is always room for the man who can be relied upon to deliver the goods.

Many persons make the mistake of trying to do too many kinds of work.  
Many persons make the mistake of trying to do too many kinds of work.  
Many persons make the mistake of trying to do too many kinds of work.

Keeping a little ahead of conditions is one of the secrets of good business.  
Keeping a little ahead of conditions is one of the secrets of good business.  
Keeping a little ahead of conditions is one of the secrets of good business.

There is a difference between sober initiative and foolhardy going ahead.  
There is a difference between sober initiative and foolhardy going ahead.  
There is a difference between sober initiative and foolhardy going ahead.

We can not be as swift as hares, but we can get up as much speed as a tortoise.  
We can not be as swift as hares, but we can get up as much speed as a tortoise.  
We can not be as swift as hares, but we can get up as much speed as a tortoise.

Staying power is more important than braying power.  
Staying power is more important than braying power.  
Staying power is more important than braying power.

**Directions.**

3. Read over Information Topic No. 6 before going on with the following exercises.

4. Make one perfect copy of the following exercises each period:

**EXERCISE C**

Dear Charles:

Do not give up just because you find a particular sheet extra difficult. The truth may be that you have tried to go too fast. If that is the case, you should seize the opportunity to go more slowly, and, above all, hit the keys with an equal degree of regularity. You may not be able to see the great advantage of this at first, but you will if you apply yourself to your task with a full belief that success is within the reach of only those who are painstaking and who hasten slowly. I should not give this advice so often were it not true that many students sacrifice accuracy on the altar of speed.

Wishing you every success, I remain

Yours sincerely,

**EXERCISE D**

My dear Arthur:

When I was a little lad I was often very idle. One day, having been set to do a task, I lay down in a shady nook and fell asleep. My father awakened me and told me that he had heard it said that a quick brown fox jumps over the lazy dog.

Feeling heartily ashamed of myself, I resolved to be a lazy dog no longer, but to be always on the lookout for any quick brown fox which might be jumping in my direction. After working very hard for a few hours my task was done. My father, having observed my resolute manner, rewarded me with a golden eagle. In after years I renewed my flagging energies many times by thinking of how I earned that golden eagle.

With best wishes for your future welfare, I remain

Yours sincerely,

**EXERCISE E**

To Whom It May Concern:

Laziness is the most hopeless disease. Avoid lazy students. Do not join in their conversation, for it encourages them in being idle and takes your attention from your work. You cannot talk and think where the keys are at the same time. In order to remember anything, you must concentrate all the powers of your mind upon one thing at a time.

Do not try to write too quickly. Your whole aim should be to produce perfect work. Do not write one word rapidly and the next slowly, but write all words at a regular rate. If you do this it will prevent a jerky style of writing, and will aid you in acquiring an even touch. Keep the hands near the keys and hit the keys with a low lift of the hands. Do not strike the punctuation marks with as much force as you strike the ordinary letters.

**EXERCISE F**

Dear Sir.

In your letter you ask why your daughter Lizzie is still in the sixty words a minute class, whereas her friend, Miss Jones, who entered at the same time, is

now taking dictation at the rate of one hundred words a minute. I am sorry to report, that upon inquiry, it appears that Lizzie is lazy. Each student is expected to practice the exercises in the textbook fifteen times. I find that Miss Jones never did an exercise less than the number of times required, and sometimes, for the sake of the extra practice, worked them twenty or thirty times. The result was that, though they joined the first speed class at the same time, her friend was able to pass the test at sixty words a minute within two weeks, while Lizzie has had to remain in it for a much longer time.

Hoping that you will now see that you have no just grounds for complaint, I remain

Very truly yours,

**Information.**

The following exercise is designed to keep the student familiar with the numeral keys and should be reviewed every week during the course.

**Directions.**

5. Make three perfect copies of the following exercise:

REVIEW EXERCISES

1. shady 67897 bunch 67897 flown 67897 steam 67897 throb 67897 shady 67897.
2. annoy 78423 touch 78423 drown 78423 dream 78423 knack 78423 annoy 78423.
3. track 84972 steal 84972 force 84972 friar 84972 claim 84972 track 84972.
4. slack \$2.71 world \$2.71 enjoy \$2.71 quail \$2.71 alarm \$2.71 slack \$2.71.
5. laugh 73590 flare 73590 story 73590 flirt 73590 juror 73590 laugh 73590.
6. state #9034 could #9034 guano #3094 level #9034 light #9034 state #9034.
7. lapse 6871\* sight 6871\* perch 6871\* civic 6871\* jaunt 6871\* lapse 6871\*.
8. shock 837- $\frac{1}{2}$  prove 837- $\frac{1}{2}$  silks 837- $\frac{1}{2}$  knoll 837- $\frac{1}{2}$  watch 837- $\frac{1}{2}$  shock 837- $\frac{1}{2}$ .
9. local 4- $\frac{3}{8}$  dodge 4- $\frac{3}{8}$  berry 4- $\frac{3}{8}$  atlas 4- $\frac{3}{8}$  sleek 4- $\frac{3}{8}$  local 4- $\frac{3}{8}$ .
10. found 29713 think 29713 joint 29713 gully 29713 lemon 29713 found 29713.
11. knave 30819 label 30819 irony 30819 hover 30819 churn 30819 knave 30819.
12. force 97.1% human 97.1% lymph 97.1% heath 97.1% honey 97.1% forge 97.1%.
13. horse (168) issue (168) forty (168) blame (168) learn (168) horse (168).
14. legal 90354 judge 90354 sadly 90354 pined 90354 leave 90354 legal 90354.
15. screw 245.1 ocean 245.1 clock 245.1 quart 245.1 lynch 245.1 screw 245.1.
16. month 81093 limit 81093 ideal 81093 occur 81093 sense 81093 month 81093.
17. happy \$8.31 lilac \$8.31 nasty \$8.31 reply \$8.31 plush \$8.31 happy \$8.31.
18. nudge (402) merry (402) nurse (402) lurch (402) nomad (402) nudge (402).
19. young 39571 plant 39571 motor 39571 labor 39571 brick 39571 young 39571.
20. shoes 8,390 merit 8,390 gains 8,390 fence 8,390 mirth 8,390 shoes 8,390.

**SUGGESTIONS FOR THE INSTRUCTOR**

1. During one of the periods devoted to this Unit Operation an opportunity should be given the students to read over Information Topic No. 7 and to ask any questions concerning the mechanism of the typewriter.

2. Beginning with this Unit Operation the students will be checked on speed in addition to the other requirements. A speed of 15 words per minute will constitute a perfect score in this Unit Operation.

3. In giving speed tests, the following method should be used:

Select such material for the test that there will be no exceptional amount of shifting, numerals or figures, or unusual and technical words. This should be material which the student has not previously read or copied. The material given for the speed test in this Unit Operation is chosen for these qualities.

4. Prepare the material in a greater amount than any student is likely to complete in the time allotted.

5. Have the material mimeographed in double spacing with lines lengthwise of the paper, so that line division will not be the same as in the student's copy.

6. Direct all the students to commence writing at the same time and to stop at the same time on signal from the instructor. The time required to give the test should be five minutes.

7. In scoring speed tests, the following rules will govern. The student's speed for the test will be computed as follows: The difference between the total number of words in the test and the number of errors, divided by the time in minutes, will give the index. This index must be equal to or greater than the speed in words per minute required for the Unit Operation or proficiency test being given. No student will be considered proficient, on whose paper the number of errors, counted as directed below, exceeds 7 per cent of the total number of words in the test. For example, suppose a student writes 165 words of the proficiency test given in connection with Unit Operation No. 28 in 5 minutes, having 8 errors. His speed is calculated as follows:

$$\frac{165 - 8}{5} = \frac{157}{5} = 31 \text{ words per minute}$$
$$\frac{8}{165} = 4.8 \text{ per cent}$$

which is within the allowable percentage. This student is proficient at a speed of 31 words per minute.



8. The following will constitute unit errors to be counted in speed tests, except that not more than one error will be counted in any one word:

- Each line written over another, either in whole or in part.
- Each omitted or repeated word, or group of words.
- Each word or group of words added or substituted.
- Each transposition of words.
- Each failure to capitalize or punctuate as in copy.
- Each failure to space between words.
- Each case of inconsistent spacing between lines.
- Each stroke of a letter instead of the space bar.
- Each mark of punctuation placed on the next line from the word it follows.
- Each word unfinished because of coming to the end of a line, the word being rewritten on the next line.
- Each case of running off the paper on the right-hand margin.
- Each irregularity in the left-hand margin.
- Each strike over.
- Each transposition of letters in a word, or figures in a number.
- Each incorrect division of a word at the end of a line.
- Each omission of the hyphen when needed at the end of the line.
- Each interlineation of a word or group of words.
- Each erasure.

#### MATERIAL FOR SPEED TEST

The War Department was created by Congress to assist the President in executing the laws passed by it to provide for the common defense. It is responsible to the President and he to the people for doing this in an efficient and adequate way. For this purpose it may make plans and develop policies. Congress, however, decides what the military policy shall be and how much money shall be spent for that purpose.

Our history shows that unpreparedness at the beginning of each war necessitated the reckless expenditure of money and materials. The organization of the War Department had to be enlarged each time to provide for the army of untrained men in the best way it could. At the beginning of these emergencies, the cost was no item. "Win the war" was the primary purpose, and all other purposes were subsidiary to this. But at the close of the war, when the storm had passed and in the calm of peace, the costs of this reckless but necessary expenditure loomed so large on the horizon that the other extreme was practiced. Under the guise of economy the Army has always been reduced below the point of peace-time efficiency and the department crippled from lack of adequate appropriations. This history has repeated itself with each war.

## SPEED AND ACCURACY

### Information.

The following exercises are intended to develop speed, accuracy, and an acquaintance with forms which the student will be required to use as a telegraph operator.

### Directions.

1. Copy each exercise carefully several times. Concentrate on one exercise each period. A perfect copy of at least one exercise will be required for each period.

### EXERCISE A

My young friends, make yourselves believe while in school that when you leave to take a position all the knowledge you have obtained, and a great deal more, will be required of you; then you will get the most out of your course. When a position is offered, you will accept it with more self-confidence; you will feel that you have the ability to do any work in your line that may be demanded of you. Some students go through the course in a half-hearted manner, doing only what is required to be done. There are others who seem to lack an important element—self-confidence. By their look, their dress, their walk, and their talk, they show lack of faith in themselves; an employer will not give them a trial because he sees they lack the qualities they should have—ambition, enthusiasm, aggressiveness, and efficiency. It is not enough even to look intellectual—as though you “knew”; you must look as though you could “do.” Do not believe the requirements for graduation are too high, but consider that the requirements of the business world are a little higher and then set your standards a little higher still. Feel satisfied only when you have reached your standards.

### EXERCISE B

Municipal government, or the government of a village or city, is, in many particulars, like a department store with its several departments of health, public safety, education, justice, etc., in which we are all stockholders and partners. It is to our interest to see that the fire department is well equipped, that the water pressure is sufficient, that its administration is efficient, in order that our property may be protected from destruction by fire. This interest is on the same level as is our interest in seeing that our grocer uses a pair of scales that will give us what we pay for. In no sense can this business instinct be construed into meaning allegiance or love of country. Our love is for our country, not for our State, county, or locality. It is the love of country that makes all State, and local government secure and worth while, that leads men to forsake home, business, and all personal interests and offer themselves for their country's good. No true American, by intimating that government is “essentially a business proposition,” will slander the memory of those whose unselfish acts and deaths have made government in the smallest unit possible. Patriotism is the true foundation and motive power of all popular government.

**Directions.**

2. The following exercise contains examples of the proper form for received telegraph messages. These forms should be observed carefully and the same arrangement followed in copying messages given in later exercises. Regular telegraph blanks should be used in copying these and subsequent messages. In handling these blanks the student should conform to the following standard telegraph practice:

*To insert a message blank.*—A supply of telegraph blanks should be kept within easy reach of the right hand. When the receiving operator reaches the period, after the address, on the message he is copying, he places a new message blank behind the cylinder with the top of the blank between the cylinder and the message blank already there. This second blank remains behind the first and works into place as the operator writes on the first. When the first blank is withdrawn from the typewriter, the second will be in place, or nearly so, to be copied upon.

*To remove the message from the machine.*—Grasp the paper, as shown in Fig. 7, and pull straight up. This pull must be steady so as not to tear the message. As the cylinder turns when this blank is removed, the second blank is drawn into place.

**EXERCISE C**

(1)

1N RK 10

NEWYORK NY 835A JAN 23 1925

ALBERT SMITH

836 EIGHTH AVE BIRMINGHAM ALA

WIRE ME AT ONCE IF YOU ARE COMING HOME LOVE

MRS ALBERT SMITH

910A

(2)

2N RK 12 COLLECT NITE

NEWORLEANS LA JAN 22 1925

J E JOHNSON

532 FRONT ST TRENTON NJ

PLEASE SHIP CAR CATTLE AT ONCE VERY MUCH IN NEED  
WIRE

SWIFT AND CO

935A JAN 23

(3)

10N RK 12 3 EXTRA COLLECT 35 CTS ONLY

WASHINGTON DC VIA BALTIMORE MD JAN 23 1925

HARRY TARREYTON

836 EAST NINTH ST NEWBRUNSWICK NJ

YOUR MAIL WENT FORWARD TODAY CARE NEWBRUNSWICK  
HOTEL

JOHNSON

1035 A

### EXERCISE D

Coffee derives its name from the city of Kaffa, Abyssinia, in which country, it is believed, the coffee tree originated. If left to grow in its natural state, a coffee plant may grow into a shrub fourteen to eighteen feet high, consisting of a long and slender trunk without branches on the lower part. The plant has thin and numerous roots that grow deep into the earth, one central root going straight down, the length of which depends on the height attained by the plant. When cultivated, however, the shrub is generally not allowed to grow beyond six feet in poor sandy soil and eight feet in rich soil. The coffee tree must be restricted to this height because, when the plant grows above this height, the difficulties of cultivating it increase. The leaves are at first of a bright green color, turning into the olive shade when they are full grown. Healthy coffee trees produce in the spring, on each leaf, from twelve to sixteen buds, which bloom promptly and have an exquisite perfume. A coffee plantation may be in full blossom on one day and two days later the ground will be covered with white flowers.

### EXERCISE E

A pencil is one of the simplest things in existence. It has only two parts, the lead and the cedar case, and yet very few people understand exactly how the lead is put into the pencil. If you will take a pencil that does not have a rubber tip on it and look at the end opposite the point, you will see that the cedar is in two parts, carefully glued together and that the lead is exactly half in one part and half in the other. The cedar is brought from Florida in little strips that are seven inches long and about one half the thickness of the pencil. Grooves of the exact diameter of the lead are cut into these strips, the lead is then placed in the grooves and the two pieces are glued together and put under heavy hydraulic pressure. After this the pencils are cut apart and shaped into the desired form by one machine in a single operation. The sand papering, polishing, varnishing and stamping follow. Then the pencils are labeled, tied and boxed ready for delivery. In short, a pencil that has a nickel tip and an eraser on it goes through thirty-eight different operations before it is ready for the market.

### EXERCISE F

(1)

The existence of confidence in banking institutions is seen in their functions of credit. People deposit money in the bank for the purpose of saving it or for the purpose of drawing checks against it. In either case the people have confidence in the bank. If they deposit for the purpose of saving, the bank uses the money commercially. It makes loans to industrial enterprises, receives interest in return and then pays to the depositor part of the interest thus received for the money used. Banks accept checking accounts because, by this means, they secure the use of surplus money. On the other hand, the depositor opens a checking account in order to pay his bills through the bank credits without the intervention of money transactions. Another leading function of banks is the discounting of notes, bills of exchange and other forms of commercial paper. A merchant may have a note payable in sixty days and may wish to realize credit on this note without delay. By taking it to the bank he secures in return for it money or credit. Naturally, for this accommodation he pays a discount, which is one of the chief sources of revenue to banking institutions. In a similar manner, banking houses discount bills of exchange.

(2)

13N RK 15 RADIO SS LEVIATHAN CAPE MAY JAN 23 1925 HOWARD S  
JONES PITTSBURG PA RECD RADIO OK BROTHER 1035A

### EXERCISE G

(1)

It is obvious that something must be wrong with either man or concern posing as a public promoter and ready at any and all times to take any and all enterprises and carry them through to financial success. Concerns and individuals willing and anxious to undertake all this do exist and are not hard to find, but speaking generally, they do not "make good." The very fact that they advertise their ability and willingness to secure capital for enterprise is enough to stamp their claims as false. A few successful "financings" would alone be sufficient, without any other advertising, to bring them all the enterprises to be financed that they could possibly desire. The chief difficulty of concerns that really finance enterprises is to escape the importunities of those who wish to bring them business of this kind. They do not dream of advertising.

(2)

7N RK 14 COLLECT 4 EXTRA BREWTON ALA 1038A JAN 23 1925  
HUDSON MILLING CO 816 BROADWAY NEW YORK NY CAN YOU  
USE COTTON MENTIONED IN LETTER JANUARY SEVENTEENTH  
GEORGE HUTTON SUPT ALA MILLING CO 236P

(3)

8N RK DH SELMA ALA JAN 23 1925 HAYES ATLANTA GA PLEASE  
WIRE QUICK BALANCE DUE FROM OPERATORS AND CLERKS  
FORM 4 R GEROME TOMORROW WINTERS 730P

### EXERCISE H

Fourscore and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that Nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting place for those who here gave their lives that that Nation might live. It is altogether fitting and proper that we should do this. But in a larger sense, we cannot dedicate—we cannot consecrate—we cannot hallow this ground. The brave men, living and dead, who struggled here, have consecrated it far above our poor power to add or detract. The world will little note nor long remember what we say here, but it can never forget what they did here. It is for us, the living, rather to be dedicated here to the unfinished work that they have thus far so nobly carried on. It is rather for us to be here dedicated to the great task remaining before us, that from these honored dead we take increased devotion to the cause for which they here gave the last full measure of devotion, that we here highly resolve that the dead shall not have died in vain; that this Nation, under God, shall have a new birth of freedom; and that government of the people, by the people, and for the people shall not perish from the earth.

## EXERCISE I

(1)

The shore is made up of rocks, millions of rocks, rocks as big as a house and rocks as tiny as a humming-bird's egg; as the big waves roll in, they lift the smaller pebbles and carry them a little way up the beach and then, receding, they drop them back again and they roll and tumble and make a noise like a hundred trains of cars in one, but it lasts only for an instant and then for a brief space, there is absolute quiet, the quiet of death. It is a dreary noise, that rolling and tumbling and that snakelike hiss as the waters recede and it is made all the more dreary by the dense silence that comes between the retreat of one wave and the advance of the next. Now and then, there are patches of white sand and when I get to one of these I stoop down and take a handful and scatter it afar; it is like throwing fire, for it is full of phosphorus and the least disturbance makes it gleam and glisten like molten gold.

(2)

8N RK 10 GOVT BALTIMORE MD 836A JAN 23 1925 POSTMASTER  
GENERAL WASHINGTON DC WALTERS HUSTED HALTER HOBBY  
SWIFTLY POLISH HABERSACK PULPIT CROCODILE WHOLSTON  
SEYMOUR 931A

(3)

11N RK SVC LOSANGELES CALIF YR 47 PD BLUE CEDARRAPIDS  
FERTILIZER CO SGD LOSANGELES DISTRIBUTING CO UNDELD  
NSF HERE AS CEDARRAPIDS FERTILIZER CO CEDARRAPIDS IA  
JAN 23 1925 533P

## EXERCISE J

And there is no better way of making a sure thing of failure than by allowing yourself to be picked before you are ripe—and this applies especially to those who are now but students. I remember when I was a lad—it is a good many years ago, of course, more years than I like to look back upon, but I can remember those days, well enough, and I recollect that I had all the traits of the ordinary boy and that I possessed some of those traits in a superior degree. I had the longing common to all boys for the fruits of the earth and I had just the same disposition to gather them into my midst before they were ripe that boys have now. Red apples were my delight and long before they had begun to apply the rouge to their cheeks I used to bombard the trees with sticks and stones. For the life of me I cannot now reason out what there was in those hard, acrid, stonelike green lumps that appealed to my appetite, and to this day I cannot understand why a boy will hanker after such things—but they do and I did at that time.

## EXERCISE K

(1)

When the moose yard in the winter, that is, restrict their wanderings to a well-defined section of the forest or mountain, trampling down the snow and beating paths in all directions, they browse off only the most dainty morsels first; when they go over the ground a second time, they crop a little cleaner; the third time they sort still closer, till by and by nothing is left. Spruce, hemlock, poplar, the

barks of various trees, everything within reach is cropped close. When the hunter comes upon one of these yards the problem for him to settle is, Where are the moose? for it is absolutely necessary that he keep on the lee side of them. So he considers the lay of the land, the direction of the wind, the time of the day, the depth of the snow, examines the spoor, the cropped twigs, and studies every hint and clew like a detective; Uncle Nathan said he could not explain to another how he did it, but he could usually tell in a few minutes in what direction to look for the game. His experience had ripened into a kind of intuition or winged reasoning that was above rules.

(2)

12N RK SVC BREWTON ALA CT OR GBA YD HUDSON MILLING CO  
SGD HUTTON SUPT ALA MILLING CO NSN AS 8167 BROADWAY BA  
NEWYORK NY JAN 23 1925 1233P

(3)

3N RK 42 NL SEATTLE WASHN JAN 22 1925 EASTMAN GARDNER  
LUMBER CO LAUREL MISS PLEASE SHIP OUR ORDER OF JANUARY  
THIRTEENTH ORDER NUMBER SEVEN THREE NAUGHT FOUR  
SEVEN ONE CAR TWO BY FOUR TWENTY TWO FEET LONG ONE  
CAR TWO BY SIX TWENTY THREE FEET LONG TWO CARS ONE BY  
ONE AND ONE QUARTER WIRE ANSWER QUICK SEATTLE CONSTN  
CO 936 A JAN 23

#### EXERCISE L

(1)

Nothing is more fitted to elevate the mind toward the infinite than the pensive contemplation of the starry vault in the silent calm of the night. A thousand fires sparkle in all parts of the somber azure of the sky. Varied in color and brilliancy, some shine with a vivid light, perpetually changing and twinkling; others again, with a more constant light, one more tranquil and soft. While very many only send us their rays intermittently, as if they could scarce pierce the profundity of space.

To enjoy this spectacle in all its magnificence, a night must be chosen when the atmosphere is perfectly pure and transparent, one neither illuminated by the moon, nor by the glimmer of twilight or of dawn. The heavens then resemble an immense sea, the broad expanse of which glitters with gold dust or diamonds.

(2)

I do not know how it is at the present time because I have not made a deep study of the matter but, when I was a boy, there was not a lad in all the country round who did not feel it in his bones that he was cut out to be a sailor, that he was born into the world for that sole purpose and that, therefore, it was his duty to defy all parental advice, tie his clothes up in a bundle some dark night, and crawl out into the shed from a back window, drop to the ground and run away to sea. As a rule the door would have given him a much more easy means of exit and would have been fully as safe so far as the other members of the family were concerned, for they were all sleeping soundly in their beds, but the rules of the game as laid down by many a sea tale were very explicit on the point that the window was the proper card to play and so the window it was in every

case. When the boy came back, which was usually in about three days, he crawled into the house in the same way without making any noise about it, mindful of the fact that his father had retired for the night and that it would be a sin to wake him up when it was not at all necessary to do so.

### EXERCISE M

(1)

And now the typewriter was successfully launched upon the ocean of commerce. It was no longer a freak or a plaything, it was a necessity. But now comes the strangest part of the whole affair. Every machine had to have an operator if it were to be written upon, somebody must perforce do the writing, that was evident. At first, these operators were bright employees, possibly the corresponding clerk of whom I have spoken. Then the routine was something like this: The letters were written in pen or pencil and handed to the machine operator who in turn copied them on the typewriter, put them through the copying press and sent them out in the mail. Of course there was something wrong with this plan and it soon became evident what it was. Nothing was gained except the one thing that absolute legibility resulted, but so far as the work of the original composer was concerned, it was in no wise lessened; his drudgery was the same as before; it was only the result that was bettered.

(2)

4N RK 47 BLUE LOSANGELES CALIF 836A JAN 23 1925  
 CEDARRAPIDS FERTILIZER CO CEDARRAPIDS IA PLEASE  
 WIRE US CAR NUMBERS OUR ORDER JANUARY TWELFTH  
 ONE CAR FOURTEEN PERCENT ACID PHOSPHATE ONE  
 CAR BLOOD AND BONE ONE CAR NITRATE OF SODA  
 WILL HAVE TO CANCEL UNLESS THIS ORDER CAN BE  
 FILLED AT ONCE ALSO MAIL US BILL OF LADING  
 WIRE ANSWER COLLECT IMMEDIATELY LOSANGELES  
 DISTRIBUTING CO 1000A

### EXERCISE N

(1)

Probably my friend was right, his sample was one which it would be hard to duplicate; it makes me think of a family I know of that had trouble with its cooks. Finally, however, they got hold of one that seemed to fill the bill; no burned steaks; no policeman in the kitchen and all was lovely and serene until one fine day the mistress of the house got hold of a cook book which set forth a plan for the making of many fine dishes, and the cook was called up stairs. "Mary," said the lady of the house, "I want you to make some of this. Follow the directions very closely indeed and be sure you do not omit anything." An hour afterwards there was a smell of burned cotton coming up from the kitchen and the mistress went down to



see what was up. On the table lay the cook book, open at the proper place, but the cook was gone. Somewhat perplexed, the lady took up the book and read "Mix well, then sit on the stove and stir constantly." The mystery was explained; the cook had followed directions very carefully indeed. Whether she "stirred constantly" has never been learned—probably she did.

(2)

5N RK 6 CABLE LONDON JAN 23 1925 BUGARDT CHICAGO  
JE SUIS ICI LEBLANC 1036A

(3)

14N RK 14 FREE SY NEWYORK NY 235P JAN 23 1925  
TRAGENT PHILADELPHIA PENNA PERCH MRS ANN  
STEWART 836 EAST MAIN ST BOWER MRS JAMES  
STEWART TRAGENT 255P

#### EXERCISE O

By having granted that much, that you can succeed as a stenographer and typist, we come to the point that there are degrees of success, that what would be accounted great success in one would be but mediocre attainment in another. You may have a piece of steel which would be excellent for the making of a magnet, because it is soft, but which would be utterly valueless as material out of which to fabricate a watch-spring, or at any rate would have to go through the tempering process—would have to be hardened by fire—before you could use it for such a purpose, and then its value for magnet making would be lost forever. It is just so with the stenographer and typist, and you have to be one thing or the other. You may be soft steel and as such find employment where such material is wanted, and where, therefore, it fills the bill and everybody is satisfied; but if you are called upon for the finer grades, if a watch-spring is what is desired, you have to go through the tempering process, after which you can never again be satisfied with the humbler calling.

#### EXERCISE P

There must be some school where waiters are trained to do the things they do, for they all go through the same motions in the same way; they do not vary a hair's breadth from the regular routine and they never came naturally by it all. When I have my legs nicely placed under the table I glance down and notice that there is a napkin neatly folded in front of me; I used to take it up, unfold it and put it under my chin, but I do not do it any more, because it is not the

right thing to do. I let it alone until James takes it and twists it into a sort of cone and stands it on its big end; I do not know why he does it and maybe he does not, but he never fails. Then he goes off somewhere and gets a goblet, wipes it on a napkin he carries up his sleeve and places it on the table, then goes off again and comes back with some cracked ice.

### EXERCISE Q

When the leaves on the trees begin to change from vivid green to rainbow tints and mountain and valley revel in all the hues of the painter's palette; when I look at the hills through half-closed lids and imagine myself gazing with rapture on Turner's famous painting of "The Shipwreck"; when the corn is cut and gathered into little stacks like Indian tepees and the fields where they stand look like homemade quilts, with patches of brown earth, green stubble and bright yellow pumpkins; when the wild goose honks at me in the early morn and the black duck makes his call on me at eventide; when the piping tenor of the little frogs and the deep bass of the bulls sound their chorus all through the lonely night from the edge of every pond and marsh; when all these things happen and some others which I cannot now recall, I feel an intense desire hard to define and often harder still to gratify, a longing which is akin to an instinct and yet one which will not be denied; it is the call of the wild and when I hear it I know it is up to me to go into the attic and get out my gun.

### EXERCISE R

(1)

As the Maud got within a mile of shore, we could see that she was sailing high and dry, with the young woman at the helm and the father watching the rigging. The force of the gale took her a little off her course and it was seen that she would be obliged to make for a point beyond the end of the breakwater instead of coming in through the gap, which was no great hardship, as the water inside the harbor and under the lee of the rocks was smooth. She was handled with such skill that admiration showed itself upon the face of every man on the wharf, and more than one pair of lips were on the point of voicing their owner's praise, but they never did, for all at once a groan went up as the young woman was seen to stand up in the stern of the sloop with a part of the tiller in her hand; it had broken short off at the post and the boat was left to drift helplessly in the trough of the sea.

(2)

6N RK NPR WASHINGTON DC JAN 22 1925 TRIBUNE NEWYORK NY  
THE RESULTS OF A VERY INTERESTING INVESTIGATION BEING  
CARRIED ON AT THE PAULSON LABORATORIES WILL BE MADE  
PUBLIC TOMORROW BY MR JOHN Q NELSON. FOR THE PAST  
TWO AND ONE HALF YEARS MR NELSON HAS BEEN INVESTI-  
GATING THE SOURCE AND MEANING OF CERTAIN SIGNALS WHICH

ARE RECEIVED AT INTERVALS OF THIRTY ONE HOURS AND TWENTY SEVEN MINUTES. THE SAME SET OF SIGNALS IS RECEIVED ON ELEVEN CONSECUTIVE OCCASIONS, AFTER WHICH A NEW SET IS RECEIVED ELEVEN DIFFERENT TIMES. THE SIGNALS CONSIST OF GROUPS OF THREE MUSICAL NOTES, ALL NOTES BEING SOUNDED FOR THE SAME LENGTH OF TIME, NOTES IN THE SAME GROUP BEING SEPARATED BY INTERVALS OF SILENCE EQUAL IN LENGTH TO THE LENGTH OF THE NOTES. THE SIGNALS ARE RECEIVED ON A WAVE LENGTH OF TWENTY-ONE METERS AND VARY NOTICEABLY IN STRENGTH WITH ATMOSPHERIC CONDITIONS. MR. NELSON HAS HAD ASSOCIATED WITH HIM IN HIS INVESTIGATION MR PAUL W FRIESLAND, THE CIPHER EXPERT OF THE DEPARTMENT OF AGRICULTURE. HADLEY 935P.

### EXERCISE S

At last we arrived at the brook. We had walked for over an hour since we left the road, up hill and down dale and at length we came to a little run, high up among the crags and peaks and in the midst of this dell flowed the brook, clean and clear as cut glass, now rushing and roaring over big boulders, now flowing quietly over a shelf of rock or a sandy bed and now resting at the foot of some huge cliff in a wide pool; it was in the shade of the ferns on the bank of such a pool or beneath the patches of foam which floated on its surface that I knew I would find the finny tribe I was in search of. It was good to look at and I was glad to be there for more reasons than one. My guide gave me some ideas as to the general lay of the land and the course of the brook and said he would leave me there while he went down stream a mile or two, he would then fish down; I was to fish down also and he would wait for me where we were to start for home, at a place where the traveled road made its first crossing over the stream; then he went away.

### EXERCISE T

The time we have for preparation is such a little part of the sum total of our existence that the loss of the work of one day makes a sad inroad upon it. A wasted day is a cypher in our receipts and when the clock strikes six and the book is closed, even the gods cannot change it. Boast not thyself of tomorrow for it has not yet come and its message has not been delivered, nor yet of yesterday for even the gods cannot change it, but today, today is the time in which you can make history for yourself and if it ends with a task well done, with all that can be expected of you, properly finished, then the gods themselves can do no better. The time allowed to accomplish any result in life is limited and the loss of the work of a single day adds a day to that time and takes away a day from something else of equal or greater importance. This finally leads to a grand deficit and to mental and moral bankruptcy, and it marks the difference between the successful and the unsuccessful man.

### EXERCISE U

When a man is alone in a boat on the vast ocean of life, when the wind and the tide are both against him, when the waves run mountain high and even the hardiest seabirds seek safety on land, when the sun has sunk below the horizon and the lights on the shore shine dimly and afar off, or maybe can not be seen at all through the thick fog of despair, or the blinding spray of poverty and misfortune, when trouble in many shapes looms up dark and foreboding through the

thick mists, when no help is at hand and the very elements seem to be in league against him, then there is one kind of pull and only one that will be of avail. He must take a firm grip on the oars, must dip them deep in the water and bend his back with every stroke, must use every ounce of power that lies in his muscles, and, though his limbs ache and his breath fails, must keep the prow pointed ever in one direction, always into the teeth of the gale, without for a moment ceasing his efforts.

### EXERCISE V

The day is at hand when one may say without question that business is practically carried on by correspondence alone, or perhaps a better way of putting it would be; There is little business which could be carried on without correspondence; and one might add that as a rule the greater the daily mail the greater the business. Letters beget letters, and business grows just in the proportion that the mail bag becomes heavier each day. If such is the case, then it follows naturally that the motto: "Do it now and do it quick," which I have quoted, must be applied to the getting out of the daily mail.

### EXERCISE W

All great men have had ambitions and no doubt it was the ambition which made them great, but the outcome is often more far-reaching than would appear at the first glance. Peter Cooper had an ambition to make the best glue that could be made and he stuck to it until he made the kind that would stick to everything else. It gave him fame and fortune, and yet the last place in the world where one would go in search of ambition is a glue factory, or so it seems to me. It is good for a man to have an ambition but he ought to be sure he gets the right brand, for you can not always tell by reading a label on the box. There are men who would have done great things if their ambition had pointed in the direction of the anvil or the shovel, the tailor's goose or the cobbler's bench, but it did not; it was aimed at the church pulpit or the lawyer's shingle and while it was so strong that it kept them going until they reached the coveted spot, when they got there it was only to find that the space was too big for them to fill.

### EXERCISE X

But to get back to the shadows. I have always liked that line in the Bible which tells us that "sufficient unto the day is the evil thereof," and, of late years, have tried to keep it in mind, for it means to me just what the old farmer told me when I was a boy, that I must not be afraid of a shadow, or in other words that I must not look ahead to tomorrow with the fear in my heart that I may run up against the shade of some huge dragon that by and by will come roaring out of nowhere with its mouth wide open and ready to chew me up. I do not know who gave birth to the slang phrase which has now almost become a classic: "I should worry," but in any case he was a friend to the human race, for the philosophy in it is all wool and a yard wide. The man who does not worry will not live in fear of his shadow because he will not look for it and will not see it, or if he does he will know that it is but an ugly and misshapen thing that one need not be afraid of, that it is nothing to worry over or cause him to make even the smallest change in his way of doing things, but rather is a thing to smile at and then to forget. Do not be afraid of your own shadow, I want to repeat it again and still again, it is the best of advice and you who are now on the threshold of life have a chance to carry it into effect; I cannot do so but he is a wise man who learns from the scars on the body of others, for, when the end comes, he will have just so many scars less on his own.

### EXERCISE Y

When I was a lad I ran across a line or two in the Bible which bothered me not a little and which read like this: "For unto every one that hath shall be given and he shall have abundance, but from him that hath not shall be taken away even that which he hath." It troubled me, as I have said, for I could see no just reason why, if I had five cents and another boy had a quarter, his money should go on to increase and multiply while my nickel had to go for car fare, but I see things differently now and I have learned that there is nothing more true in the Good Book. It was my application of the law that was at fault, for a law it is and it fits every phase of our social and business life. What we are all aiming for is success. It is the right and proper thing for us to do, and if you will go into any business office in the land and apply the rule I have quoted, you will find that it is "he that hath" that has the most power, reaches the higher place and gets the larger salary, and those are the things by which success is measured in these days. Put two boys from the same school into the same office on the same day and in like positions and in nine cases out of ten you will find that one of them will forge ahead of the other and that before long the latter will be out of the race, and you will also find that the winner is "he that hath." As a rule, it takes but a day or two for the keen eye of the boss to see the difference and "he that hath" will become a fixture, while "he that hath not" will be told that he does not seem to be quite up to the mark, that he ought to have a bit more experience before trying to do office work, and "that which he hath" will be taken from him and out he goes into the cold world, ready to throw business to the dogs and take to digging ditches or being an actor in the movies.

And here is something about the word "experience," a word which has been hurled at a good many beginners with fatal results. One may be inclined to ask where he can get it if nobody will give him a chance. The trouble is that he does not know the truth or does not grasp the fact that he can get more real experience by spending an extra month or two at school than in any other place on earth. People used the word because there seems to be no other to take its place, but it is not the right word, for no boss cares a rap about experience if, in its place, there is ability. In the slang of the street, it is the fellow who can furnish the goods that is wanted, and I have known a good many students who were better able to do that than many another who had pounded a machine for year in some office. Take a boy from a cheese factory and put him with a concern which makes autos and how much of value would there be in what he would call his experience? But, when you speak of ability, it is a horse of a different color. The man with ability will succeed anywhere, and that is really what a boy wants when he prates about experience.

