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THE TECHNIQUE OF ARMY TRAINING

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WAR DEPARTMENT
THE ADJUTANT GENERAL'S OFFICE

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THE TECHNIQUE OF ARMY TRAINING.

INTRODUCTION.

In a major emergency, speed of organization and of training troops is of primary importance. Rapid and thorough training methods are also essential to success with the National Guard, the Organized Reserves, and the citizens military training camps in time of peace. Nothing so stimulates interest in these organizations and makes men enthusiastic in their support as a snappy, progressive schedule that leaves every man with a sense of satisfaction at his personal progress for each day's work.

For these reasons the development of army training methods, until they achieve the results required with maximum thoroughness in minimum time, will be given great weight in the Military Establishment. This document on technique of army training summarizes the best practice in this matter as developed by war experience and since. Sections I to VII define the essential elements of a sound training program and the procedure for producing the necessary aids to instruction. Section VIII presents the solution of the problem for a single type of technical specialist, the radio operator. This typical illustration outlines the several steps that must be taken and the documents that must be prepared for every phase of army training before firm foundations for a well coordinated and efficient system will be laid.

Documents do not produce training. They define objectives and assign missions. Educational experience has demonstrated unequivocally that the more clearly the objective is defined and the more specifically the mission is described, the greater the success of instruction. The best marksman can not hit the bull's-eye unless he sees the target. The best instructors likewise must have their objectives and missions well defined by specifications, standards, and job analyses, as herein described, before they can achieve maximum thoroughness of instruction in minimum time.

I. Personnel Specifications.—In order that the man power of the Army may be utilized to its maximum efficiency, not only in time of peace but more especially in time of war, it is essential that each man

be assigned to duty where his services will count most. The first step in achieving this objective is the preparation of personnel specifications which define briefly the personal characteristics, skill, and knowledge needed to perform efficiently every type of service required in the Army.

The first important function of personnel specifications is that of an index or catalogue by which a unit commander can requisition men needed to complete his organization. They are used in this way when there is available a large number of men of all kinds and the problem is to assign each man quickly where his specific abilities will enable him to render the greatest service. They furnish the standard terminology by means of which personnel officers classify available men in the same categories used by commanding officers in requisitioning men.

Personnel specifications have a second important function. They define the objective which training for every type of service must achieve. They are the guide in constructing courses of instruction to train raw or partly qualified men to meet the requirements. The personal characteristics indicate the type of men to select for each type of training, and the skill and knowledge specifications define what the man must be made to master by the instruction.

II. MINIMUM SPECIFICATIONS.—It is of the utmost importance that the assignment of men to military organizations be so made that the combat branches, on which success in battle primarily depends, secure the requisite amount of intelligence and leadership. Therefore, specifications for personnel of the noncombatant branches and for technical specialists of the combatant branches should mention only the indispensable personal characteristics and the lowest acceptable standards of skill and knowledge essential for proficiency in each grade or rating. If these specifications really contain only the minimum requirements, and if all officers concerned adhere to them accurately, they are a powerful and essential tool in conserving man power. Such specifications are called minimum specifications to distinguish them from specifications that call for degrees of skill and knowledge higher than those actually needed to do the job.

Since personnel specifications also define the objectives of training, they should mention only the essential requirements for proficiency in order to make possible maximum thoroughness of training in minimum time.

Minimum specifications are statements of the essential specific abilities and the lowest acceptable standards for a given grade or rating.

Specific abilities mentioned in minimum specifications are of three kinds, namely:

(*a*) Skill: A list of the things a man must be able to do well in order to qualify for the grade or rating.

(*b*) Knowledge: A list of the things a man must know in order to qualify for the grade or rating.

(*c*) Personal characteristics: Those characteristics of physique, temperament, and natural bent essential for the required degree of proficiency.

Standards mentioned in minimum specifications define the required degrees of the various specific abilities.

III. TESTS.—When minimum specifications are used as criteria for selecting and assigning men who already have occupational skill, some means must be provided for quickly and accurately determining what kinds and degrees of specific ability are possessed by the candidate.

The best tests are those by which the candidate's abilities and proficiencies are determined most accurately with the least expenditure of time and energy. To accomplish this the candidate's performance should leave a record that shows obviously his degree of proficiency or deficiency in one or more of the required abilities. Such tests are called objective tests to distinguish them from examinations or interviews, the results of which depend mainly on the personal or subjective judgment of the examiner. Hence—

Objective tests are devices for determining quickly and without personal bias what kinds and degrees of specific ability are possessed by individuals. Objective tests are of two general kinds:

Aptitude tests, which reveal whether a candidate has the kinds of specific abilities required for a given grade or rating; and

Tests of proficiency, which indicate relative degrees of proficiency for a specific ability or a particular group of specific abilities.

Tests of proficiency make possible a rapid classification of men in their order to excellence with regard to the specific abilities tested. In order to use them as a measure of proficiency, a critical score must be chosen to mark the dividing line between proficiency and deficiency. The selection of the critical score requires giving the test to a number of men whose relative proficiency has been judged by several competent observers over an adequate period of observation. The validity of tests of proficiency thus rests on the judgment of competent observers. Their advantage lies in the fact that they enable an officer to secure quickly a proficiency classification which is as good or better than he could secure in weeks by observation of the men on the job.

This process of determining the critical score that marks the dividing line between proficiency and deficiency for a given grade or rating is called standardization of the test. Hence—

A standardized test is an objective test in which the critical score required for each grade or rating has been reliably determined.

IV. INSTRUCTION UNITS.—When minimum specifications are used as an objective for training men to qualify for any given grade or rating, green or partially qualified men must be selected to take the work and suitable courses of instruction must be prepared. The essential personal characteristics mentioned in minimum specifications furnish the guide for selecting men best suited temperamentally for the work. The skill and knowledge specifications define the various kinds of proficiency that must be acquired by training. Experience indicates that the preparation of a course that achieves thoroughness and speed necessitates, first, the analysis of the required skills and knowledge into operations or elements each of which is a good unit of instruction and, second, the combination of these instruction units into a practical school program.

The requirements of any grade or rating may be analyzed in an unlimited number of ways. Efficiency of instruction depends in large measure on how the analysis is made. Experience indicates that a logically coherent analysis into what may by analogy be called points, lines, and planes is inexpedient for instruction of the sort of soldier the Army actually has to train. For purposes of instruction it is more expedient to break up the requirements for proficiency into fragments, each of which must obviously be mastered in order to become proficient, because it occurs frequently in substantially the same form, either alone or in combination with other similar fragments, in practical work. Such natural fragments of the work required in a grade or rating are called unit operations.

A unit operation is a group of manipulative processes which is large enough to make a good instruction unit and which occurs frequently in substantially the same form, either alone or in combination with other unit operations, in practical work.

