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TM 11-432

*U.S. Dept. of Army*

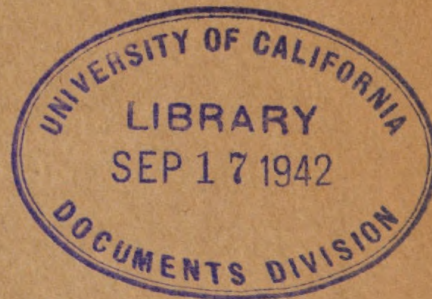
**WAR DEPARTMENT**

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**TECHNICAL MANUAL**

**CODE PRACTICE EQUIPMENT**

**February 2, 1942**



30. **Keyer TG-10-(\*)**.—The general instructions given for the Lon-Ga-Tone unit apply to the automatic **Keyer TG-10-(\*)**. To disengage the \* \* \* words per minute.

[A. G. 300.7 (27 Jul 48).] (C 1, 30 Aug 43.)

35. **Preliminary adjustment of tone level.**

\* \* \* \* \*

c. *Using Keyer TG-10-(\*)*.—Same as for Lon-Ga-Tone, type 7.

\* \* \* \* \*

[A. G. 300.7 (27 Jul 48).] (C 1, 30 Aug 43.)

39. **Keyer TG-10-(\*)**.—The circuit diagram of **Keyer TG-10-B** appears as figure 33. **Circuit diagrams for other Keyers TG-10-(\*)** appear in **TM 11-447**. A back view of the chassis of **Keyer TG-10-B**, with the parts marked to correspond with the wiring diagram, follows as figure 34.

\* \* \* \* \*

a. *Functioning of circuit*.—The circuit of \* \* \* the 6V6 type. **Circuit details for Keyers TG-10-(\*)** are shown in **TM 11-447**.

[A. G. 300.7 (27 Jul 48).] (C 1, 30 Aug 43.)

\* \* \* \* \*

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

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

✓

TECHNICAL MANUAL  
CODE PRACTICE EQUIPMENT

CHANGES }  
No. 2 }

WAR DEPARTMENT,  
WASHINGTON 25, D. C., 20 April 1944.

TM 11-432, 2 February 1942, is changed as follows:

APPENDIX III (ADDED)

EMERGENCY CODE PRACTICE EQUIPMENT

1. **General.**—In order that field units and installations may give instructions in transmitting and receiving the International Morse characters even though the regulation code practice equipment is not available, information is furnished in this appendix to permit improvising equipment. The exercise of ingenuity will produce other means for improvising equipment. This information, however, is not to be used as authority to requisition any of the equipment mentioned.

2. **Sources of tone.**—*a.* A tone source for practice may be obtained by connecting a buzzer as shown in figure 52. The headphones are in series, with a capacitor across the coil of the buzzer. The strength of the signal in the headphones may be reduced by the use of smaller capacitors. The buzzer may be made from a doorbell by removing the gong and clapper. A better tone, and one that is more nearly identical to the note heard in the radio receiver, may be produced by the use of a vacuum tube audio-oscillator as shown in figure 53. In addition to key and headphones, the necessary parts are a grid resistor and capacitor, tube (1G4G or equivalent), socket, and audio-transformer. If the circuit fails to oscillate, one winding of the audio-transformer should be reversed. This equipment can supply power for only a few head sets, but by use of the oscillator shown in figure 53, together with a small audio-amplifier, more power can be obtained.

*b.* In the use of buzzers or oscillator circuits for code practice training, all necessary precaution should be taken to prevent interference with operational radio equipment.

*c.* An interference check can be made by the use of a radio receiver adjusted for maximum sensitivity and located near the training equipment and a check of the operational frequencies made.

\*These changes supersede section II, Training Circular No. 35, War Department, 1943.