### EXERCISE Z

Many and many years ago, deep in the shadow of the dark green wood, there grew a violet. When the warm days of May came on she would unfold her hood of purple and greet with a smiling face the narrow shafts of sunlight which she now and again through the tangled branches of the old oak tree at the foot of which she grew. Night after night she was lulled to sleep by the tinkle of the little brook as it danced and rippled onward through wood and through meadow on its long journey to the sea; morning after morning she was awakened by the twitter of the birds as they peered at her through the chinks between the leaves and sang to her of the great world outside the wood. And so the summer came and went and the bleak heralds of coming winter moaned through the tree tops

and when her feathered companions bade her good-bye and flew away toward the sunny south, and the soft-white flakes sifted down upon her, and the Frost King shut in the song of the brook, she dug her roots more firmly down into the rich warm earth, and lay dreaming of the time when her good friend, South Wind, should again bid her don her feminine finery and the birds and the brook should again gossip with her of the great things which they had seen far beyond the boundary of the dim and silent wood. And so, as time went on, she grew hearty and strong, and with her strength increased her beauty, also.

But still she murmured and complained not a little of her lot. The robin sang to her of beautiful women upon whose bosoms rested violets whose fragrance could not compare with hers. The saucy little wren lisped to her of the lover he had seen under the maple at the edge of the wood and who had given to his mistress a nosegay of violets but they were as nothing, he chattered, when compared with her own radiant hues. And the little brown-breasted sparrow whispered to her of the sick child who kissed and fondled the bunch of purple blossoms which its mother had placed in its fever-stricken fingers. And the modest woodland violet heard all these things and deep down in her heart she longed to take part in the joys and sorrows of the outside world.

At last there came a time when the seasons seemed to reverse the order of their coming. The winds of March were hot, like those of the great Sahara; the showers of April refused to fall, or were sucked up in an instant by the parched earth; the sun of May burned and shrivelled like that of August; the springs dried up and all the flowers of the field withered and died. But through all this dreary time the woodland violet, protected by the shadow of the gray old oak and cooled by draughts of crystal from the little brook, thrived and flourished and grew hearty and strong as of old and again put on her glorious attire to which she had added hundreds of beautiful blossoms.

One day a fisherman strolled along the bank of the little rivulet. He was an old man, and, from his bearing, it would seem that he cared but little for the sport in which he was engaged, which was true; he wandered apart and alone filled with a great sorrow. His best friend, a man among men, a hero to all the earth for his deeds of charity and good will, lay dead—and the whole world mourned. As the fisherman reached the oak he cast aside his tackle and throwing himself down upon the ground he wept as only a strong man can weep in the extremity of his grief. Then his eyes caught sight of the purple garden at his feet and through his tears there came a smile. "They were his favorites," he whispered, and he gathered the pretty posies, down to the tiniest bud, and went his way.

Nextday the hero lay in state in the marble halls of the Capitol and a mighty throng passed review before all that remained of their universal friend; but one and all marvelled at the wondrous beauty of the bunch of violets which lay upon the dead hero's heart. And that night the birds and the brook told the story of the honored place attained by their humble friend, the woodland violet and said, with one accord "It is always so; to him who waits and hopes, allowing no discouragement to dim the beauty of his soul or the pride of his strength, there comes the greatest of all things at the last."

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**SUGGESTIONS FOR THE INSTRUCTOR**

1. Opportunity should be given the students to read over Information Topics 8 and 9 at attendances during which work is done on this Unit Operation. Before doing Exercise C of this Unit Operation the students should have explained to them the meaning of the various parts of a telegraph message and the method of inserting telegraph blanks into the typewriter. They should be required to keep and handle their blanks as prescribed in Direction 2 of this Unit Operation.

2. Speed tests must be given at every attendance when the student has commenced work on this Unit Operation. The following speeds will constitute perfect scores:

Exercises A to D, inclusive, 20 words per minute.

Exercises E to G, inclusive, 22 words per minute.

Exercises H to Q, inclusive, 25 words per minute.

Exercises R to Z, inclusive, 30 words per minute.



**PROFICIENCY TEST NO. 3**  
**TOUCH TYPEWRITING**

The student will be considered proficient in Touch Typewriting when he can, without looking at the keyboard, copy strange matter at a speed of 30 words per minute. His paper should be scored by the method explained in the Instructors Guide section of Unit Operation No. 27.

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**PART IV**  
**EQUIPMENT**

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## PRIMARY CELLS—THE GRAVITY CELL, TYPE BA-12

### Equipment.

Complete parts for type BA-12 gravity cell as follows:

- 1 glass container, 5 inches diameter by 7 inches high.
- 1 zinc element (crowfoot type).
- 1 copper element.
- 3 pounds copper sulphate (blue vitriol).
- 1 voltammeter, Weston, type 280, with leads.
- 1 type BA-10 cell (fully charged).
- 1 bottle paraffin oil.

### Information.

Cells are divided into two general classes: *a*, Primary cells; *b*, Secondary cells.

Ordinarily a primary cell consists of two dissimilar metals (elements) immersed in a chemical solution called *electrolyte*. An electromotive force is produced in this cell by chemical reaction between one of the metal elements and the chemical solution or electrolyte.

When in use, a primary cell will continue to produce electricity until the active metal element is eaten away and the chemical solution weakened. In order to continue the production of electricity from this cell, the active metal element must be replaced by a new one and the weakened electrolyte replaced by a new solution.

The secondary or storage cell is somewhat similar to a primary cell. The storage cell, like the primary cell, generates electricity by chemical reaction. The principal difference, however, is that before the storage cell can generate electricity, it must first be *charged*. In other words, a direct current from an outside source of electricity, commonly a generator, must be sent through the cell. After the cell has been in use for some time, the chemicals, as in the primary cell, cease to function. Instead of replacing the elements or the electrolyte, a current of electricity from the generator is again passed through the cell for a certain length of time, after which the storage cell is again ready for use.

This course deals only with primary cells. Although there are many types of primary cells, only two types are commonly used in connection with telegraphy, namely, the gravity cell and the Edison cell. The gravity cell will be studied in this Unit Operation and the Edison cell in the Unit Operation following.

### THE GRAVITY CELL

The gravity cell is one form of primary cell very extensively used in telegraph work where only small, steady currents are desired.

As shown in Figure 11, this cell consists essentially of two metal elements called electrodes, one copper and the other zinc, contained in a cylindrical glass jar with a flat bottom and open top. The electrolyte used in the cell is a solution of sulphate of zinc. In order to prevent the accumulation of gas bubbles at the copper plate from increasing the resistance, or polarizing the cell, a second solution called a *depolarizer* is used. The depolarizer is sulphate of copper.

The zinc element is cast in the form of a crowfoot which is suspended from the rim of the jar by a hook. A binding post for making wire connections is incorporated in this hook. The crowfoot arrangement of the material is used to obtain a greater surface for making contact with the electrolyte.

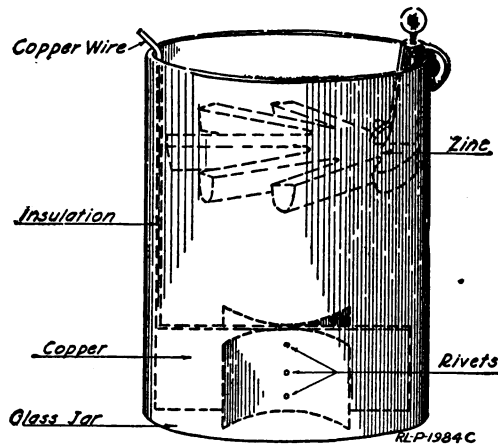


Fig. 11.—The gravity cell, type BA-12

The copper element is composed of three strips of copper riveted together at their mid points. The ends of the copper strips are spread as far apart as possible so as to present a large surface to the solution. A wire, insulated with rubber, is riveted to one of the copper strips and brought out at the top of the jar for connections. Before the gravity cell is set up, it is necessary to see that the insulation on this wire is in perfect condition. If it is not, the cell will be short-circuited through the wire and electrolyte.

**Questions.**

- (1) *Into what two general classes are batteries divided?*
- (2) *What is a primary cell?*
- (3) *What two primary cells are used for telegraph work by the Signal Corps?*
- (4) *What are the constituents of a gravity cell (including solutions)?*

(5) *If it is desired to connect a line wire to the rubber insulated wire of the copper electrode, what kind of splice should be used?*

(6) *Should this splice be taped? If so, how?*

(7) *Why are the copper strips riveted rather than soldered?*

**Directions.**

1. *a.* Examine the zinc and copper elements. Note the provisions made for external connections.

*b.* Spread the strips of the copper element apart. Place the copper elements in the bottom of the container, allowing the insulated wire to extend above the rim of the container. (See Fig. 11.) (Make sure that the insulation on the wire is intact.)

*c.* Cover the copper element with sulphate of copper crystals (about 3 pounds).

*d.* Hang the zinc element on the rim of the container so that the hook part is opposite the wire from the copper element. (See Fig. 11.)

*e.* Pour water (distilled water if available) into the container until the zinc element is covered.

*f.* Cover the water with the contents of the bottle of paraffin oil.

**Questions.**

(8) *Why should distilled water be used?*

(9) *What is the color of the solution near the bottom of the jar?*

**Directions.**

2. *a.* Connect the positive and negative 3-volt terminals of the type 280 voltmeter across the terminals of the cells. The + (positive) binding post of the voltmeter should be connected to the + (positive) or copper terminal of the cell and the - (negative) 3-volt binding post to the - (negative) or zinc terminal of the cell.

*b.* Take the voltmeter reading. This reading represents the initial voltage of the cell.

**Questions.**

(10) *How does this voltage reading compare with the voltage reading of a fully charged BA-10 cell?*

**Direction.**

3. *a.* Remove the lead from the 3-volt binding post on the meter and connect it to the binding post marked "3 amps."

*b.* Take the amperage reading. This reading represents the initial amperage of the cell.

*c.* Make notes of the readings in Directions 2 *a* and 3 *a*. These readings should be kept for future reference.

**Questions.**

(11) *How does the amperage reading compare with that of a BA-10 cell the charging of which has just been started?*

(12) *State in proper order the steps in assembling a gravity cell.*

**Directions.**

4. *a. Disconnect the voltammeter from the cell.*

*b. Connect the lead wire of the copper element to the binding post of the zinc element. Allow this connection to remain in position for 24 hours. This is called "short-circuiting" the cell.*

**SUGGESTIONS FOR THE INSTRUCTOR**

1. The equipment as listed in the Unit Operation will be prepared in advance for each student.
2. Explain to the class the proper way to assemble the elements of the cell and prepare it for service as outlined in the Students Manual.
3. Explain how voltage is measured and how to measure the short-circuit current.
4. Instruct the students to perform the operations as directed in the Students Manual. While they are doing the work, inspect it, and ask questions similar to those in the Students Manual as the work proceeds.
5. While the newly prepared cells are being short-circuited for 24 hours the class should go on with other Unit Operations. Upon completion of the 24-hour short-circuit, Unit Operation No. 32 should be taken up.
6. No instruction test will be given with this Unit Operation, as its material is covered by the test given under Unit Operation No. 32.





## EDISON PRIMARY CELL, TYPE BA-14

### Equipment.

- 1 battery jar and cover.
- 1 zinc element.
- 1 copper-oxide element and holder.
- 1 can caustic soda.
- 1 bottle mineral oil.
- 1 voltammeter, Weston, type 280.
- 2 lead wires.
- 1 gravity cell, type BA-12.
- Distilled water.

### Information.

The battery jar of the Edison primary cell is made of enameled steel. The steel makes the jar unbreakable in transportation or sudden changes in temperature, and the enamel prevents the electrolyte from corroding the steel. The old Signal Corps type V differs from it only in that the jar was larger at the top than at the bottom, while the new type BA-14 jar is cylindrical. The cover is provided with a rubber gasket ring which makes the cell nearly splash-proof.

The constituents of the cell are:

- Positive element, two zinc plates.
- Negative element, copper-oxide plate.
- Electrolyte, caustic soda solution.

The caustic soda is put up in air-tight cans to prevent deterioration, each can containing about  $1\frac{1}{4}$  pounds, sufficient for one cell. A heavy mineral oil is furnished to cover the electrolyte and thus prevent the evaporation of water from the electrolyte.

This cell has a capacity of about 150 ampere-hours. An ampere-hour is a current of 1 ampere flowing for 1 hour, or its equivalent. This cell then will furnish a current of 1 ampere for 150 hours, or half an ampere for 300 hours. On a telegraph line having but a single wire the current required would be 0.05 ampere, which this cell could furnish for 125 days.

The electromotive force of the cell under working conditions is about 0.67 volt. Its internal resistance is about 0.125 ohm. When the cell is completely exhausted, the voltage drops very rapidly from its steady working value. The electrolyte and electrodes should be replaced before this point of complete exhaustion is reached, to prevent interruption of the service. This battery is well adapted for use in cold climates, as the freezing point is several degrees below zero Fahrenheit. For this reason it is used in Alaska by the Signal Corps.

This cell needs very little attention during its life, but should be examined at least once a month and in hot climates more often, to make certain that the electrolyte is always above the top of the plates and that the plates are in good condition. It may be necessary to add water to the electrolyte occasionally, as it will evaporate in spite of the protecting layer of oil, if kept in a warm room.

Need of renewal of electrodes or electrolyte will be indicated by (1) failure to deliver current, or (2) the condition of the plates. Whenever the cover is removed from the jar, the cover and electrode assembly must be washed thoroughly to prevent damage being done by the caustic soda. If the zinc plates are eaten through in any place, they should be thrown away. The oxide plate may be tested by picking into the body of the plate with a sharp-pointed penknife. If there is a layer of black (oxide of copper) in the interior of the plate, there is some life left, the amount depending on the thickness of this layer, and the plate should be continued in use. If on the other hand, it is red throughout, it is completely exhausted and should be thrown away. If the condition of the zinc and oxide plates is such that both should be thrown away, the caustic soda should also be thrown away, but all other parts can be used again.

When renewing the oxide plate, it may be desirable to brighten up the metal parts of the holder with emery paper if they are corroded, and particularly the inside grooves of the frames, where contact is made with the copper oxide. If emery paper is not available, the cleaning may be effected by immersing the metal in a dilute solution of one part of sulphuric acid and four parts of water and then carefully rinsing in clear water to remove all traces of the acid. These precautions are necessary to insure good electrical conditions and a low internal resistance.

#### Directions.

1. Mix the electrolyte as follows:
  - a. Be sure the battery jar is clean and dry.
  - b. Fill the jar to within about  $1\frac{1}{2}$  inches of the top with distilled water or rain water. If neither is available, use ordinary tap water; but this should be free from salts of iron, lime, copper, and sulphur.
  - c. Add to the water *slowly* the contents of one can of caustic soda. Stir the solution constantly with a glass rod or wooden stick until all the soda is dissolved.
  - d. Dissolving the caustic soda generates heat, and the solution should be allowed to cool.
  - e. When cool add enough water to replace that which evaporated.
2. Assemble the electrodes as follows:

a. Pass the screw of the zinc element (Fig. 13) through the middle hole in the cover of the jar. The dowel will fit into the other hole on the same diameter of the cover. Replace the leather washer and the jam nut, clamping the zinc electrode firmly to the cover.

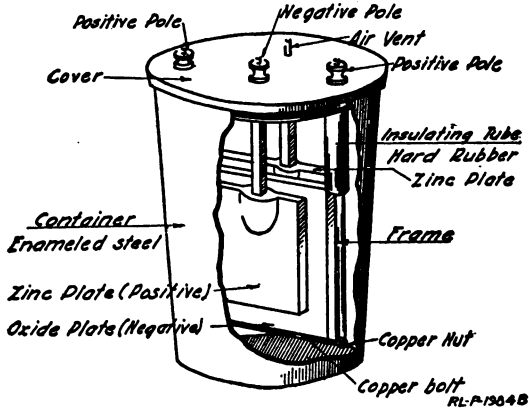


Fig. 12.—Edison primary cell, type BA-14

b. Leaving the flat leather washers in position on the screws of the copper side pieces, pass the screws through their holes in the cover and secure them firmly with their jam nuts.

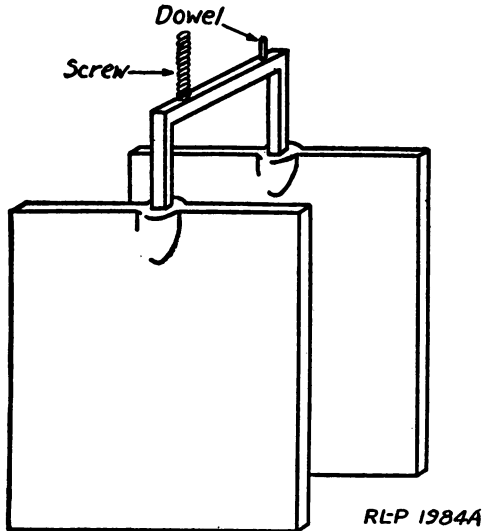


Fig. 13.—Zinc plates of Edison primary cell

c. Slip the two hard-rubber insulating tubes into place over the two side pieces. These insulators protect the side pieces from the action of the electrolyte and confine it to the oxide plate.

d. Slide the oxide plate far enough into the frame so that the copper bolt can be passed just underneath it and through the slots in the bottom of the copper side pieces.

*e.* Tighten the nut on this copper bolt until the oxide plate is gripped firmly. It will be found that the three plates are nearly parallel, as shown in Figure 12, the oxide plate halfway between the two zinc plates, from each of which it is separated by a distance of three-eighths to one-half of an inch. The positive and negative elements must not touch.

3. Place the elements in the electrolyte by putting the cover in place. Wetting the rubber gasket which separates the jar and cover will make the cover fit into place more easily.

*a.* Make certain that the top of the electrolyte is 1 inch above the upper edges of the electrodes.

*b.* Pour the contents of one bottle of mineral oil onto the electrolyte, taking care that the plates are kept under the electrolyte. If, for any reason, the oil has been poured onto the electrolyte before the plates were immersed, they should be soaked in water and while still wet the cover with the plates should be put into place.

4. The cell is now ready for use. Connection to the negative element is made at either one of the binding posts on the copper frame.

*a.* Measure the voltage of the cell.

*b.* Measure the short-circuit current of the cell.

#### Questions.

(1) *How does the voltage of this cell compare with that of a gravity cell?*

(2) *How does its internal resistance compare with that of a gravity cell?*

(3) *If a gravity cell and an Edison primary cell were connected in turn to a 4-ohm sounder and the current measured, from which cell would the greater current be obtained?*

(4) *For how many hours will this cell furnish a current of 0.15 ampere, assuming the life of the cell as 150 ampere-hours?*

#### Information.

The copper-oxide plate is copperplated to give a good electrical contact with the electrolyte, as the oxide itself is not an electrical conductor. If this plating becomes tarnished by exposure to moisture or damp air, the cell will not behave properly when it is assembled. This may be remedied as follows:

Connect the cell to an external resistance and allow the normal current—say, 1 ampere—to flow until the plate acquires the copper color. This may be continued for half an hour if necessary. If, however, the cell must be used immediately, the plate can be treated quickly by short-circuiting the cell for periods of three minutes with intervals of five minutes between each short-circuiting until the plate acquires the correct color.

Whenever the cover and plates are removed from the jar they should be washed thoroughly to remove all traces of the electrolyte, which would injure skin and clothing, and if allowed to dry on the plates would cover them with an insulating coating which would increase the internal resistance of the cell if the plates were subsequently used. The plates must be thoroughly wet before they come in contact with the oil, or the oil will decrease the active surface of the plate and increase the internal resistance of the cell. The electrolyte is kept well up over the plates so that their entire surface will be active and internal resistance kept down.

The following precautions should be observed in the use and handling of the Edison primary cell:

Distilled water should be used in the electrolyte whenever obtainable.

Care must be observed in the handling of caustic soda and its solution to keep it off the hands and clothes. If it is spilled, plenty of water or a weak acid solution followed by liberal application of water will minimize its effect. Coating the hands with oil beforehand will prevent stray caustic from burning the skin.

Do not unwrap the copper-oxide plate until it is needed for use.

Keep the positive and negative plates from touching when assembled or the cell will be short-circuited.

Do not let oil touch the electrodes while they are dry

The frame which holds the copper-oxide plate must be free of tarnish, particularly in the grooves, to insure good electrical contact.

Do not permit electrodes to dry until they have been thoroughly washed.

#### Directions.

5. Measure the voltage of—
  - a. the Gravity cell.
  - b. the Edison primary cell.
6. Connect these two cells in parallel.
7. Read the joint voltage of the assembly.
8. Connect the ammeter between the positive terminals of the two cells, the negative terminals remaining connected, and observe its reading, if any.

#### Questions.

- (5) *Was the joint voltage of the cells connected in parallel higher or lower than that of the gravity cell alone?*
- (6) *Was it higher or lower than that of the Edison primary cell alone?*
- (7) *Was there any current flowing between the cells in Direction 4? If so, what amount?*

(8) *Was the current in Direction 4 doing any useful work?*

(9) *Would the current in Direction 4 increase or decrease the life of the cells?*

**Information.**

When sources of electrical energy are connected in parallel, they must be of equal voltage. Otherwise there will be a steady current through the cells or dynamos even when the external circuit is open. This current will flow in the direction given by the higher voltage and will represent a total loss of energy.

### SUGGESTIONS FOR THE INSTRUCTOR

1. The object of this Unit Operation is to familiarize the student with the BA-14, its assembly, characteristics, care, and maintenance.
2. A new word encountered in this Unit Operation, which it is important the student should understand, is "Ampere-hour."
3. At the assembly of the class before performance of the experiment by the students the instructor should show the class:
  - 1 cell, unassembled, including caustic soda and mineral oil.
  - 1 cell, assembled, serviceable.
  - 1 cell, assembled, unserviceable.
  - 1 set of electrodes, unserviceable.
4. Go through the process of assembling a cell and preparing the electrolyte, observing all precautions, so that the class may have a correct example to follow. Let the class compare the voltages and short-circuit currents of the serviceable and unserviceable cells. Show the class the unserviceable electrodes, calling the attention of the students to the indications of unserviceability, and having the students inspect these unserviceable electrodes individually.
5. Each student should then be required to follow out the directions given in the Students Manual for this Unit Operation. After the experiment is completed and questions answered, the following instruction test or a similar one should be given:

#### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 30-A (PERFORMANCE)

##### Directions to the Instructor.

##### Equipment.

- 1 cell, type BA-14, serviceable, assembled.
- 1 set of electrodes; may be either serviceable or unserviceable.

##### Procedure.

1. Direct each student to tear down a cell, requiring him to observe all precautions given in the Students Manual. When he has done this check the work to see that the cell is completely torn down. Record the time taken to do the work.
2. Next require the student to reassemble the cell, observing precautions given.
3. Require the student to determine whether the electrode presented to him is serviceable or unserviceable.

#### INSTRUCTION TEST No. 30-A (PERFORMANCE)

##### Directions to the student.

1. At the position assigned to you is the following apparatus:
  - 1 cell, type BA-14.
  - 1 extra set of electrodes.
  - 1 knife.
2. When the instructor directs "Begin," perform the following operation carefully and quickly.



PROBLEM NO. 1

1. Tear down completely the assembled cell which is before you, observing all precautions given in the Students Manual. Do not pour out the electrolyte.

2. Notify the instructor when you have finished by facing about and raising your right hand. The instructor will inspect the work and will record the time taken.

PROBLEM NO. 2

1. When the instructor again directs "Begin," start work promptly on the following operation:

2. Reassemble the cell which you have just torn down, observing all precautions given in the Students Manual. Use the same electrolyte and the same electrodes as were in the cell originally.

3. When you have finished, notify the instructor by facing about and raising your right hand. The instructor will record the time taken to assemble the cell and will inspect to see that it is properly done.

PROBLEM NO. 3

1. When the instructor again directs "Begin," perform the following operation carefully and quickly:

2. Determine whether the extra electrodes given you are serviceable or unserviceable.

3. When you have reached a decision, notify the instructor by facing about and raising your right hand. The instructor will notify you whether or not your decision is correct.

Scoring.

1. The maximum score for this test is 24 points.
2. The score required to pass this test is 18 points.

3. DIRECTIONS FOR SCORING:

	Points
a. If the cover has been properly removed, allow a credit of.....	1
b. If the electrodes have been properly washed, allow a credit of...	4
c. If the copper oxide plate has been properly removed from the frame, allow a credit of.....	1
d. If the copper frame has been properly removed from the cover, allow a credit of.....	1
e. If the zinc electrode has been properly removed from the cover, allow a credit of.....	1

PROBLEM NO. 2

- a. If the zinc electrode is firmly fastened in place, allow a credit of... 1
- b. If the copper frame is firmly fastened in place, allow a credit of... 1
- c. If the oxide plate is firmly fastened in place, allow a credit of... 1
- d. If the whole electrode assembly has been wetted, allow a credit of 4
- e. If the electrodes are well separated, allow a credit of..... 3
- f. If the cover is properly placed on the jar and the electrolyte is correct in height, allow a credit of..... 2

If the student assembles the electrodes, leaving the oxide electrode in contact with the zinc, no credit will be allowed.

PROBLEM NO. 3

- a. If the condition of the zinc electrodes has been properly determined, allow a credit of..... 2
- b. If the condition of the oxide electrode has been properly determined, allow a credit of..... 2

Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.

INSTRUCTION TEST No. 30-B (INFORMATION)

**Directions to the student.**—Below are a number of unfinished statements. After each statement are several numbered answers. Only one of these answers is correct. Write on the dotted line at the right the number of the correct answer.

1. If the condition of the zinc and oxide plates is such that they should be thrown away,
  - (1) The jar should also be thrown away.
  - (2) The electrolyte should also be thrown away.
  - (3) The electrolyte may be used again.
  - (4) The electrolyte may be renewed by adding more caustic soda. -----
2. If the copper oxide plate is tarnished, it may be put in good condition
  - (1) By short-circuiting the cell for short periods.
  - (2) By immersion in a weak acid.
  - (3) By the use of emery paper.
  - (4) By scraping bare to the black oxide. -----
3. The electrolyte for BA-14 cells is shipped in
  - (1) 2-quart bottles.
  - (2) Air-tight tin cans.
  - (3) 1¼-pound packages wrapped in oiled paper. -----

4. The elements of a BA-14 cell are dipped in water before placing in the electrolyte
- (1) To remove any foreign substances picked up in handling.
  - (2) To give them good electrical contact with the electrolyte.
  - (3) To keep the oil from coating them with an insulating layer. -----
5. Oil is poured on top of the electrolyte of a BA-14 cell
- (1) To prevent "creeping salts."
  - (2) To prevent evaporation of water from the electrolyte.
  - (3) To prevent short-circuiting of the electrodes. -----

**Directions to the student.**—Below are a number of statements. Read each statement carefully, and if what it says is true (correct) make a plus sign (+) on the *short dotted line* in the right margin. If what it says is not true (incorrect), make a minus sign (–) on the dotted line.

6. The mineral oil is poured on top of the electrolyte to keep the electrolyte from evaporating. -----
7. The electrodes of a BA-14 cell are made of copper oxide and of zinc. -----
8. A cell having a life of 150 ampere-hours will furnish a current of 0.05 amperes continuously for 3,000 hours. -----
9. Exhaustion of a cell is indicated by a sudden drop in voltage or failure to deliver current. -----
10. When renewing a cell only the electrodes need be replaced. -----
11. The oxide electrodes are copperplated to keep the electrolyte from corroding them. -----
12. Water should never be added to the electrolyte after it has been prepared and the cell used. -----
13. The zinc plates should be thrown away as soon as they are eaten through at any spot. -----
14. Connection to the negative electrode may be made at either of the binding posts of the copper frame. -----
15. The water from an ordinary tap is distilled water. -----
16. The positive element of a BA-14 cell is a pair of zinc plates. -----
17. The electrolyte of a BA-14 cell is copper sulphate solution. -----
18. The E. M. F. of an Edison primary cell is greater than that of a gravity cell. -----
19. Placing two BA-14 cells in series introduces twice the internal resistance of a single cell into the circuit. -----

## ELEMENTARY CIRCUITS—RESISTANCE—OHM'S LAW

### Equipment.

- 2 gravity cells, type BA-12, in serviceable condition.
- 1 4-ohm sounder.
- 1 voltammeter, Weston, type 280.
- 1 key.
- Lead wires.
- Necessary paper and pencils.

### Information.

In dealing with any electrical circuit there are three factors which we must consider. First, there is the source of electrical energy, such as a cell, battery, or dynamo. Second, there is the circuit connecting the terminals of the cell, battery, or dynamo. Third, there is the current flowing through the circuit.

The electrical pressure or electromotive force of the source of electrical energy is measured in terms of units called volts by an instrument called a voltmeter, just as the length of a stick is measured in units called inches by an instrument called a ruler. The electrical current is measured in units called amperes by an instrument called an ammeter.

### Directions.

1. *a.* Measure the voltage of a cell.
- b.* Connect an ammeter across the cell terminals just long enough to read the short-circuit current.
- c.* Rewrite the formula  $\text{Resistance} = \frac{\text{Volts}}{\text{Amperes}}$  substituting for "Volts" the value just read on the voltmeter and for "Amperes" the value just read on the ammeter. Solve this fraction for the value of the resistance.

### Information.

It is customary to let the letter *I* stand for the number of amperes and the letter *E* for the number of volts. Also the letter *R* usually stands for the value of the ratio  $R = \frac{E}{I}$ . *R* is the resistance of the circuit and is measured in ohms. Resistance is the property of a circuit which determines the value of the current in the circuit when a given electromotive force (abbreviated *E*, M. F.) is applied.

The resistance in an electrical circuit is comparable to the resistance or hindrance to the movement of traffic on a city street. If the street be wide and straight, traffic moves very freely; but if the street be narrow and crooked traffic moves more slowly, and in a given time

less traffic reaches its destination. If the street be paved with concrete, traffic moves rapidly and easily, whereas if it be a rough dirt road, full of ruts and bumps, traffic must move very slowly and with difficulty. In the same way, if the electrical circuit is composed of fine wire, less current will reach its destination than if the wire is coarse. Also a copper wire, comparable to the paved street, will pass a larger current than an iron wire of the same size, which is like the dirt road.

In Direction 1 there is practically no resistance to current flow in the external circuit, because an ammeter is so made that this will be true. All the resistance to the current flow must therefore be inside of the cell, and is known as the internal resistance of the cell.

**Questions.**

(1) *In Direction 1, if  $E$  had the same value as was found, and  $R$  had half the value found for it, what would be the value of  $I$ ?*

(2) *In Direction 1, if  $E$  had the same value as was found for it, and  $R$  had twice the value found for it what would be the value of  $I$ ?*

**Information.**

Pieces of electrical apparatus are said to be connected in series when all the electrical current which flows through one of them must flow through them all.

Pieces of electrical apparatus are said to be connected in parallel when the main current in the circuit divides, only a portion of it passing through each piece of apparatus.

The student should review Unit Operations Nos. 4 and 5, T. M. No. 21, Basic Signal Communication, in connection with this Unit Operation.

**Directions.**

2. *a.* Connect two cells in parallel.
- b.* Measure the voltage of the two cells.
- c.* Measure the short circuit current.
- d.* Find the value of the ratio  $\frac{\text{Volts}}{\text{Amperes}}$  in this experiment.
3. *a.* Connect two cells in series.
- b.* Measure the voltage of the cells and the short-circuit current.
- c.* Write the ratio as before.

**Questions.**

(3) *a.* Was the voltage of the two cells in parallel the same as of one cell alone?

*b.* Was the current the same?

*c.* How many times smaller or larger is  $R$  of the two cells in parallel than of one cell alone?

- (4) *a. Is the R of two cells in series the same as of two cells in parallel?*  
*b. Is it the same as one cell alone?*  
*c. How many times smaller or larger is the resistance of two cells in series than of one cell alone?*

(5) *From the preceding experiments it can be said that—*

- a. The internal resistance of two cells in parallel is how many times the internal resistance of one cell alone?*  
*b. The internal resistance of two cells in series is how many times the internal resistance of a single cell?*

**Information.**

Ohm's law states that in any circuit the current is directly proportional to the ratio of the E.M.F. to the resistance, or that  $I = \frac{E}{R}$ . When the voltage is fixed, the current is determined by the amount of resistance.

Telegraph circuits have resistance in the external circuit as well as inside the cells which furnish the E. M. F.

**Directions.**

4. *a. Connect two cells in series with a key, a 4-ohm sounder, and the voltammeter so connected that it will read the current in the circuit when the key is closed.*  
*b. Measure the current.*

**Questions.**

- (6) *Is the current less or greater than that found in Direction 3?*



### SUGGESTIONS FOR THE INSTRUCTOR

1. The object of this Unit Operation is to familiarize the student with the meaning and application of Ohm's law and the effects gained by series and parallel connections.

2. It should be explained to the student that electromotive force or voltage is the driving force or pump, the circuit is the path or pipe line, and the current is that which is forced through the circuit by the electromotive force. It is by comparisons with familiar everyday phenomena that the student will come to understand electrical phenomena, and these comparisons should be introduced frequently.

3. The following words are important and the student should be required to gain familiarity with their meanings:

Circuit.	Amperes.
Current.	Ohms.
Resistance.	Volts.
Internal resistance.	Series connections.
External resistance.	Parallel connections.
Electromotive force.	Short circuit.

4. Before having the students perform the experiments the instructor should explain resistance, showing the students various forms of resistance, such as lamps, coils, rheostats. Circuits properly wired to read voltage or current should be shown, and details of connecting apparatus in series and in parallel should be demonstrated thoroughly at the blackboard.

5. After completion of the experiments and answering any questions that may have been brought up, the following instruction test, or one similar to it, should be given.

### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 31-A (PERFORMANCE)

#### Directions to the instructor.

#### Equipment.

- 2 cells, gravity, type BA-12, in serviceable condition.
- 1 resistance, type RS-6, 10, 16, or 33.  
TG-1, 2, EE-11.  
LM-4, 6, or 10.
- 1 voltammeter, Weston, type 280.
- 1 key
- 5 lead wires, insulated copper, each 1 foot long.
- Pencil and paper.



**Procedure.**

1. Prepare in advance several sets of the above equipment, selecting for the resistance an article which the student has not previously measured. Direct the student to measure the resistance of the prescribed piece of apparatus.
2. After having done this he should be directed to connect the cells and resistance so that the largest (or smallest) possible current will flow through it.

**INSTRUCTION TEST No. 31-A (PERFORMANCE)**

**Directions to the student.**

1. At the position assigned to you is the following apparatus:
  - 2 cells, gravity type.
  - 1 lamp (rheostat, relay, or sounder).
  - 1 voltammeter.
  - 1 key.
  - 5 lead wires, insulated copper, each 1 foot long.
  - Pencil and paper.
2. When the instructor directs "Begin," start work promptly. Perform the following operation carefully and quickly:

**PROBLEM NO. 1**

1. Find the resistance of the lamp (or other article furnished).
2. Notify the instructor when you have finished by facing about and raising your right hand. The instructor will record the time taken to do the work and will then inspect connections and results.
3. When the instructor has checked your first problem, disconnect all apparatus.

**PROBLEM NO. 2**

1. When the instructor again directs "Begin," start work promptly on the following operation:
2. Using both cells connect the apparatus so that the greatest (or smallest) current will flow through the lamp (or other article furnished).
3. Again notify the instructor when you have finished by facing about and raising your right hand. The instructor will again record the time and check your connections.
4. When the instructor has checked your second problem disconnect all apparatus.

**Scoring.**

1. The maximum score for this test is 8 points.
2. The score required to pass this test is 4 points.

**3. DIRECTIONS FOR SCORING:**

- |  | Points |
|--|--------|
| a. If the resistance of the lamp (or other article furnished) is correctly measured, give a credit of .....  | 4      |
| b. If proper connections are made for obtaining maximum (or minimum) current give a credit of .....  | 4      |
| c. When a student fails to complete a problem or performs any part of it incorrectly, a grade of zero will be given for the incomplete or incorrect problem. |        |

**INSTRUCTION TEST NO. 31-B (INFORMATION)**

**Directions to the student.**—Below are a number of unfinished statements. Following each one are several words or phrases, each preceded by a number. Only one of these is correct. Write the *number* of the correct word or phrase on the *dotted line* at the right.