Related to the technique of performing the unit operations there are usually a number of auxiliary facts which a man must know if he is to be really proficient. If these facts are not brought to his attention in the process of doing the unit operations, they should be presented to him by means of questions in class discussions or by means of required study of reference books. Groups of such auxiliary facts are called information topics. Hence—

An information topic is a group of related facts, the mastery of which is essential to proficiency in a given grade or rating.

A complete analysis of the requirements of a minimum specification is a list of both the unit operations a candidate must be able to do and the additional information topics he must know. Such a list is called the operations index.

V. INSTRUCTION MANUALS are of two kinds, students' manuals and instructors' guides.

The students' manuals consists of three essential parts, namely:

1. *The operations index*, containing the unit operations and information topics into which the requirements for a grade or rating have been analyzed for purposes of instruction.

2. *Operation sheets* give in natural order directions for performing the unit operations mentioned in the operations index, together with the necessary drawings, illustrations, and list of significant questions.

The objective of the operation sheet is to guide the student to rapid acquisition of correct technique in those manipulative operations which are automatisms in a skilled workman. The directions are clear, concise, and follow the natural order of procedure established in standard practice. The questions are generally of such nature that they can be answered by observation or a little experimenting while doing the work itself. They do not lead far afield for information not essential to quick mastery of correct manipulative technique.

3. *Information sheets* contain brief discussions of the information topics mentioned in the operations index, together with the necessary drawings, illustrations, significant questions, and references for further study.

The discussions in information sheets are clear, concise, and limited to information really essential to proficiency in technique. The questions guide the student to see relationship among the facts learned and ultimately to discover general principles involved.

In some cases it is most expedient to use each unit operation as a separate assignment or job. In other cases it is better to assign men to jobs that involve several of the unit operations. In the latter case it is convenient to use a—

Job assignment sheet, which is a blank containing spaces for—

(*a*) A concise definition of the job.
(*b*) Specifications of detail.
(*c*) Sketch or drawing.
(*d*) List of unit operations in the order to be performed.
(*e*) Significant questions by the instructor.
(*f*) Answers written in by the students.

The instructors' guide contains suggestions for instructors concerning such matters as:

Equipment and shop set-up.
Securing productive work for classes.
Prerequisites for admittance to the work.
Selection of type jobs.
Organizing productive jobs to cover all unit operations required.
Circulation of students among jobs.
Preliminary exercises, drills, information, and problems.

Records, grades, standards, and tests.

VI. RATINGS.—The instructor's estimate of the excellence of the student's performance is entered on the rating card. The rating card (Form 758, A. G. O., "Proficiency Rating in Vocational Training") contains the operations index on the left and a series of 10 vertical blank columns on the right. When a student has completed an operation, the instructor draws a horizontal line opposite the operation and of such length as to indicate the student's proficiency. The horizontal lines are gradually lengthened as practice increases proficiency. At the end of the course the rating card shows graphically which of the operations have been done and what degree of proficiency has been attained in each. A brief inspection of the card enables an officer to determine what grade of work the man is qualified to do. (Cf. Special Regulations 121, Apr. 8, 1921.)

Standardized tests, when available, are used by instructors as more accurate means of measuring progress and determining proficiency. Such tests are also useful for higher authority in appraising results of instruction and checking proficiency. A standardized test may be constructed to measure proficieny in one operation listed in the operations index or it may be designed to measure proficiency in the course as a whole.

VII. TABLES OF REQUIRED TIME FOR TRAINING.—After the work described in the preceding six sections has been finished, the complete solution of the problem requires a determination of the average time required for an average green man to qualify under an average instructor for a given grade or rating. In other words, it is necessary to know whether it takes 200 or 400 hours of practice and instruction for a man who possesses the required personal characteristics to qualify as to skill and knowledge.

This data must be secured by experiment with as large a number of men as is possible. It will take several years to make it accurate. It is possible within a few months to set upper and lower limits and to decree that any man who can not qualify for a given rating in, say, 200 hours, had better be assigned elsewhere. When this data is secured, a training schedule can be constructed which will make it possible to set the date on which any specified number of men properly qualified for any rating can be delivered.

VIII.—The radio operator has been selected as an illustration of the procedure described above because this type of specialist is common to all combat arms. The steps in the production of the necessary instruction aids are presented in the following order:

1. Minimum specifications for the third, the second, and the first class operator.
2. Operations index (complete for all classes of operator).
3. Operation sheets (2 samples from students' manual).

4. Information sheets (1 sample from students' manual).
5. Instructors' guide (3 sections).
6. Tests of proficiency (3 samples).

MINIMUM SPECIFICATIONS FOR RADIO OPERATORS.

THIRD CLASS.

Skill.—Transmit and receive in International Code 15 code groups of 5 letters each per minute for 3 minutes, transcribing received signals with pen or pencil in printed characters with a maximum of 6 erroneous letters. Make properly the prescribed splices and ties of signal types of wire. Perform the cycle of operations necessary to effectively obtain and terminate a telephone connection. Change the batteries in any type of field telephone. Set up and make the necessary connection for the operation of all radio sets furnished his particular arm. Make necessary adjustments for the proper tuning and operation of all radio sets furnished his particular arm. Test and care of storage batteries.

Knowledge.—Working knowledge of: The different parts of transmitting and receiving apparatus of all radio sets used by his particular arm. Batteries furnished for radio sets used by his particular arm. Radio procedure, standard abbreviations and conventional signals. Standard message blank. Number of letters or numerals in code groups used in the radio message of his arm.

Attain a minimum of 75 per cent on the Army examination for operators, third class.

Personal.—(*a*) Required: General standards of a private. Auditory acuity—20/20, Army test. Good civil or service record. Intelligence, 45 points, Army alpha test.

(*b*) Desired: Sense of rythm. Good memory span. Ability to concentrate.

SECOND CLASS.

Skill.—That required of third class radio operators and the following:

Classroom test: Transmit and receive in International Code 18 code groups of 5 letters each per minute for 3 minutes, transcribing received signals with pen or pencil in printed characters with a maximum of 4 erroneous letters.

Message and procedure test (on table nets or sets in the field): Receive two coded tactical messages from a message center, each composed of 20 code groups of 5 letters each, required to complete the preamble according to the directions written on the message, and transmit them to the designated receiving stations and obtain receipt

in 10 minutes. Receive two coded tactical messages, each composed of 20 code groups of 5 letters each, from a designated transmitting station and prepare them for delivery to message center with proper interpretation of procedure signals. Code a 20-word, of 5 letters each, radio service message, in radio service code, correctly in 5 minutes. Diagnose trouble and make ordinary repairs on all radio sets used by this particular arm.

Knowledge.—Attain a minimum of 75 per cent on the Army examination for operators, second class.

A working knowledge of: Different parts of transmitting and receiving apparatus of radio sets issued his arm of the service. The radio organization of a combat division. The panel code.

FIRST CLASS.

Skill.—That required of a second-class radio operator and the following:

Classroom test: Transmit and receive in International Code 22 code groups of 5 letters each per minute for 3 minutes, transcribing received signals with pen or typewriter with a maximum of 2 erroneous letters.

Message procedure test: Acting as chief operator on a net control station in a net of three or more stations required to clear the following traffic: One message for station outside net. Two messages for secondary stations in his net. An important message which a secondary station desires to transmit.

Knowledge.—A working knowledge of: All sets issued by the Signal Corps within an army. The radio organization of an army.

Attain an average of 75 per cent on an Army examination for operator, first class.

RADIO OPERATORS OPERATIONS INDEX.

UNIT OPERATIONS.

SECTION I.

1. Code practice, block No. 1.
2. Code practice, block No. 2.
3. Code practice, block No. 3.
4. Code practice, block No. 4.
5. Code practice, block No. 5.
6. Code practice, block No. 6.
7. Code practice, block No. 7.
8. Receiving and transmitting practice.
9. Operate "break-in" table nets under radio procedure rules.

10. Operate "nonbreak-in" table nets under radio procedure rules.
11. Operate nets on sets in a building.
12. Operate field nets.
13. Operate field nets under varying tactical conditions.
14. Solve chief operator's problems on field nets.
15. Solve net command station problems on field nets.

SECTION II.

16. Make splices and ties in field wire.
17. Connect and operate field telephones.
18. Test and change batteries in various types of field telephones.
19. Connect and test primary batteries used in radio sets.
    (*a*) Series and parallel connections with specified sets.
    (*b*) Determine voltage per battery.
20. Connect and test secondary batteries used with radio sets. Use both series and parallel connections with specified sets.
21. Set up and operate SCR–105 sets.
22. Locate and repair troubles on SCR–105 sets.
23. Make adjustments on the SCR–105 sets.
24. Set up and operate SCR–130 set.
25. Locate and repair troubles on SCR–130 sets.
26. Test tubes for SCR–130 set.
27. Set up and operate SCR–77 set.
28. Locate and repair minor troubles in SCR–77 set.
29. Calibrate SCR–77 set.
30. Test tubes for SCR–77 set.

INFORMATION TOPICS.

SECTION I.

1. Correct position at key and grip of key.
2. Radio procedure.
3. Procedure for handling message blanks.
4. Procedure for handling traffic on "break-in" table nets.
5. Procedure for handling traffic on "nonbreak-in" nets.
6. Procedure for handling traffic on field nets.
7. Problems chief operators must solve.
8. Problems net command stations must solve.

SECTION II.

9. Types of wire and splices.
10. Connecting up and operating field telephone and testing and changing batteries.

11. Primary batteries used in radio sets.
12. Series and parallel connections of batteries.
13. Ohm's law and use of D. C. measuring instruments.
14. Secondary batteries used with radio sets.
15. Care and testing of batteries by radio operators in the field.
16. Ohm's law applied to batteries connected in series and parallel.
17. Antenna systems.
18. Use of crystal detectors in the receiving circuit.
19. Method of locating and repairing troubles on SCR–105 set.
20. Induction as illustrated in the buzzer transformer.
21. The spark gap in SCR–105 set.
22. Adjustments on the SCR–105 set.
23. Method of determining wave length by wave meter.
24. Power equipment with SCR–130 set.
25. Condensers used in SCR–130 set.
26. Simple vacuum tube amplifier and its modifications in the SCR–130 set.
27. Method of tuning SCR–130 set for resonance.
28. Comparison of grounds and counterpoises in the case of the SCR–130 set.
29. Methods of locating and repairing troubles on SCR–130 set.
30. Methods of testing tubes in SCR–130 set.
31. Methods of locating and repairing minor troubles in SCR–77 set.
32. Methods of calibrating SCR–77 set.
33. Methods of testing tubes on SCR–77 set.
34. Difference in methods of detecting signals in the SCR–130 and SCR–77 sets (autodyne and heterodyne).

RADIO OPERATORS' UNIT OPERATION NO. 1.

BLOCK I.

1. Learn the symbols for the following letters (International Morse Code):

A • —	N — •
E •	T —
I • •	R • — •
S • • •	L • — • •
H • • • •	

2. Practice on the following list of words until each of the symbols are mastered. *Each letter should be sent or received at top speed* of not less than at the rate of 20 words per minute. At first a greater space may be made between each letter or between each word, so that at first only a few words will be sent per minute.

Question: 1. Why is it better to send or receive each letter at maximum speed from the very beginning?

O. S. 2.

GROUP 1.—AENST.

an	ate	net	sent	tent
ant	assent	nest	sane	test
as	attest	neat	sense	tea
ass	eat	sat	tan	tease
at	east	set	ten	taste

GROUP 2.—Add "R" to Group 1.

are	ear	near	tar	rat
art	earn	star	tare	ran
anest	err	start	tares	rare
				rent

GROUP 3.—Add "I" to Group 2.

air	entire	sit	stir	rise
attain	nit	saint	stair	rinse
attire	sin	sister	stain	rite

GROUP 4.—Add "L" to Group 3.

all	sales	sail	last	listen
ale	slat	tail	least	learn
ail	slate	tale	less	latent
eel	slant	rail	latter	lantern
sale	slain	rill	little	late
salt	snail			

GROUP 5.—Add "H" to Group 4.

hat	hasten	hit	shin	than
hate	hare	hill	shine	these
hall	hen	either	shrine	that
hail	her	neither	shatter	thin
hair	here	rather	the	then
has	hear	she	their	thirst
haste	hell	share	there	this

GROUP 6.—Review.

air	enter	in	list	sail
all	entire	interest	listen	salt
an	hair	is	little	sat
are	has	it	near	sea
art	hat	last	neither	seat
as	he	late	nest	see
at	hear	learn	nine	seen
ear	heart	least	rain	sell
earth	heat	led	raise	sent
ease	her	less	ran	set
east	here	let	rather	shall
eat	hill	letter	real	she
either	his	lie	rest	shine
else	ill	line	rise	sir

sister	tale	than	there	till
sit	tall	that	these	tire
star	taste	the	thin	train
start	tea	thee	this	tree
still	tear	their	thru	trust
street	tell	then	tie	truth
tail	ten			