1. To put a current of 1 ampere through a sounder of 4 ohms' resistance from four cells, each of which has an E. M. F. of 2 volts and an internal resistance of 1 ohm,
  - (1) The four cells must be connected in parallel.
  - (2) The cells must be connected in two parallel groups, each group consisting of two cells in series.
  - (3) Only three cells connected in series must be used.
  - (4) The four cells must be connected in series. -----
  
2. The voltage of a cell
  - (1) Depends upon its internal resistance.
  - (2) Is greater if the external resistance is greater.
  - (3) Is always the same.
  - (4) Can not be read while a current is being drawn from it. -----
  
3. If a cell of 1 ohm internal resistance and 2 volts E. M. F. be connected in series with
  - (1) A 5-ohm sounder, a current of one-third of an ampere will flow.
  - (2) A 9-ohm sounder, a current of one-seventh of an ampere will flow.
  - (3) An 11-ohm sounder, a current of one-ninth of an ampere will flow. -----
  
4. If two cells in parallel are used to operate a sounder,
  - (1) The increased current will wear the cells out faster.
  - (2) The individual cells will last longer, since there is less use of each.
  - (3) The loss will be the same, since the current is the same. -----

5. The voltage of three cells in parallel
- (1) Is one-third that of one cell alone.
  - (2) Is three times that of one cell alone.
  - (3) Is the same as that of one cell alone.

6. The current passed through a sounder of 4 ohms' resistance by four cells of 2 volts and 1 ohm internal resistance each, connected in parallel, is

- (1) Four-fifteenths of a volt.
- (2) Half an ampere.
- (3) Eight-seventeenths of an ampere.
- (4) Two volts.

7. Ohm's law states that when the voltage is constant

- (1) The current increases as the resistance decreases.
- (2) The current decreases as the resistance decreases.

**Directions to the student.**—Below are a number of sentences. Read each sentence carefully, and if what it says is true (correct) place a plus sign (+) on the *short dotted line* in the right margin. If what it says is not true (incorrect) place a minus sign (—) on the dotted line.

8. The voltage of a cell can not be read while current is flowing.

9. The voltage in a circuit being constant the current increases as the resistance increases.

10. If two sounders are connected in series, the voltage required to operate them is twice what it would be if they were in parallel.

11. Copper wire has less resistance than iron wire of the same size.

12. If a cell of 1 ohm internal resistance and 2 volts E. M. F. is short circuited, a current of 2 amperes will flow.

13. The resistance in a circuit is large if the ratio of volts to amperes is small.

14. The resistance of a coiled wire may be decreased by making it straight, just as the delay to traffic on a straight street is less than on a crooked one.

15. All positive terminals should be connected to one lead and all negative terminals to another when connecting cells in series.

16. In any circuit, when the voltage is doubled the current is halved if the resistance remains unchanged.

17. The internal resistance of two cells in parallel is half that of one cell alone.

18. The current from two cells in parallel through a sounder of 4 ohms' resistance is twice what it would be from one cell alone.

## PRIMARY BATTERIES—THE GRAVITY CELL

(Its condition after being short-circuited for 24 hours)

### Equipment.

- 2 gravity cells (short-circuited 24 hours).
- 1 voltammeter.
- 1 BA-10 cell.
- Necessary leads.

### Directions.

1. *a.* As directed in Unit Operation No. 29, take a voltmeter reading of the cell.  
*b.* Compare it with the reading obtained before the 24-hour short circuit was applied. Do you notice any difference? If so, why?
2. *a.* Take a short-circuit current reading of the cell.  
*b.* Compare it with the previous current reading. Is there any difference? Why?
3. By Ohm's law determine the internal resistance of the cell. What is the maximum current obtainable from one of these cells?

### Information.

The bluestone (copper sulphate crystals) was dissolved by the water, forming the blue copper-sulphate solution at the bottom of the cell. When the cell was short-circuited, a solution of zinc sulphate was formed around the zinc electrode. This solution is clear and lighter in weight than the copper-sulphate solution. The two solutions are therefore kept apart by the action of gravity, from which the cell receives its name. The line of separation, or top of the blue solution, should be very clearly marked if the cell is not shaken.

The zinc of the zinc electrode is used up in the formation of zinc sulphate, while the copper sulphate is used up in forming the zinc sulphate and a deposit of copper on the copper electrode.

The direction of current flow within the cell is from the zinc electrode through the electrolyte to the copper electrode. From the terminal of the copper plate (positive terminal) the current enters the external circuit, reentering the cell at the zinc binding post (negative terminal).

As the cell continues in service the copper-sulphate (blue) solution tends to grow weaker and the zinc-sulphate (clear) solution tends to grow stronger. This latter soon becomes a saturated solution; that is, no more zinc sulphate can be held in solution, and it starts to crystallize out on the zinc and the jar, the crystals carrying some sulphuric acid (which has a corrosive action) with them. Since the crystals are conducting, their formation on the jar tends to short-circuit the cell. The coating of paraffin oil is to prevent the creeping action.

If a cell is required for immediate use after assembly, a tablespoonful of common salt may be added to the water before putting it in the cell. This procedure is not recommended, as it tends to make the cell dirty and shorten its life.

#### RULES FOR THE USE AND CARE OF GRAVITY CELLS

The cell should be kept on a closed circuit for part—say, 60 per cent—or all of the time.

After a gravity cell has been put in service it should be inspected once a week.

Any formation on the zinc should be removed by scouring with sand.

Bluestone should be added when the solution at the bottom of the jar is no longer blue and the crystals are nearly all dissolved.

Examine all connections, as they are very likely to corrode, due to an accumulation of creeping salts. When corroded, they should be cleaned.

If the zinc-sulphate solution becomes too strong, some of the zinc-sulphate solution may be removed with a battery syringe and replaced by distilled water.

If the copper-sulphate solution becomes too strong, the blue line will rise. This must be watched, since if the blue line should touch the zinc the cell would be short-circuited. When the blue line in rising gets within an inch of the zinc, some of the copper-sulphate solution should be drawn off with a battery syringe and replaced by distilled water.

The electrolyte must always cover the zinc. This level is maintained by adding water as needed.

When adding water, do so gently, so as not to disturb the solution. The use of a battery syringe for this work is recommended.

When the zinc electrode is badly eaten away, it should be replaced by a new zinc.

The cells should be cleaned at regular intervals, varying from three weeks to three months or more, depending on the amount of current they have been supplying. The zinc should first be removed from the jar and thoroughly washed immediately to prevent the formation of hard deposits on it. It should be scoured with sand on wet cotton waste or other similar means.

Next pour or siphon off the oil and, afterwards, the zinc solution, into separate jars. Remove the copper strips and clean them if necessary. Pour or siphon off the copper-sulphate solution, taking care not to disturb the sediment in the bottom of the jar. Throw away the sediment, clean the jar and dry it carefully. Reassemble the parts as in originally assembling the cell. If necessary, add water to the zinc solution to bring it to the proper level; or add zinc solution from other cells.

**Questions.**

- (1) *Which electrode of the gravity cell is eventually used up?*
- (2) *What is—*
  - a. *The positive pole?*
  - b. *The negative pole?*
- (3) *What was the effect of short-circuiting the cell for 24 hours?*
- (4) *How does the gravity cell now compare with a BA-10 cell which has been in use for a short time?*
- (5) *What elements of the gravity cell must be replaced from time to time?*
- (6) *What is the working voltage of the cell?*
- (7) *What is the short-circuit current of the cell when it is in working condition?*



### SUGGESTIONS FOR THE INSTRUCTOR

The cells used in this Unit Operation should be those which the students prepared in Unit Operation No. 29, the cells having been short-circuited for 24 hours.

Upon assembling the class, the students will first determine the voltage, current, and internal resistance of the cells. Immediately thereafter the instructor should explain to the class the chemical action which has taken place in the cell and discuss with the class point by point the directions for care and maintenance of the gravity cell. If available, there should be shown to the class gravity cells which have been in use for some time and have crystal formations which require removal. If enough such used cells are available, require the members of the class to clean them, following the directions given in the Students Manual.

#### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 32-A (PERFORMANCE)

**Directions to the instructor.**

**Equipment.**

- 1 gravity cell.
- 3 extra battery jars or similar receptacles.
- 1 battery syringe.
- Cotton waste.
- Water.

**Procedure.**

Have the equipment laid out before the test begins. Direct each student to perform the operations of cleaning and reassembling the gravity cell as prescribed in the Students Manual.

#### INSTRUCTION TEST No. 32-A (PERFORMANCE)

**Directions to the student.**

1. At the position assigned you the following equipment is laid out:

- 1 gravity cell.
- 3 extra battery jars.
- 1 battery syringe.
- Cotton waste.
- Water.

2. When the instructor directs "Begin," perform the operations of cleaning the cell as prescribed in the Students Manual. When the cell is completely torn down and clean, face about and raise your right hand. The instructor will note the time taken and will inspect the work.



3. When the instructor again directs "Begin," reassemble the cell and electrolyte, making sure that the proper amount of electrolyte is in the cell. When you have completed this operation, face about and raise your right hand. The instructor will again note the time taken and will inspect the work.

**Scoring.**

1. The maximum score on this test is 14 points.
2. The score required to pass the test is 12 points.
3. DIRECTIONS FOR SCORING:

	<b>Points</b>
a. If the electrodes are taken out separately, give a credit of .....	2
b. If the zinc electrode is cleaned and dried, give a credit of .....	4
c. If the jar is cleaned and dried, give a credit of .....	2
d. If the electrodes are reassembled with proper distance of separation give a credit of .....	2
e. If the solutions are poured back in proper order, give a credit of ..	2
f. If the oil layer over the electrolyte is replaced, give a credit of ....	2
g. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.	

**INSTRUCTION TEST NO. 32-B (INFORMATION)**

**Directions to the student.**—Below are several sentences, and just after each one is a short dotted line (.....). Read each statement carefully and if what it says is true write a plus sign (+) *on the line*. If what it says is *not* true, write a minus sign (−) *on the line*.

1. Zinc is the positive element in a gravity cell. ....
2. The solution in which the zinc element is immersed in a gravity cell is called the electrolyte. ....
3. The voltage of a gravity cell which has been properly placed in service is about 2 volts. ....
4. The zinc binding post of a gravity cell is the negative pole. ....
5. The current within a gravity cell flows from the zinc to the copper element. ....
6. Distilled water is used in a gravity cell because it freezes at a lower temperature than ordinary water. ....
7. Gravity cells are used on telegraph lines where only a small current is required occasionally. ....
8. When a gravity cell is placed in service, the zinc element wastes away. ....
9. If the solution at the bottom of the cell rises to within an inch of the zinc element, the cell will be short-circuited. ....
10. The addition of a tablespoonful of common salt to the solution in a gravity cell will lengthen its life and decrease its internal resistance. ....

11. A primary cell is renewed by renewing the chemicals, while a secondary cell is renewed by running a current from an outside source through the cell. -----
12. Zinc sulphate is the depolarizer in the gravity cell. -----
13. The copper strips are riveted rather than soldered to the wire lead to prevent local action. -----
14. The strength of the copper-sulphate solution in a gravity cell increases with use. -----
15. The paraffin oil helps prevent concentration of the zinc-sulphate solution by decreasing evaporation. -----



## MAGNETS—THE ELECTROMAGNET

### Equipment.

- 1 steel rod, 6 inches long.
- 1 soft-iron rod, 6 inches long.
- 1 small piece soft iron.
- 1 piece, Nos. 18 or 20, of insulated wire, 10 feet long.
- 2 dry cells.
- 1 voltammeter, Weston, type 280.

### Information.

A magnet is a body possessing the property of attracting to itself particles of iron. There are two kinds of magnets, natural and artificial.

In Siberia and the Scandanavian Peninsula iron ore is found which contains magnetic properties. Smaller quantities of this ore are found in other parts of the world. Pieces of this ore are natural magnets. These natural magnets were known for centuries before they were put to practical use as rude compasses. As the only natural magnets known are iron ore, and as iron ore contains much impure matter, such as dirt and stone, it follows that natural magnets do not have the strength of artificial magnets made of refined metal. Therefore natural magnets are not now used.

Artificial magnets are of two kinds, permanent and temporary.

Permanent magnets are made of refined tempered steel, which has been magnetized either by being brought into contact with another magnet or by an electric current. Once magnetized, the best grades of hard steel hold their magnetism permanently. Permanent magnets are used in many of the more delicate telegraph instruments. Such instruments will not be dealt with in this Manual.

Temporary magnets are made of very soft steel or iron and retain their magnetism only while under the influence of another magnet or an electric current.

Temporary magnets whose magnetism is caused by an electric current are called "electromagnets." These magnets are used in all common telegraph instruments, such as are described in this Manual.

Many years ago it was discovered that if an insulated wire were wound around a piece of iron and an electric current then passed through the wire, the iron would become magnetized. The wire wound around the iron is called the "coil" of the magnet. The iron around which the wire is wound is called the "core" of the magnet. If the iron used is pure and soft, all magnetism will disappear the moment the electric current ceases to flow. Should the

iron be hard or contain certain impurities, a trace of magnetism will remain after the current ceases to flow. This is called "residual magnetism."

Residual magnetism decreases the efficiency of an instrument. The efficient operation of all instruments described in this Manual depends on a quick rise and fall of magnetism. Residual magnetism prevents this.

The strength of an electromagnet depends upon two things, the strength of the current through the coil and the number of turns of wire in the coil. Thus a certain magnetic strength may be obtained by a coil having a few turns and large current, or many turns and a small current.

Most telegraph instruments are designated by their resistance, as a 4-ohm sounder, a 150-ohm relay. The longer the wire the greater the resistance; also, the longer the wire the greater number of turns there will be in the coil; therefore the greater the resistance the more turns in the coil.

It has been shown that a high resistance means a large number of turns; also, a large number of turns requires but a small current for operation. Therefore an instrument having a high resistance will operate on a small current, while an instrument having a low resistance requires a large current. A 4-ohm sounder requires 250 milliamperes, while a 150-ohm relay operates on 40 milliamperes.

Instruments of low resistance are used on circuits of small resistance. The 4-ohm sounder is used on the local circuit in an office where the total resistance of the circuit, aside from the sounder, is seldom more than 2 ohms. Therefore a battery of low voltage will provide sufficient current.

Instruments of high resistance are used on circuits having high resistance. The 150-ohm sounder is used on the main line, where the resistance of the circuit, aside from the sounder, is usually above 1,000 ohms.

Therefore, instruments having a high resistance are used on long lines, and those having a low resistance on short lines.

#### **Directions.**

1. *a.* Wind a piece of insulated wire several times around a steel rod.

*b.* Connect the two terminals of the wire to the terminals of a single cell.

*c.* Test, with a piece of soft iron, the magnetic effect of a current passing through a wire wrapped around a steel core.

2. Remove the cell. Test the magnetic effect again with a piece of soft iron.

Does the steel core retain its magnetism after the battery has been removed? Why?

3. a. Replace the steel core with a soft-iron core.

b. Apply the battery. Is there any magnetic effect while the current is passing through the wire? How does it compare in strength with that of the steel core?

4. Remove the battery. Has the soft-iron core any magnetic effect on metal objects, such as soft iron, after the battery has been removed? Why?

5. Double the number of turns of wire around the core. Read the current. Does the strength of the magnet increase or decrease?

6. Connect the two cells in parallel to the winding. Again read the current. Does increasing the current increase the strength of the magnet?

**Questions.**

(1) *What is a permanent magnet?*

(2) *What is an electromagnet?*

(3) *What is the difference between soft-iron and steel cores in retaining their magnetism after the current in a wire around them, has been broken?*

(4) *What is residual magnetism?*

(5) *On what things does the strength of an electromagnet depend?*

(6) *Are telegraph instruments ordinarily designated by their resistance, number of turns, or operating current?*

(7) *On what kind of a circuit are the different classes of instruments used? Why?*



### SUGGESTIONS FOR THE INSTRUCTOR

1. The equipment as listed in the Unit Operation will be prepared in advance for each student.
2. Assemble the class and discuss the subject of magnets and their application to the telegraph. Ask questions on points which may not be clear to the students.
3. Instruct the students to perform the operations as described in the Students Manual.
4. Answer any questions which the experiments may have brought up. Assemble the class and give the following instruction test.

### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 33-A (PERFORMANCE)

#### Directions to the instructor.

#### Equipment.

- 1 iron magnet case.
- 1 spool of insulated magnet wire.
- 1 spool of bare copper wire.
- 1 dry cell.
- 1 piece of soft iron.

#### Procedure.

Prepare in advance several sets of the above equipment. Direct each student to construct an electromagnet and test it for magnetism.

### INSTRUCTION TEST No. 33-A (PERFORMANCE)

**Directions to the student.**—*a.* The following equipment is laid out at the position assigned you:

- 1 iron magnet case.
- 1 spool of insulated magnet wire.
- 1 spool of bare copper wire.
- 1 dry cell.
- 1 piece of soft iron.

*b.* (1) Using the above equipment, construct an electromagnet, winding it with 50 turns of wire.

(2) Test the magnet with the piece of soft iron.

When you have completed these operations face about and raise your right hand.

#### Scoring.

1. The maximum score in this test is 4 points.
2. The score required (to pass the test) is 2 points.



3. DIRECTIONS FOR SCORING:

	Points
a. If the windings are made neatly and insulated wire used.....	2
b. If bare wire is used.....	0
c. If connections are made properly for test.....	2
d. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.	

INSTRUCTION TEST No. 33-B (INFORMATION)

Directions to the student.—Below are a number of sentences and just after each one is a dotted line. Read each sentence carefully, and if what it says is true put a plus sign (+) on the dotted line. If what it says is not true, put a minus sign (–) on the dotted line.

1. Artificial magnets are the only kinds used in the construction of telegraph instruments. -----
2. Electromagnets are the only kind used in the construction of telegraph instruments. -----
3. The strength of an electromagnet depends upon the strength of the current passing through the coil and upon the number of turns in the coil. -----
4. An electromagnet retains its magnetism after current has stopped flowing in the coil surrounding it. -----
5. Iron makes a better electromagnet than steel. -----
6. The strength of an electromagnet depends upon the size of the wire surrounding it. -----
7. Iron retains more residual magnetism than steel. -----
8. A magnet inclosed in a large number of turns of wire will acquire more strength with a given current than one inclosed in a small number of turns. -----
9. The wire around the core should be insulated. -----
10. Increasing the current flowing through the winding of an electromagnet increases the strength of the magnet. -----

## THE RELAY

### Equipment.

- 1 150-ohm Morse relay.
- 1 150-ohm box relay.
- 5 dry cells.
- 1 milliammeter.
- 1 rheostat.

### Information.

In telegraphy there is a great variety of circuits:

- (a) Short lines, which require but a low voltage to furnish a strong current.
- (b) Long lines, where sufficient voltage to maintain a strong current would be dangerous.
- (c) Lines designed to carry two messages at once.
- (d) Lines designed to carry four messages at once.
- (e) Lines designed to carry six or eight messages at once.

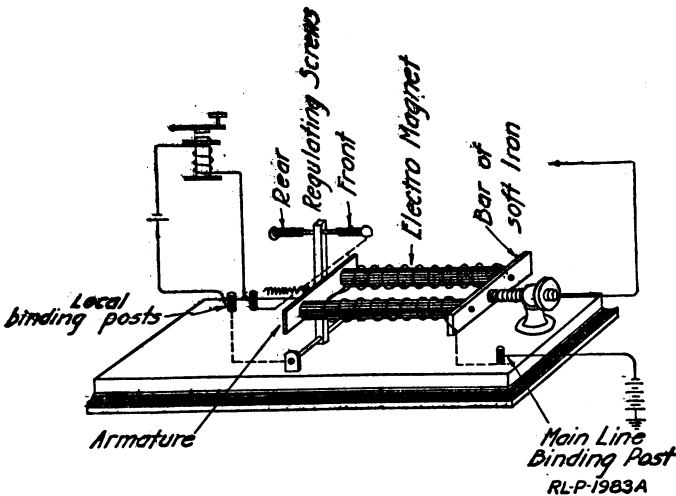


Fig. 14.—Circuits of the common relay

Each different class of line requires a different instrument, and in some cases more than one style of relay has been designed for the same duty. A number of these relays are quite intricate. As this Manual is basic and deals only with simple telegraph circuits, only relays used on such circuits will be described herein. They are:

The common relay, 150-ohm, 2,350 turns No. 30 wire, B. & S.

The box relay, 150-ohm, 40-milliamperere operating current.

The pocket relay, 150-ohm, 50-milliamperere.

All three of these relays work on the same principle and have the same kind of windings. Figure 14 shows the windings of a common relay. From this figure the action of all three relays can be understood.

In construction the common relay consists of:

a. Two electromagnets, mounted parallel to each other and horizontally in respect to the base. The cores of these magnets are of soft iron.

b. The ends of these cores most distant from the main-line binding posts are close to, but never touch, the armature.

c. The opposite ends, those closest to the main-line binding posts, are fastened rigidly to a bar of soft iron, which acts as a part of the magnetic circuit.

d. This bar has a hole drilled at the center through which passes one end of a screw. The other end of this screw passes through a hole in a brass post.

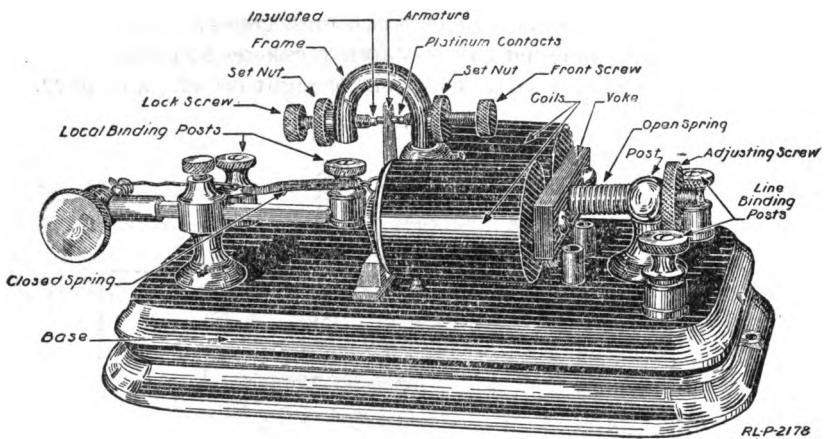


Fig. 15.—The common relay

e. Coiled around this screw is an open coiled spring, one end resting against the iron bar and the other end resting against the brass post.

f. This brass post is secured firmly to the base of the relay in a perpendicular position. On the end of the screw which projects beyond the post, there is a set nut.

g. This combination of screw, spring, and set nut is for the purpose of adjusting the air gap between the magnets and the armature.

h. Turning the nut to the right draws the screw through the brass post, which pulls the magnets away from the armature. Turning the screw to the left permits the screw to slip back through the hole in the post; the coiled spring then opens and pushes the magnets toward the armature.

i. The windings of these two coils are in series and have 2,350 turns of wire on each coil. That is, a wire leads from one main-line binding post to the nearest coil, makes 2,350 turns around the coil,

thence to the second coil, where the same number of turns are made, and then to the second binding post. Both coils are wound in the same direction.

*j.* The armature is in a vertical position, close to those ends of the magnets most distant from the main-line binding posts. It is hinged at the bottom and moves at the top. The distance the top can move is regulated by two set screws (regulating screws) which pass through a supporting frame. The bottom of the armature is connected, electrically, to one of the local-circuit binding posts.

*k.* The screws which regulate the amplitude of the movement of the top of the armature pass through a part of the supporting frame. The front screw has a platinum tip to make contact with a like tip near the top of the armature, and is connected electrically with the supporting frame. The back screw is also in contact with this frame, but has an insulated tip which effectively prevents any flow of current from the armature to the frame when the armature rests against the back screw.

*l.* The supporting frame is connected, electrically, to one of the local-circuit binding posts, one of which is electrically connected to the bottom of the armature and the other to the supporting frame.

*The action of the armature comprises:*

(a) Backward movement. A closed coiled spring is attached to the armature in such a manner as to tend to draw the armature away from the coils.

(b) Forward movement. When an electric current flows through the windings of the coils the soft-iron cores become magnetized and attract the soft iron armature.

*NOTE.*—*The pull of the coiled spring is constant whether or not there is any attraction between the cores of the coils and the armature. Therefore, to obtain the best results the magnetic "pull" must be about twice that of the spring.*

### ACTION OF THE RELAY

*a.* As has been said, a wire leads from one main-line binding post to and through the first coil, to the second coil, and thence to the second binding post. When an electric current is caused to flow through these coils the soft iron cores become magnets and attract the armature.

*b.* When the armature is drawn forward, the platinum tip, at its top, makes contact with the tip of the front regulating screw, making an electrical contact therewith. As one of the local-circuit binding posts is electrically connected to the armature, and the other to the supporting frame, the forward movement of the armature completes the circuit between them. When this has been accomplished, the relay is said to be "closed."

c. When the current ceases to flow through the coils, the soft-iron cores become demagnetized, attraction for the armature becomes zero, and the coiled spring draws it against the back screw. As the back screw has an insulated tip, this action opens the circuit between the two local-circuit binding posts. Under these conditions the relay is said to be "open."

This relay is adapted to any line, whether good or bad. The armature is light and has little inertia. It will work where the fluctuation of the line current is as high as 50 per cent of its normal value. Therefore it gives good service on long lines or those poorly constructed.

The sound of such a relay, as produced by the armature, is too light to be read, except in a very quiet office. Therefore, a local circuit operating a sounder is necessary.

One end of a wire is attached to one of the local-circuit binding posts, the other end to a sounder, through the sounder to a battery, through the battery to the other local-circuit binding post. The closing of the relay closes the local circuit, which in turn closes the sounder. Opening the relay opens the sounder. Thus, the armature of the relay acts as a key to make and break the local circuit.

#### ADJUSTMENTS

The front regulating screw should be so placed that the armature will stand vertical when in its forward position. Then the back regulating screw adjusted until the top of the armature has a play of six-thousandths (0.006) of an inch.

The coiled spring should have sufficient tension to draw the armature quickly away from the coils when the circuit is opened, but not enough tension to strain the spring. Then ask the distant station to send and by listening to his sending adjust the magnets until the armature strikes the two regulating screws with equal force.

NOTE.—A coiled spring is said to be "open" when the use to which it is to be put is to push two objects away from each other. A "closed" spring draws the objects together.

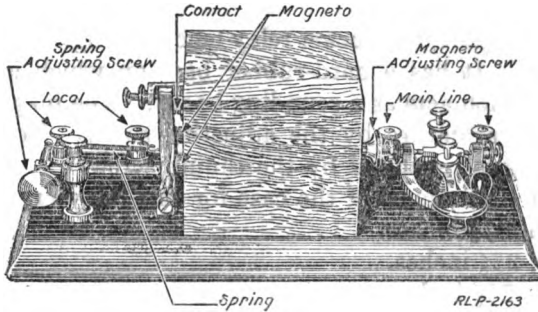
#### THE BOX RELAY

In the box relay the coils are the same as those of the common relay, except that they are inclosed in a small box mounted on the base. (See Fig. 16.)

The screw and coiled spring for regulating the air gap between the magnets and armature are the same.

The armature is a piece of soft iron attached to a vertical aluminum or brass bar. This is hinged at the bottom and has the regulating screws at the top, the same as the common relay. The difference is

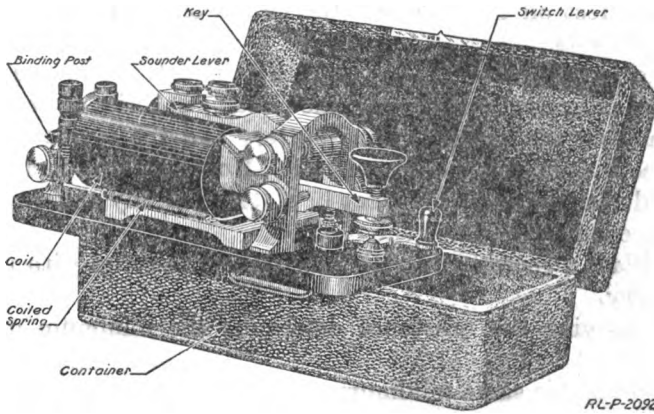
that this bar has weight and strikes the two regulating screws with a clear distinct sound, which can be read by the operator. The box which covers the coils accentuates this sound and in fact acts as a sounding board. This obviates the necessity of a local circuit and sounder.



**Fig. 16.—The box relay**

The base of this instrument is longer than that of the common relay and has a key mounted thereon. Thus it is a complete set (key, relay, and sounder) in itself.

The combining of the complete set in one instrument makes it more portable, especially so since no local battery is needed. This is a



**Fig. 17.—The pocket relay**

point which is of great importance in the forward areas under field conditions.

The objections to the box relay are that, as the armature is heavy, it has more inertia and requires more current to operate than a common relay. Also, when using a typewriter it can not be placed in a resonator, both on account of its size and the fact that the key is on the same base and must be kept in a convenient place for sending.

Connections are provided for the use of a local circuit and sounder. This is not good practice, as the common relay will give better service if the additional sounder is used.

### THE POCKET RELAY

As its name implies, the pocket relay (shown in fig. 17) was designed for portability. It has a hard-rubber base on which is mounted a metallic base which acts as a sounding board. The magnets are held away from the armature by the adjusting screw. Tension on the retractile spring is regulated by the thumb screw.

The outside dimensions of the case for this relay are:

Length,  $5\frac{7}{8}$  inches.

Width,  $2\frac{7}{8}$  inches.

Height,  $2\frac{5}{8}$  inches.

The very compactness of this relay reduces its utility, and it is seldom used except by repair men.

#### Directions.

1. Examine the construction of a Morse relay. Note the iron core, iron armature, iron pole piece, method of connecting the windings, local circuit, and contacts and the adjustments.

2. *a.* Apply a battery of five cells to the coil terminals. Note the magnetic effect on the core and the action of the armature. Note the adjustments.

*b.* Using a milliammeter measure the current. How much is it? How is an ammeter connected in the circuit; in series or parallel?

3. Knowing the voltage of the battery and the current strength, determine the resistance of the circuit. How does this compare with the rated resistance of the relay? If there is any difference, how do you account for it?

4. *a.* Place a rheostat (variable resistance) in series with the relay and battery.

*b.* By varying the resistance determine the minimum operating current.

*c.* Produce this same minimum operating current by reducing the voltage instead of by varying the resistance. Which is the more economical way to reduce current, adding resistance or reducing the voltage?

5. Remove the battery. What is the effect on the core and the armature? Why?

6. Examine the construction of the box relay. Compare this relay with the one previously examined. Why is no sounder used with the box relay? Is there any difference in the two armatures? Why?

**Questions.**

- (1) *Do all relays work on the same principle?*
- (2) *Describe the action of a common relay.*
- (3) *Why is it necessary to provide a sounder in connection with this relay?*
- (4) *What is the local circuit?*
- (5) *What distance should the top of the armature move?*
- (6) *What are the advantages and disadvantages of the box relay?*
- (7) *How does the armature of the box relay differ from that of the common relay?*
- (8) *What is the pocket relay?*





### SUGGESTIONS FOR THE INSTRUCTOR

The equipment as listed for this Unit Operation in the Students Manual will be prepared in advance for each student.

Assemble the class and—

*a.* Explain the construction, operation, and use of the Morse relay and of the box relay.

*b.* Disassemble the Morse relay and the box relay and compare the various parts.

*c.* Reassemble the relays and demonstrate the proper adjustments of the coils, armature, and retractile spring.

Require the students to perform the operations as directed in the Students Manual.

Assemble the class and give the following instruction test, or one of similar nature.

### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 34-A (PERFORMANCE)

Directions to the instructor.

#### Equipment.

- 1 Morse relay.
- 1 box relay.
- 1 rheostat.
- 1 milliammeter.
- 5 dry cells.
- 5 feet insulated wire.
- 1 tag.

#### Procedure.

1. The instructor should prepare several sets of equipment in advance, writing or printing the words "Morse Relay" and "Box Relay" on each tag.

2. Direct each student to connect the Morse relay, rheostat, milliammeter, and battery in series and adjust the relay and rheostat so that the relay armature is working on the smallest possible current. Have the same operation performed using the box relay.

### INSTRUCTION TEST No. 34-A (PERFORMANCE)

1. Directions to the student.—The following equipment is laid out at your assigned position:

- 1 Morse relay.
- 1 box relay.
- 1 rheostat.
- 1 milliammeter.
- 5 dry cells.
- 5 feet of insulated wire.
- 1 tag.

2. When the instructor says "Begin," with the above equipment test the relays for minimum operating current as follows:

a. Connect the Morse relay, rheostat, milliammeter, and battery in series.

b. Adjust the relay and the rheostat so that the relay armature is working on the smallest possible current. Record this reading on the tag after the words "Morse Relay" and notify the instructor by facing about and raising your right hand.

c. Substitute the box relay for the Morse relay and repeat the test. Record this reading on the tag after the words "Box Relay" and again notify the instructor by facing about and raising your hand.

**Scoring.**

1. The maximum score on this test is 16 points.

2. The score required to pass is 10 points.

3. DIRECTIONS FOR SCORING:

	Points
a. If the connections are properly made.....	4
b. If the Morse relay adjustment is correct.....	4
c. If the box relay adjustment is correct.....	4
d. For each correct current reading.....	2
e. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.	

**INSTRUCTION TEST NO. 34-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a dotted line inclosed in parentheses, thus (.....). Fill in each blank space with a word or number which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like "armor-plated" or "back-fire," counts as one word.

1. A Morse relay has an (.....) core.

2. A Morse relay will operate on (.....) current than a box relay.

3. A Box relay makes a louder sound than a (.....) relay.

4. A Morse relay is (.....) efficient than a box relay.

5. A 100-ohm relay in series with a battery and a line having a resistance of 200 ohms carries a current of 0.05 amperes. The E. M. F. is (.....) volts.

6. A milliammeter is placed in (.....) in a circuit to measure the current.

7. A voltmeter is placed in (.....) with the battery to measure the voltage.

8. A Morse relay operates on 0.05 ampere. The E. M. F. applied is 5 volts. The resistance of the relay is (.....) ohms.

9. The pocket relay is (.....) efficient than the Morse relay.



## THE SOUNDER

### Equipment

- 1 4-ohm sounder and leads.
- 1 150-ohm main line sounder.
- 5 dry cells.
- 1 rheostat.
- 1 milliammeter.
- 1 resonator.
- 1 relay.

### Information.

There are two classes of sounders in common use:

- a. Those designed for use on local circuits.
- b. Those designed for use on the main line.

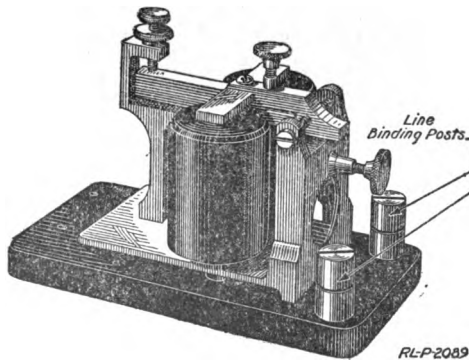


Fig. 18.—Sounder for local circuits

In external appearance these two instruments closely resemble each other.

Sounders designed for use on local circuits usually have but little resistance, 4, 20, or 50 ohms, which means there are comparatively few turns of wire on the coils. (See Fig. 18.) Sounders designed for main-line work have many turns of wire on each coil. The type in most common use has a resistance of 150 ohms.

On local circuits the current strength will not fluctuate; therefore there is but one adjustment, the tension of the coiled spring at the back end of the sounder bar. On the main line the current strength will fluctuate, therefore there are two adjustments, that at the rear of the sounder bar and the adjustment of the position of the magnets as related to the armature. These two are the same as those of the main-line sounder with key or the box relay.

In construction these sounders are the same as the main-line sounder with key, except that, there being no key, the bases are shorter, which permits them to be placed in a resonator.

The main-line sounder in common use (Fig. 19) has a resistance of 150 ohms. Sounders for special use are wound as desired. That in the Signal Corps field duplex has a resistance of 900 ohms.

The main-line sounder with key (Fig. 20) is essentially a field instrument on account of its ruggedness and simplicity. The base is of wood. The key shown is the usual closed-circuit key attached securely to the wooden base.

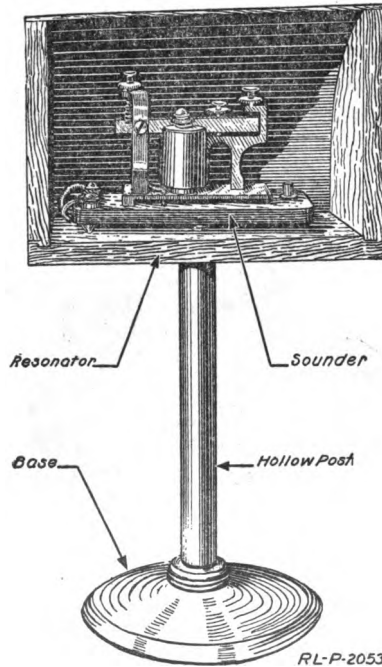


Fig. 19.—Main-line sounder with resonator

The sounder itself is composed of:

a. A metallic base secured to the wooden base by three machine screws, the heads of which are below the wood and the threaded end in the metallic base. Each screw passes through a metallic collar, about one-eighth of an inch thick, which is between the wooden and metallic bases.

b. This separation between the two bases permits the metallic base to vibrate freely and act as a sounding board to accentuate the stroke of the sounder bar. If the metallic base made a flat contact with wood, its vibration would be deadened and its sounding-board qualities would be lacking.

c. A rigid frame is attached securely to the metallic base. To this rigid frame are attached the sounder bar and a movable frame.