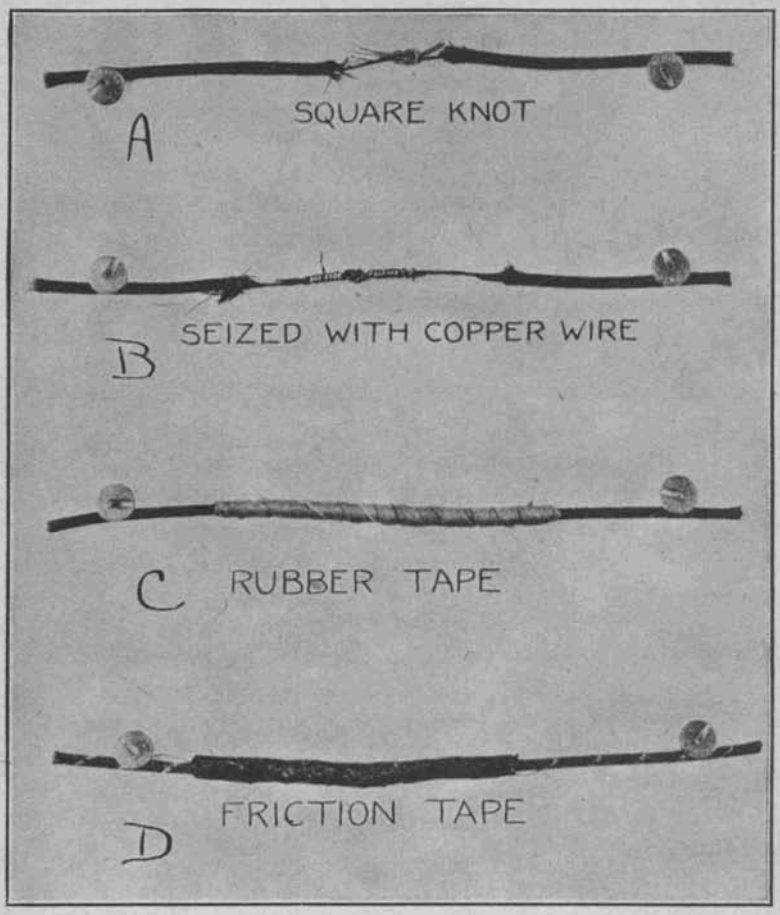

FIG. 1.

O. S. No. 1

UNIT OPERATION NO. 16.

MAKING SPLICES AND TIES IN FIELD WIRES.

Directions.

1. With a pair of pliers cut a 1-foot section of field wire from the piece issued.

2. Cut off about 3 inches of one wire at each end of the twisted pair.

3. Remove about 2 inches of the insulation from all four ends by squeezing the insulation with the pliers, cutting the insulation with a circular motion by means of the knife or pliers and peel off the insulation.

4. Tie a square knot. (See fig. 1 (a).)

5. Seize the joint with No. 20 copper wire, taking care that the ends of the steel wire lie flat against the main wire. (See fig. 1 (b).)

6. Wrap with rubber tape, starting at one end, overlapping the insulation by 1 inch. Wrap in one direction, ending about 1 inch beyond insulation at the other end. (See fig. 1 (c).)

7. Wrap at joint with friction tape in the reverse direction. (See fig. 1 (d).)

8. Repeat this series of operations with outpost wire.

Questions.

1. Would removing 1 inch of insulation permit tying the knot?

2. Why not use iron wire for seizing?

3. Can a joint be made by lapping the two wires side by side and then seized, be pulled apart easily?

4. Can a joint made with a square knot and seized, be pulled apart?

RADIO OPERATORS INFORMATION TOPICS.

SECTION II, No. 9.

Types of wires and splices.—There are three common types of wire in use in a combat division: (1) Twisted pair field wire, (2) outpost wire, (3) outside distributing 17–2 wire.

1. Telephone circuits, wherever possible, are made metallic and not grounded. In a metallic circuit there is a wire going to and a wire returning from the telephone. These wires are usually twisted together and commonly called "twisted pair." In a grounded circuit one wire is all that is necessary between two stations, the earth forming the return path.

2. The poor service offered by a grounded telephone circuit and the possibility of the enemy readily intercepting messages when transmitted over such a system make this method prohibitive.

3. Twisted pair field wire (type W–40) consists of 10 steel wires, 12 mills (0.012 inch) in diameter, twisted about one copper wire 28 mills in diameter, the whole being covered with rubber insulation and cotton braid. This wire will usually be found on circuits laid by the division signal company and sometimes by infantry brigade communication platoons and by all artillery units.

4. Twisted pair outpost wire (type W–44) is lighter than field wire and has three steel and three bronze wires each 13 mils in diameter twisted about one bronze wire 14 mils in diameter and covered with rubber insulation and paraffined cotton braid. This wire is used by all infantry communication platoons.

5. Outside distributing wire (17–2), which means No. 17 Brown & Sharpe wire gauge 2 conductors, is used in commercial telephone installation, and no doubt would be furnished to the Army in large quantities in case of hostilities, due to its ease of manufacture. This wire is used by the division signal company and artillery units.

6. Splices in all three of the above-mentioned wires are important to a radio operator, for in operations he would have a field telephone installed at or near his radio apparatus and would be called upon to repair broken connections near his station or perhaps to actually install the telephone.

7. Splices in twisted pair should be staggered.

8. The most satisfactory splice for field wire is made by stripping the ends of the wire for about 2 inches, then tying the bare ends in a square knot and seizing or wrapping the ends, so that they will lie flat, with a piece of soft copper wire, No. 18 or No. 20, about 6 inches long, and then cover with rubber and friction tape. If wire for seizing is not available, the steel wires can be cut away, leaving enough of the copper wire to seize the joint. When it is impossible to use either of these two methods, great care must be used to make a tight knot and wrap it securely with tape, because the springy character of the steel wires may cause their ends to puncture the tape insulation and cause a ground which prevents talking over the telephone.

1. Why are the joints in twisted pairs staggered?
2. What is the purpose of the rubber tape?
3. What is the purpose of the friction tape?
4. What is the purpose of the copper-wire seizing?

RADIO OPERATORS INSTRUCTOR'S GUIDE.

SHOP AND CLASSROOM SET-UP—CODE PRACTICE EQUIPMENT.

A. *Break-in table nets*, for use in training operators in transmission and reception and for "break-in nets." Equipment required:

1. A switchboard (a telegraph switchboard is preferable, but an improvised one can be easily made).

2. A source of tone supply must be provided. A power buzzer from a T. P. S. set may be used or a five to nine hundred cycle motor generator set may be used or a vacuum tube oscillator or a field buzzer will answer this purpose very well.

3. Telegraph keys and head sets for each student's position desired.

4. Table or tables for mounting keys and head sets, preferably separated by a high board down the center and partitions between the operators.

5. Two and three stations on each circuit, which can be connected by means of the switchboard to form a net of two, three, four, or more stations as may be desired.

6. The stations on any one circuit should not be adjacent, so that

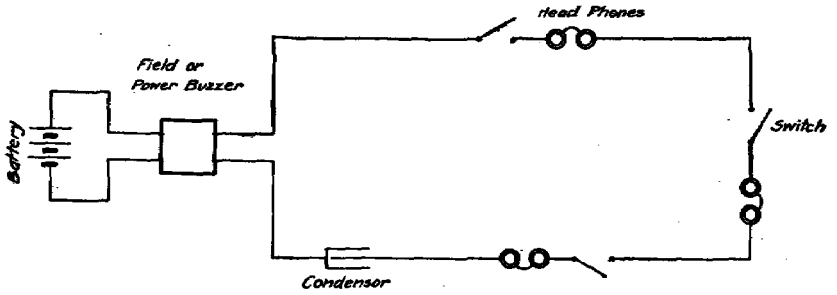

FIG. 2.

operators in the same net can not talk to each other or see each other's work, but must work through their own key and head set.