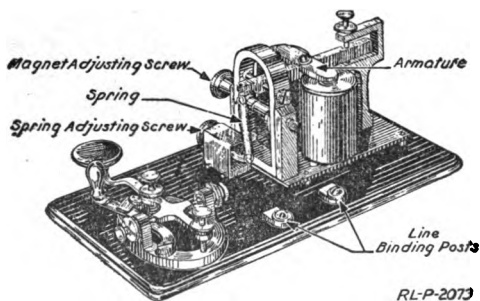
d. The movable frame is secured to the rigid frame and pivoted at the trunnion screw.

e. The sounder bar is held in place by the trunnion screws and the distance it can move is fixed by the position of regulating screws.

f. The armature is attached to the sounder bar.

g. The coils are secured rigidly to the movable frame in a vertical position, with the upper end of the iron cores just below and directly under the armature.

h. To raise the coils and bring the magnets closer to the armature, the adjusting screw is turned to the right. This pushes the movable frame forward at the bottom. As this frame is pivoted at the trunnions, pushing it forward causes that part forward of the trunnions to rise, bringing the magnets closer to the armature.



**Fig. 20.—Main-line sounder with key**

i. The sounder bar is drawn down by the magnets, and when they become demagnetized it is drawn to its upper position by the retractile spring.

The resonator is a convenient receptacle for a sounder. There are two types of resonators in use. The most common and convenient resonator is the swivel-arm type. The stand of this type is fastened firmly to the table; the arm works on swivels, so that the operator can place the sound close to his ear. (See Fig. 21.) The resonator and stand are less convenient than the swivel arm, therefore are used less. In this resonator the base is broad and is not secured to the table but can be moved to any desired position. (See Fig. 19.)

**Directions.**

1. Examine construction of the sounder. How does the sounder bar compare with the armature of the Morse relay? Note the adjustments. How do the adjusting springs compare in the two cases?

2. Draw the circuit of the sounder and the circuits of the relay. What is the reason for the extra circuit in the latter case?



3. Apply a cell to the terminals of the sounder coil.
4. With a milliammeter, measure the current in the sounder circuit.
5. Knowing the voltage of the cell and the current strength, determine the resistance of the circuit; of the sounder coils. What is the difference between the resistance of the sounder and that of the relay? Why?
6. By experiment determine the minimum operating current. How does this compare with the minimum operating current of a Morse relay?
7. Place the sounder in a resonator and note the advantage.

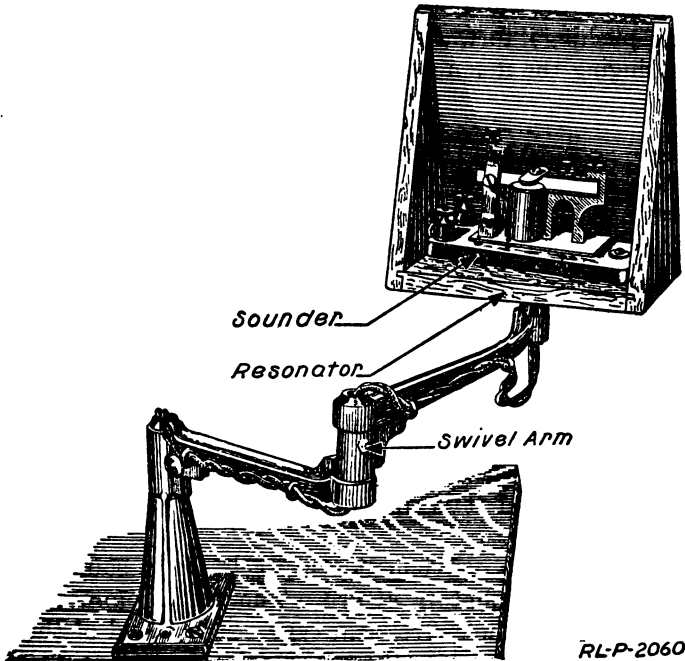


Fig. 21.—Resonator, swivel-arm type

**Questions.**

- (1) *Why are sounders necessary?*
- (2) *Why not use sounders in place of relays on long lines?*

**Directions.**

8. Examine the construction of the main-line sounder.
9. Apply a battery to the terminals of the coils and measure the current.
10. Compute the resistance of the coils. How does this compare with that of the sounder and the relay?

11. Determine the minimum operating current. How does it compare with the minimum operating current of the Morse relay?
12. Note the adjustments.

**Questions.**

- (3) *Which instrument, the main-line sounder or the Morse relay, makes the louder sound?*
- (4) *Under what circumstances may main-line sounders be used?*
- (5) *What difference is there in the winding of sounders designed for use on local and main line circuits?*
- (6) *Does the current fluctuate—*
  - a. *In a local circuit?*
  - b. *In a main-line circuit?*
- (7) *What is a resonator? What is its purpose?*



### SUGGESTIONS FOR THE INSTRUCTOR

1. The equipment as listed in the Students Manual will be prepared in advance for each student.
2. *a.* Assemble the class and explain the need for the local sounder in addition to the Morse relay.  
*b.* Draw the relay and sounder circuits on the blackboard and explain how the relay operates the sounder.  
*c.* Draw the main line sounder circuit on the blackboard and compare the operating efficiency of this instrument with that of the Morse relay and the local sounder.
3. Instruct the students to perform the operations as directed in the Students Manual.
4. Assemble the class and give the following instruction test, or one of similar nature.

### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 35-A (PERFORMANCE)

#### Directions to the instructor.

#### Equipment.

- 1 Morse relay.
- 1 4-ohm sounder.
- 1 dry cell.
- 10 feet of twisted pair wire.

#### Procedure.

1. Have the several sets of equipment prepared in advance.
2. Direct each student to connect the sounder, relay, and dry cell so that movements of the relay armature actuate the sounder.

### INSTRUCTION TEST No. 35-A (PERFORMANCE)

1. **Directions to the student.**—*a.* The following equipment is laid out at the position assigned you:

- 1 Morse relay.
- 1 4-ohm sounder.
- 1 dry cell.
- 10 feet of twisted pair wire.

- o.* Using the above equipment, install the sounder in the resonator. Connect it to the relay and one dry cell. Adjust the sounder.
- c.* When the work is completed and the sounder responds properly to movements of the relay armature, face about and raise your right hand.

**Scoring.**

1. The maximum score in this test is 7 points.
2. The score required to pass is 7 points.
3. DIRECTIONS FOR SCORING:

	Points
a. If the connections are properly made allow a credit of.....	4
b. If the relay operates the sounder and the sounder is properly adjusted allow a credit of.....	3
c. Where the student fails to complete the test or has failed to perform the experiments correctly, a grade of zero will be given for incomplete parts or parts incorrectly performed.	

**INSTRUCTION TEST 35-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a dotted line inclosed in parentheses, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like armor-plated or back-fire, counts as one word.

1. The operating current of the 4-ohm sounder is (.....) milliamperes.
2. The 4-ohm sounder requires an E. M. F. of (.....) volt to operate it.
3. The normal main-line current is (.....) milliamperes. A main-line sounder would operate efficiently on this current.
4. To amplify the sound, a sounder is sometimes placed in a (.....).
5. The main-line sounder requires (.....) operating current than the Morse relay.
6. The main-line sounder requires (.....) adjustments than the Morse relay for operating on a fluctuating current.
7. A current which varies in strength is called a (.....) current.
8. To reduce the current through a coil without changing the battery (.....) should be added in series.

## THE KEY

### Equipment.

- 1 closed-circuit key and leads.
- 1 4-ohm sounder.
- 1 dry cell.
- 1 open-circuit key.

### Information.

The key is that part of the apparatus used in making and breaking the circuit, thus sending pulses of current, in the form of dots and dashes, which represent characters of the Morse alphabet.

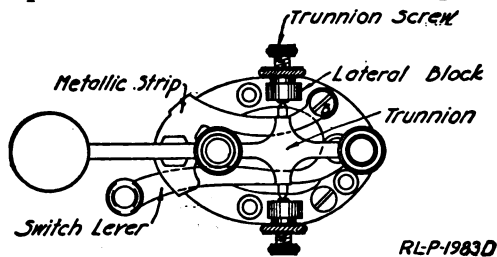


Fig. 22.—The closed-circuit key (top view)

There are three kinds of keys in use.

- a. The closed-circuit key.
- b. The open-circuit key.
- c. The pole-changing key.

The closed-circuit key is used on any line where it is desired to maintain the circuit and keep battery on the line when no business is

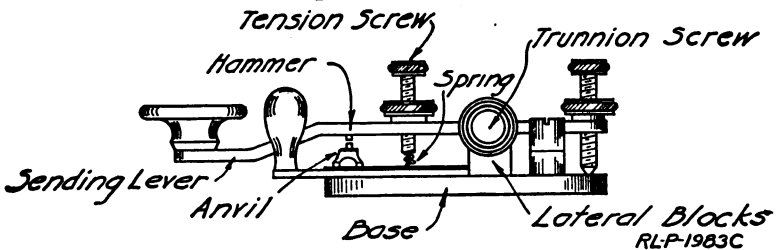


Fig. 23.—The closed-circuit key (side view)

being transacted. The closed-circuit key (shown in Figs. 22, 23, and 24) consists of a metal base with lateral blocks above and on each side. These blocks are drilled and threaded to permit a trunnion screw to pass through each, from the outside toward the center. The inner ends of the screws point toward each other and are drilled smooth, to support the conical-ended trunnions of the sending lever.

This lever, being pivoted at the trunnions, can be raised or depressed at the front end. There is a platinum contact projecting downward

on the under side of the lever, directly over the front part of the metallic base. This contact piece is called the "hammer" and is secured firmly, both electrically and mechanically, to the lever.

On the base, exactly below the hammer, is a similar platinum contact projecting upward, which is called the "anvil." The anvil is secured to the base mechanically, but insulated from it electrically. As shown in the figure, there is a metallic strip connecting the anvil to a binding post which is also insulated from the base. Thus we have the anvil and one binding post connecting together, electrically, but insulated from the rest of the key. The other binding post is connected to the base both mechanically and electrically.

Depressing the front end of the lever brings the hammer and anvil into contact, thus completing the circuit, through the key from one binding post to the other.

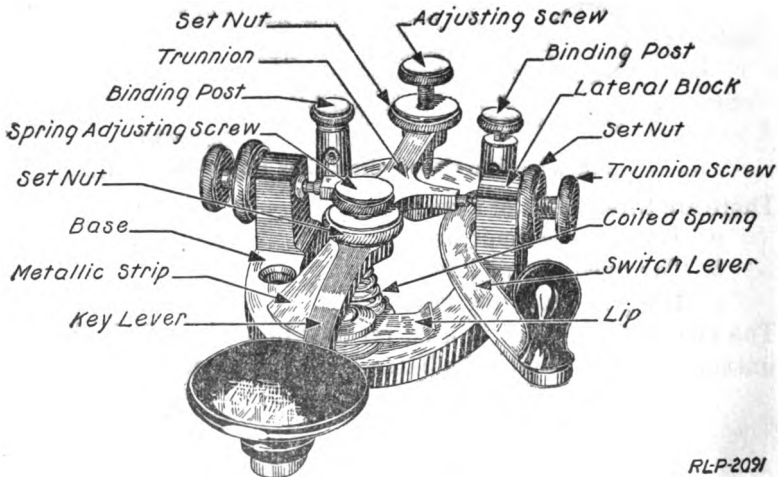


Fig. 24.—The closed-circuit key (perspective)

The metallic strip which connects the binding post to the anvil extends a little beyond the anvil, forming the lip, which affords a convenient contact with the switch lever. The switch lever is connected to the binding post which is not insulated. When the key is not in use, it is necessary to provide a path for the line current, and thus permit other stations to work. This is done by "closing the key," that is, by bringing the switch lever into contact with the lip. As the lip connects with one binding post and the switch lever with the other, connecting the two completes the circuit through the key.

The hammer and anvil are kept apart by a coiled spring shown under the tension screw. The tension of this spring is regulated by that screw.

The distance between the hammer and anvil is regulated by the back set screw.

The open-circuit key is used where it is desired that no current be on the line when not in use. When this key is used, each station must have a main-line battery, sufficient to operate the entire line. The adjustments of the open-circuit key are the same as the closed-circuit key. The construction of the base, lateral blocks, and trunnions is the same as the closed-circuit key. It has no switch lever. The sending lever is provided with a hammer contact at both the front and rear, the rear hammer being on the lower end of the back set screw. There is also an anvil at both the front and rear. Each of these anvils is connected to a binding post, and both the anvil and the binding post connected thereto are insulated from the base of the key. There is a third binding post connected, electrically, to the base of the key. As the sending lever is also connected to the base of the key, through the trunnions, the third binding post is connected electrically to the hammers at both the front and rear of the sending lever.

The pole-changing key is used when it is desired to alternate the polarities to be sent to the line. As this key is not used with any instruments mentioned in this Manual, it will not be described.

Each operator must learn by experience to adjust his key to suit himself.

As already stated, the distance between the hammer and anvil is regulated by the back set screw. This distance should be about 0.008 inch. The tension of the coiled spring should be such as to balance the sender's hand. This does not mean that the upward pressure should equal the weight of the sender's hand, as some operators with large hands are light senders. It does mean that the sender will close the front contacts by a downward pressure, and when this pressure is removed the contacts are opened by the upper pressure of the spring. Thus muscular force is used to close but not to open it.

#### **Directions.**

1. Examine the construction and adjustment of the closed-circuit key.
2. Draw a diagram of the circuit of a closed-circuit key. What does the key lever do?
3. Adjust the contacts of the key to 0.008 inch approximately. Adjust the spring so that the weight of the hand will just close the key.
4. Connect the key, sounder, and battery in series. Why is the key placed in the circuit?
5. Examine the construction and circuits of the open-circuit key.



**Questions.**

- (1) *Of what use is a key?*
- (2) *What three kinds of keys are there? Where is each kind used?*
- (3) *How must an operator adjust his key?*

**SUGGESTIONS FOR THE INSTRUCTOR**

1. The equipment as listed in the Students Manual will be prepared in advance for each student.
2. *a.* Assemble the class and discuss the different kinds of keys and their uses.  
*b.* Trace the circuit of the key and call attention to the method of insulating.  
*c.* Demonstrate the proper adjustments of the key.
3. Instruct the students to perform the operations as directed in the Students Manual.
4. Assemble the class and give the following instruction test.

**SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 36-A  
(PERFORMANCE)**

**Directions to the instructor.**

**Equipment.**

- 1 closed-circuit key.
- 1 4-ohm sounder.
- 1 dry cell.
- 5 feet of insulated wire.

**Procedure.**

When each student has practiced the use of the keys, direct him to connect the closed-circuit key, sounder, and cell in series, adjusting the key and operating the sounder by the key.

**INSTRUCTION TEST No. 36-A (PERFORMANCE)**

**Directions to the student.—***a.* The following equipment is laid out at the position assigned you:

- 1 closed-circuit key.
- 1 4-ohm sounder.
- 1 dry cell.
- 5 feet of insulated wire.

*b.* (1) Using the above equipment, connect the key, sounder, and battery in series.

(2) Adjust the key in accordance with instructions given in the Unit Operation.

(3) Operate the sounder by means of the key.

*c.* When the work is completed, face about and raise your right hand.

**Scoring.**

1. The maximum score on this test is 8 points.
2. The score required to pass is 4 points
3. DIRECTIONS FOR SCORING:

	Points
a. If the circuit connections are properly made.....	4
b. If the key is adjusted properly.....	4
c. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.	

**INSTRUCTION TEST NO. 36-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a dotted line, inclosed in parentheses, thus, (.....).

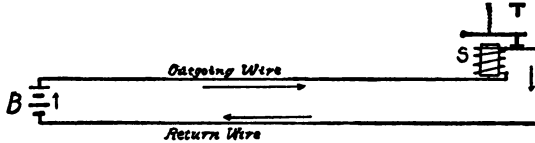
Fill in each blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like armor-plated or back-fire, counts as one word.

1. The (.....) circuit key is the most commonly used key.
2. The closed-circuit key is in (.....) with the line.
3. The open-circuit key is in (.....) with the line when the key is closed or open.
4. The closed-circuit key has (.....) binding posts.
5. The open-circuit key has (.....) binding posts.
6. The (.....) circuit key places battery to the line when the key is closed.
7. The (.....) circuit key has a circuit-closing switch.

## TELEGRAPH CIRCUITS

### Equipment.

- 2 Morse relays.
- 2 keys.
- 2 sounders.
- 8 dry cells.
- Necessary wire.



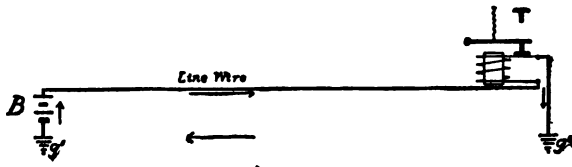
*Diagram of Metallic Circuit*

Fig. 25.—Telegraph circuit, metallic

### Information.

To permit the flow of electricity, a circuit must be complete. That is, there must be a path, composed of electrical conductors, from the starting point through the instruments, the line, the battery, etc., and back to the starting point.

These circuits are of two kinds, metallic and grounded. A metallic circuit is one in which all parts of the path are composed of metal. Figure 25 shows such a circuit. A grounded or ground return circuit



*Diagram of Ground-Return Circuit*

Chas. S. S. S.

Fig. 26.—Telegraph circuit, ground return

St. J. S. S. S.

is one in which the earth is used as the path along which the current travels to return to the place from which it started. Fig. 26 shows such a circuit. It will be noted that one side of the battery is grounded and the other side connected to the line. The line connects to the instruments at the distant end, and from these to ground.

The circuit can then be traced from the ground through the battery, the line, the distant instruments, and back to ground. To return to the place from which it started, that is, to complete the circuit, it must pass through the ground.

This is called a "grounded" circuit. Practically all main-line telegraph circuits are of this class.

On long telegraph circuits there are two advantages in the ground return:

First, lower cost of construction.

Second, one-half the line resistance.

It is easy to see that the cost of construction will be reduced as but one wire need be used. The resistance of the line will be very little more than that of one wire between the two terminals. This is due to the fact that the ground return has a very small resistance.

**Directions.**

1. Construct a metallic circuit consisting of two Morse relays, two keys, and a six-cell battery connected in series.

Does one key control all the relays?

Can the relays be read easily?

2. Connect a 4-ohm sounder and one cell in series with the local contacts of each relay.

What controls the operation of the sounder?

Can the sounder be read more easily than the relay alone?

3. Construct a grounded circuit by disconnecting one pole of the battery and grounding it, also grounding the distant end of the circuit. What is the difference between a grounded and metallic circuit?

4. Vary the above arrangement by dividing the battery, placing three cells at either end of the line and grounding them.

If the positive pole is grounded at one end of the line, what pole of the battery is grounded at the other end of the line?

5. Note that the earth acts as a return conductor of very low resistance, due to the fact that the mass of the earth being so great a very great number of conducting paths are offered in parallel.

**Questions.**

(1) *What are the two classes of telegraph circuits, considering the nature of the conductor?*

(2) *Where is each kind of circuit used?*

(3) *What are the advantages of each?*

### SUGGESTIONS FOR THE INSTRUCTOR

1. The equipment as listed in the Students Manual will be prepared in advance for each student.
2. Assemble the class and discuss the subject of telegraph circuits, confining the discussion to the simple circuits covered in the Manual.
3. Instruct the students to perform the operations as directed in the Students Manual, the students working in pairs. The ground used should be designated by the instructor at the preliminary assembly of the class.
4. Assemble the class and give the following instruction test.

#### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 37-A (PERFORMANCE)

##### Directions to the instructor.

##### Equipment.

- 2 Morse relays.
- 2 closed-circuit keys.
- 2 4-ohm sounders.
- 8 dry cells.
- 10 feet of insulated wire.
- 2 ground connections.

##### Procedure.

Direct each student to construct a two-station ground-return Morse circuit, installing half the battery at each terminal, adjusting the instruments and placing the keys in operation.

#### INSTRUCTION TEST No. 37-A (PERFORMANCE)

Directions to the student.—*a.* The following equipment is laid out at the position assigned you:

- 2 Morse relays.
- 2 closed-circuit keys.
- 2 4-ohm sounders.
- 8 dry cells.
- 10 feet of insulated wire.
- 2 ground connections.

*b.* (1) Using all of the above equipment, construct a two-station ground-return Morse circuit, installing one-half of the battery at each terminal.

(2) Adjust the instruments and place the circuit in operation.

*c.* When the work is completed, face about and raise your right hand.

**Scoring.**

1. The maximum score on this test is 12 points.
2. The score required to pass is 8 points.
3. DIRECTIONS FOR SCORING:

	Points
a. If the two batteries are connected to the line properly.....	4
b. If both relays and keys are connected to the line properly.....	4
For each error in line connections of relays and keys, deduct one point.	
c. If both sounders are properly connected using one dry cell for each sounder.....	4
d. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.	

**INSTRUCTION TEST NO. 37-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences and just after each one is a dotted line. Read each sentence carefully, and if what it says is true write a plus sign (+) on the line. If what it says is not true, write a minus sign (–) on the dotted line.

1. There are two classes of circuits, metallic and ground return. ....
2. Main-line telegraph circuits are usually ground return. ....
3. A ground-return circuit has more line resistance than a metallic circuit. ....
4. A metallic circuit has twice the line resistance of a ground-return circuit. ....
5. The return path through the earth has a high resistance. ....
6. A ground-return circuit must have battery at both terminals of the line. ....
7. The battery at one terminal of the line must have the positive pole grounded and the one at the other terminal must have the negative pole grounded. ....
8. A ground-return circuit costs less to construct. ....
9. A ground-return circuit requires less battery than a metallic circuit for the same current strength. ....
10. In either a metallic or a ground-return circuit there must be but one possible path over which the current can flow. ....

### SWITCHBOARDS

#### Equipment.

- 1 peg switchboard with pegs and leads.
- 1 box relay with leads.

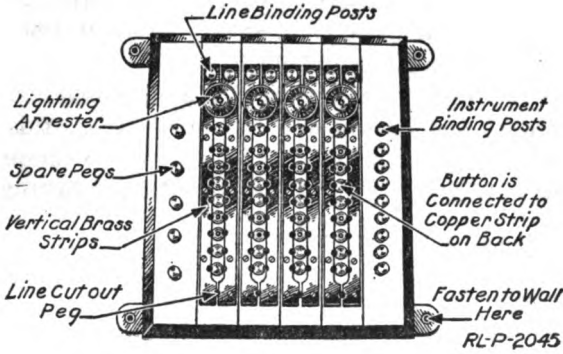


Fig. 27.—Telegraph switchboard (front view)

#### Information.

The switchboard is a piece of apparatus which provides a convenient method of switching (changing) instruments from one wire to another or of switching the connections between wires.

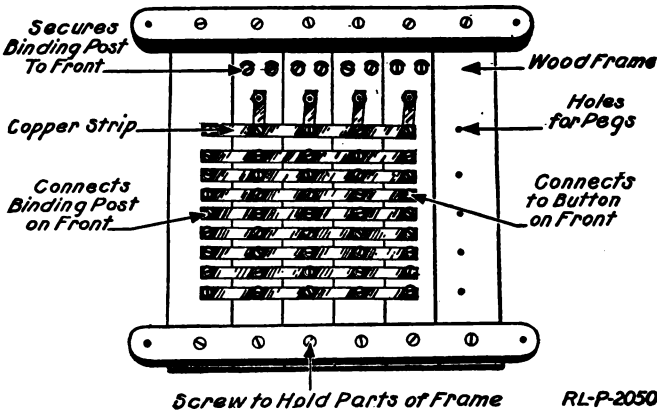


Fig. 28.—Telegraph switchboard (rear view)

The peg switchboard, on account of its simplicity and ruggedness, is used in small offices. (See Fig. 27, a front view, and Fig. 28, a rear view.)

On this type of switchboard each line wire terminates at a binding post at the top of the board. Each binding post is fastened securely to the top of a strap of brass, which extends to the bottom of the board.



This brass strap is rigidly fastened to the board. As it is a conductor of electricity, it serves as an extension of the wire from the top to the bottom of the board. A contact with any point on this strap is equivalent to a contact with the wire attached to the top.

These straps are assembled in pairs, with a vertical row of buttons between each pair. The distance between the straps and the size of the buttons is such that there is an air gap of about one-sixteenth of an inch between either strap and button.

Opposite each other across the air gap a small segment of a circle is cut out of both the button and the brass strap; this provides a round hole in which a brass peg may be inserted to complete an electrical connection between a strap and any desired button.

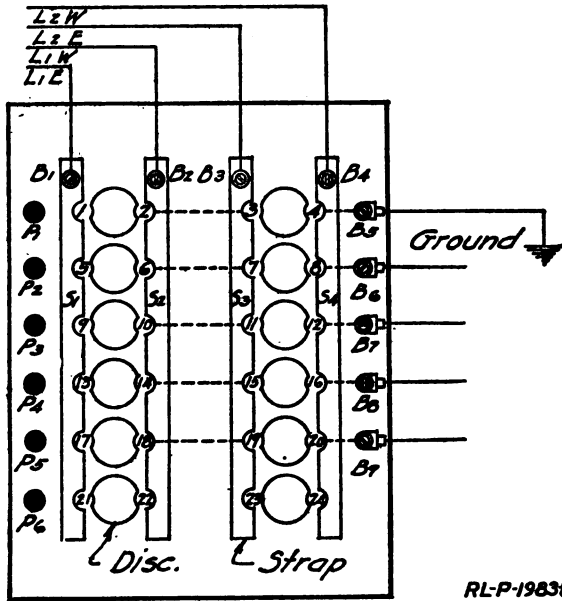


Fig. 29.—Diagram of connections to telegraph switchboard

The wires leading from the instruments are connected to binding posts at the side of the board. (See Fig. 29.) Each of these binding posts is drilled at the base to receive a machine screw. These screws pass through the board from the back to the front. The tip of each screw makes electrical contact with a binding post, while the head, at the back of the board, makes contact with a brass or copper strap. (Fig. 28.)

These brass or copper straps on the back of the board extend across horizontally; that is, at right angles to the vertical straps on the front of the board. These straps are extensions of the instrument wires

in the same manner that the vertical straps are extensions of the line wires. A contact with any point on one of these horizontal straps is the same as a contact with the instrument wire connected thereto.

These horizontal straps on the back of the board are electrically connected to the horizontal row of buttons opposite the binding post to which that strap is attached. This means that a horizontal row of buttons is connected to each instrument wire.

As each vertical strap is connected to a line wire, and each horizontal strap to an instrument wire, the insertion of a peg connecting a vertical strap to a button of some horizontal row connects a line wire to an instrument wire.

The top horizontal row of buttons is usually connected to a ground wire, as shown in Fig. 29. The insertion of a peg between a vertical strap and one of these buttons connects that vertical strap to ground.

Line battery may also be connected to a horizontal strap. When this is desired, one pole, either negative or positive, is connected to the binding post of a horizontal strap and the other pole is grounded, or if desired both poles may be connected to horizontal straps, and a ground may be applied in the switchboard to either pole, thus making the battery reversible.

#### Directions.

1. Examine the construction of the peg switchboard, noting the arrangement of vertical and horizontal straps terminating in binding posts. (Fig. 27.)
2. Connect line wires to two binding posts.
3. With two pegs cut the wires through the board. (See Fig. 34.)
4. Connect a Morse set to two binding posts.
5. Connect the instrument to the wires with two plugs. (See Fig. 31.)
6. *a.* Remove and examine the ground strap. Note its use as a lightning arrester.
- b.* Replace the ground strap.
7. Connect a ground wire to the top binding post at the side of the board.
8. Ground one of the line wires by connecting it to the ground strap with a plug. (See Fig. 33.)

**Questions.**

- (1) *What is the purpose of a switchboard?*
- (2) *What is the type of switchboard most commonly used in small offices? Why?*
- (3) *What part of the switchboard acts as an extension—*
  - a. Of the line wires?*
  - b. Of the instrument wires?*
- (4) *How is a line wire connected—*
  - a. To an instrument wire?*
  - b. To the ground?*
  - c. To battery?*
- (5) *Are line wires connected to vertical or horizontal straps?*
- (6) *How are instruments connected to this switchboard?*
- (7) *How is the ground wire connected to this switchboard?*

**SUGGESTIONS FOR THE INSTRUCTOR**

1. The equipment as listed in the Students Manual will be prepared in advance for each student.
2. At the preliminary meeting of the class, explain the function of the switchboard and discuss its operation.
3. Trace and explain the various circuits and connections in the peg switchboard.
4. Require each student to perform the operations as prescribed in the Manual. Supervise the work and make necessary explanations.
5. Assemble the class and give the following instruction test:

**SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 38-A  
(PERFORMANCE)**

**Equipment.**

- 1 peg switchboard.
- 4 line wires.
- 2 Morse instruments.
- 1 ground connection.

**Procedure.**

1. Prepare an intermediate station peg switchboard with wires Nos. 1 and 2, north and south, going through the board and with Morse instruments Nos. 1 and 2 connected to horizontal straps. Connect a ground wire to the board.
2. Direct each student to perform the following operations:
  - a. Connect No. 1 instrument to No. 1 wire.
  - b. Connect No. 2 instrument to No. 2 wire.
  - c. Connect instruments Nos. 1 and 2 to No. 1 wire.
  - d. Ground No. 2 wire north and open it south.

**INSTRUCTION TEST No. 38-A (PERFORMANCE)**

**Directions to the student.**

1. At the position assigned you is the following equipment:
  - 1 peg switchboard.
  - 2 line wires, Nos. 1 and 2, north and south, going through the board.
  - 2 Morse instruments, Nos. 1 and 2, connected to horizontal straps on the board.
  - 1 ground wire connected to the board.
2. When the instructor directs "Begin," perform quickly the following operations:
  - a. Connect No. 1 instrument to No. 1 wire.
  - b. Connect No. 2 instrument to No. 2 wire.

3. When you have completed these operations, face about and raise your right hand. The instructor will note the time taken and check your work.

4. When the instructor again directs "Begin," perform quickly the following operations:

- a. Connect instruments Nos. 1 and 2 to No. 1 wire.
- b. Ground No. 2 wire north and open it south.

5. When you have completed the operations, face about and raise your right hand. The instructor will note the time taken and will check your work.

**Scoring.**

- 1. The maximum score on this test is 14 points.
- 2. The score required to pass this test is 8 points.

**3. DIRECTIONS FOR SCORING:**

	Points
a. For performing each of the two operations under Direction 2 correctly.....	2
b. For each instrument correctly connected as prescribed in Direction 4 a.....	2
c. For each of the two operations prescribed in Direction 4 b.....	3
d. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.	

**INSTRUCTION TEST NO. 38-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line inclosed in parentheses, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like armor-plated or back-fire, counts as one word.

- 1. The (.....) provides a convenient means of connecting instruments and wires.
- 2. The (.....) wires are connected to the vertical straps.
- 3. The (.....) are connected to the horizontal straps.
- 4. The ground wire is connected to the (.....) binding post of the switchboard.
- 5. A vertical strap may be connected to a horizontal strap by means of a (.....) (.....).
- 6. A wire may be grounded by connecting its vertical strap to the (.....) strap by means of a brass peg.

**Directions to the student.**—Below are several sentences and just to the right of each is a short dotted line. Read each statement carefully and if what it says is true write a plus sign (+) *on the line* at the right. If what it says is *not* true, write a minus sign (–) *on the line*.

7. Two horizontal straps are necessary to connect an instrument to a wire. -----
8. The ground strap acts as a lightning arrester. -----
9. To connect a set of Morse instruments to a wire, it is necessary to make two connections. -----
10. A wire is opened by removing any peg which may be in its vertical strap. -----
11. An instrument must be connected to every line which passes through the switchboard. -----
12. A line wire should be grounded only through battery. -----
13. Line battery should be connected to a horizontal strap. -----



## LINE TROUBLES

### Equipment.

- 1 switchboard.
- 2 Morse sets.
- 1 voltmeter.
- 2 line wires.
- 1 ground connection.
- Necessary battery.

### Information.

"Troubles" are faults in some portion of the line or apparatus which interfere with the proper operation thereof. The interference may be partial or complete.

Line troubles usually are:

- Grounds, or leaks.
- Crosses.
- Opens.

A wire is said to be "grounded" when some part of that wire is connected to the earth.

A wire has a "leak" when it is connected to the earth through a resistance.

Generally speaking, the difference between a "ground" and a "leak" is that the "ground" causes a complete interruption of business over that section of that wire, while business can be transacted over a "leaky" line, but generally with some difficulty.

Grounds are caused by a wire becoming loosened from one or more insulators and making contact with the earth, or with a conductor which is connected to earth, such as a guy wire, messenger strand, etc.

Leaks are the same as grounds except that contact to the ground is made through some substance which is a poor conductor of electricity, such as foliage or wet wood.

A swinging ground or leak is one where the contact is made intermittently; that is, the fault will come and go.

Wires are said to be "crossed" when two or more of them are in contact with each other.

Crosses are divided into two classes, partial and complete.

A complete cross is one in which two or more wires make contact through very little or no resistance.

A partial cross is one of high resistance.

Crosses are caused by wires being swung together by the wind, by a pole falling and wires becoming entangled, by some metallic substance falling across two or more wires, or any other manner in which two or more wires may become electrically connected.



Partial crosses are caused in the same manner, except that the contact is poor. For instance, suppose a piece of rusty wire falls across two wires. Trouble would show, but through such a high resistance that business might possibly be transacted.

A swinging cross is one where the trouble is intermittent.

When two or more wires are crossed, only one circuit can be used regardless of how many wires may be entangled.

A wire is said to be "open" when the continuity of the circuit is broken.

Opens occur frequently in instruments by small wires becoming corroded until they break.

On lines, opens are caused by falling limbs from trees, by high winds, by sleet, and by combinations of these causes.

An open may also cause a ground, providing that when the wire breaks it makes contact with the earth or some conductor connected thereto.

An open may also be intermittent. Such an open is not likely to occur where the wires are supported on poles. It usually occurs in instruments, office wiring, or in cables where broken wires would not be displaced by their weight.

#### **Directions.**

1. Establish a terminal test office equipped with switchboard; positive and negative main-line battery; a voltmeter; two Morse sets and a ground; two main-line wires, Nos. 1 and 2, taking battery at both the distant station and the home station.

2. *a.* Open No. 1 at some intermediate point.

*b.* Connect a relay in series with No. 1. How is it affected?

*c.* Remove the relay and connect a voltmeter in series with No. 1. How is it affected?

3. *a.* Ground No. 1 at some intermediate point.

*b.* What effect has this on a relay placed in the circuit when battery is applied at the home station? When a ground is applied?

*c.* What effect has it on a voltmeter placed in the circuit when battery is applied? When a ground is applied?

4. *a.* Cross Nos. 1 and 2 at some intermediate point.

*b.* Cut relays in on Nos. 1 and 2.

*c.* How are the relays affected when battery is applied to one wire and a ground to the other at the home station?

*d.* How are the relays affected when positive battery is applied to one wire and negative to the other?

5. Open No. 2 at the home station and at some point beyond the cross. What effect has this on the relays?

6. *a.* Remove the cross on Nos. 1 and 2.

- b. Ground No. 2 at some intermediate point.  
 c. Open No. 2 at the distant terminal without removing the intermediate ground.  
 d. How does this affect a relay at the home station?

NOTE.—An escape or leak is a ground containing high resistance and is tested for in the same manner as for a ground.

**Questions.**

- (1) *What are "troubles"?*
- (2) *What is the nature of the usual faults?*
- (3) *What is a ground?*
- (4) *What is a leak?*
- (5) *What is the difference between a leak and a ground?*
- (6) *What is a swinging ground?*
- (7) *What is a cross?*
- (8) *What two classes of crosses are there?*
- (9) *What is the difference between a complete and a partial cross?*
- (10) *What causes crosses, complete or partial?*
- (11) *What is a swinging cross?*
- (12) *What is an open?*
- (13) *What is a frequent cause of opens in wires?*
- (14) *What is a frequent cause of opens in instruments?*
- (15) *Can an open be the cause of—*
  - a. *A ground? How?*
  - b. *A cross? How?*
- (16) *Can an open be intermittent?*
- (17) *Could an intermittent open occur on an open wire?*
- (18) *What is the test which would show the presence—*
  - a. *Of an open?*
  - b. *Of a ground?*
  - c. *Of a cross?*



### SUGGESTIONS FOR THE INSTRUCTOR

1. At the preliminary meeting of the class the instructor will discuss the subject of line troubles, explaining the various kinds of troubles that occur, such as opens, crosses, grounds, and escapes, and how they may be recognized and located.
2. Require the students to install the equipment designated in the Unit Operation.
3. Require each student to perform the operations as prescribed in the Manual. Supervise the work carefully and instruct the students in the proper manner of making the tests. Have each student draw out the circuit diagram in each case to assist in visualizing what is taking place.
4. Assemble the class and give the following instruction test, or one of similar nature.

### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 39-A (PERFORMANCE)

#### Directions to the instructor.

#### Equipment.

- 1 peg switchboard.
- 1 line battery.
- 1 ground connection.
- Morse relay with key.
- 5 line wires.
- 1 Weston, type 280, voltammeter with leads.
- 1 tag.

#### Procedure.

1. Before starting the test the instructor should install the above equipment as a terminal office with five line wires, numbered 1, 2, 3, 4, and 5, connected to the switchboard, taking battery at the distant station. The following trouble should be put on the wires indicated:
  - No. 1, grounded.
  - Nos. 2 and 3, crossed.
  - No. 4, opened.
2. One student at a time should be directed to determine the nature of the trouble on each line.

### INSTRUCTION TEST No. 39-A (PERFORMANCE)

Directions to the student.—*a.* The following installation is provided for this test:

- A terminal office equipped with—
  - 1 peg switchboard.

Line battery, ground wire, Morse relay with key and 5 line wires numbered 1, 2, 3, 4, and 5, connected to the switch-board.

- 1 Weston, type 280, voltammeter with leads.
- 1 tag.

b. The four line wires extend to a distant station where they take battery. Certain of these wires are in trouble between the two line terminals.

Tests should always be made in the following order: (1) Test for open, (2) test for ground, (3) test for open and ground, (4) test for cross, (5) test for open and cross.

c. Perform the following operations in order:

d. (1) Test and determine the nature of the trouble on No. 1 wire. Make the proper notation on the tag.

(2) Repeat this for Nos. 2, 3, 4, and 5.

(3) Write your name on the tag. Face about and raise your right hand.

**Scoring.**

- 1. The maximum score on this test is 12 points.
- 2. The score required to pass is 8 points.
- 3. DIRECTIONS FOR SCORING:

	Points
a. For the condition of each wire determined correctly.....	4
b. Where the student has failed to complete the test or has failed to perform the experiments correctly, a score of zero will be given for incomplete parts or parts incorrectly performed.	

**INSTRUCTION TEST NO. 39-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a dotted line inclosed in parentheses, thus (.....).

Fill in each blank space with a word which will make good sense and at the same time be technically correct. A hyphenated word, such as armor-plated or back-fire, counts as one word.

- 1. A wire which is broken but does not touch the ground is said to be (.....).
- 2. A poorly insulated line is subject to (.....) in rainy weather.
- 3. An escape or leak is a (.....) resistance ground.
- 4. Two wires in contact are said to be (.....).
- 5. When two wires touch intermittently they are said to have an (.....) (.....).

6. When two wires are crossed, one of them can be cleared by (.....) the other, each side of the cross.

7. An open wire on a metallic circuit may be made partially serviceable by (.....) it on each side of the open.

8. When two wires swing together, one of the wires may be cleared by (.....) the other.

9. It may be possible to work through an escape if the resistance of the escape is very (.....).

10. If three wires are crossed, only (.....) can be cleared.



## PATCHING

### Equipment.

- 4 peg switchboards.
- 2 line wires.
- 8 Morse sets.
- Ground connections.
- Necessary cells.

### Information.

By patching is meant any change of wire connections which will result in a new routing of wires already established. Patching is resorted to when sections of some wires are in trouble and when the volume of business changes. Figs. 31 to 37 show simple patches in offices.

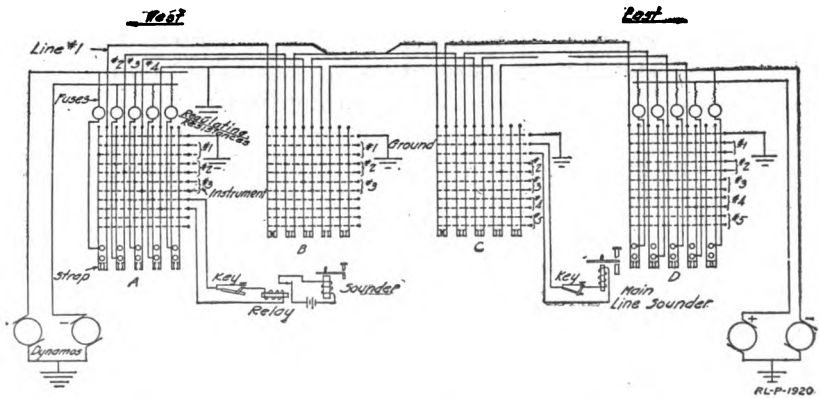


Fig. 30.—Four-station telegraph line with connections

It is frequently the case that several wires pass through an office which is equipped with but two or three instruments. In this case the wires having no instruments are "cut through" as shown at the bottom of the board.

Wire No. 2, Fig. 34.

Wire No. 1, Fig. 30, stations B and C.

Suppose a line (Fig. 30) has four wires and four stations, A west, B and C intermediate, D east. Wire No. 4 is grounded between A and B, wires Nos. 1 and 2 are crossed between B and C, and wire No. 3 is opened between C and D.

By testing, the wire chief at A would classify and locate the fault. He finds he has trouble on each one of the four wires.

No. 4 will not work between A and B.

No. 3 will not work between C and D.

Nos. 1 and 2 are crossed, so that but one of them can be used between B and C, but he finds three available wires at any point on the line.



To utilize them he gives the following orders:

Orders to operator at B—

- Open No. 4 west and No. 2 east.
- Put No. 4 east to No. 2 west with instruments.
- Cut No. 3 through with instruments.
- Cut No. 1 through.

Orders to operator at C—

- Open No. 2 west.
- Ground No. 3 east.
- Cut No. 4 through with instruments.
- Cut No. 3 west to No. 2 east with instruments.
- Cut No. 1 through.

By this he has three wires for the entire distance.

The reason for his orders are:

No. 4 is grounded between A and B and can not be used over that section. He orders B to open his line. As it is grounded, it still appears to be closed to A, so he places an instrument on it to show when it opens. No. 4, is now available from B to D.

As Nos. 1 and 2 are crossed between B and C, but one of them can be used. He therefore has No. 2 disconnected (opened) on both sides of the cross (at B and C); this leaves No. 2 available from A to B, and from C to D, but useless from B to C and permits communication from A to D, over No. 1. (One wire through.)

He now uses No. 2 from A to B, where he connects (patches) it to No. 4, which is available from B to D. (Another wire through.)

No. 3 is good from A to C but open between C and D, while No. 2 is good from C to D. He therefore patches No. 3 west to No. 2 east and has a third circuit from A to D.

As No. 3 is open between C and D, it is grounded at C and an instrument put on at D to register when the line closes.

As there are no instruments on No. 1 at B and D, it may be supposed that this is a through wire, while the others are being used to handle local business.

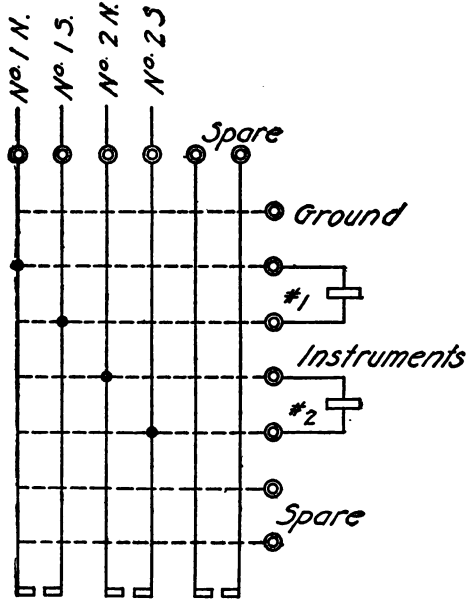
It will be noted that as all wires are in trouble at different points the wire chief at A has no available wire with which to get in touch with C and D to make the necessary tests and wire instructions for patching. However, by calling all stations on Nos. 1 or 2 and 4, he would soon get an answer from B on Nos. 1 or 2, which are crossed between B and C. His tests at B would determine the location of the trouble on No. 4 and would cause him to order No. 4 east patched to either Nos. 1 or 2 west. This would give him a good wire from A to D and enable him to make further tests and patches.

**Directions.**

Establish an intermediate office equipped with a peg switchboard containing two wires, Nos. 1 and 2; two single-line Morse sets; and a ground. Mark the north and south terminals of each line wire.

*Operation 1:*

- (1) Connect No. 1 instrument to No. 1 wire.
- (2) Connect No. 2 instrument to No. 2 wire. (See Fig. 31.)

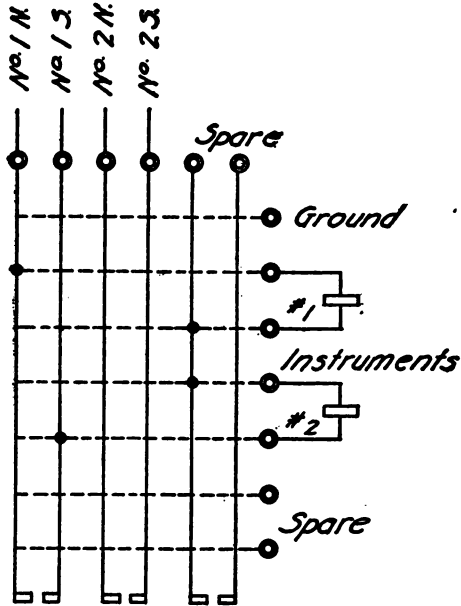


*No. 1 Inst. on No. 1 Wire  
No. 2 Inst. on No. 2 Wire*

**Fig. 31.—Patching**

*Operation 2:*

Connect instruments Nos. 1 and 2 to No. 1 wire, leaving No. 2 wire open. (See Fig. 32.)



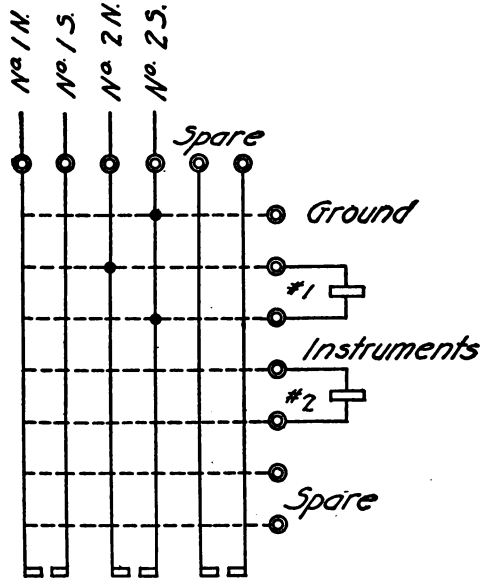
*Both Instruments on No. 1 Wire*

**Fig. 32.—Patching**

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*Operation 3:*

- (1) Connect No. 1 instrument to No. 2 wire.
- (2) Ground No. 2 south.
- (3) Leave No. 1 wire open. (See Fig. 33.)



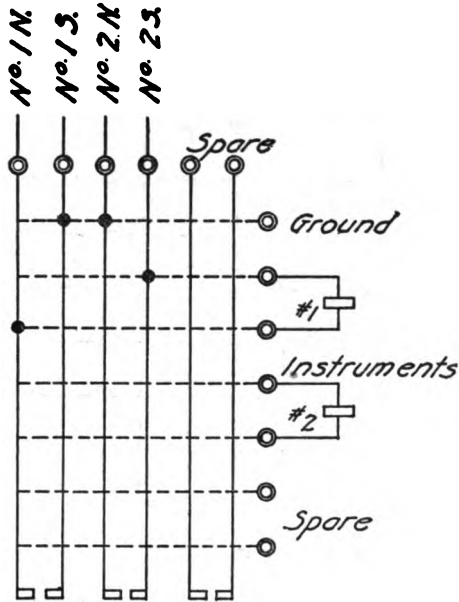
*No. 1 Inst of No. 2 Wire  
No. 2 Wire grounded south  
No. 1 Wire open both ways*

Fig. 33.—Patching



*Operation 5:*

- (1) Connect No. 1 north to No. 2 south and cut No. 1 instrument in.
- (2) Ground No. 1 south.
- (3) Ground No. 2 north. (See Fig. 35.)

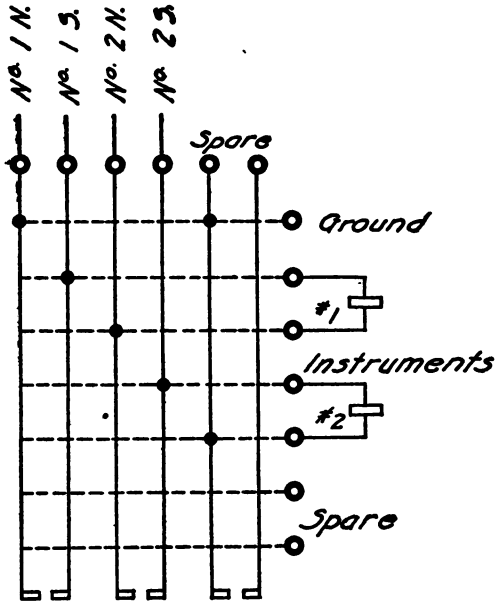


*No. 1 N. to No. 2 S. with No. 1 inst.  
No. 1 S. grounded  
No. 2 N. grounded*

**Fig. 35.—Patching**

*Operation 6:*

- (1) Connect No. 1 south to No. 2 north and cut in No. 1 instrument.
- (2) Cut No. 2 instrument in on No. 2 south and ground the circuit.
- (3) Ground No. 1 north. (See Fig. 36.)



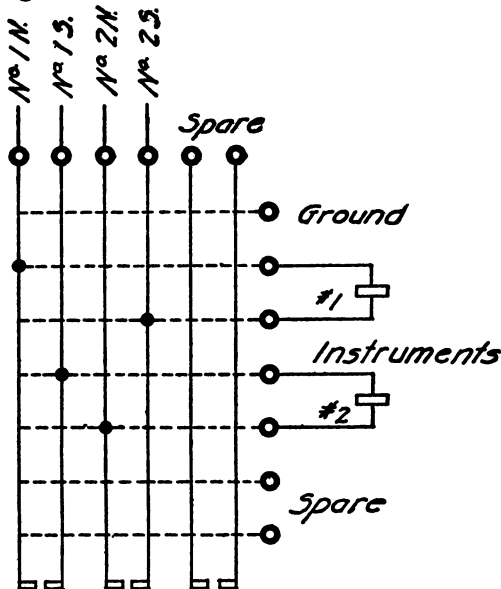
*No. 1 S. to No. 2 N. with instrument #1  
 #2 inst on No. 2 S. to gnd. No. 1 gnd. N.*

Fig. 36—Patching

*Operation 7:*

- (1) Connect No. 1 north to No. 2 south and cut in No. 1 instrument.
- (2) Connect No. 1 south to No. 2 north and cut in No. 2 instrument.

(See Fig. 37.)



*N° 1 N. to N° 2 S. - #1 inst.*  
*N° 1 S. to N° 2 N. - #2 inst.*

Fig. 37.—Patching

RL-P-1922

*Operation 8:*

- (1) Establish two terminal offices each equipped with a peg switchboard and positive and negative storage battery.
- (2) Establish two intermediate offices equipped as in the first seven operations.
- (3) Commencing at west terminal name the offices A, B, C, and D.
- (4) Connect wires No. 1 and 2 between terminal offices, passing through both intermediate boards without connecting instruments. Connect line battery and instrument at terminal offices. (See Fig. 30.)

*Operation 9:*

- (1) Connect No. 1 west to No. 2 east, and No. 2 west to No. 1 east, at station B. No instruments on wires.
- (2) Connect No. 2 west to No. 1 east, and No. 1 west to No. 2 east, at station C. No instruments.



This arrangement (1 and 2) patches No. 1 into No. 2 circuit and No. 2 into No. 1 circuit between B and C.

(3) Connect instruments in both circuits at B and C without changing the patches.

**Questions.**

- (1) *What is patching?*
- (2) *When is patching resorted to?*
- (3) *What is meant by the expression "cut through"?*
- (4) *What wire would be considered as a "through" wire and why?*

### SUGGESTIONS FOR THE INSTRUCTOR

1. At the preliminary meeting of the class the instructor will discuss the subject of wire patching, explaining the necessity of this expedient when wires are in trouble or when circuit routes are changed, and the part the switchboard plays in the operation. He will show the class how wires are opened, interconnected through the switchboard, grounded and given battery, and how instruments are connected to wires.

2. *a.* Require the students to install the equipment designated in the Unit Operation.

*b.* Require each student to perform the operations as prescribed in the Manual. Supervise the work and instruct the students carefully, requiring each student to trace the circuits through the switchboard.

3. *a.* For work on Operations 8 and 9 divide the class into four sections and assign a section to each of the four stations.

*b.* Designate one student wire chief at station A and one student at each of the other stations to act as operator.

*c.* Direct the wire chief to give the necessary orders by telegraph to secure the performance of the operations prescribed in the Unit Operation.

*d.* Rotate the assignments of wire chief and operators so that all students may perform the various operations.

4. Assemble the class and give the following instruction test or one of similar nature.

### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 40-A (PERFORMANCE)

#### Directions to the instructor.

#### Equipment.

1 peg switchboard.

4 line wires, Nos. 1 east, 1 west, 2 east, 2 west, connected to the board and properly labeled.

2 Morse sets connected to the board and properly labeled.

1 ground wire connected to the board

#### Procedure.

1. The equipment listed above should be prepared in advance by the instructor.

2. Direct each student to perform the following operations:

*a.* Patch No. 1 east to No. 2 west and cut instrument No. 1 in the circuit.

*b.* Open No. 1 west.

*c.* Ground No. 2 east and cut instrument No. 2 in the circuit.

INSTRUCTION TEST No. 40-A (PERFORMANCE)

Directions to the student.

a. The following installation is provided for this test:

An intermediate telegraph office equipped with—

1 peg switchboard.

4 line wires, Nos. 1 east, 1 west, 2 east, and 2 west, connected to the board and properly labeled.

2 Morse sets connected to the board and properly labeled.

1 ground wire connected to the board.

b. When the instructor directs "Begin," perform the following operations:

(1) Patch No. 1 east to No. 2 west and cut instrument No. 1 in the circuit.

(2) Open No. 1 west.

(3) Ground No. 2 east and cut instrument No. 2 in the circuit.

(4) When the work is completed, face about and raise your right hand.

Scoring.

1. The maximum score on this test is 10 points.

2. The score required to pass is 6 points.

3. DIRECTIONS FOR SCORING:

	Points
a. For the correct performance of Test No. 1.....	4
b. For the correct performance of Test No. 2.....	2
c. For the correct performance of Test No. 3.....	4
d. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.	

INSTRUCTION TEST No. 40-B (INFORMATION)

Directions to the student.—Below are a number of sentences and just after each one is a short dotted line. Read each sentence carefully and if what it says is true write a plus sign (+) on the dotted line at the right. If what it says is not true write a minus sign (–) on the dotted line.

1. Three wires may be properly interconnected in a switchboard. ....

2. A wire entering a switchboard must be either open, grounded, or take battery at the switchboard. ....

3. A wire may pass through a switchboard without being connected to an instrument. ....

4. A wire may be connected to more than one instrument in a switchboard. ....

- 5. A wire may not be connected to more than two instruments in a switchboard. -----
- 6. One instrument may be connected properly in two circuits. -----
- 7. The wire chief tests wires and gives the orders for all wire assignments and patches in his territory. -----
- 8. Operators may open or ground wires to clear trouble without orders from the wire chief. -----
- 9. If an operator at an intermediate station finds that his instruments may be adjusted better by grounding the wire, he should do so. -----
- 10. If an operator wishes to call a station south of him while the wire is busy north of him, he should ground the wire for this purpose. -----
- 11. An operator should examine his switchboard connections and his instruments occasionally and thus avoid accidental opens, grounds, and crosses in his office. -----
- 12. On closing an office for the night all instruments should be cut out. -----



## SINGLE-LINE REPEATERS

### Equipment.

- 1 Signal Corps shunt locking repeater set.
- 16 dry batteries or equivalent.
- 1 station as described in Unit Operation No. 40.

### Information.

It sometimes becomes necessary to connect two separate single-line Morse circuits in such a manner that the signals originating on one circuit will be repeated to the other. It is usually necessary to arrange so that this operation may be reversed, thus allowing signals from either circuit to be repeated to the other at will.

The simplest form of repeater is a Morse relay with its local contact points connected in series with the opposite line. With this device signals originating on one line are automatically repeated to the other. This is called a one-way repeater.

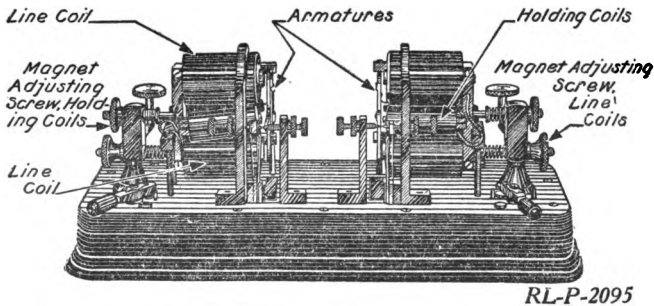


Fig. 38.—Shunt locking repeater

While it is easy to repeat signals one way, it is more difficult to provide for two-way repetition. The reason is that if a repeating relay be placed in each line both sets of contacts would open the first time any key opened, and it would be impossible to close either line again, as neither repeater would have control of the circuit.

To obviate this difficulty, several repeaters have been devised, in all of which provision is made to either keep one relay armature closed when the other is open or to place a shunt around one set of relay points when the other relay is open. In this manner the repeating relay which opens first controls the circuit.

### Directions.

1. Examine and trace circuits of the Signal Corps shunt locking repeater. (Fig. 38.)
2. Connect one terminal of 24-volt local battery to binding posts marked "Battery." Ground the other terminal.

3. Connect a ground to binding post marked "Ground."
4. Adjust contacts so that they make and break properly.
5. Connect two single Morse lines through a set of repeaters as follows: Connect two wires to the main-line coils of each repeater relay and extend them to the switchboard as if they were Morse relays. Next connect each repeater to a line wire and ground by means of pegs.
6. Adjust and operate.
7. Cut repeaters out by means of switches in repeater set.
8. Connect two single Morse lines through a set of repeaters.
9. Connect a Morse set in each line at the repeater station. This connection is made with pegs in the switchboard exactly the same as if each repeater coil was a Morse set.
10. Operate the circuit through the repeaters.

### SUGGESTIONS FOR THE INSTRUCTOR

1. At the preliminary meeting of the class the instructor will explain the function of the repeater and how it operates. He will trace the circuits and explain the operation and adjustments of the Signal Corps shunt locking repeater.
2. Require each student to perform the operations as prescribed in the Manual. Supervise the work and see that all connections and adjustments are made properly.
3. Assemble the class and give the following instruction test.

#### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST NO. 41-A (PERFORMANCE)

##### Directions to the instructor.

##### Equipment.

- 1 peg switchboard, to which are connected 2 line wires, Nos. 1 east and 1 west, both grounded in the board and taking battery at the distant terminals.
- 1 24-volt battery (16 cells or equivalent).
- 1 set of Signal Corps shunt locking repeaters.
- 10 feet of insulated wire.

##### Procedure.

1. The equipment listed above should be prepared in advance by the instructor.
2. Each student, working alone, should be directed to connect the repeaters into the circuits and get them working properly.

#### INSTRUCTION TEST NO. 41-A (PERFORMANCE)

##### Directions to the student.

1. The following installation is provided for this test:
  - 1 peg switchboard to which are connected 2 line wires, Nos. 1 east and 1 west, both grounded in the board and taking battery at the distant terminals.
  - 1 24-volt battery (16 dry cells or equivalent).
  - 1 set of Signal Corps shunt locking repeaters.
  - 10 feet of insulated wire.
2. When the instructor directs "Begin," perform the following operations:
  - a. Connect the repeaters to suitable binding posts on the switchboard.
  - b. Connect the battery and ground to the repeaters.
  - c. By means of pegs cut the repeaters into the circuits of Nos. 1 east and 1 west.



- d. Adjust the repeaters so they repeat either way.
- e. When the work is completed, face about and raise your right hand.

**Scoring.**

1. The maximum score on this test is 16 points.
2. The score required to pass is 12 points.
3. DIRECTIONS FOR SCORING:

Points

- a. If the repeaters are all connected properly to binding posts at the side of the board..... 4
- b. If the battery and ground are connected properly..... 4
- c. If the repeaters are connected to the line wires correctly..... 4
- d. If the adjustments are made so the repeaters function properly... 4
- e. Where the student has failed to complete the test or has failed to perform it correctly, a grade of zero will be given for incomplete parts or incorrect answers.

**INSTRUCTION TEST NO. 41-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences and just after each one is a short dotted line. Read each sentence carefully, and if what it says is true write a plus sign (+) on the dotted line. If what it says is not true, write a minus sign (–) on the dotted line.

1. Repeater are used to break a long line up into small sections each of which may be operated on a low voltage. ....
2. Repeater are used to repeat signals from one circuit to another. ....
3. Signals may be repeated from one line to several other lines by means of repeaters. ....
4. When repeaters are used, more than one station can send signals on the line at the same time. ....
5. Repeater may be used to advantage at an intermediate station where line battery is not available. ....
6. In any two-way repeater two line relays are necessary. ....
7. If one of the line relays in a repeater is adjusted properly and the other relay is not, the signals will pass properly from either direction. ....
8. More than two lines can be connected to one set of repeaters. ....
9. The local battery in a repeater is used to renew the line circuits. ....
10. In the shunt locking repeater only one of the shunt circuits is open at any one time when signals are being repeated. ....

## THE SIMPLEX

### Equipment.

- 2 repeating coils, type 26A or 37A, with leads.
- 2 telephones.
- 2 Morse sets.
- 2 ground rods.
- 5 dry cells or their equivalent.
- 20 feet of twisted pair wire.

### Information.

The simplex provides for telegraphing over a metallic circuit, which is at the same time being used for telephony. This is accom-

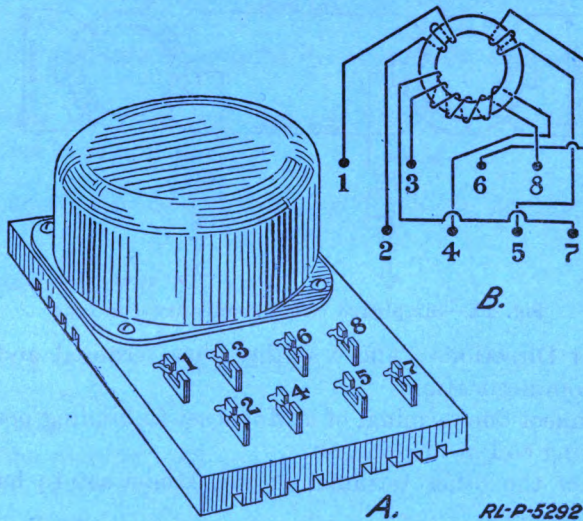


Fig. 39.—Repeating coil 37-A

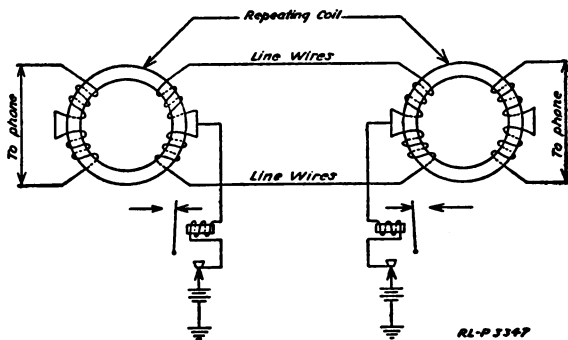
plished by bridging a simplexing coil across the circuit at each terminal. A tap is taken from the middle of each coil and placed in series with a Morse relay, a key, battery, and the earth. In this way the telegraph current is caused to pass over a grounded circuit, consisting of the battery, relay, the simplexing coil, relay, battery, and back through the earth.

As the telegraph current passes through the simplexing coil in opposite directions, and over both line wires in the same direction, it does not affect the telephone, which is operated over the metallic circuit.

The simplexing coil is composed of a set of four windings in an iron case. (See Fig. 39.) The terminals of the four windings are usually brought to lugs for convenience in making various connections and the lugs are numbered.

**Directions.**

1. Examine the circuits of a repeating coil.
2. Connect the coils in pairs for simplexing as follows: With a short wire connect binding posts 1 and 6, 3 and 8. These connections should be soldered.
3. With coils connected as in Direction No. 2 connect binding posts 4 and 7 to the two wires of a metallic telephone circuit.
4. Connect the terminals of a telephone to binding posts 2 and 5. This establishes a telephone station at one terminal of a line through a simplexing coil.



**Fig. 40.—Simplex circuit, repeating-coil type**

5. Repeat Directions 3 and 4 at the other terminal and establish telephone communication.
6. *a.* Connect one terminal of a Morse set to binding post No. 3 of the simplexing coil at one station.  
*b.* Connect the other terminal of the Morse set to battery and ground the battery.
7. At the distant station repeat the operation, leaving the battery out and grounding the Morse set instead.
8. Operate the telegraph and telephone circuits. Note the effect of Morse signals on the telephone.

### SUGGESTIONS FOR THE INSTRUCTOR

1. At the preliminary meeting of the class the instructor will draw the circuits of the 37-A simplexing coil on the blackboard and show the class how the coils may be connected in pairs and the proper method of connecting to a metallic circuit, to a drop switchboard, and to a Morse set. He will also draw a complete circuit simplexed at both terminals and trace the paths of the telephone circuit and the telegraph circuit. He will call attention to the fact that the Morse sets may be replaced by telephones, giving a ground return telephone circuit in addition to the metallic circuit.

2. Require the students to install the equipment designated in this Unit Operation.

3. Require the class to perform the operations as prescribed in the Manual.

4. Assemble the class and give the following instruction test or one of similar nature.

#### SUGGESTIONS FOR CONDUCTING INSTRUCTION TEST No. 42-A (PERFORMANCE)

##### Directions to the instructor.

##### Equipment.

- 1 repeating coil, 37-A. with leads.
- 1 field telephone.
- 1 ground rod.
- 1 main-line sounder with key.
- 5 dry cells or equivalent.
- 20 feet of insulated wire.

##### Procedure.

1. Several sets of the equipment listed above should be laid out in advance.
2. Each student should be directed to connect up one station of a simplexed telephone line and place it in operation.

#### INSTRUCTION TEST No. 42-A (PERFORMANCE)

##### Directions to the student.

1. The following equipment is laid out at the position assigned you:
  - 1 repeating coil, 37-A, with leads.
  - 1 field telephone.
  - 1 ground rod.
  - 1 main-line sounder with key.
  - 5 dry cells or equivalent.
  - 20 feet of insulated wire.

2. When the instructor directs "Begin," perform the following operations carefully and quickly:

- a. Make the proper cross connections between the coil terminals to prepare it for simplexing.
- b. Connect a metallic telephone line to the proper coil terminals and extend it to an adjacent station.
- c. Connect a telephone to the coil.
- d. Connect the main-line sounder to the coil and battery for Morse operation.
- e. Ground one terminal of the battery, first arranging with the adjacent station as to the pole to be grounded.
- f. Place telephone and telegraph in operation.
- g. When the work is completed, face about and raise your right hand.

**Scoring.**

1. The maximum score on this test is 22 points.
2. The score required to pass is 16 points.
3. DIRECTIONS FOR SCORING:

	Points
a. If the coil terminals are properly cross connected.....	4
b. If the line is connected to the proper coil terminals.....	4
c. If the telephone is connected to the proper coil terminals.....	4
d. If the sounder is connected to the coil and battery correctly.....	4
e. If the correct battery terminal is grounded.....	2
f. If telephone and telegraph circuits operate properly.....	4
g. Where the student has failed to complete the test or has failed to perform the experiments correctly, a score of zero will be given for incomplete parts or parts incorrectly performed.	

**INSTRUCTION TEST NO. 42-B (INFORMATION)**

**Directions to the student.**—Below are a number of sentences and just after each one is a short dotted line. Read each sentence carefully, and if what it says is true write a plus sign (+) on the dotted line. If what it says is not true, write a minus sign (–) on the dotted line.

1. In connecting the repeating coil for use in simplexing, the windings should be so connected that the current flows in the same direction in all windings. -----
2. The telegraph circuit obtained by simplexing a telephone circuit can not be used for telephonic communication. -----
3. Ringing on the telephone circuit makes the sounders of the telegraph circuit rattle. -----
4. A telephone connected into the telephone circuit between the simplexing coils will not affect nor be affected by the telegraph circuit. -----

**SUGGESTIONS FOR CONDUCTING PROFICIENCY TEST NO. 4-A  
(PERFORMANCE)**

**Equipment.**

**Problem No. 1:**

- 4 peg switchboards.
- 3 lines, with 2 intermediate stations.
- 4 main-line sounders.
- 6 relays.
- 6 local sounders.
- 10 keys.
- Ground connections.
- Necessary cells and leads.

**Problem No. 2:**

- 2 telephones.
- 2 repeating coils.
- 2 Morse sets.
- 2 dry cells or their equivalent.
- 2 ground connections.
- Line wires.
- Necessary leads.

**Procedure.**

**PROBLEM NO. 1**

1. *a.* Prepare the equipment listed in advance, divided up between two terminal and two intermediate stations, main-line battery being supplied at terminal stations only, lines laid out and tagged but not connected:

*b.* Assign one student to each station to connect up the equipment and get all lines working through.

*c.* Direct each student, acting as operator at an intermediate station, to carry out the directions for patching sent by the instructor, acting as wire chief at a terminal station, over No. 1 wire.

The directions for patching should be similar to the following:

Operator at station B:

- Open No. 3 west and No. 2 east.
- Cut No. 2 west to No. 3 east with instruments.
- Cut No. 1 through with instruments.

Operator at station C:

- Open No. 2 west.
- Ground No. 3 east.
- Cut No. 3 west to No. 2 east with instruments.
- Cut No. 1 through with instruments.

PROBLEM NO. 2

2. *a.* Prepare the equipment beforehand divided between two stations. Repeating coils should be entirely free of connections between lugs.

*b.* Require each student to connect up one station of a two-wire circuit so as to give one telephone channel, and one Morse telegraph channel.

PROFICIENCY TEST No. 4-A (PERFORMANCE)

PROBLEM NO. 1

**Directions to the student.**

1. *a.* At the position assigned you is the following equipment:

1 peg switchboard.

6 lines, tagged Nos. 1, 2, and 3 east and west.

(3 lines, tagged Nos. 1, 2, and 3 east (or west) at terminal stations.)

1 main-line sounder.

1 relay (2 at terminal stations).

1 local sounder (2 at terminal stations).

2 keys (3 at terminal stations).

Ground connection.

Cells and leads.

*b.* When the instructor directs "Begin," perform quickly and carefully the following operations:

(1) Connect the lines to the board.

(2) Connect the ground to the board.

(3) Connect the instruments to the board.

(4) At terminal stations connect the main-line batteries to the board.

(5) Connect the local sounders to the relays.

(6) Connect the main-line sounder to No. 1 wire.

(7) Connect No. 1 relay to No. 2 wire.

(8) Connect No. 3 east to No. 3 west without instrument. At terminal stations connect No. 2 relay to No. 3 wire.

*c.* When you have completed these operations, face about and raise your right hand. The instructor will check your work and note the time.

*d.* Prepare to receive telegraphic instructions from the wire chief. When you have received and acknowledged the instructions, carry them out as quickly as possible, notifying the instructor when you have finished by facing about and raising your right hand. The instructor will note the time and check your work.

PROBLEM NO. 2

**Directions to the student.**

2. *a.* At the position assigned you is the following equipment:

- 1 telephone.
- 1 repeating coil.
- 1 Morse set.
- Dry cells or their equivalent.
- Ground connection.
- 2 line wires.
- Lead wires.

*b.* When the instructor directs "Begin," perform quickly and accurately the following operation:

Using the equipment at your position, set up one station of a circuit over which there is one telephone channel and one Morse telegraph channel.

*c.* When you have completed this work, face about and raise your right hand. The instructor will note the time and check your work

**Scoring.**

1. The maximum score for this test at intermediate stations is 44 points.
2. The maximum score for this test at terminal stations is 48 points.
3. The score required to pass this test at intermediate stations is 30 points.
4. The score required to pass this test at terminal stations is 34 points.