7. Figure 2 illustrates one method for forming the circuits for "break-in nets." This method has the following disadvantages:

(*a*) Requires a separate source of tone supply for each circuit.

(*b*) Field buzzer and century buzzers get out of adjustment and the tone is not constant.

(*c*) Separate circuits can not be thrown together easily.

8. Figure 3 shows a much more flexible method than the one described under 7. This has a common sound of tone supply.

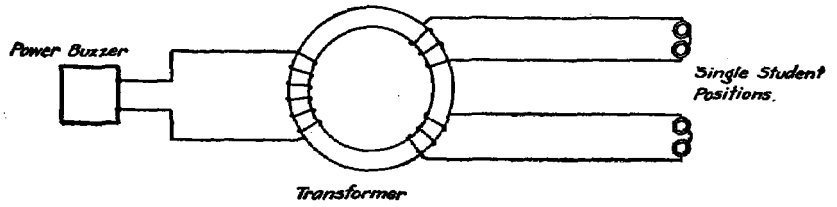

FIG. 3.

A suitable transformer can be made by using the core of a Western Electric 25-A telephone repeater coil upon which is wound 300 turns of No. 22 D. C. C. magnet wire to form the primary. Five turns for each secondary circuit will give sufficient voltage to supply a tone of proper loudness to one head set when 100 volts is applied to the primary. Ten turns are required for two head sets in series and 15 turns for three head sets in series.

Figure 4 is a diagram which shows the actual connections of the secondary of the transformer, the switchboard and two head sets.

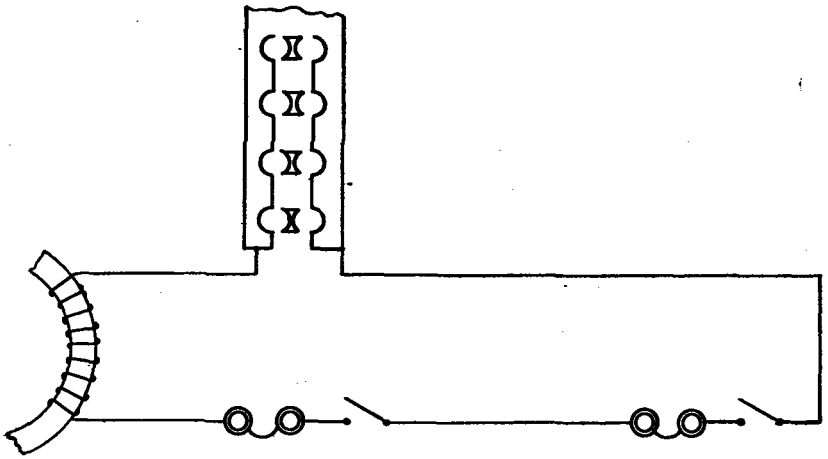

FIG. 4.

Figure 5 shows the method of arranging circuits so that operators can not talk. Assuming that there are six circuits with two student positions 1 and 1, 2 and 2, etc., on each circuit.

2	1
4	3
6	5
1	2
3	4
5	6

FIG. 5.

B. "*Nonbreak-in table nets.*"—Equipment same as in "break-in" nets, with double pole, double throw switch, added for each student's position.

Figure 6 shows the connections when the student's change-over switch is thrown to transmit, and figure 7 shows the switch on the receiving position. Three wires must be run to each student's position.

Figure 8 shows the complete wiring of student's position.

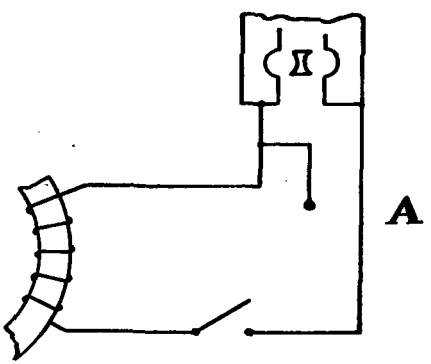

FIG. 6.

In connecting several lines on the board to form a net the board is so plugged that the lines are in parallel. One line will not operate by itself. When several switches are in a net on "receive" their head sets are in parallel across the line and those on "transmit" have their transformer secondaries and keys individually in series and these series in parallel across the line.

Thus, if two stations in the same net transmit at the same time, each of these will hear nothing, but stations on "receive" will hear a com-

bination of both transmissions. This is actually what takes place in the field on sets under similar circumstances.

UNIT OPERATION NO. 1, CODE PRACTICE, BLOCK NO. 1.

1. In teaching the International Morse Code, each letter, at top speed of about 20 words of 5 letters each per minute, has a distinct rythm peculiar to itself. The speed is so fast that it becomes impossible actually to count the dots and dashes. "S" is "S" because it has three dots, and "H" is "H" because it has four dots. "R" is "R" because it has dot, dash, dot; but they can not be actually counted, therefore the characteristic rythm for each letter must be learned and practiced until it becomes a habit or an automatism.

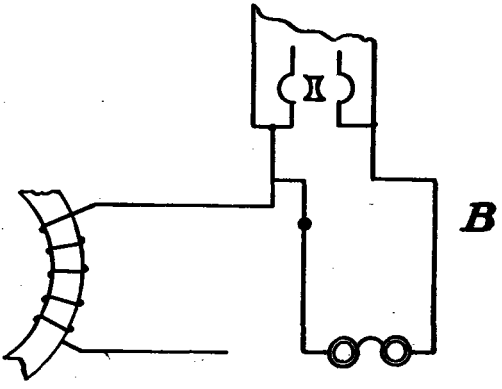

FIG. 7.

It is apparent, therefore, that every letter should be learned at top speed from the very first.

With the beginner, the space between letters may be lengthened, also the space between words should be lengthened; thus the actual number of words that can be sent and received per minute will be

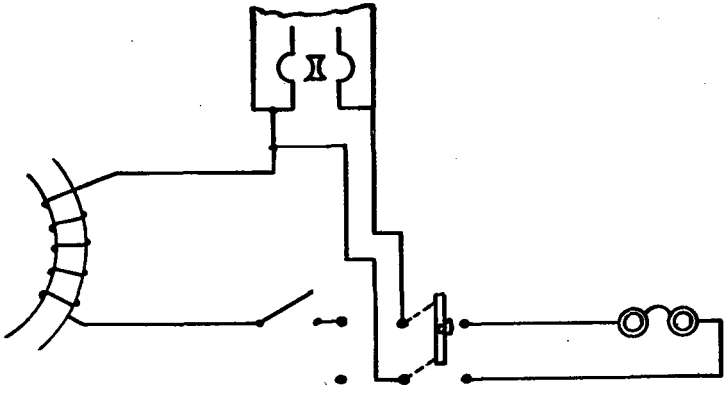

FIG. 8.

reduced, although the speed at which each letter is sent or received is top speed.

As the student becomes more and more familiar with each rythm characteristic of each letter and numeral, then the space between

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letters and words may be gradually reduced until the desired speed in words per minute has been acquired.

2. A schedule should be arranged to permit code practice for 6 periods of 20 minutes each, distributed over the working day. The other period may be devoted to the study of the apparatus and different installations called for in the other unit operations or a study of the information sheets and other references.

The student will be taught the symbols for each of the letters given in the student's manual, block 1, group 1. Each of these letters should be sent repeatedly at top speed until the student learns the rythm of each letter.

In group 2 an additional letter, "I," is added. This should be explained and sent to the student until the rythm becomes familiar. Then have the student practice on the words given in group 2, in which the new letters in each word appear, together with letters already mastered in group 1.

In a similar manner give the other letters in groups 3 to 6.

An examination is to be given by the instructor for promotion into block 2.

UNIT OPERATION NO. 16.

MAKING SPLICES AND TIES IN FIELD WIRE.

1. Equipment. The following equipment should be ready to issue to each student:

One pair of pliers, 6-inch or 8-inch.
One electrician's knife.
Eight feet of twisted pair field wire (type W–40).
Eight feet of twisted pair outpost wire (type W–44).
Eight feet of outside distributing wire (17–2).

2. At the meeting of the class when the job is assigned, exhibit and describe the different types of wire used in a division and what units use the different types. (See Information Topic No. 9.)

3. In a similar manner, exhibit and demonstrate the different types of splices on field wire.

4. In a similar manner, exhibit and demonstrate the making of a splice on 17–2 wire.

5. Suggested types of questions to be asked the students for discussion at preliminary meeting:

(1) Why is it important to make a good mechanical joint?
(2) Is a rat-tail joint a good joint if liable to stress?
(3) Why should stranded conductors not be spliced in the form of a Western Union joint?

6. In the laboratory have each student make splices on field wire and outpost wire. This should be continued until the student becomes proficient.

7. In a similar manner have each student practice making splices on 17–2 wire.

The student is sufficiently proficient when he can make a satisfactory field-wire splice in four minutes and a 17–2 wire splice in two minutes.

8. Informal questions should be asked by the instructor as he makes his rounds in the laboratory. These questions should be designed to help a man who is experiencing difficulty in doing the job assigned or who may need a clearer understanding of some phase of the job while doing the work.

9. After the job is completed, the student or group of students should be reviewed by the instructor. At this time such questions should be asked as are necessary to lead to a fuller comprehension of what has been done, to the end that the men utilize as fully as possible for succeeding work the experience gained.

(1) For what reasons has the square knot been adopted for this class of work rather than other types?

(2) Would steel wire be equally as good for seizing as soft copper wire?

(3) Would it have been just as satisfactory to have placed the friction tape on first and then the rubber tape?

RADIO MESSAGE BLANK.

(For tactical use only.)

(For Message Center Clerk)

JACKSON (code name) Message Center. Serial No. 5

Encoded by JONES 14:21 (time) 12/1/21 (date)

Send this message to FIRST DIVISION

Have it repeated back. √

Class: Official.

(For Radio Operator)

XZ2	V XY7				NR 5
Station Called	Station Calling	Relay via	Transmit to	Originally from	Message Center Serial No.

	G	OD	Gr 12	BT
Receiving station will not acknowledge	Repeat back	Type of message	Group in Body of message	Following groups sent now

AHWO LBTR

Nr 1 (Writer's Serial No.) 13:50 (Writer's time) DFC–4 (Code Used)

QMTV	HBJY	UOTZ	WBVN	HDQU
PDRO	FWHX			

R		
Time Filled in when "F" is not sent	If "F" was sent, indicate transmission time	Check in this space if message can not be sent by radio.

FORM "A"

ARMY TEST, RADIO OPERATORS.

TECHNICAL.

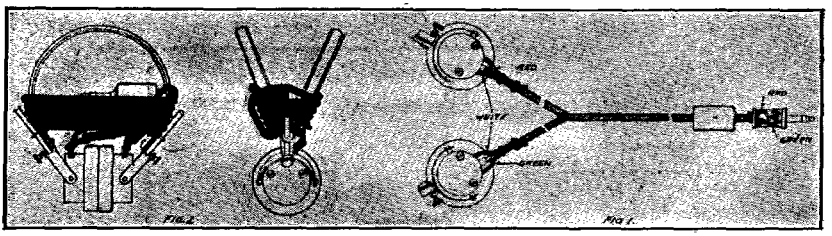

FIG. 9.

1. Question. What does Figure 9 represent?
Answer. Head receivers for a radio set.
2. Question. Why are the receivers placed the way they are?
Answer. To protect the diaphrams.
3. Question. Why are they wound with a telephone cord?
Answer. To hold the receivers together during transportation.

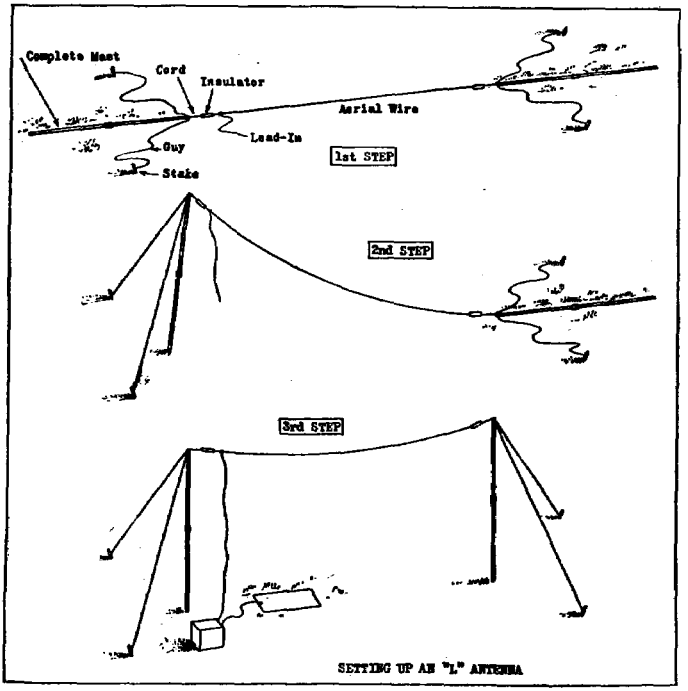

FIG. 10.

4. Question. What set uses the type of antenna shown in Figure 10?
Answer. The SCR–105 set.
5. Question. What is the name of this type of antenna?
Answer. Inverted "L."

6. Question. What does the diagram in Figure 11 represent?
Answer. A circuit diagram of a buzzer transformer.
7. Question. What is the name of the part marked "B"?