5. DIRECTIONS FOR SCORING:

PROBLEM NO. 1

<i>a.</i> Setting up the station:	Points
(1) For each line wire properly connected to the board.....	1
(2) For ground properly connected to the board.....	2
(3) For each instrument properly connected to the board, key in circuit.....	2
(4) For connecting main line batteries to the board properly (at terminal stations only).....	3
(5) For each local sounder circuit properly connected to relay, using one cell per sounder.....	2
(6) For each line properly pegged through the board.....	2
<i>b.</i> Patching:	
For executing the telegraphic directions from the wire chief....	8



PROBLEM NO. 2

Connecting simplex telephone Morse telegraph circuit:

- (1) For proper connections of repeating coil telephone and line. 12
- (2) For Morse telegraph circuit properly connected..... 4

Where the student has failed to complete the test or has failed to perform it correctly, a score of zero will be given for incomplete parts or parts incorrectly performed.

PROFICIENCY TEST No. 4-B (INFORMATION)

Directions to the student.

Below are a number of sentences and just after each is a short dotted line. If what the sentence says is true (correct), write a plus sign (+) on the line. If what it says is not true (incorrect) write a minus sign (-) on the line.

- 1. A primary cell may be renewed when exhausted by replacing the chemical elements of the cell. ....
- 2. A secondary cell may be renewed when exhausted by replacing the electrolyte. ....
- 3. The mineral oil is used in certain wet cells to separate the electrolyte from the depolarizer. ....
- 4. A gravity cell is short-circuited for 24 hours after being set up to give the copper sulphate time to dissolve. ....
- 5. The open-circuit voltage of the gravity cell is greater than that of the Edison cell, type BA-14. ....
- 6. The resistance of the gravity cell is less than that of the Edison cell, type BA-14. ....
- 7. When two cells are connected in parallel, all the current that flows through one flows through them both. ....
- 8. The gravity cell is used for furnishing small, steady currents, while the Edison cell is used for furnishing strong, intermittent currents. ....
- 9. The black oxide plate in the Edison cell is the negative plate. ....
- 10. A battery of 125 ampere-hours capacity will furnish a steady current of 0.25 ampere for 250 hours. ....
- 11. Water should never be added to the electrolyte of a primary cell after the cell has been prepared and used. ....
- 12. The unit by which electromotive force is measured is the volt. ....
- 13. Copper wire has less resistance than iron wire of the same size. ....
- 14. If a cell of 1 ohm internal resistance and 2 volts E. M. F. is short-circuited, a current of 2 amperes will flow. ....

15. All positive terminals should be connected to one lead and all negative terminals to another when connecting cells in series. -----
16. The current from two cells in parallel through a sounder of 4 ohms resistance is twice what it would be from one cell alone. -----
17. A voltmeter should be connected in series with the circuit whose voltage it is desired to measure. -----
18. An electromagnet with a steel core will retain more residual magnetism than one with an iron core. -----
19. Telegraph instruments are commonly designated by their operating currents. -----
20. Artificial magnets are the only kind used in the construction of telegraph instruments. -----
21. The main-line sounder has two binding posts. -----
22. If a Morse relay operates on 0.05 ampere when the E. M. F. applied is 5 volts, the resistance of the relay is 100 ohms. -----
23. The key is placed in the local circuit when a relay operates a local sounder. -----
24. The most important difference between the local and main-line sounder is in size. -----
25. The springs of a key should be so adjusted that the weight of the hand will close it. -----
26. The resistance of a typical telephone circuit is usually more than that of a typical telegraph circuit having the same distance between terminals. -----
27. The main-line battery is ordinarily concentrated at one station on a telegraph circuit. -----
28. If a line is grounded, the relay armature contact will stay closed at the terminal station. -----
29. A wire is opened by removing any peg which may be in its vertical strap. -----
30. If two wires are crossed, one of them may be used by grounding the other wire both sides of the cross. -----
31. If a line is grounded at an intermediate point, the relay will be closed when a ground is applied at the home station. -----
32. It may be possible to work through an escape if the resistance of the escape is very low. -----
33. Three wires may be properly interconnected in a switchboard. -----
34. A wire entering a switchboard must be either open, grounded, or take battery at the switchboard. -----

35. Operators ordinarily open or ground wires to clear trouble without orders from the wire chief. -----

36. On closing an office for the night all instruments should be cut out. -----

37. Repeaters are used to break a long line up into small sections, each of which may be operated on a low voltage. -----

38. In the shunt locking repeater only one of the shunt circuits is open at any one time when signals are being repeated. -----

39. In connecting a repeating coil for use in simplexing, the coils should be so connected that the telegraph current flows in the same direction around the core in the coils connected together. -----

40. Ringing over a simplexed telephone circuit makes the sounders of the telegraph circuit rattle. -----

41. A telephone connected into the telephone circuit between simplexing coils will not affect nor be affected by the telegraph circuit. -----

42. The strength of the zinc-sulphate solution in a gravity cell increases as the cell is used. -----

43. The ground wire is ordinarily connected to a horizontal strip on the telegraph switchboard. -----

**Directions to the student.**

Below are a number of unfinished statements. After each statement are several words or phrases each preceded by a number. Only one of these answers is correct. Write the *number* of the word or phrase which properly completes the statement on the dotted line to the right.

44. The type of cell most commonly used in telegraph work is (1) primary cell, (2) secondary cell, (3) dry cell. -----

45. Caustic soda is used in the Edison cell, type BA-14, as the (1) electrolyte, (2) negative electrode, (3) depolarizer. -----

46. A gravity cell is short-circuited for 24 hours after setting up to (1) cool the electrolyte, (2) dissolve the copper sulphate, (3) form the zinc-sulphate solution. -----

47. Ohm's law says that

(1) Resistance decreases as current decreases, voltage being constant.

(2) Current decreases as voltage decreases, resistance being constant.

(3) Voltage increases as current decreases, resistance being constant. -----

48. The elements of a BA-14 cell are dipped in water before placing in the electrolyte

- (1) To remove any foreign substance picked up in handling.
- (2) To give them good electrical contact with the electrolyte.
- (3) To keep the oil from coating them with an insulating layer. -----

49. Creeping salts in the gravity cell are caused by

- (1) Too great concentration of the electrolyte.
- (2) Too great concentration of the depolarizer.
- (3) Excess of copper sulphate crystals in the jar. -----

50. Telegraph instruments usually secure their magnetic effect by means of

- (1) Permanent magnets.
- (2) Natural magnets.
- (3) Electromagnets.
- (4) Residual magnetism. -----

51. The telegraph instrument which operates on the smallest current is the

- (1) Morse relay.
- (2) Pocket relay.
- (3) Main-line sounder.
- (4) Local sounder. -----

52. A main-line sounder would be uneconomical as a local sounder because it would require too much (1) attention, (2) current, (3) resistance, (4) adjustment. -----

53. The typical telegraph circuit is (1) metallic, (2) ground return, (3) open. -----

Directions to the student.—Below are a number of sentences from which certain words have been omitted. Each word which has been omitted is indicated by a short dotted line inclosed in parentheses, thus (.....). Fill in each blank space with a word which will make good sense and at the same time be technically correct. A word spelled with a hyphen, like armor-plated or back-fire, counts as one word.

54. The water most desirable for use in cells is (.....) water.

55. The voltage in a circuit being constant, the current increases as the resistance (.....).

56. The magnets used in telegraph instruments usually have cores made of (.....).

57. The pocket relay is (.....) efficient than the Morse relay.

58. To amplify the sound, a sounder is sometimes placed in a (.....).

59. The open-circuit key has (.....) binding posts.

60. Telephone circuits are usually metallic, while telegraph circuits are usually(.....) (.....).

61. The line wires are ordinarily connected to the (.....) strips of a telegraph switchboard.

62. The chief telegraph line troubles are (.....), (.....), and (.....).

63. A change of wire connections which will result in a new routing of wires already established is called (.....).

64. Two long telegraph lines may be operated in series without increased voltage if they are connected through (.....).

65. The (.....) provides for telegraphing over a metallic circuit which is at the same time being used for telephony.

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## INFORMATION TOPICS

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**CODE PRACTICE TABLES AND CONTENTS OF EDIPHONE CODE  
PRACTICE RECORDS**

**TEST RECORD or TEST TABLE A**

A X A X A X CH CH CH CH CH E E E E E N N N N N O O O O O U U U U U  
 A X A X A X CH CH CH CH CH E E E E E N N N N N O O O O O U U U U U  
 A X A X A X CH CH CH CH CH E E E E E N N N N N O O O O O U U U U U  
 A X A X A X CH CH CH CH CH E E E E E N N N N N O O O O O U U U U U

NOTE.—In testing the operating aptitude of students by means of the above and the following Test Records or Tables, the students will copy the letters without accent marks, for example, A CH E N O U A CH, etc.

**TEST RECORD or TEST TABLE B**

A CH E N O U CH N U A E O E O A N U CH E A  
 CH O N U E X CH E N O A U N CH O E N U A CH  
 U CH O N A A O U N E CH E O U A N E O A U  
 E U O N A CH CH E N A U N O E A CH O N A E  
 O CH E A O N U E A CH E N CH O U A N E U O  
 U CH N A O E U E CH A N N A CH E U O A E N  
 O E A CH N U E N O A X E O N CH E U A U N  
 CH N E O U N E A U A

**RECORD or TABLE NO. 1-A**

D H C 9 X Z ?

NOTE.—Each character is sent five times, before sending the next.

**RECORD or TABLE NO. 1-B**

D H C 9 X Z ? H 9 Z ? D X C ? Z H X 9 Z ? C D C 9  
 ? H 9 Z 9 D C H 9 9 C H ? D C X ? H Z X Z 9 ? D Z  
 C ? X H Z X D Z ? X D C 9 Z ? 9 D C H ? 9 C H D C  
 9 Z D 9 ? H D Z X D Z ? X 9 Z 9 ? D C H X ? Z 9 X  
 D ? C C D 9 H ? D Z X 9 X 9 ? H X 9 C H D C D ? H  
 H D ? X C 9 H Z X ? 9 C D C X ? D Z 9 C ? X Z D D

**RECORD or TABLE NO. 2-A**

1 L or Ø S A M Q .

NOTES.—a. L and Ø (zero) are transmitted by the same Morse character. Whether L or Ø is referred to must be determined from the context.

b. Each character is sent five times, before sending the next.

**RECORD or TABLE NO. 2-B**

1 L Ø S A M Q , L Ø D H Z S M X C Q , A 1 Z M Q 1 H D  
 S C 9 X L Ø , D H Q 9 S A , X C , ? Z H 1 M D A Q 9  
 M Q D S H Q Z X 9 C L Ø M A , C S Q 1 9 L Ø H D A 9 Q  
 Q L Ø A Z 9 X S H Z M , H ? Q Z X C D M H S , D H Z  
 A M S 1 Z 9 ? X Z Q X 9 , Z L Ø M 1 ? S Z H ? 9 Q X  
 M A S 9 , Q X ? Z 9 ? A , Z C X 1 9 D L Ø H S M X Q



RECORD or TABLE NO. 3-A

7 O or Ø 3 4 K P \$

NOTES.—a. Ø (zero) is sometimes transmitted in place of the letter O, but the letter O is never transmitted in place of Ø (zero).

b. Each character is sent five times before sending the next.

RECORD or TABLE NO. 3-B

7 OØ3 4 K P \$ D S K \$ 3 9 1 LØ Z Q X 7 , 4 1 3 P H  
S LØ ? 7 K \$ P D S P H Q Z C X M A , \$ C X 1 7 3 K  
4 7 3 1 , A \$ P S H K Q ? X Z C LØ P 7 D K OØ C Z X  
3 1 K H Z S C D OØ 4 LØ M H P K , 7 4 K Z P X Q S P  
K 3 7 Z 1 , A H S 4 ? \$ D OØ M Q ? P X C Z D C LØ S  
1 Z X H D ? LØ S OØ , Z \$ X C M Q A , 9 Q K 9 P M A

RECORD or TABLE NO. 4-A

E W Y 2 & U .

NOTES.—a. The letter E is used to denote a fraction. For example, the fraction  $\frac{1}{2}$  is sent 1 E 2.

b. The period, given on Record No. 4-A, is not identical with the decimal point (.) given on Record No. 5-A.

c. Each character is sent five times before sending the next.

RECORD or TABLE NO. 4-B

E W Y 2 & U . Y 2 1 7 X W E 2 Q D Y U & \$ . W 3 W  
Y , W E U . X Z ? \$ Y C Z S E Z 7 D & Q 2 OØ M P K  
Y E S W A , . U D 2 Q X 1 LØ M 9 \$ 7 4 3 1 2 S A Y  
2 7 1 LØ 3 A U S H P U Q D ? \$ S X E W U Y C E M A  
\$ & E S Z S E P K A , 9 7 9 ? 3 ? K Q X D C X \$ S  
X LØ K Q Y S W U A . Y W . D M ? . Q Z P Y K S P .

RECORD or TABLE NO. 5-A

V R T 8 F I (.)

NOTES.—a. (.) denotes a decimal point; not a period.

b. Each character is sent five times before sending the next.

RECORD or TABLE NO. 5-B

V R T 8 F I (.) R C Z 8 1 V T S H I P F R V U A K R  
R F 2 3 4 7 8 9 (.) . \$ I U V LØ Q X R T F Q U . \$ Y  
W & 8 F Z OØ 7 . F Q R C (.) A , \$ C X (.) M Y R W K P  
8 I E S F V U M C Z T . 9 7 LØ 8 1 4 2 ? , U V F R  
T 8 (.) S E Z E I R I E C Z . Y U 2 W R 8 F V I & W  
V U 2 8 X S Z M . , R \$ OØ A X Q V 4 Q 3 F (.) & E S

RECORD or TABLE NO. 6-A

B N G 6 J 5 Paragraph

NOTES.—a. In the following exercises the paragraph will be indicated by writing Pgh.

b. Each character is sent five times before sending the next.

RECORD or TABLE NO. 6-B

B N G 6 J 5 Pgh G . N B G 6 P M 5 Pgh F Q U R V T LØ K  
G B J 5 N 6 H P S I E Y W \$ & D Q M Pgh K 7 OØ Q 3 V  
J 6 N A G J V F J R C Z Q X . ? (.) Pgh Y Z C R OØ Y J  
6 5 7 G V 4 T LØ N A M G 7 J ? . U D , D N ? G B 8  
D B 8 N D R 5 G 4 V U 2 A N 1 K D C 9 J Q R X Y W  
X 2 Q U V G 7 P 6 J 4 3 Q 5 G B 8 ? 9 . LØ G B N J

**RECORD or TABLE NO. 7**

:	;	- dash	:-	- hyphen
" begins	" ends	'	" begins	:"
(	)	— begins	— ends	%
[ or ]	" begins	;	- hyphen	" ends
— begins	" begins	:	:-	'
:"	— ends	- hyphen	" ends	- dash
:-	" ends	(	[ or ]	)
%	- hyphen	" begins	:	" ends
- dash	- hyphen	:"	:	(
[ or ]	;	" ends	- hyphen	" begins
(	- dash	;	:	" ends
(	[ or ]	" ends	- hyphen	" begins
:-	:"	%	" begins	- hyphen
" ends	(	)	- dash	" begins
" ends	'	" ends	— begins	— ends
:	:-	:"	%	- hyphen
:	'	— ends	" begins	;
" ends	" begins	:"	(	— begins
[ or ]	%	" begins	'	:"
— ends	- dash	:-	" begins	:"
)	" begins	" ends	:"	'
:-	(	:	:	— begins
[ or ]	;	— ends	" begins	" ends
:	- dash	:"	" begins	(

*Key to Morse characters representing marks of punctuation in Record of Table No. 7*

Apostrophe.....	'	----	sent as QX
Brackets.....	[ or ]..	----	sent as BX
Colon.....	:	----	sent as KO
Colon followed by dash.....	:-	----	sent as KX
Colon followed by quotation.....	:"	----	sent as KQ
Dash.....	-	----	sent as DX
Hyphen.....	-	----	sent as HX
Parenthesis (begin).....	(	----	sent as PN
Parenthesis (end).....	)	----	sent as PY
Per cent.....	%	----	sent as PC
Quotation begins.....	"	----	sent as QN
Quotation ends.....	"	----	sent as QJ
Quotation within a quotation.....	'	----	sent as QX
Semicolon.....	;	----	sent as SI
Underline begins.....	—	----	sent as UX
Underline ends.....	—	----	sent as UJ

**RECORD or TABLE NO. 8—MORSE HOMONYMS**

Tim Till Time Lime Litter Titter Tiller Timer Tow Low Lamp Tump Tally Lally  
 Letter Teller Taller Tamer Tatter Tatter Lop Top Lap Tap Late Tale Lake Take Lack  
 Tack Look Took Lame Tame Lag Tag Hag Hame Lub Tug Logs Togs Tomes  
 Lone Tone Long Tong Loot Tool Lore Tore Loss Toss Lilt Tilt Kill Kilt Etta  
 Ella Bell Belt Bull Butt Bum Hog Home Hum Hull Him Hill Hitt Ham Hall Dig  
 Dime Gag Game Nag Name Fag Fame Prig Prime Plug Plume Sag Same Call  
 Cam Cart Carl Hip Pip Bats Bath Cell Celt Coot Cool Cub Cuts Cure Curt Dog  
 Dome Dare Dart Dim Dill Fell Felt Filler Filter Fitter Gassed Gashed Goal Goat  
 Hate Hale Heater Healer Jim Jil Joas Josh Lose Lost Meat Meal Mole Mote  
 Muss Mush

RECORD or TABLE NO. 9—MORSE HOMONYMS

Oats Oath Hop Pop Peep Hope Pope Case Cast Coat Coal Cog Come Doe Dot  
Done Dont Date Dale Ease East Feel Feet Gale Gate Girl Girt Gulled Guttet  
Heat Heal Jags James Jelly Jetty Kate Kale Mate Male Mile Mite Mull Mum  
Muse Must Pane Pant Pat Pal Pace Pact Peal Peat Hump Pump Pose Post Puss  
Push Rolled Rotted Seller Setter Sat Sal Sot Sol Tote Tole Vase Vast Wall Watt  
Will Wilt Wile Pale Pate Pats Path Pill Pitt Pore Port Puller Putter Roller Rotter  
Role Rote Sill Sim Sale Sate Tart Tare Tool Toot Witty Willy Wish Wisp Well  
Welt Am All Ate Ale Gum Gull Butter Buller Dolly Dotty Tine Line Tint Lint  
Mint Mine Pine Pint Boss Bosh Ice Yet Hold Heeled Peeled Poled Bullied Butted  
Hire Sire Sure Pure Hurt Rig Rime Tick Lick

RECORD or TABLE NO. 10—COMMERCIAL MESSAGES

[This is a Paid Day Message (Black)]

23 N 10

NEW YORK NY 230 PM 15

C L BROWN & SON

1726 MILWAUKEE AVE CHICAGO ILL

[.] WHY HAVE YOU NOT SHIPPED OUR ORDER OF SEPT FIRST  
(SG) SMITH MERC CO [.]

[This is a Collect Day Message (Black)]

7 CH 10 Collect

CHICAGO ILL 345 PM 23

WHITE & CO

72 BROADWAY LONG BRANCH NJ

[.] YOUR ORDER WENT FORWARD YESTERDAY WILL REACH  
YOU TOMORROW

(SG) J R JONES & CO [.]

[This is a Night Message (Red)]

75 On 13 Nite 3 Ex Dely Chgs Gtd

BOONE IA 15

M R SMALL

3 MILES EAST ST CHARLES ILL

[.] MOTHER LEAVES TOMORROW MEET HER ON THE 350  
(SG) MARY [.]

NOTE.—“[.]” is transmitted as a period, but is not copied by the student

RECORD or TABLE NO. 11

[This is a Paid Day Letter (Blue)]

17 DX 36 Blue

DICKINSON ND 1200 PM 17

MURPHY & CRONIN

ST PAUL MINN

[.] WORK BEING HELD UP ACCOUNT LACK OF MATERIAL LAST  
CAR FAILED TO SHOW UP AM GOING AHEAD WITH CONCRETE  
WORK CAN KEEP GOING TWO DAYS MORE WHEN WILL HAVE  
TO LAY MEN OFF UNLESS LUMBER ARRIVES

(SG) KELLY [.]

27 Z 38 NL

[This is a Paid Night Letter (NL)]

ST PAUL MINN 5

JAMES A HICKS

1423 WINONA AVE OSKALOOSA IA

[.] ARRIVED SAFELY AM RESTING UP AFTER A RATHER TIRE-SOME TRIP MINNIE HAS PLANNED A PICNIC AT MINNETONKA TOMORROW IF IT DOES NOT RAIN IT IS MUCH COOLER HERE THAN IN IOWA WISH YOU COULD BE WITH US LOVE

(SG) MARTHA [.]

NOTE.—“[.]” is transmitted as a period, but is not copied by the student.

RECORD or TABLE NO. 12

45 CH 6

[This is a Straight Paid Cable]

CHICAGO ILL 337 PM 15

BOHMGARD

PARIS

[.] JE SUIS ICI

(SG) LEBLANC [.]

21 C Collect NPR

[This is a Press Special]

TRENTON MO 15

TRIBUNE

MINNEAPOLIS MINN

[.] A DISASTROUS WIND STORM PASSED THROUGH THE SOUTH END OF THIS COUNTY LAST NIGHT DESTROYING MUCH PROPERTY. ROOFS WERE BLOWN OFF MANY BUILDINGS AND TREES WERE UPROOTED EVERYWHERE. JOHN MCALPINS HOUSE WAS STRUCK BY LIGHTNING AND THE HOUSE PARTIALLY DESTROYED. NO ONE INJURED OR KILLED.

FILED 710 PM

(SG) WATSON [.]

NOTE.—“[.]” is transmitted as a period, but is not copied by the student.

RECORD or TABLE NO. 13-A

180 characters

YB	ST	BL	ø3	87	CY	..	FA	YQ	82	71	NU	\$7	53	87	18	XV	VJ
IL	RD	84	71	UB	CM	25	68	71	ø5	ZG	QP	FL	.PGH61	ø8	HX	BJ	
RX	UI	EL	OG	EX	14	24	EC	YT	IX	QW	82	ø3	FK	RI	HV	NA	28
UQ	TE	LC	DS	84	14	95	37	KI	DG	LP	7	DC	øø	16	93	TH	25
HW	ø2	.\$	FA	MG	64	ø9	KU	DS	FH	AB	39	12	RZ	IQ	VL	AY	94

TABLE NO. 13-B

180 characters

EM	ZI	3ø	46	28	\$.	23	71	TA	IK	HL	KX	CV	71	54	69	IV	WG
83	76	JO	PF	YG	13	84	QL	RP	PGH,MO	21	86	IB	LO	FG	74	43	
IB	65	LO	43	FG	27	XW	AG	TM	44	38	75	SU	XR	øø	RJ	34	ZM
EF	TS	ZJ	86	WR	NB	KW	57	43	ø9	IC	\$(.)	21	IB	LO	FG	75	42
41	EJ	..	NR	57	ø6	GN	IP	XK	IH	38	ø4	AX	JR	21	UR	QX	LF

NOTE.—There is no record for Table No. 13-B.

RECORD OF TABLE NO. 14-A

240 characters

QCA	WND	BVM	YEF	288	1/2	KZB	LKO	TSP	283	764	\$(.)	JGU	YUB	RGM	824	UYB
RGM	CHA	LFG	TWQ	IFJ	EVO	824	399	976	283	3/4	XZS	ENK	FLO	RND	MAB	287
GHZ	YTU	829	385	7/8	UJC	FWK	285	VQK	HPE	CSR	891	1/2	JIA	DZW	IOF	925
NVI	128	EFL	6/8	QKG	985	RUP	MTH	HKP	FGHT.	DJV	GMI	ANS	824	399	1/2	
YQJ	TEX	UZB	135	986	ELD	JYQ	NIE	995	837	GSH	MEL					

TABLE NO. 14-B

240 characters

824	385	173	FOE	QHJ	SPM	GIW	AUR	173	499	1/4	NHR	QMS	FOR	PAV	867	483
QYX	AKI	TGN	GZP	SML	EVU	OWE	14.	FRJ	928	391	589	3/8	VUO	WEH	GJF	EJD
DFZ	KRI	888	KGP	TWV	ESH	UGM	QOY	188	1/2	YRA	BCL	NJV	285	376	UID	BCO
AIN	ESO	GHR	UYG	QMY	PJW	(.)	PGH	YFC	JNV	288	149	586	HDQ	LFS	MYE	UIZ
993	582	174	3/8	ONG	LIX	REV	STI	QWF	DOT	AEH	UIE					

NOTE.—There is no record for Table No. 14-B.

RECORD or TABLE NO. 15-A

300 characters

<u>1591</u>	<u>7019</u>	ARGM	KQVX	NANG	TKYQ	2281	YKHB	PUJP
ITLC	SZQS	EFWV	HOUW	GONH	ORAX	MVGN	8356	4400
HMWP	XKBQ	DSZC	\$(.)	EZLL	1355	1/12	XUBW	3629
VYAO	FFOO	HVUS	QWAE	TNYR	IPLJ	RXJV	KITL	4771
5395	MAAD	NKEC	PQQU	CWGG	3/16	HQRX	IDDO	1109
<u>7012</u>	BTMH	LFGM	JSZY	2154	6745	UTWI	YOEU	FOFB
VLSO	AXEC	PGH.?	PVJH	9930	5/12	XRVS	IQLX	AJDM
5832	KACW	QZUH	WGGN	QPYD	DPOA	2642	TIHV	FYMK
SCYV	PLWZ	QIRY						

TABLE NO. 15-B

300 characters

AOWP	QTVM	2642	<u>1704</u>	NWRY	,\$7(.	JGZJ	7160	9083
4470	XIOU	JQGC	KEWH	SZFQ	MRNT	5281	TJYU	1387
5/16	ECIV	FOCK	WWRY	ZFYA	5189	5/12	OGUS	JHIB
LXBQ	XPVH	QNAI	PDSB	2779	GHIC	0652	RWVG	4134
9981	DMMQ	IDZV	,\$PGH	ZJQE	2896	7/16	RYTA	JTUX
CFVK	OOKL	4280	0335	WRYZ	FDAP	5049	GRST	LKBX
XEQF	PUNZ	NNIQ	6478	2782	SHBA	HSCO	1691	WXGA
NGQM	DIVD	0886	7997	BOPT	VELJ	JIDV	XZJN	6214
RFUQ	IYFU	LKDH						

NOTE.—There is no record for Table No. 15-B.

RECORD or TABLE NO. 16-A

390 characters

52069	JJMBA	ZEHUI	24718	11/12	WFDCP	.,7\$PGH	XYXK	EDONG
08762	13594	68201	ITGTB	YRUXZ	34195	62940	VKWAZ	FYCJN
ACYBD	41678	15/16	TRYHS	ZCZCD	\$2(,)89	PKJDE	45178	EHQTU
32456	<u>10100</u>	<u>71029</u>	62651	ADTRY	JDOJK	85097	34781	NCEFR
45376	49186	11/12	PMMSE	AHERT	GDGUE	VAREM	45361	68908
NFJGR	BJRIM	IQXVC	UXYHM	68908	16547	26799	NFTHY	23987
ADOLF	PJERG	68908	91654	7,799	XPPVI	JGEHR	GKBWI	95214
02589	17365	75873	GIWKD	KRXQH	ZWLGD	72834	98170	34425
86514	<u>70311</u>	60862	<u>73158</u>	11/15	NSVXO			

TABLE NO. 16-B

390 characters

78234	ONH DU	89510	GCQXW	KJHSD	FGDKT	67842	KIVNG	15/16
BXCMK	45783	ASXLR	14536	DSHJK	ERTYH	KISEO	23489	WERQK
LKISD	QAZED	EDCRF	32(.)59	PLMKI	UJNHY	45101	87432	TGBHY
32469	16712	EDCRF	QWERT	ASDFG	ZXCVB	93697	PAMYL	14759
98563	QPALZ	WOETR	SLDKT	35796	AMKLS	96281	ECHGI	11/12
SRZEP	11001	BLOAW	78900	72843	XPHTN	QMZQA	43650	GDTBJ
TGBER	68903	ASXEZ	5,347	SEKCL	KXSER	URSOP	27946	YHSKN
67593	REUIE	28152	LOGFX	71023	VKEYZ	78783	NTQIV	HJASB
68476	60216	15/16	RZULE	IXCQN	64187			

NOTE.—There is no record of Table No. 16-B.

RECORD or TABLE NO. 17-A

480 characters

SQMNE	OCRYL	HITED	WJQFX	GKWZU	PVJBD	AIBLM	AWMZI	IOJGD
BSJHT	MPWCV	IQTNA	YZIUZ	RKDXF	GOLEA	8KDHE	SJDHE	NJUJK
LUKGJ	POINS	QJHZF	MQWRX	YTCEV	DBZTR	GXHEP	WDMNE	NHYGF
TRGXA	OISPE	YUHEC	NQXCE	AWMZI	CUTSH	LVOPF	KRPLM	AIBLE
WICLG	KVSDX	NYTFN	UHRGL	PEZAD	QUWGM	KMTHL	KJSTR	DJYXO
DMENH	RPLMA	IBLMB	HESIF	QWCOX	UYGTV	SLDHE	JUJEN	AKIOD
EYJBS	SMVGA	DKLAF	XPWNR	BLFHE	SHDNE	BHAGT	VFDIK	MXBCV
SLDIH	TRGXA	OISPE	YUHFR	KVJLZ	NQBCN	KDWDV	OPFLS	JVJDH
JVBXZ	EOMBP	XTDRL	ICWUN	SHYCQ	YASLF	DIRKV	QUCPM	HNSWO
SHDUJ	ASDFG	HJKLP	OIUYT	REWQA	ZXCVB	MNKJH	VFRED	XSWQA
CKEOH	DLQYI	GSOTQ	AFNML	RVWJX	BPGAN			

TABLE NO. 17-B

480 characters

BOQJS	WICLG	KVSDX	NYTFN	UHRGL	PEXAS	SHDUW	YBJSB	SJYYH
EIYBF	JPHXT	WURZL	AODXV	KGMCV	QSNVP	SHDYE	SIDUJ	QOAHN
SULHB	FNGQC	EXMWT	ZIOGJ	JASKD	SHQDN	QCXIF	GBKRA	JSVDD
PZOXC	IVUBY	NTMRE	QMWEN	ALKJU	NHYTA	SIJHN	BGTAD	VFREQ
DQHOE	JDYVM	DYEHS	QRLTB	AYGSE	COLGY	WKSAA	XSREY	LPURS
BTTAI	FOJSV	MAJAB	BYLHV	PQKNZ	SPAHW	GVECD	BPNMU	PLSOW
BIDTX	DQEHY	SKNIM	ASHHN	TIXER	XLONG	VPNMY	QJOLP	UMNPF
CDEVG	FETSS	JIDHS	CJUHA	NHYTG	SODKM	NYAKJ	CNHYA	SGCBQ
BIDTX	DQEHY	SKNIM	ASYHN	TIXER	OQQKL	IVHWE	UNHSW	NHYAD
PYYJT	QGPIB	GBUPV	OVVNG	YEBPV	EBTFI	YTQFA	JCHZA	NHYUJ
RJIPV	BZSNO	EYHZU	FCXMG	WJAIL	WKDXJ			

NOTE.—There is no record for Table No. 17-B.

**RECORD of TABLE NO 18-A**

600 characters

DEOAN	LKJPW	VPQES	UIXJZ	MECHG	TRYSW	TKYUD	NOJUE	RCMFT	HAIGD
PQZV	ABDQU	WGMKN	THLXJ	STRBJ	YIOIF	ZCMWO	XPCFM	UJTG	KLWSG
KQZR	BAHED	XRKVQ	UCPMH	NSWOF	TIME	ADGJT	LYSQT	HDLVL	PMKOC
HEVTI	GRAIB	ZFWER	CTKLP	COHNR	NYIXF	SBVDZ	QWUAJ	NEHST	RYQZG
YQXGJ	SBNIN	NQWKE	OFESY	LHVGN	GQCEX	MWVTI	OGJAK	RVPJG	HYNJG
DPKHY	KQEQE	OGIYI	AZZTG	NVEIX	LABGS	KBARB	JEHAN	PQEH	WUDBN
VVWZQ	FGRFW	QMKWW	EKVEK	SNQRD	UTUGL	IHCTV	ZLPKA	XXMLU	HGFC
MSNCP	VTSOO	CRWHF	HDOZE	GJFES	TYTNY	RILYL	YORH	SILXV	WFEG
TZASN	KCDBG	VMGVQ	UWJDC	DOYZE	NXLQX	OPYWM	XFSUW	UCQAT	EMTJZ
SJTMO	RUHNI	CJDEO	MTLHG	JGYSJ	BYLTA	ZKNRK	HLPYR	AYMQV	ISKZP
XIFBP	KLCJD	WVQCH	FUMNS	VXDAG	KLIPO	BXEXY	TZCQU	MFVDP	IANJO
HYUGL	KXRZT	DIYKA	IDLQT	GUOBJ	RCWSH	VPNKE	FMZOH	EQEGS	ZNSET
<b>TABLE NO. 18-B</b>									
LEGCN	FUFFS	PKWFF	ZIZEE	EJOMM	GGMDG	BTYEL	WXUQC	KHNLX	HNVQH
XYEKO	NSUYE	OOFIF	VDAZI	ZQXJ	DZNVZ	GLDNR	AVQPP	IHYA	CJRGV
UGWIP	QHGAG	YCOTT	ACBUB	MWLWE	VADSD	MTTBV	WZXJR	ZKUEH	PFCGM
YJYDJ	GPTMU	QIMHP	OTQPA	IRWLL	TKAAK	EPJQT	XZVVI	KERIS	AFGCK
BVTWB	EDBER	CCGXF	UZZYT	LGOZY	VMNDK	GMBY	QQBSM	MRVFO	XORCL
BLSQC	YGEOF	SYEZY	SYNZY	OJREIN	HJURN	RXNGD	WHRZK	IVEUD	WXCNF
JXIGL	DQNH	YSDAY	XCXYC	FZJGW	URMAT	COBCB	QABPI	KLCIM	BJASH
EGWJK	PTPUK	FPLKV	OBNQE	EDEFS	AERSP	LENVA	ASDRE	ASKKE	ZCYVM
NVVQH	EUBRT	VDZFT	MNJR	REPJV	HIAOX	BLKAB	QJYZU	OLNGQ	LUFVM
DVDBC	QUMY	ASOIJ	SQSYQ	YFWNI	UTECL	REMWH	WNHRR	OGXLD	IMCXN
GATW	YXIAC	PPWZS	SOLFEE	HJEKE	QXQCL	BKKLU	KHPDY	GDURK	YHFGT
OHOMQ	VTZJH	IPSRY	ASVOB	MDDEQ	UELQG	TATUA	YTRPP	ZMGZC	XOJUE

NOTE.—There is no record for Table No. 18-B.



TELEGRAPH OPERATOR

RECORD or TABLE NO. 19

450 characters

<del>4327</del> <u>53</u>	<del>4473</del> <u>51</u>	<del>6812</del> <u>85</u>	<del>9537</del> <u>64</u>	<del>976</del> <u>14</u>
<del>325</del> <u>43</u>	<del>3226</del> <u>67</u>	<del>9412</del> <u>58</u>	<del>393</del> <u>(.)76</u>	<del>221</del> <u>723</u>
<del>596</del> <u>374</u>	<del>7658</del> <u>82</u>	<del>639</del> <u>445</u>	<del>299</del> <u>927</u>	<del>113</del> <u>828</u>
<del>421</del> <u>6</u> <u>53</u>	<del>418</del> <u>76</u>	<del>099</del> <u>932</u>	<del>394</del> <u>891</u>	<del>385</del> <u>542</u>
<del>998</del> <u>125</u>	<del>5678</del> <u>99</u>	<del>751</del> <u>26</u>	<del>633</del> <u>695</u>	<del>418</del> <u>78</u>
<del>221</del> <u>726</u>	<del>4473</del> <u>56</u>	<del>8128</del> <u>96</u>	<del>976</del> <u>14</u>	<del>511</del> <u>689</u>
<del>741</del> <u>397</u>	<del>641</del> <u>429</u>	<del>329</del> <u>(.)56</u>	<del>694</del> <u>821</u>	<del>977</del> <u>664</u>
<del>331</del> <u>486</u>	<del>943</del> <u>321</u>	<del>625</del> <u>433</u>	<del>618</del> <u>995</u>	<del>943</del> <u>553</u>
<del>191</del> <u>955</u>	<del>146</del> <u>819</u>	<del>024</del> <u>689</u>	<del>558</del> <u>876</u>	<del>139</del> <u>421</u>
<del>998</del> <u>834</u>	<del>641</del> <u>423</u>	<del>896</del> <u>445</u>	<del>028</del> <u>788</u>	<del>251</del> <u>336</u>
<del>418</del> <u>72</u>	<del>34</del> <u>(.)25</u>	<del>195</del> <u>899</u>	<del>129</del> <u>682</u>	<del>311</del> <u>596</u>
<del>292</del> <u>999</u>	<del>625</del> <u>174</u>	<del>334</del> <u>994</u>	<del>385</del> <u>549</u>	<del>435</del> <u>587</u>
<del>421</del> <u>6</u> <u>51</u>	<del>394</del> <u>895</u>	<del>785</del> <u>517</u>	<del>433</del> <u>496</u>	<del>385</del> <u>549</u>
<del>589</del> <u>932</u>	<del>268</del> <u>776</u>	<del>251</del> <u>159</u>	<del>813</del> <u>991</u>	<del>979</del> <u>568</u>
<del>49</del> <u>7853</u>	<del>325</del> <u>(.)36</u>	<del>122</del> <u>149</u>	<del>49</del> <u>1847</u>	<del>859</del> <u>991</u>

## TELEGRAPH PROCEDURE

### TYPES AND CLASSES OF TELEGRAPH MESSAGES

1. From the standpoint of the Army telegraph operator, there are four general types of telegraph messages: "Government Official" messages, both tactical and nontactical, "Commercial" messages, "Wire" messages, and "Service" messages.

2. GOVERNMENT OFFICIAL MESSAGES, those pertaining to official business of the United States Government, transmitted by Government operators or over Government circuits, are divided into three distinct classes as follows, for the purpose of determining which shall be sent first (see footnote):

Class in order of precedence	Classifying symbol or abbreviation	Where used
Urgent priority.....	OIIP.....	On the Army's tactical circuits.
Priority.....	P.....	On the Army's tactical and nontactical circuits.
Routine.....	(None).....	Do.

a. *Routine* messages carry no classifying symbol. They require no special precedence. They are generally transmitted in the order in which they are received. *Routine* messages on hand for more than one telegraph office, may be transmitted in the manner which will clear the traffic in the shortest possible time.

b. *Priority* messages, classifying symbol "P," are of such importance that they are given precedence over all routine messages waiting to be sent. The actual transmission of a routine message will not be interrupted to send a *Priority* message. If an operator accepts such a message when the line is busy, he will wait until the message then being transmitted is completed; then he will "break in" and sign "P." Other operators will give way, unless they are handling business of equal or greater importance. Messages giving orders for the immediate movement of troops, requesting such authority, reporting events which will cause such orders, requesting or directing fire of any kind not immediately needed, are examples of the type of messages which may be classed as *Priority* for the telegraph office of a tactical organization in the combat zone. For other telegraph offices, as at Army posts, etc., messages of the utmost importance may be classed as *Priority* when they are to be handled between Government operators. This classification is not to be used over commercial circuits manned by commercial personnel.

c. *Urgent priority* messages, classifying symbol "OIIP," are used only during combat or when combat is imminent, and are of such

importance that they take precedence over all priority and routine messages. They will be sent immediately upon receipt, even if the operator has to "break in" or interrupt the actual transmission of a priority, or routine message. Should an operator accept a message so marked, he will transmit it immediately. Should the wire be busy, he will "break in" and sign "OIIP." Other offices will give way for this sign. Operators have no option. These orders are explicit. Slight delays may bring serious consequences. Requests for fire required immediately, airplane messages to ground stations, and messages where delay may mean immediate loss of life, are examples of the type of messages which may be classed as *Urgent priority*.

d. In the field, the classification of messages will generally be made by the message center. Under no circumstances will an operator change such a classification.

NOTE.—Another classification, *Urgent*, classifying symbol, "O" is used by the Navy only. It ranks between *Priority* and *Urgent priority*.

e. Tactical messages generally reach a field telegraph office through a tactical message center. If in clear, the message as written by the writer, plus message center record data and special instruction, is sent to the telegraph office. If in code or cipher, it may have been encoded or enciphered (address, body, and signature) by the message center, in which case it will generally be on a special blank, and the message center will have indicated to the telegraph office the final destination of the message.

The following is an example of a tactical message in clear, as delivered by the message center to the telegraph office. Space at the top of such a blank is used at the telegraph office for the heading. The remaining data inserted by the operator, after transmission is completed, goes wherever space is available. All of the information on this message, including number, date, and hour signed (but *not* "Lee Leonard, Brig. Gen.") will be transmitted. When the message is delivered to the addressee, it will appear in practically the same order as below.

3. **COMMERCIAL MESSAGES**, telegraph messages transmitted by Government operators to commercial operators, or received from commercial operators, conform to the rules of the commercial telegraph company. These rules are contained in the tariff book of the telegraph company. The most commonly used classes of commercial telegraph messages and their classifying symbols are as follows. Different colored blanks are sometimes used for certain of these classes of commercial telegrams.

The Day Message (BLACK).

The Night Message (RED).



The Day Letter (BLUE).

The Night Letter (NL).

The Press Special (SPL).

• The Cable (CABLE).

In addition to the above, there are many others; such as the Full Rate Cable, Cable Letter, Deferred Cable, the Marconigram, the CND or Market Quotations, the Weather Report (Sigs), the Baseball Scores, etc. Detailed instructions for handling such messages will be found in tariff books of the commercial companies.

4. WIRE MESSAGES, those pertaining to the maintenance of the system. They refer to repairing, rerouting, patching, testing, etc., and usually are either to or from the wire chief. Very few such messages are actually sent. As the wire chief is usually in direct touch with the offices on all wires under his care, he comes on the wire and holds "conversation" with the station or stations concerned, and changes are made as he gives directions. When there is a branch wire, or for some other reason he can not reach a certain office direct, he will send a message. Such messages are usually addressed to the station concerned, either by name or call letter, and signed with the personal sign of the wire chief. Example of a "wire" message:

3AN WIRE

SUMMIT

GROUND 15 EAST TO CLEAR WITH EVERETT

JN JAN 17/22

4AN WIRE

SUMMIT

15 AND 19 XD 7 MILES EAST OF ALLORTON SEND LINEMAN

JN JAN 17/22

As "wire" messages pertain to the maintenance of the system, they generally take precedence over all other business. It can be easily seen that keeping the system in working condition to handle all business is of more importance than any part of that business. However, the wire chief must be careful that wire testing and patching do not interfere with the transmission of "priority" and "urgent priority" messages when the wire is working through. It can likewise be seen that there may be conditions where a "priority" must be delayed by a "wire" pertaining to the establishment of communication.

5. SERVICE MESSAGES, those between offices on the system, pertaining to the handling of business. They usually are between operators in charge of telegraph offices. Service messages are addressed to and signed with the name of the station. Examples of "service" messages:

a. EVERETTE

YD MAJ SMITH SGD JONES UNDLD GBA OR WE FILE

SUMMIT

which would mean "Your message date to Maj. Smith, signed Jones, is undelivered; give better address or we file."

b. EVERETTE

DFS MAJ SMITH SGD JONES NOW DLD

SUMMIT

which would mean "Disregard former service referring to message to Maj. Smith signed Jones. Message now delivered."

A service message may be of great or of little importance. Should it refer to a priority message, or to an urgent priority message, it must be treated as pertaining to that class. The operator in charge or the counter clerk should show how important it is by indicating the class in the check, as "SVC P," "SVC OP," or just "SVC."

## TELEGRAPH PROCEDURE

### RULES FOR DETERMINING THE COUNT AND CHARGES ON TELEGRAPH MESSAGES

#### 1. APPLICATION OF RULES

*a.* These rules apply to domestic messages, i. e., messages to points in United States, Alaska, Canada, and Mexico.

For count of cable messages, see cable rules in Government or commercial tariff books.

*b.* The necessary address and a signature are not counted nor charged for.

For the rules concerning extra, chargeable matter in address, signature, and check, see subdivisions 3, 4, and 5 of these rules.

#### 2. THE COUNT—GENERAL

The body of the message and chargeable matter in the address, signature, and check will be counted as follows and the message charged for accordingly:

*a.* Dictionary words taken from the English, German, French, Italian, Dutch, Portuguese, Spanish, or Latin languages will be counted as one word each, irrespective of length.

Examples:

	Words
Excursion (English dictionary)-----	1
Herzlichen Glueckwunsch (German dictionary)-----	2
Nous arriverons dimanche (French dictionary)-----	3
Dolce far niente (Italian dictionary)-----	3
Mijne groete aan mevrouw (Dutch dictionary)-----	4
Tudo esta perdido (Portuguese dictionary)-----	3
Un cabello haze sombra (Spanish dictionary)-----	4
Errare est humanum (Latin dictionary)-----	3

*b.* Combinations of two or more dictionary words, or mutilated dictionary words, written together contrary to the usage of the language, will be counted according to the number of words of which they are composed.

Examples:

	Words
Firstclass (properly written "first class")-----	2
Carlots (properly written "car lots")-----	2
Warrisk (properly written "war risk")-----	2
Billading (properly written "bill lading")-----	2
Allright (or alright) (properly written "all right")-----	2
Dothe (for "do the")-----	2
Itis (for "it is")-----	2
Havyu (for "have you")-----	2

c. It is important that the message shall carry its original count throughout its transmission and that its progress shall not be delayed by questioning of the check between operators. Therefore the employee with whom the message is filed shall indicate his count of any compound word or combination of words, concerning the count of which there may be doubt on the part of operators in the course of further transmission, and his count of any group of separate words which are counted together as one word, by underscoring the word or words, and writing the figure indicating his count under the underscore. When a combination written as one word is counted as more than one word, he shall also indicate by a vertical line the point of separation between the words separately counted as one each.

Examples:

<u>Carload</u>	<u>post office</u>
1	2
<u>war risk</u>	<u>rear end</u>
2	2
<u>New year</u>	<u>per cent</u>
2	1
<u>any one</u>	
2	

d. The following will be counted as indicated:

	Words
Western Union.....	1
Dayletter (or Day Letter).....	1
Nightletter (or Night Letter).....	1
Parcelpost (or Parcel Post).....	1
New Year (or Newyear).....	2
Per Cent (or Percent).....	1
Cannot (or can't).....	1
Can not.....	2

e. All groups of letters, when such groups are not dictionary words of one of the eight languages enumerated in paragraph (a), or combinations of such dictionary words, or proper names, will be counted at the rate of one word for every five letters or fraction of five letters.

Examples:

	Words
Ababa.....	1
Bando.....	1
Erix.....	1
Hhgga.....	1
Egadol.....	2
Ceghxo.....	2
Dutimerodal.....	3
Gghrccexqdr.....	3

When a message contains any such combination or combinations of more than five letters and hence counted as more than one word each, the message will be given a double check, the first figure in the check showing the number of words counted and charged for and the second figure the number of words as written by the sender.



For example, a message reading

Offer for September shipment ympirgoamo netirbosoc prompt acceptance  
will be checked "10 S Paid" if it be a paid message, or "11/9 Collect"  
if it be a collect message.

f. Surnames of persons will be counted as one word each.

Examples:

	Words
Van Dorne.....	1
McGregor.....	1
O'Connor.....	1
DeWitt.....	1

g. Initials will be counted as one word each.

Examples:

	Words
G. W. E. A.....	4
W. H. Brown.....	3
B. & O.....	3

Exceptions:

	Words
A. M.....	1
P. M.....	1
F. O. B. (or fob).....	1
C. O. D. (or cod).....	1
C. I. F. or C. F. I. (or cif or cfi).....	1
C. A. F. (or caf).....	1
L. C. L. (or lcl).....	1
O. K.....	1
S. S. (steamship).....	1

h. Proper names will be counted according to the number of words and initials which they contain.

Examples:

	Words
John L. Sullivan.....	3
Hudson's Bay.....	2
Long Island.....	2
Puget Sound.....	2
S. S. Admiral Goodrich.....	3
Nippon Maru (or Nipponmaru).....	2

i. *Exceptions.*—Names of countries, states, territories, provinces, counties, cities, towns, and villages and abbreviations of such names will be counted as one word each. When the word "City" is customarily used in connection with the name of a city, it will be considered as a part of the name.

Examples:	Words
United States (country).....	1
New York (State or city).....	1
New York City.....	1
District of Columbia.....	1
Nova Scotia (Canadian Province).....	1
Red Hill (county).....	1
St. Louis (city).....	1
East St. Louis (city).....	1
Red Bud (town).....	1
South Orange (village).....	1
New York, New Haven & Hartford Railroad.....	5
N. Y.....	1
S. C.....	1
D. C.....	1

Names of forts, barracks, Army posts, Army stations, and military camps listed in the tariff book will be counted as one word each.

Examples:	Words
Fort Slocum.....	1
Camp Upton.....	1
Camp Alfred Vail.....	1

j. Abbreviations of weights and measures and other abbreviations in common use will be counted as one word.

Examples:	Words
Lbs.....	1
Cwt.....	1
Hhds.....	1
No.....	1
St.....	1
Ave.....	1
Dr.....	1

k. Figures, decimal points, and bars of division will be counted as one word each. In groups consisting of figures and letters each letter and figure will be counted as one word. In ordinal numbers the affixes "st," "d," "nd," "rd," and "th" will be counted as one word.

Examples:	Words
4442 (figures).....	4
44.42 (figures and decimal point).....	5
74¾ (figures and bar of division).....	5
A1 (letters and figures).....	2
42B618 (letters and figures).....	6
A3GHF (letters and figures).....	5
GVC24.....	5
1st (ordinal number and affix).....	2
10th (ordinal number and affix).....	3
No. 185 West 22d St.....	9

When a message containing figures is presented, it should be pointed out to the sender that there is less liability to error, and in many cases greater economy in telegraph tolls if the amounts are written in words; but if he declines to substitute words for the figures the message will be accepted as written.

When figures and a decimal point are to be transmitted, underscore the combination, draw an arrow pointing to the decimal mark, as follows:

44.42  
↑

and write in the check the words "dot ctd" (dot counted).

l. Punctuation marks are transmitted only when specially directed by the sender, and in such cases will be counted as one word each, except:

	Words
" " (quotation marks).....	1
( ) (parentheses).....	1

When a message is written so that its meaning is dependent on punctuation, it should be tactfully suggested to the sender that he may desire to rearrange it to avoid the possibility of misunderstanding by the addressee. It may be suggested that the word "stop" may be used to advantage to indicate the end of a sentence in the message, when otherwise the meaning may be obscure.

When a period or periods or other punctuation marks are at the sender's request to be transmitted, add the words, "Period ctd" (period counted), or "Pctns ctd" (punctuations counted), as the case may be, to the check.

When the sender of a message written in paragraphs insists on having it transmitted in paragraphs, count and charge for as many additional words as there are paragraphs, less one, and add that number and the words "cnt. pghs." to the check. For example: A 60-word telegram to be transmitted in four paragraphs—Check "63 Paid cnt. 3 pghs."; check to be transmitted "63 cnt. 3 pghs." There is no charge for the words "cnt. 3 pghs." in the check. A 100-word Night Letter to be transmitted in seven paragraphs—Check "106 NL Paid cnt. 6 pghs."; check to be transmitted "106 NL cnt. 6 pghs." In Morse operation the Morse character for a paragraph (four dashes) will be transmitted before each paragraph except the first, and the receiving operator in writing the message will make a new paragraph wherever this signal occurs.

m. When the symbols shown below appear in a message, the sender should be requested to substitute the corresponding words to insure correct transmission. The cost to him will be the same.

- % should be written "percent."
- # should be written "No." or "Number."
- ¢ should be written "cent," "cents," "ct." or "cts."
- @ should be written "at" or "to" (according to the sense in which it is used).
  - ° (signifying degrees) should be written "degrees."
  - ' (signifying minutes) should be written "minutes."
  - ' (signifying feet) should be written "feet."
  - " (signifying seconds) should be written "seconds."
  - " (signifying inches) should be written "inches."

n. Accents (as in "à, é, â, ñ," etc.) and the double dots used in certain languages over vowels to denote diphthongs (as in "ä," "ö," and "ü") can not be transmitted.

### 3. ADDRESSES

a. The address of a message, that is to say, whatever matter is required to afford the necessary information to enable the company to identify and locate the addressee, is carried free. All additional matter will be counted and charged for.

In an address such as

John Brown,  
care E. C. Brown & Co.

or

Mr. Jones,  
E. C. Brown & Co.

the words "care E. C. Brown & Co.," or "E. C. Brown & Co.," are added to aid the telegraph company to find Mr. Brown or Mr. Jones, and hence are a part of the address proper and not extra words.

In an address such as

James Brown, President.  
James Brown, President American Mfg. Co., etc.,

the words "President" or "President American Mfg. Co.," inasmuch as they serve to identify the addressee, will not be charged for.

The designation of a department in an address, as for example:

Jones & Co., Dept. 15,

will not be charged for as extra words.

Matter added to the address to indicate the disposition or treatment of the message after delivery or for some other purpose not related to the delivery of the message, and not necessary to enable the telegraph company to deliver the message, will be counted and charged for.

**Examples (extra words indicated by underscore):**

- E. C. Brown & Co., attention Mr. Harris.
- E. C. Brown & Co., Mr. Harris.
- General Manufacturing Co., E. W. Jones.
- John H. Brown, personal.

The words "phone," or "don't phone," added to an address are not charged for as extra words.

b. In alternative addresses the words constituting the alternative will be counted and charged for.

**Examples (extra words indicated by underscore):**

	Extra words
John Smith <u>or James Brown</u> , 80 Wall St., New York-----	3
John Smith, 1191 Broawday, <u>or James Brown</u> , <u>61 Wall St.</u> , New York-----	7
John Brown, 61 Wall St., <u>or 162 Madison Ave.</u> , New York-----	6
John Brown, Haskell 6123, <u>or Main 5238</u> (alternative telephone numbers)-----	6
John Brown, Statler Hotel, <u>or care Smith, Jones Co.</u> , Buffalo, N. Y.-----	5
John Brown, Statler Hotel, <u>or care some implement house</u> , Buffalo, N. Y.-----	5

It should be pointed out to the sender that such uncertain addresses do not offer a sufficiently definite basis to insure delivery, and if the sender is unable to furnish a definite address, he should be informed that the message will be accepted at sender's risk only.

Where a message is addressed to two persons in the alternative, as shown in the first two examples above, only one message will be sent and delivery to one of the persons to whom it is addressed will be sufficient.

In an address giving both the street number and telephone number of the addressee, as for instance:

James Brown,  
62 Brown St., Main 432,  
Kalamazoo, Mich.

the telephone number is not an alternative address and is not to be counted or charged for as extra words.

c. A message addressed to more than one person will be treated as a separate message to each of the persons addressed.

**Examples:**

- John Jones and Henry Brown, 25 Halsey St., Chicago, Ill.
- John Jones, 25 Halsey St., and Henry Brown, 216 La Salle St., Chicago, Ill.

The number of messages should be noted in a conspicuous place on the original as follows:

- ② messages
- ④ messages

When the names in the address constitute a firm name, the message will be treated as a single message. In such cases the message will be marked

① message

When the sender of a message addressed jointly to two or more persons, wishes to indicate to each of the addressees that he is sending the same message to the other addressee or addressees, he should do so by appropriate notation in the text.

A message addressed to two or more members of the same family, as

Mr. and Mrs. John H. Brown  
John H. Brown and Family

will be treated as a single message.

In none of the foregoing cases will there be any charge for extra words in the address.

d. The words "phone" or "don't phone" in an address will not be charged for.

#### 4. SIGNATURES

a. One signature will be carried without charge.

Where there is more than one signature, all signatures except the last will be counted and charged for.

This applies only to messages signed jointly by a number of individuals or concerns. It should not be confused with cases where there is really only one signature proper, and a name or other matter is added to the signature, as explained in paragraphs (b) and (c).

Examples (extra words underscored):

J. H. Jones, Wm. C. Brown, Edw. W. Green.

J. H. Jones and Wm. C. Brown.

No extra words will be counted and charged for where such a signature constitutes the firm name of a single concern.

In the case of family messages signed by more than one member of a family, as for instance:

Mother and Father  
John and Emma  
John, Emma, James and Henry  
Mother, Father, George and Mary  
H. A. Brown and family

the entire signature will be treated as a single signature and there will be no charge for extra words.

When a signature consists of the name of a company or firm, preceded by the title of an official, the title and the name of the concern together constitutes one signature and there are no extra words.

Examples:

- President Federal Rubber Co.
- Treasurer Adams Express Co.
- Cashier First National Bank.
- Agent Prudential Insurance Co.

b. Words added to the signature proper by way of description or identification of the sender or to indicate the status, capacity, or authority of the sender will be counted and charged for.

Examples (extra words underscored):

	Extra words
John Brown, <u>President</u> .....	1
Geo. H. Wilson, <u>General Manager</u> .....	2
Thomas Green, <u>Agent</u> .....	1
Henry Jones, <u>Receiver</u> .....	1
Union Trust Company, <u>Trustee</u> .....	1
John Jones, <u>Receiver American Mfg. Co.</u> .....	4
John Jones, <u>President American Shoe Mfg. Co.</u> .....	5
Thomas S. Witherspoon of <u>Dallas</u> .....	2

Titles or their abbreviations in their ordinary use, preceding the name of the sender, such as "Dr.," "Rev.," "Lieut.," etc., will not be counted or charged for, but count and charge for descriptive designations added after the signature, as for example:

	Extra words
John Jones, <u>Second Lieutenant</u> .....	2

c. Matter added to the signature by way of explanation or information, to the addressee, or to indicate by which particular branch or department of, or individual connected with, a firm or concern the message was sent or authorized, will be counted and charged for.

Examples (extra words underscored):

	Extra words
Cronck Mfg. Co., <u>Dept. 14</u> .....	3
Star Oil Co., <u>Atlas Branch</u> .....	2
<u>Atlas Branch</u> , Star Oil Co.....	2
<u>Manning, Maxwell &amp; Moore, Inc., Bridgeport Works</u> .....	2
John J. Ryerson & Son, <u>Credit Dept</u> .....	2
<u>Credit Dept.</u> John J. Ryerson & Son.....	2
Ryerson, <u>Credit</u> .....	1
Studebaker, <u>New York Export</u> .....	2
<u>General Motors Truck Co., Division of General Motors Corporation</u> .....	6
John Smith, <u>New Era Insurance Co</u> .....	4
New Era Insurance Co., <u>John Smith</u> .....	2
Smith & Co., <u>by John Smith</u> .....	3
American Shoe Mfg. Co., <u>John Jones, President</u> .....	3
Annie L. Lowry Band of Mercy, <u>John F. Cozens, Director</u> .....	4
Nash Motors Co., <u>by John Johnson</u> .....	3
Nash Motors <u>Johnson</u> .....	1

The designations "Sr.," "Jr.," or "3rd" added to the names of persons, and "Inc." or "Ltd." added to the names of firms or corporations, form a part of the name and are not extra words when appearing in connection with a free address or signature. When appearing in the body of the message or in chargeable matter added to an address or signature, they will be counted and charged for.

For example, if a message is addressed or signed, "John Smith, Jr.," the "Jr." is not an extra word, but "John Smith Jr.," appearing in the body of a message will be counted as three words, and in an address, "Continental Manufacturing Co., attention Mr. John Smith Jr.," there are five extra words, and in a signature "Smith Mfg. Co., by John Smith Jr.," four extra words, as indicated by the underscore.

#### 5. CHECKS

a. When extra words in the address, signature, or check, are counted and charged for, the number of extra words will be indicated in the check. The words "Deliver and report charges," "Delivery guaranteed," "Report delivery," "Repeat back" and "Valued \$ . . . . ." in the check, will be counted and charged for. For example, where there are 10 text words and 3 extra words in the address, signature or check, the message, if a paid message, will be checked

13 paid 3 Extra

or, if a collect message, will be checked

14 Collect 3 Extra.

b. The word "Collect" in the check of a collect message will be counted, but not charged for or noted as an extra word.



## TELEGRAPH OPERATOR

### OPERATORS' SIGNS AND STATION CALLS

1. It is important to have a way of identifying each operator without the use of his full name. To accomplish this, each operator is given a sign of one or two letters by which he is known on the wire. Where convenient, the sign should be an abbreviation of the operator's name, such as "BN" for Brown, "JN" for Johnson, etc.

2. The chief operator of the station will arrange these signs. No two operators in the same office may have the same sign, as such a condition would make identification difficult. Operators in different offices may use the same sign.

3. When an operator reports to a new station, it is customary that the chief operator ask him what he signs. Should it happen that no one in the office is using that sign he will be permitted to keep it.

4. Once an operator takes a sign he will not change it without the permission of the chief operator.

5. Each office on the wire is known by a "call letter" or "call letters" referred to as a "station call." In commercial life these calls, where practicable, are abbreviations of the names. The call for New York is "N;" for Chicago, "CH." In the Army, in the service of supply or any portion of the system so located that the enemy will not be able to intercept any business going over the lines, the same custom prevails. In the forward areas calls offering no suggestion of the real name are assigned. These may be changed frequently for purposes of secrecy.

## TELEGRAPH OPERATOR THE NUMBER SHEET

1. One of the greatest crimes that can be charged against a telegraph operator is that he has lost a message, or what amounts to the same thing, that he has sent one and marked it off without having received an acknowledgment, because if the receiving operator does not acknowledge receipt it is probable that he did not get it. If it has been sent, marked off, and filed but not received at the other end, it is lost so far as the addressee is concerned.

2. To avoid such losses, "Operator's number sheets" are provided. A number sheet (see Fig. 41) is ruled with double perpendicular columns, one side of this double column for "sent" and the other side for "received" messages.

3. Each telegraph office is furnished with such a number sheet. One double column is used to keep a record of the number of messages sent to and received from each office with which it has direct communication by wire.

4. When an operator commences sending to a station, he looks at his number sheet to ascertain the number of the next message to that station. When he finishes sending, he marks off in the proper column the numbers of the messages he sent and places his personal sign opposite the numbers thus marked off to indicate who sent them.

5. Likewise, when an operator answers a call to him from another office he looks at his number sheet to see what the number of the next message from that office should be. When his receiving is completed, he marks off in the received column the numbers of the messages received and places his personal sign opposite them to indicate who received them.

6. As stated in the previous paragraph, the receiving operator always looks at his number sheet before he commences to receive. Should the sending operator at the other station begin with a message numbered other than the next number not marked off, the receiving operator will immediately break him. Both operators then examine their files to see who is in error. It may happen that one or the other has failed to mark off the last message or messages handled, or it may be that the receiving station did not get them, in which case they will be sent again.

7. At the close of business each day every office will compare numbers with each other office with which it communicated that day. Should errors be found, they will be corrected before the offices close.

8. In all cases for each double column message number 1 for messages sent to that station will be the first message sent after midnight; similarly, message number 1 for messages received from that station will be the first message received after midnight.

**SIGNAL CORPS, UNITED STATES ARMY**  
**OPERATOR'S NUMBER SHEET**

Numbers must be exchanged nightly at closing hour. Inform time and personal signal on sheet. Receiving and sending operators will be held responsible for correct records of numbers. Check off immediately. Inform all delays and causes, so far as known on back of each message and notify chief operator immediately. Register all unanswered calls made on back of number sheet. The time of transmission or receipt of messages to be indicated on the number sheet.

Date \_\_\_\_\_  
Office \_\_\_\_\_

SENT-	RECEIVED-	SENT-	RECEIVED-	SENT-	RECEIVED-
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
0	0	0	0	0	0

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Fig. 41.—Operator's number sheet

## **SERVICE MESSAGES, AND SPECIAL SIGNALS AND ABBREVIATIONS FOR TELEGRAPH OPERATORS**

1. No unnecessary service message should be sent. Use the mails in all cases when the service will not suffer by the delay.

2. Service messages will not be sent free for the information of customers nor to correct their errors.

3. Service messages should be made as concise as is compatible with clearness of expression and the covering of essential points.

4. All service messages requiring answers must be replied to promptly. When relating to telegrams of current date, they should be answered within fifteen minutes, unless delayed by the necessity of communicating with the sender.

5. If a received telegram shows a branch office call in its date, a service message relating to it must be addressed to the branch office so shown. For example, a service message relating to a received message dated "FX New York" must be addressed "FX New York."

6. A service message sent by a main office should be signed only with the name of the city or town from which it is sent.

Service messages sent by main office delivery departments in very large cities, like New York, Chicago, Philadelphia, St. Louis, etc., where there are many branch offices, should show in the signature the contraction "DLY" as well as the name of the city from which the service message is sent.

A service message sent by a branch office must show in the signature the branch office call as well as the name of the city or town from which it is sent.

Service messages should not be signed with the names of individuals, unless special circumstances make it necessary to do so.

7. The address of a reply to a service message must read exactly like the signature of the service message to which it is an answer. For example, if a service message be received signed "CO New York," the reply must be addressed "CO New York"; if the received service message be signed "Smith FX New York," the reply must be addressed "Smith FX New York," etc.

8. With a view to condensing necessary service correspondence within the smallest compass, the following signals and abbreviations are authorized for "service" and "wire" messages, and where applicable, in the heading of other messages.

Signal or abbreviation	Meaning	Signal or abbreviation	Meaning
4-----	Start me; or where?	MGR-----	Manager.
5-----	Have you anything for me?	MIN-----	Wait a moment.
9-----	"Wire" message.	MK-----	Make.
13-----	Do you understand?	MOVED-----	Addressee has moved from address given; present local address unknown.
25-----	Busy on other wires.		
30-----	No more for to-day.	MSG-----	Message.
73-----	Accept compliments.	NAME TO-----	Addressee.
ADS-----	Address.	NITE-----	Night message.
ADSD-----	Addressed.	NL-----	Night letter.
ANR-----	Another.	NM-----	No more.
ANS-----	Answer.	NO-----	Numbers.
BKG-----	Bookkeeping Dept.	NPR-----	Night press rate.
BLACK-----	Full-rate telegram.	NR-----	No record.
BLUE-----	Day letter.	NRD-----	No record destination.
CABLE-----	Cable message.	NSA-----	No such address.
CAK-----	"Contract" message.	NSN-----	No such number.
CFN-----	Confirmation.	NSS-----	No such street.
CHGS-----	Charges.	OB-----	Official business.
CK-----	Check.	OFS-----	Office.
CLOSED-----	Addressee's place closed until A. M.	OGNL-----	Original.
CNT-----	Count.	OIIP-----	Urgent priority message.
COLLECT-----	Collect or Collect tolls there, payment refused by addressee.	OK-----	All right.
		OPR-----	Operator.
		OUR-----	Our message of date.
CTD-----	Counted.	P-----	Priority or PM (depending upon location).
CY-----	Copy.	PCTNS-----	Punctuations.
CYS-----	Copies.	PR-----	Payment refused.
DFS-----	Disregard former service.	QK-----	Quick.
DH-----	Deadhead.	RADIO-----	Radio message.
DLD-----	Delivered.	RD-----	Report of delivery.
DLR-----	Deliver.	RDS-----	Reads.
DLY-----	Delivery or Delivery Dept.	REL-----	Release.
DPR-----	Day press rate.	RP-----	Reply prepaid.
DSTN-----	Destination point.	RPT-----	Repeat.
DSTC-----	Delivered subject to correction.	RPTN-----	Repetition.
DUP-----	Duplicate.	SG-----	Signature.
ESTC-----	Erase, subject to correction.	SGD-----	Signed.
		SPL-----	Special.
FLT-----	Filing time.	SVC-----	Service message for Service Dept.
FM-----	From or originating point.	UNCALL-ED-----	Message returned undelivered; addressee failed to call.
GA-----	Go ahead.	UNDLD-----	Undelivered.
GBA-----	Give better address.	UNKN-----	Addressee is not known.
GONE-----	Addressee is said to have left for ----- (City).	WD-----	Word.
GQA-----	Get quick answer.	WIRE-----	"Wire" message; give way. (See signal 9).
GSA-----	Give some address.	WO-----	Who.
GNTTEE-----	Guarantee.	XD-----	Crossed.
GNTTEED-----	Guaranteed.	XU-----	Sender authorized delivery personnel to state that an answer by telegraph is desired.
GOVT-----	Government message.	YR-----	Your message date. (If referring to back date message, follow by date, as "Yr 3d," etc.)
HA-----	Hurry answer.		
HO-----	Hour of signature.		
HR-----	Here (or) Here is (or) Here are.		
HW-----	Herewith.		
IIFD-----	If incorrect fix with office of destination.		
LC-----	Addressee is said to have left city; forwarding address unknown.		

9. **FORM OF SERVICE MESSAGES.**—The following examples are standards to be followed as closely as possible:

*Notice of nondelivery—*

Yr R. C. Jones, 175 Wall St. (reason for non-delivery)

(The service message should always contain the local address (for example, "175 Wall St.") as given in the received message. Otherwise the office to which the service message is addressed has no means of knowing whether the local address may not have been dropped in transmission of the original address, thus necessitating additional service messages.)

In the space marked "Reason for nondelivery" information as follows should be given:

"Unkn," if addressee is unknown at given number.

"NSN," if no such number.

"LC," if addressee is said to have left and whereabouts not known.

"Gone Boston," if addressee is said to have left city for Boston.

"Moved," if addressee has moved from address given and can not be located.

If the notice of nondelivery refers to a collect message, the body of the service message should be preceded by the word "Collect."

In preparing service messages reporting uncollected tolls on received collect messages in cases where payment is refused by the addressee, the abbreviation "PR" (payment refused) will be used as the last text word. The correct form for such service messages will be as follows:

Yr Jones Coll PR.

*Correction of address—*

Our Jones, 275 Wall St. Rpt. 275.

*Requesting repetition of a doubtful word—*

Yr R. C. Jones, Rpt. 4th Orleans.

*Answers to above—*

Our Jones 4th Orleans OK.

Our Jones 4th Orphan Rpt. Orphan.

Requests for repetition or duplication of messages shall give the check of the message in all cases so that the message involved may be positively identified at the office of origin.

*Requesting repetition of entire body of telegram—*

Yr 21 CK 10 R. C. Jones Rpt. body.

*Answer to above—*

Our Jones Rds. (quote body of message).

10. When on receipt of a service message asking repetition of a word or words or of an entire message, it is found that the original message was filed by telephone, and comparison of the service mes-

sage with the message as recorded by the employe who received it - over the telephone shows that there was no error in telegraph transmission, the sender should be called on for verification of the correctness of the word or message before the service message is replied to, and any correction developed by such inquiry of the sender should be indicated in the service message.

11. Prepare all service messages in carbon duplicate and attach the carbon copies to the messages to which they refer.

## MECHANISM OF THE TYPEWRITER

1. The principal parts of the typewriter are frame, keys, type bars, carriage, and escapement. In connection with these are numerous devices which assist in the ease and speed of operation.

2. Every type bar in the machine prints two characters. The position of the cylinder (which is also known as the platen, and sometimes called the roller) determines which of these characters shall strike the paper. Depressing the "shift key" raises the carriage so that capitals are printed.

3. When the cylinder occupies its lower position, the small type or figures on the lower register strike the paper. By depressing the "shift lock" the cylinder can be held in its raised position without keeping the finger on the "shift key."

4. The "space bar" is located directly below and in front of the keys where it can be conveniently operated by the right thumb. By depressing it the carriage is shifted one space forward.

5. The "carriage" is that part of the machine which carries paper and cylinder and which feeds the paper across the machine as the letters are struck.

6. The "feed rolls" are small rollers under the cylinder, but attached to the carriage, which hold the paper in close contact with the cylinder and thereby assist in the even movement of the paper.

7. The "paper release key" is a small lever at the right and on the carriage, connected with the feed rolls. By depressing it, the feed rolls are moved away from the cylinder and the paper is released for the purpose of removing or straightening.

8. The "platen knobs" are small, black, knurled knobs attached to each end of the cylinder, by which the cylinder may be turned by hand.

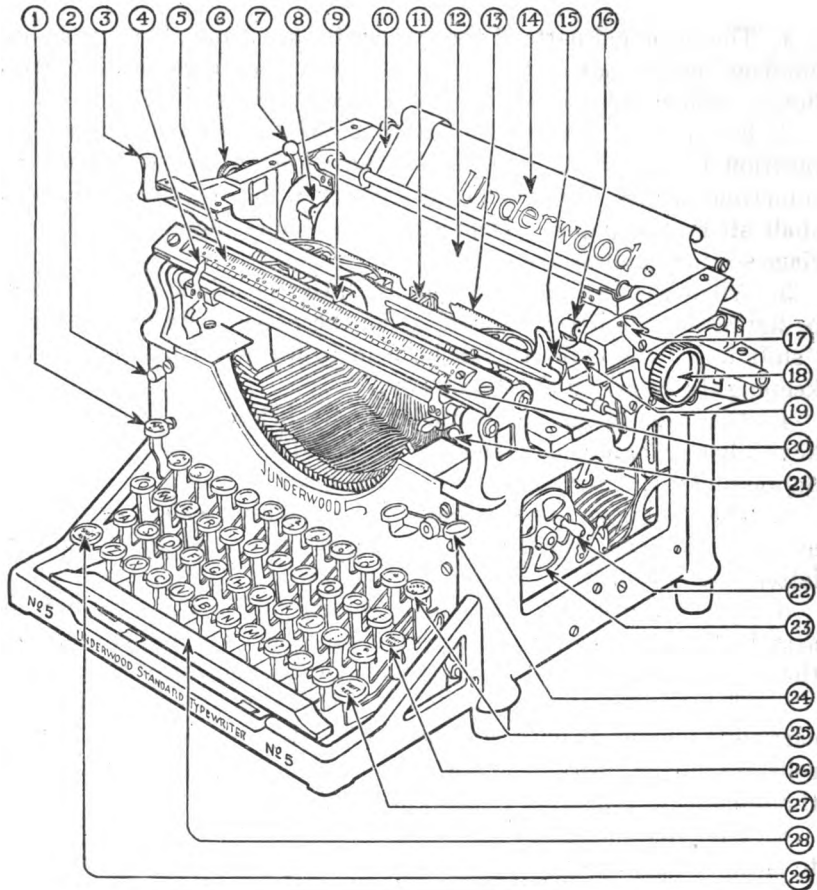
9. The "variable line space mechanism" is located on the carriage and by its use the space between the lines can be changed to write single, double, or triple space. This mechanism is so arranged that the cylinder is moved forward as the carriage is returned to starting point.