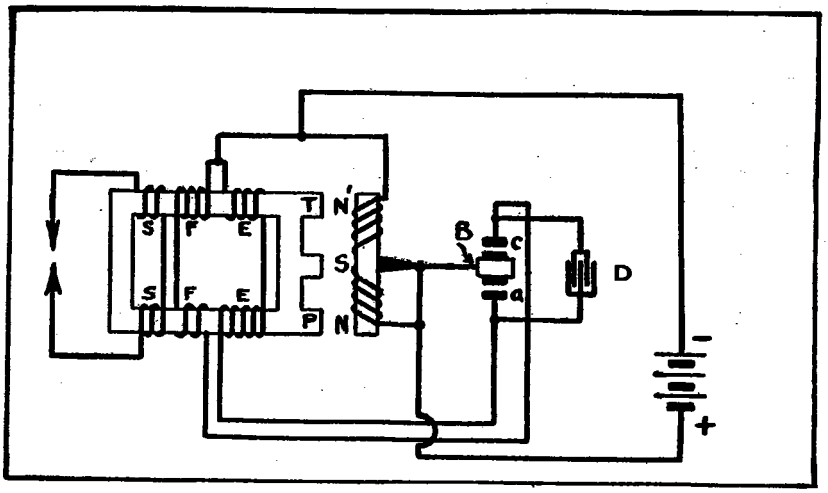

FIG. 11.

Answer. (1) Vibrator. (2) Armature arm. (3) Buzzer.
8. Question. What is the name of the windings marked "F" and "E"?
Answer. Primary.
9. Question. What is the name of the windings marked "S"?

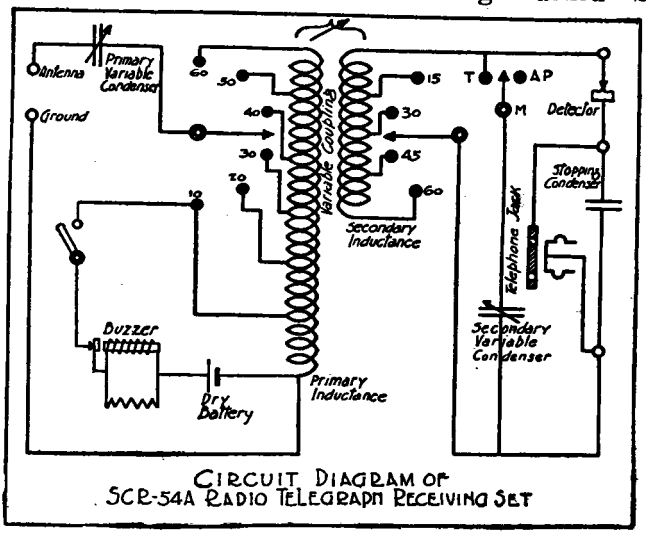

FIG. 12.

Answer. The secondary.
10. Question. What is the part marked "D"?
Answer. Condenser.

11. Question. In Figure 12, with what is detection of signals accomplished in the circuits shown?

Answer. A crystal detector.

12. Question. What is the purpose of the buzzer in this circuit?

Answer. To find a sensitive point on the crystal detector.

13. Question. What kind of waves will such a set receive?

Answer. Damped waves.

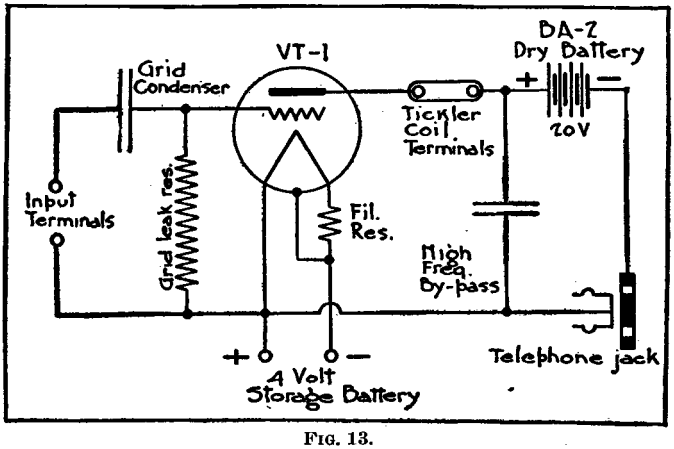

FIG. 13.

14. Question. What is the device called by means of which the detection of signals is accomplished in the circuit shown in Figure 13?

Answer. A vacuum tube.

15. Question. What is the purpose of the grid leak resistance?

Answer. To let the negative charge leak off the grid.

16. Question. What is the purpose of the "BA–2" battery?

Answer. To furnish plate voltage.

17. Question. Of what set is Figure 14 a circuit diagram?

Answer. SCR–77.

18. Question. Place the letter "O" alongside the oscillator tube on this set.

Answer. (The left tube.)

19. Question. What is the voltage of the battery used to light the filaments?

Answer. Four volts.

20. Question. In what circuit is the key placed in this set?

Answer. In the plate circuit.

21. Question. Which tube is used as a detector tube?

Answer. The one on the left.

22. Question. Designate with the letter "A" all amplifier tubes in this set.

Answer. The two on the right.

23. Question. Of what set is Figure 15 a photograph?

Answer. The SCR–105 set.

24. Question. What is the name of the part labeled "K"?

Answer. The spark gap.

25. Question. How could the plates and separators in this gap be removed?

Answer. By unscrewing the thumb nut shown in the picture.

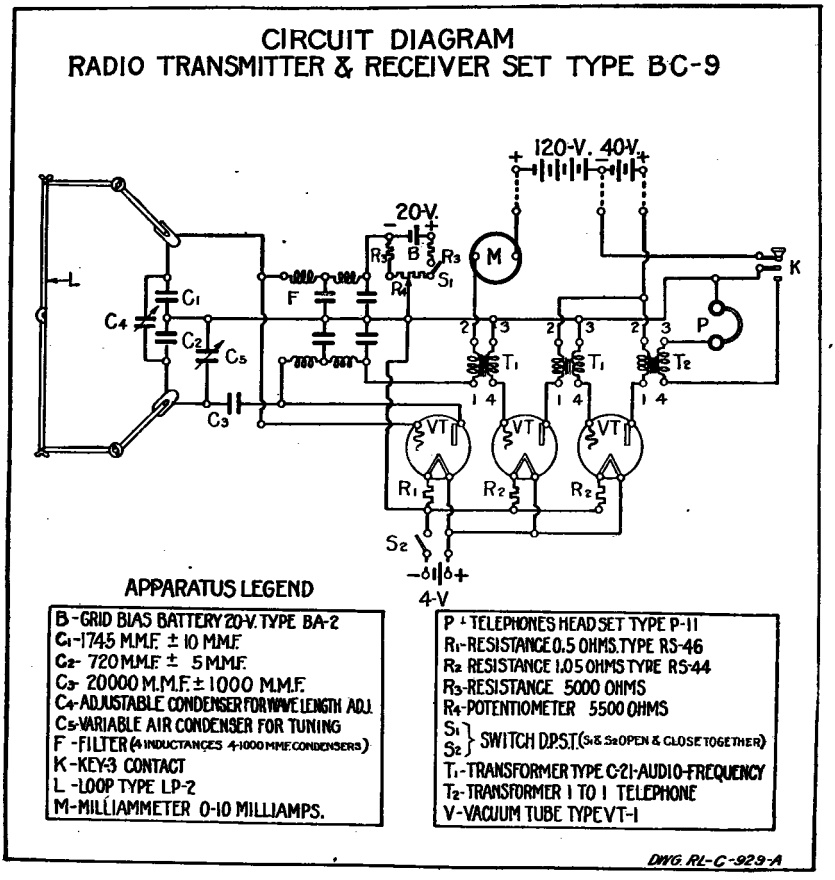

FIG. 14.