10. By means of the "variable line space lock" this spacing mechanism can be thrown out of action, and the cylinder held firm at any point.

11. The "key-lever lock release," located on the left front of the frame, permits the writing of a few letters after the carriage has been stopped by the left marginal stop.

12. Depressing the "carriage release lever" at either end of the carriage permits the carriage to be moved freely either to the left or right.





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Fig. 42.—Parts of the typewriter

- |   |                                     |
|---|-------------------------------------|
| 1. Back space key.                          | 16. Paper clamp (right).            |
| 2. Key-lever lock release.                  | 17. Paper release lever.            |
| 3. Line-space lever.                        | 18. Cylinder knob (right).          |
| 4. Marginal stop (left).                    | 19. Carriage release lever (right). |
| 5. Front scale.                             | 20. Marginal stop (right).          |
| 6. Variable line-space push button or lock. | 21. Ribbon switch lever.            |
| 7. Line-space adjusting lever.              | 22. Ribbon-spool ratchet handle.    |
| 8. Paper clamp (left).                      | 23. Ribbon-spool ratchet wheel.     |
| 9. Carriage-frame pointer.                  | 24. Bichrome-ribbon shift lever.    |
| 10. Lateral paper guide.                    | 25. Tabular key.                    |
| 11. Type guide.                             | 26. Shift lock.                     |
| 12. Cylinder or platen.                     | 27. Shift key (right).              |
| 13. Cylinder scales.                        | 28. Space bar.                      |
| 14. Paper rest.                             | 29. Shift key (left).               |
| 15. Marginal-stop release lever.            |                                     |

## TYPEWRITER RIBBONS

1. The action of the ribbon mechanism on all modern typewriters is automatic. Once a ribbon has been inserted, it moves from right to left and in the opposite direction, reversing automatically.

2. Ribbons can be procured with one-half the width red and the other half of some other standard color. The ribbon should be inserted with the red half downward.

3. Some late model machines are equipped with a two-color ribbon device, by which it is possible to write with either the top or bottom half of the ribbon. By moving the device so that the indicator points to red, the ribbon is raised so that the type strikes on the red half of the ribbon, and by moving the indicator so that it points to black, the type strikes on the black half of the ribbon.

4. With single color ribbons, after the top half has been worn, the lower half can be brought into service by moving the indicator of the ribbon device so that it points to the red.

5. In making stencils, the type should not strike the ribbon, but should strike directly against the blue stencil sheet. An attachment on the ribbon device is provided on many machines by which the ribbon mechanism is thrown out of play. If the machine to be used is not so equipped, the ribbon must be removed before writing stencils.

6. Some machines use wider ribbons than others. Some ribbons are equipped with metal eyelets which engage the reversing mechanism.

7. The spools on which the ribbons are wound vary with the make of the machine. It is always advisable to use a ribbon prepared especially for the machine on which it is to be placed. However, an Underwood ribbon can be used on the Remington machine by winding it on the Remington spool and cutting off the end of the ribbon at the eyelets.

8. There are two general types of ribbon, the "copying" ribbon, filled with copying ink from which copies may be transferred by the copy press, gelatin duplicator, etc., and the record ribbon, which is the ordinary writing kind. A copying ribbon smears the sheet easily while the other kind does not.

### CARE OF TYPEWRITER

1. Take the type brush, resembling a stiff toothbrush, and brush all the type vigorously each morning before using. If the type is very dirty, dip the brush in gasoline or wood alcohol before brushing the type.
2. With a clean dust cloth, next wipe off all dust or sand before the machine is used.
3. If an erasure must be made, move the carriage to one side so particles of paper will not fall into the working parts of the machine.
4. After stencils have been cut, clean the type and cylinder with gasoline or wood alcohol to remove all dermax and keep it from gumming up the machine.
5. Cover the machine each night with a dust-proof cover, or close down desk top before leaving, if machine is fastened to a drop-top typewriter desk.
6. Do not leave the typewriter in a damp place.
7. About once each week oil the working parts of the typewriter, using a typewriter or sewing-machine oil, or by dipping a long metal bar about the size of a wire nail into the bottle of oil and then removing it and allowing the drop that collects on the lower end to drop upon the spot to be lubricated.
  - a. On the Underwood machine place oil on the guide roll at the back of the machine on which the carriage travels and on the small wheel on the carriage directly under the indicator on the front scale.
  - b. On the Remington machine, place a drop of oil on each end of the stationary tracks on which the carriage moves, and a drop at each end of the cylinder where it moves in the frame of the carriage.
8. After oiling move carriage back and forth several times to distribute the oil before using. Do not use too much oil.

## DIRECTIONS FOR SETTING UP AND MAINTAINING UNITED STATES SIGNAL CORPS TYPE OF EDIPHONE

### UNPACKING

Unpack the machine carefully, cut off all tie cords used for fastening it in shipment, and make sure that the cardboards, both above and below the motor, are removed. Clean the machine carefully, making sure that the slushing compound is removed from all parts of the machine, both above and below the top plate, especially from the feed screw. Nothing but a cloth should be used for this cleaning.

### SETTING UP

The standard equipment is made to run on either 110 volts direct current or 110 volts alternating current, 60 cycles. Care should be taken to see that the current-change switch at the upper right-hand corner of the motor is in the correct position.

Specially wound motors and resistances are provided where necessary. In writing Orange, N. J., for information, always state the electrical conditions.

Assemble the belt to the motor drive pulley, making sure that the idler is on the top.

Next connect the plug of the main lead to the power line. With the top plate raised, check the operation of the motor.

Lubricate the motor bearings and shaft by partially filling the oil cups provided for this purpose.

*Arctic oil or its equivalent should be used on all Ediphone motors.*

Next lubricate the idler pulley and felt frictions and governor disc.

The operation of the commutator should be checked up next. This should be clean and free from oil. Great care should be exercised to always keep the oil from this part of the machine. Brushes that become oil soaked should either be replaced or the oil burned out of them. When cleaning the commutator, never use anything but No. 00 sandpaper. The brushes should be well seated. This is accomplished by wrapping a strip of sandpaper about the commutator with the sanded side up and holding the brushes securely while revolving the commutator by hand. Care should be exercised to afterwards clean the commutator, so that it will be free from sand.

Next close the cabinet by letting down the top plate.

The speed of the motor can be adjusted by turning the speed-adjustment screw, which comes through the top plates. This is beside the start and stop switch. The mandrel speed revolutions can be counted by the slot to the extreme right of the mandrel on the end cap. These motors have a wide range of speed adjustment and are to be adjusted to suit the particular record at hand.

*Never use recorder on special blue permanent record.*

Next assemble the electric recorder and electric reproducer, making the necessary connections as described elsewhere in this Manual.

To move the carriage, throw back the lift lever, leaving the carriage free to move either from left to right, or vice versa.

To engage the arm, locate the position of the arm on the cylinder, letting the lift lever down. To engage either the recorder or reproducer, take hold of the swivel plate lever, raise it either to the left or to the right as the case may require, and let it down.

To start and stop the mandrel, finger buttons are provided at the right-hand corner of the top plate. These are marked "Start" and "Stop."

A speaker guard is provided to insure protection to both the recorder and reproducer when the lift lever of the arm is engaged. It is impossible to place a cylinder on or to take one off when the lift lever is down.

#### CARE OF EQUIPMENT

When the machine is not being used, the motor switch should be turned off and the machine protected by the cover which is provided with each outfit.

All moving parts of the top plate, as well as the motor, should be lubricated and cleaned at least once a month, care being taken not to flood the machine with oil. Care should be exercised not to overlook the clutch pulley and mandrel bearings.

This instrument is made as rugged as it is possible to make one of its type but care should be exercised not to abuse it. When trouble does develop, a responsible man should be called upon to remedy it.

## INSTRUCTIONS FOR SETTING UP AND MAINTAINING UNITED STATES SIGNAL CORPS TYPE OF SHAVER

### UNPACKING

The blocking and all of the padding and tie cords are to be removed before operating it. All slushing compound should be cleaned off thoroughly, especially from the feed screw. A cloth should be used for this purpose.

### SETTING UP

The standard type of electrically driven shaver is equipped with a Universal motor for 110 volts direct current or 110 volts alternating current, 60 cycles. This machine comes equipped with a resistance which is to be adjusted so that the arm of the shaver requires no less than 27 seconds to travel across the cylinder. This, of course, is with the knife cutting a normal shave off of the cylinder. The slower the speed, the better the results.

Specially wound motors or resistances are provided where necessary. In writing Orange, N. J., for information always state the electrical conditions.

Unlock cover by using the key supplied with the machine. The entire top plate support can be opened by raising the top. This is hinged at the back. To lower the top, slightly raise it and unlatch the side support.

Before operating machine, the motor bearings and fan casing should be lubricated. Oil cups are provided on these two units.

See that belts are properly engaged, and that the chip bag is assembled to the blower.

All oil cups on the top plate should be filled and a few drops of oil placed on the feed nut before operating the shaver.

Care should be exercised to see that there is little or no play of the mandrel and also that there is little or no play between the feed screw centers.

### OPERATION OF MACHINE

With the knife unlocked and the gate open, proceed to place a wax cylinder on it (*make sure that you are using a wax cylinder—never under any circumstances attempt to shave the special blue permanent record*) by lining up the arrow on the end of the cylinder with the mark on the mandrel. This is done so that the cylinder will always run true. By this method it is possible to shave off the dictation with two shaves and in a high percentage of cases only one shave will be found necessary.

After securely placing the cylinder on the mandrel, lock the gate, set the knife by pushing down the knife bar and then locking the adjustment. The arm is then brought to the extreme right (*or extreme left when a hand shaver is used*), and the motor started. If the knife shaves too deep, stop the motor immediately, disengage the knife, reset it on the high spot of the cylinder, and then proceed to shave. A little practice is all that is required to make one expert in this operation. To make a second cut, raise the arm after it has gone to the extreme left (*or extreme right when hand shaver is used*), and hold the second cut device (*on the front of the arm*) bring the whole mechanism to the right (*or to the left when a hand shaver is used*) and let it down. This will automatically give a second cut, making it unnecessary to stop the motor for this operation.

When you are sure that the cylinder is perfectly shaved, stop the motor, unlock the knife, unlock the gate, and push off the cylinder by using the thumb and index finger of the left hand for this operation, at the same time inserting two fingers of the right hand to take the cylinder off the mandrel.

Both styles of shavers are equipped with a stop collar so that the cylinders can not be shaved below a certain diameter. These collars are not to be disturbed, as it is important to maintain the diameter of the cylinders to insure correct operation of the Ediphone.

Machines as they leave the factory are adjusted to turn out a smooth shaved cylinder, and the knife adjustment should not be disturbed by any but one experienced or trained to make the adjustment. These knives are made of sapphire and will give a long period of service if properly handled. However, it is always wise to have an extra shaver knife on hand for emergency.

Never use a roughly shaved cylinder, as you are sure to get false signals if you do so.

*Never under any conditions attempt to adjust or set the shaving knife with a cylinder on the mandrel and the machine in operation.*

When it becomes necessary to change the adjustment of the shaving knife, loosen the clamping screw slightly and gradually rotate the knife with the adjusting screw. This should be turned very slowly either one way or the other until a perfect surface is secured. The clamping screw should then be turned home. To replace a knife, remove the clamping screw entirely, taking a chip deflector with it and remove the old knife and insert a new one, after which the clamping screw should be inserted and brought almost home until the adjustment of the knife has been secured, after which this locking screw should be turned home.

### CARE OF SHAVER

This machine should be lubricated as frequently as its use demands. At any rate it should be periodically cleaned and lubricated at least once a month. The top plate, however, should be lubricated oftener. Care should be exercised to empty the chip bag when half filled. By delaying this the wax backs up into the blower and piles up there, causing unsatisfactory operation. In short, this machine should be considered the same as a high-speed lathe, and should be treated accordingly. This part of the equipment is the heart of the system, and it should be operated by one man designated for the purpose.

### HAND-OPERATED TYPE OF UNITED STATES SIGNAL CORPS SHAVER

The same instructions as outlined for the electrical shaver hold true of this type of instrument, with the exception of the electrical part of the equipment.

Securely fasten the machine with screws to the table. You are cautioned not to race the machine and thereby turn out poorly shaved cylinders. Operate the machine by revolving the handle as steadily as you can, and never attempt to shave too deeply.

Lubricate all the moving parts of this machine, taking care not to overlook the moving parts below the top plate. The chip container should be emptied as often as the case demands.



## CODE PRACTICE EQUIPMENT

1. *a.* The instructor should see that there is on hand an adequate supply of manuals, pencils, paper, etc.

*b.* Each instructor's position should be equipped with:

- 1 key.
- 1 sounder (in resonator).
- 1 Ediphone.
- 1 4-volt storage battery.
- 1 Morse relay, 100 ohms.
- 1 switch, triple pole, double throw.
- 1 set of jacks, cords, wedges, etc.

(See Figs. 43, 44, and 45.)

*c.* One battery sufficient for the needs of the school should be provided. (See par. 5 below.)

2. *Classes.*

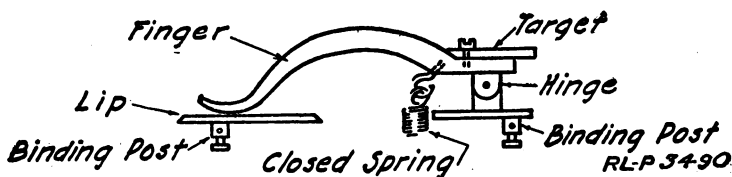


Fig. 43.—Single spring jack

*a.* It will be found that one instructor, sending manually, can handle about 12 students efficiently, if they are about the same speed. If they differ in the speed at which they can receive, they must be divided into classes accordingly, as a 5-word class, 10-word class, etc. No matter how small the class is, the students can not make progress if some are advanced and others are not. A 5-word student receives but slight benefit from listening to 15-word sending and a 15-word man gets no practice at all when copying 5 words per minute. To make progress each class must have an instructor. Until a student acquires a speed of 20 words per minute, he requires constant individual attention. When the Ediphone is used, much larger classes can be cared for by one instructor, and if necessary, one instructor can handle two or three classes simultaneously.

*b.* Each class should be seated at one table, the instructor at the end of the table and the students at the sides.

3. *a.* The installation must be so wired that the following four conditions may be met as needed:

First. That the instructor can send to all the students in his class by the use of the key or the Ediphone at his position.

Second. That each student's set can be furnished battery, separately, to permit of individual sending practice.

Third. That any two or more students' sets can be connected in series for "single-line" work.

Fourth. That any student can be connected so as to make a record of his sending on the Ediphone.

b. Each student requires a space about 36 inches wide by 24 inches deep. The instructor's position should be the full width of the table (48 inches) and about 24 inches deep. This will give ample space to install the Ediphone and the necessary switching apparatus within his reach.

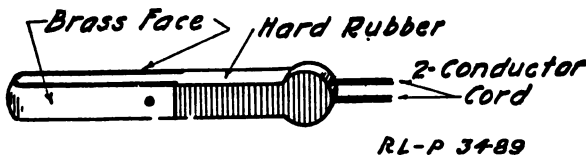


Fig. 44.—Wedge

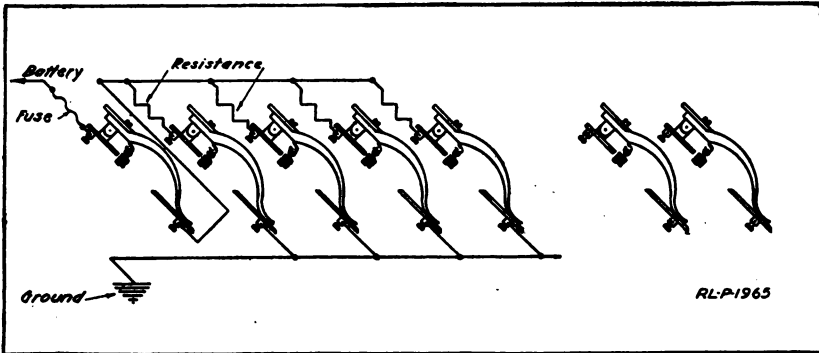


Fig. 45.—Jack position

c. At the left of the instructor's position should be installed a set of jacks. Above the jacks are receptacles for resistance units and, in front of them, holes bored through the table. If possible, a commercial telegraph wire should be available for receiving practice. It should be equipped with a Morse relay, the local points of which are extended to the jack position (Fig. 45) by means of a cord terminating in a wedge (Fig. 44). This wedge may be inserted in jack No. 1, where it will act as a key to operate sounders connected to jacks Nos. 2 to 5.

d. The power lead (battery) should be brought to the receptacle at No. 1 jack, from the receptacle to the finger of the jack, from the finger to the anvil and thence to the outer sides of the other re-

ceptacles. (See Fig. 45, which is a side view of the jacks separated.) This places No. 1 jack in series with the power; therefore the corresponding receptacle should have a fuse instead of a resistance unit. All the jacks and the corresponding resistances are in multiple from the battery lead to the ground.

*e.* Each student's set is connected to a wedge. (Fig. 44.) The wires from the instruments are carried under the table to the instructor's position. Here they connect to the double conductor cord which passes through one of the holes in front of the jack and which connects to a double conductor wedge.

*f.* The instructor's sounder is connected to a wedge which may be inserted in any desired jack. A relay, key, and a triple-pole, double-throw switch, together with an Ediphone, are installed at the instructor's position, as shown in Figure 49.

*g.* It has already been stated that the installation must satisfy the four requirements stated:

First. That the instructor can send to his entire class. This is accomplished by inserting the wedge to which his key and switch are wired into jack No. 1 and all other wedges into the other jacks. As jack No. 1 is in series with the power lead, the main circuit will be broken when his key is opened.

Second. That all students' sets can be furnished battery separately. Inserting the student's wedge under each jack except No. 1 will give each student a circuit to himself.

Third. That any two or more student's sets can be connected. Insert two or three wedges in one jack. Each jack can accommodate three wedges. Thus two or three student sets can be placed in series for single line instruction.

Fourth. Removing the Ediphone reproducer wedge from jack No. 1 and inserting the recorder wedge, together with the student's wedge in a student's jack, makes it possible to record the student's transmission. After the student has made a record it may be caused to operate his sounder by removing the recorder wedge and inserting the reproducer wedge.

NOTE.—As the jacks are all within the reach of the instructor, he can listen to the sending of any student by inserting the wedge connected to the instructor's sounder in the jack being used by that student.

*h.* When there is more than one table, an extra jack (Fig. 43) is used as "trunking" connection. A pair of wires should extend from Table No. 1 to each other table. That is, if there are three tables, there should be one pair from tables Nos. 1 to 2 and another from Nos. 1 to 3, and also a pair from Nos. 2 to 3. No matter how many tables there are, there should be a direct pair between any two tables.

Each end of any pair of wires should be equipped with a wedge. This equipment is necessary for single-line practice and is used to connect a student at one table with any other student in the room.

4. Gravity battery will not serve for such an installation unless a series-parallel connection is used. Dry cells would last but a short time. Storage battery gives the only really satisfactory service. It is recommended that 20-ohm sounders be used.

5. *Voltage.*—A battery of at least 30 volts should be used.

6. *Installation.*

a. If 20-ohm sounders are used, the resistance unit should be 130 ohms for 30 volts. Then when one wedge is inserted in a jack one-fifth of an ampere will flow; when three wedges are inserted in one jack rather less than one-sixth of an ampere will flow; 20-ohm sounders operate well with this fluctuation of current.

b. Under the first condition, where the instructor is sending to the entire class, the wedges attached to the student's sets and the instructor's sounder should be grouped under as few jacks as possible.

c. Pieces of wood or lead pencils should be inserted in the other jacks to open the circuit and prevent waste of power. As has been shown, when one wedge is inserted in a jack, one-fifth of an ampere will flow; with six such circuits working,  $1\frac{1}{2}$  amperes will flow. Suppose there are eight jacks, with three wedges in a jack, rather less than one-sixth of an ampere will flow. With three such circuits in use one-half ampere will flow. Therefore with all the instruments grouped in three jacks and the other five jacks open the power consumption will be small.

d. The instructor's sounder can not be wired in series with his key and to a wedge for the reason that his key is used to break the main current of half an ampere or more when he is sending to his class. This sounder is constructed to work on one-fifth of an ampere and currents above one-fourth ampere should never be passed through it.

7. *Instruments in General.*

a. Should it be found impossible to obtain the instruments already described, any sounders may be used, care being taken to keep the current within the limits prescribed for the instrument used. Sounders in common use are constructed as follows:

TABLE 1.—*Sounder operating currents*

Type of sounder	Current in milliamperes		
	Minimum	Normal	Maximum
4-Ohm.....	200	250	300
20-Ohm.....	120	175	225
50-Ohm.....	80	120	150

b. Sounders of high resistance which require a small current are well adapted to instruction work; at times it may be necessary to connect several in parallel. The smaller the current, the less sparking at the contacts of the key.

#### SUMMARY OF JACK AND SWITCH CONNECTIONS

For receiving practice:

Table switch to the right.

Student position plugs in jacks, one or more to a jack.

For single-line practice:

Table switch open.

Switch-cord plug withdrawn from power jack No. 1.

Two or more student position plugs in each jack as desired.

For preliminary sending practice (imitating Ediphone signals):

Table switch to the right.

Switch-cord plug in jack No. 2 together with one or more spare sounders.

Student position plugs in individual jacks.

For individual sending practice:

Table switch open.

Switch-cord plug withdrawn from jack.

Student position plugs in individual jacks.

For recording:

Table switch to the left.

Switch-cord plug in a spare jack, together with position of plug of student making record.

To reproduce his record, throw table switch to the right.

#### OPERATION AND ADJUSTMENTS OF THE EDIPHONE

The Signal Corps special Ediphone (Figs. 46, 47, and 48), consists of an Ediphone dictating machine equipped with a special recorder (6), a special reproducer (7), a buzzer (8), two condensers (9) and (10), and five binding posts (1), (2), (3), (4), and (5).

The recorder and reproducer are mounted on a swivel arm in such a manner that either may be placed in position for operation by pivoting the arm to the right or left.

The buzzer is mounted on the back of the machine, together with a condenser (9), which is bridged across the buzzer contacts to prevent sparking, and a condenser (10) in series with the reproducer coils.

The method of operation of the Ediphone is as follows:

*To make a record of the student's sending.*

Place a blank wax record on the Ediphone.

Pivot the arm to the right, placing the recorder in contact with the wax record.

Throw the table switch to the left. This places the buzzer in operation.

Place the switch cord plug in a spare jack together with position plug of the student making the record.

Start the Ediphone motor and press the clutch button to revolve the cylinder.

Direct the student to send.

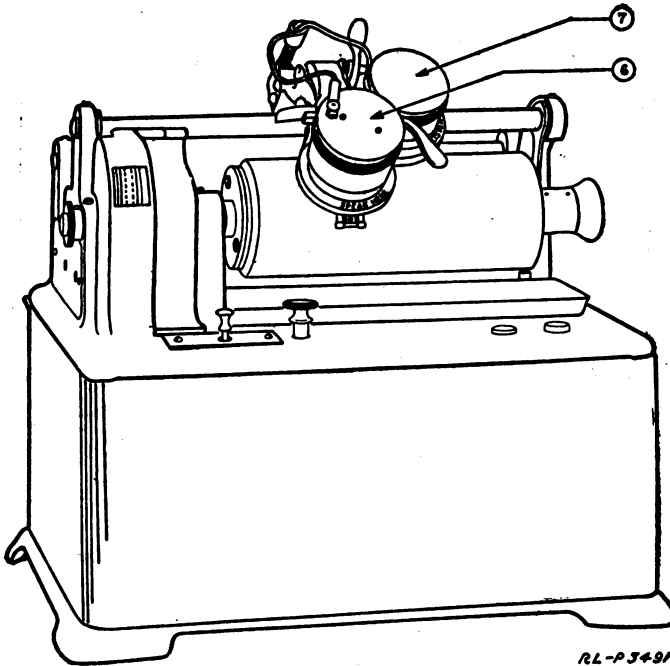
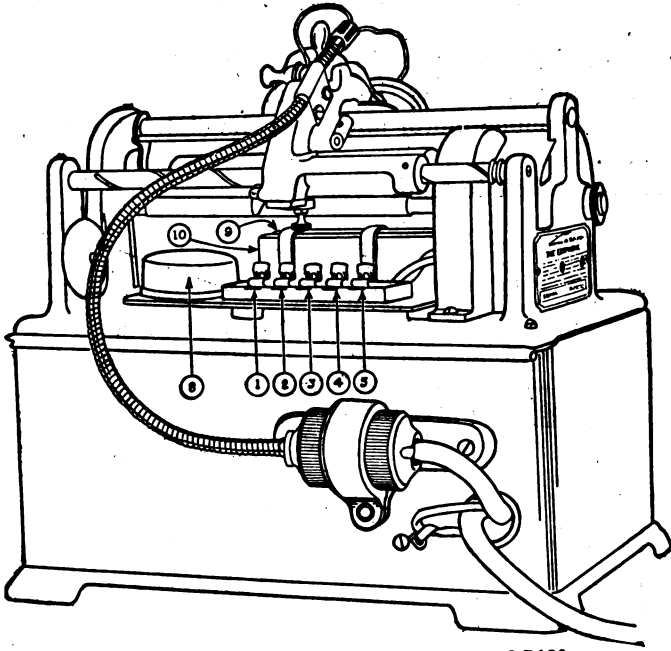


Fig. 46.—The Ediphone, front view

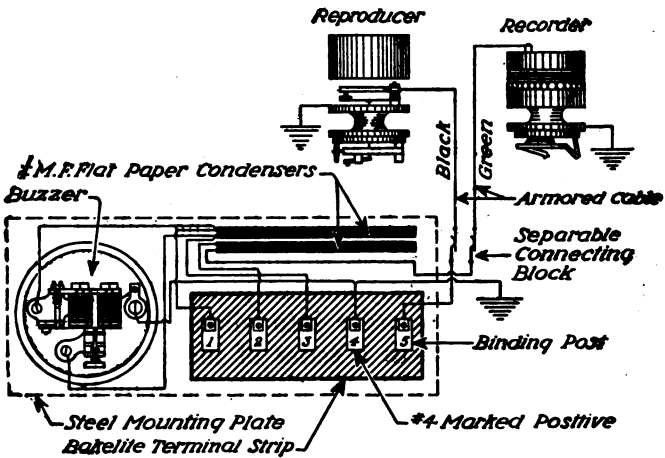
RL-P 3491

The student's key controls the operation of the table relay, the front contacts of which are in series with the coils of the recorder and the contacts of the buzzer, so that at each operation of the student's key a high frequency current passes through the recorder coils. This throws the recorder into vibration and actuates the recorder stylus, which places a series of indentations on the wax record which will correspond to the signals made by the student.



RL-P 3492

Fig. 47.—The Ediphone, rear view



RL-P 3325

Fig. 48.—Internal wiring of Ediphone

*To reproduce these signals.*

Pivot the arm to the left, placing the reproducer in contact with the wax record at the point where the signals begin.

Throw the table switch to the right.

Start the Ediphone as before.

As the reproducer stylus passes over the indentations on the record, it throws the reproducer reed into vibration. This vibration corresponds to the frequency of the buzzer with which the signal was made and is high enough to introduce considerable resistance to the flow of current through the contacts on the reed and the inertia bar directly above it. These contacts are in series with a battery and

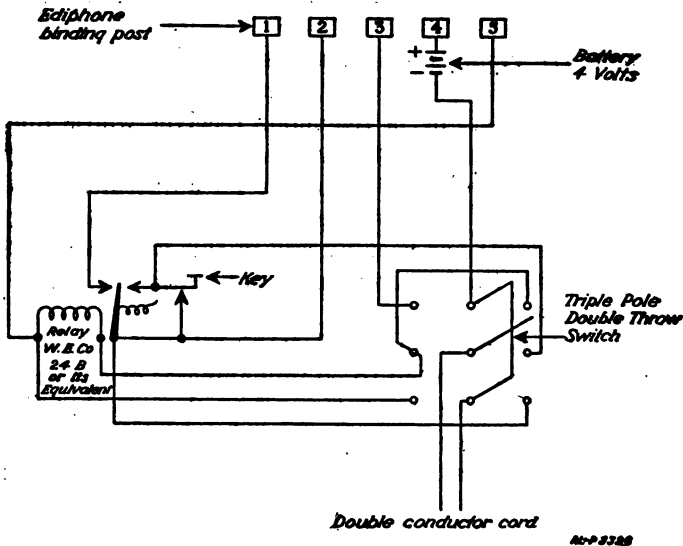


Fig. 49.—External wiring of Ediphone

coils of the table relay which results in stopping the flow of current through the relay. The local contacts of the table relay are now arranged to close when its armature opens and, as the local contacts are in series with the student's set through the table cord, each operation of the table relay will cause the student's sounder to operate in consonance with the signals impressed on the wax record.

*Receiving practice.*—For receiving practice, permanent records are used. These are reproduced as directed for wax records, excepting that the switch-cord plug is placed in power jack No. 1.

*Preliminary sending practice.*—For preliminary sending practice the table switch is thrown to the right, the switch-cord plug is in jack No. 2, together with one or more spare sounders, and the student position plugs are in individual jacks.



Preliminary sending practice is conducted as follows:

One of the A records is run on the Ediphone.

The students listen to the sounds of the characters as they are run and, between characters, they attempt to imitate them on the key.

This practice is continued with all of the A and B records, until the students can make the characters properly.

*Adjustments.*—The buzzer has only one adjustment: It should be adjusted to give a clear tone, by adjusting the contact screw. When adjusted properly, it will not spark at the contacts.

The various grounds shown in Figs. 48 and 49 indicate connections to the frame of the Ediphone. No actual connection to the earth is required.

*The reproducer requires no adjustment and should not be taken apart.*

The recorder consists of a telephone receiver whose diaphragm, when thrown into vibration, actuates a stylus through the medium of an air column. Ordinarily, it needs no adjustment and should not be taken apart or the cover removed unless it fails to operate. In case its adjustment has been altered in this way, it may be readjusted by screwing the receiver in or out until the buzzer signals make a suitable record.

The table relay is an ordinary telegraph relay of 100 ohms' resistance and operates on from 30 to 50 milliamperes of current. There should be three local binding posts on this relay, so that the proper connections may be made as shown in Fig. 49.

*Care of records.*—Wax records for recording and sending practice are very soft and great care should be taken to protect them from mechanical injury. Records should be reshaved just before using them for recording. Keep wax records in cartons when not in use. Never expose wax records to direct rays of sunlight or to excessive room heat.

The special blue record issued for receiving practice has a hard permanent surface, but this surface may be injured by rough treatment. Care should be taken in placing records on the mandrel and removing them to avoid denting the record by striking the surface against metal parts of the machine. Keep records in the felt lined box when not in use on the machine. The recorder or reproducer should always be lowered gently to contact with the record. Never trip the carriage lift lever.

*Mandrel speed.*—The mandrel speed can be adjusted by means of the adjusting screw in front of the mandrel. Never race the machine above 125 revolutions per minute or lower the speed below 50 revolutions per minute. The normal mandrel speed is 85 revolutions

per minute. The speed of the mandrel may be checked by pressing the finger lightly over the slot on the mandrel limb and counting the revolutions per minute. The average time of the blue permanent records at normal speed is six minutes. Recording on wax records should be done at or near normal speed to obtain the best results.

*Recording.*—In recording, the stylus should be lowered about three-fourths of an inch from the beginning of the record and allowed to turn ten or twenty revolutions before recording is started and should be allowed to turn ten or twenty revolutions beyond the end of recording before stopping the mandrel or raising the carriage lift. Before repeating a freshly recorded record, the mandrel should be started and the wax cylinder brushed off with the camel's hair brush so as to remove wax chips which might otherwise cause false signals to appear on the first reproduction of the record.

*Recorder and buzzer.*—The recorder consists of a specially designed bipolar telephone receiver actuating a second mica diaphragm carrying a stylus. This receiver has an adjustable air gap. The buzzer on the rear of the machine has only one adjusting-screw contact. The receiver is adjusted at the factory and ordinarily should not be changed. The adjusting screw on the buzzer should be adjusted to give a 500 to 800 cycle note. The character of recording on the wax record may be checked by comparing its surface appearance with that of the permanent records. Should a recorded cylinder fail to reproduce properly, the fault may be either in the character of the recording, in faulty relay adjustment or elsewhere in the external circuits. To check correctness of recording, the cover cap on the reproducer may be temporarily removed and the character of the recorded signals read directly from the vibrations of the reproducer reed. If this test shows false signals, the buzzer should be adjusted until faithful reproduction is obtained. This adjustment is correct when a wide margin in mandrel speed and relay adjustment is obtained.

*Reproducer and contacts.*—The interrupting contacts on the reproducer are made of pure platinum and seldom require attention. However, after a long period of use, these contacts may become pitted and fail to break the current properly. They may be dressed with a *fine cut* contact file or a burnisher, care being taken to file only enough to obtain a good smooth contact surface. The contact surfaces, after dressing, should meet squarely to obtain a large area of contact. The condenser bridged across the buzzer contacts should eliminate all sparking. Any sparking at the buzzer contacts indicates dirty contacts or faulty adjustments.

## PENMANSHIP SCALES

It is of great importance for a telegraph operator to write characters neatly and legibly. Many delays are caused by the illegible writing of an operator. In order to overcome this difficulty, the student is given a thorough course in penmanship.

It is evident that if an instructor were to grade the efforts of a student in penmanship the mark would be unfair in most cases. This is due to the fact that one instructor would grade a student's paper according to his own ideas of standard writing, while another instructor, who had totally different ideas, might give a considerably lower mark. With this handicap in view a means was devised whereby the error in the judgment of the instructor is reduced to a minimum.

Opposite page 35 is shown a table (Fig. 2) containing seven lettering charts. If carefully noticed, it will be seen that these charts range from excellent (beginning at the top) to poor (at the bottom). These charts were selected from a total number of about 200. The process of selecting the charts was somewhat as follows:

A number of officers and instructors were chosen to select by comparison, out of the 200 charts, 7 specimens which ranged from the best to the poorest. The number of officers and instructors selecting these papers was approximately 25. By averaging their selections the 7 standard charts in the table opposite page 35 were finally selected as standards. At the bottom of each chart is a number which constitutes its rating compared with the remaining charts. In determining the order of the 7 charts in the scale, writing speed was considered as well as legibility. Chart No. 1 was selected as the best, rather than chart No. 2 or No. 3, because it combines both legibility and speed.

The instructor should collect the papers of the students at the end of at least one of the periods during the daily session. With the standard writing scale in front of him he should take one paper at a time and compare it with the standard.

In these comparisons the best results are obtained in the following manner:

1. Glancing at the student's paper, note the general appearance of the writing as a whole. Look at the standard table and select a chart which has the same general appearance as the student's paper.

2. Hold the student's paper beneath the standard chart selected and compare at random a few of the individual characters. If the student's characters are slightly better than those in the standard chart, compare the paper with the next higher chart. If the student's

characters are not as good as those in the original chart selected, compare the paper with the next lower chart. The student's paper is finally scored according to the score appearing at the bottom of the chart which has been selected as bearing the greatest similarity to the student's paper. This score should be inserted on a daily grade sheet and kept for reference purposes. The instructor should observe very closely the progress of the students in writing as shown by these daily scores. If there are any students who continually perform poorly in penmanship, they should be given individual attention and required to practice outside of the regular hours.

Abbrevi  
Accepti  
Adjust  
Amper  
Aptitu  
Aptitu

Box r

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C

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## TRAINING MANUALS ON SIGNAL COMMUNICATION

(Corrected to December, 1925)

War Department training manuals prepared by the Signal Corps, relating to signal communication specialists of all arms are titled as follows:

	Training Manual
<b>Basic Signal Communication:</b>	
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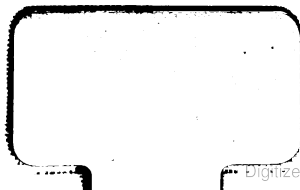




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