26. Question. Under what circumstances should they be removed?

Answer. When the operator observes that sparkling is confined to one or two points on the plates, they should be removed and polished with emery cloth.

27. Question. What is the name of the unit marked "L," "M," "N," "O," "P"?

Answer. The buzzer transformer.

28. Question. What organizations use this set?

Answer. Infantry regiments and brigades.

29. Question. What is used for detection purposes in this set?
Answer. A crystal detector.
30. Question. Where is it shown in this figure?
Answer. In the upper left-hand corner.

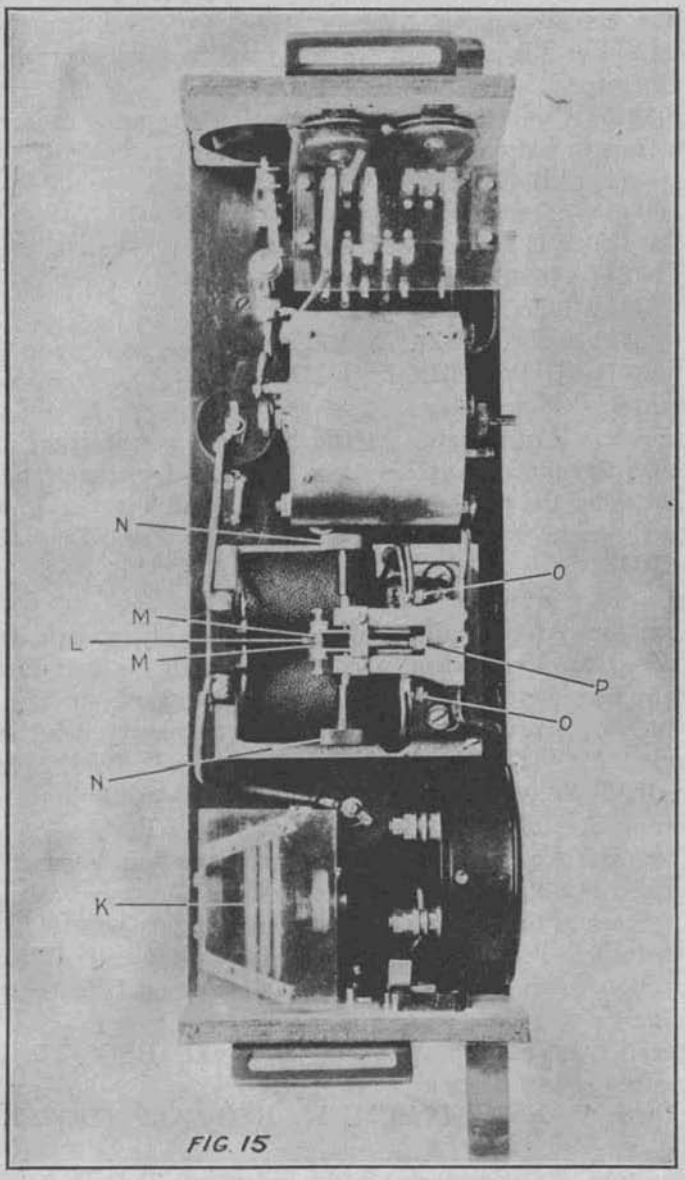

FIG. 15.

31. Question. What kind of waves does this set transmit?
Answer. Damped waves.

RADIO PROCEDURE.

32. Question. The message shown in Form "A" has just been handed to a radio operator for transmission. Fill out the preamble of the message. The call of the transmitting station is XY7. The call of the first division is XZ2.

Answer. (For the solution, see the two lines underneath, "For Radio Operator," Form "A.")

33. Question. Indicate with a check mark the types of code used by radio stations in a division.

(1) AB XY ZE
√(2) 127 821 783
(3) WHYFC LGMNO PQHYZ
√(4) 176548 732145 889137
√(5) BQY MRC KNF
(6) B3H8 F4Z6 N2L7
√(7) GHBQ RLOF KMNP

Answer. (As shown above.)

34. Question. An operator on the SCR–105 set at the First Infantry has just connected up his set and is ready for operation. State exactly in order the procedure signals sent by this station in reporting into the net. First Infantry call: MN3; First Brigade call: (NCS) MO7.

Answer. VE MO7 V MN3 II ZCH

35. Question. An operator at First Battalion, First Infantry, has been ordered to close station and advance with his battalion commander to new battalion command post 800 yards to the front. Write out all the procedure signals, in their order, which the operator sends. First Battalion, First Infantry call: BQ8. First Infantry call: YD9.

Answer. VE YD9 V BQ8 II ZCJ30 AR.

36. Question. An operator at the First Battalion, Second Infantry, is directed by the regimental signal officer to assume command of the net. State in their order the procedure signals sent by first battalion operator. First Battalion, Second Infantry call: XR5. Second Battalion, Second Infantry call: DQ8. Second Infantry (NCS) call: XF2.

Answer. VE XF2 V XR5 II ZCM II RSO AR. (XF2 acknowledges.)

VE DQ8 V XR5 II ZCM II RSO AR. (DQ8 acknowledges.)

37. Question. An operator at First Infantry call DB2, is directed by the First Brigade signal officer to assume command of the net. Write all procedure signals sent by DB2. First Brigade (NCS) call: HT3. Second Infantry call: HJ2. Net call: DZ5.

Answer. VE DZ5 DZ55 V DB2 DB2 II ZCM II BSO AR.

38. Question. Give the reply of HT3 in the above problem.

Answer. VE DB2 V HT3 II R.

39. Question. An operator call DK7 received a code message by radio from a station call, WZ1, with the following identification marks:

Nr8 OD GR17 BT Nr3 1245 DFC4.

DK7 receipted for the message and sent it to his message center. The message center asked for a repeat on this message. Write the procedure signals sent by DK7 in calling for a repeat.

Answer. VE WZ1 V DK7 II Nr8 IMI AR.

RATINGS.

Each question counts for four points.

Technical:

40 to 76 points, third class.
80 to 108 points, second class.
112 to 124 points, first class.

Procedure:

8 to 12 points, third class.
16 to 20 points, second class.
24 to 32 points, first class.