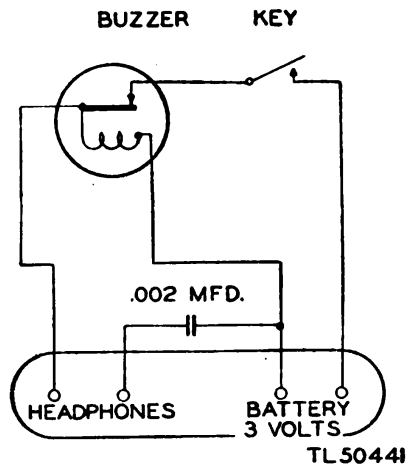


FIGURE 52.—Buzzer circuit diagram.

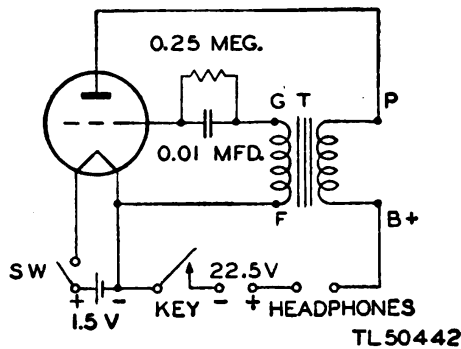


FIGURE 53.—Simple audio-oscillator.

3. Telegraph set TG-5 as source of tone.—Telegraph set TG-5 may be used as a source of tone and keying for supplying head sets. Buzzer BZ-5 may be salvaged from an unserviceable telegraph set TG-5 and used in the manner indicated in paragraph 2.

4. Instruction.—In the absence of sufficient head sets, a loud-speaker may be used for group instruction.

[A. G. 300.7 (24 Mar 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

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

✓ U.S. Army

TM 11-432

C 3

**TECHNICAL MANUAL**  
**CODE PRACTICE EQUIPMENT**

WAR DEPARTMENT

WASHINGTON 25, D. C., 17 February 1945

CHANGES }  
No. 3 }

TM 11-432, 2 February 1942, is changed as follows:

**14.1. Code Practice Equipment EE-94-B (Added).**—Figure 5.1 is a block diagram of Code Practice Equipment EE-94-B for a school of 20 students. The equipment consists of one switchboard BD-57-( ) with auxiliary patching board, six Automatic Keyers TG-10-( ), one Oscillator VO-3-( ), one Recorder BC-791-B, one Tape Puller MC-310-B, and various accessories. The physical placement of the equipment is similar to that described in paragraph 14.

**NOTE.**—This paragraph and paragraphs 14.2 through 14.4 cover typical installations of Code Practice Equipments EE-94-( ), EE-95-( ), and EE-96-( ). The components of these equipments will vary with the different models, but the general arrangements will be similar to the diagrams shown. Official nomenclature followed by ( ) indicates all models of the equipment.

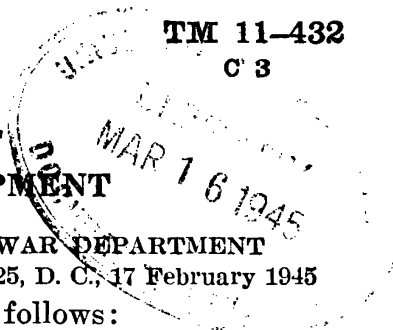
**14.2. Code Practice Equipment EE-94-E (Added).**—*a.* Figure 5.2 is a block diagram of Code Practice Equipment EE-94-E for a school of 20 students. The equipment consists of one Switchboard BD-114, six Automatic Keyers TG-34-( ), one Oscillator VO-3-( ), one Recorder BC-1016, and the various accessories. The physical placement of the equipment will be similar to that described in paragraph 14.

*b.* When using Switchboard BD-114, wire the auxiliary switchboard tone to a pair of terminals associated with the auxiliary tone jacks. Connect the tone to the primary of transformers C69 by inserting the plug of the white cord into the tone jack to which the auxiliary tone is wired. To connect the instructor's key and headset into the circuit, wire the key and headset to a plug. Insert the plug into the jack on the front panel.

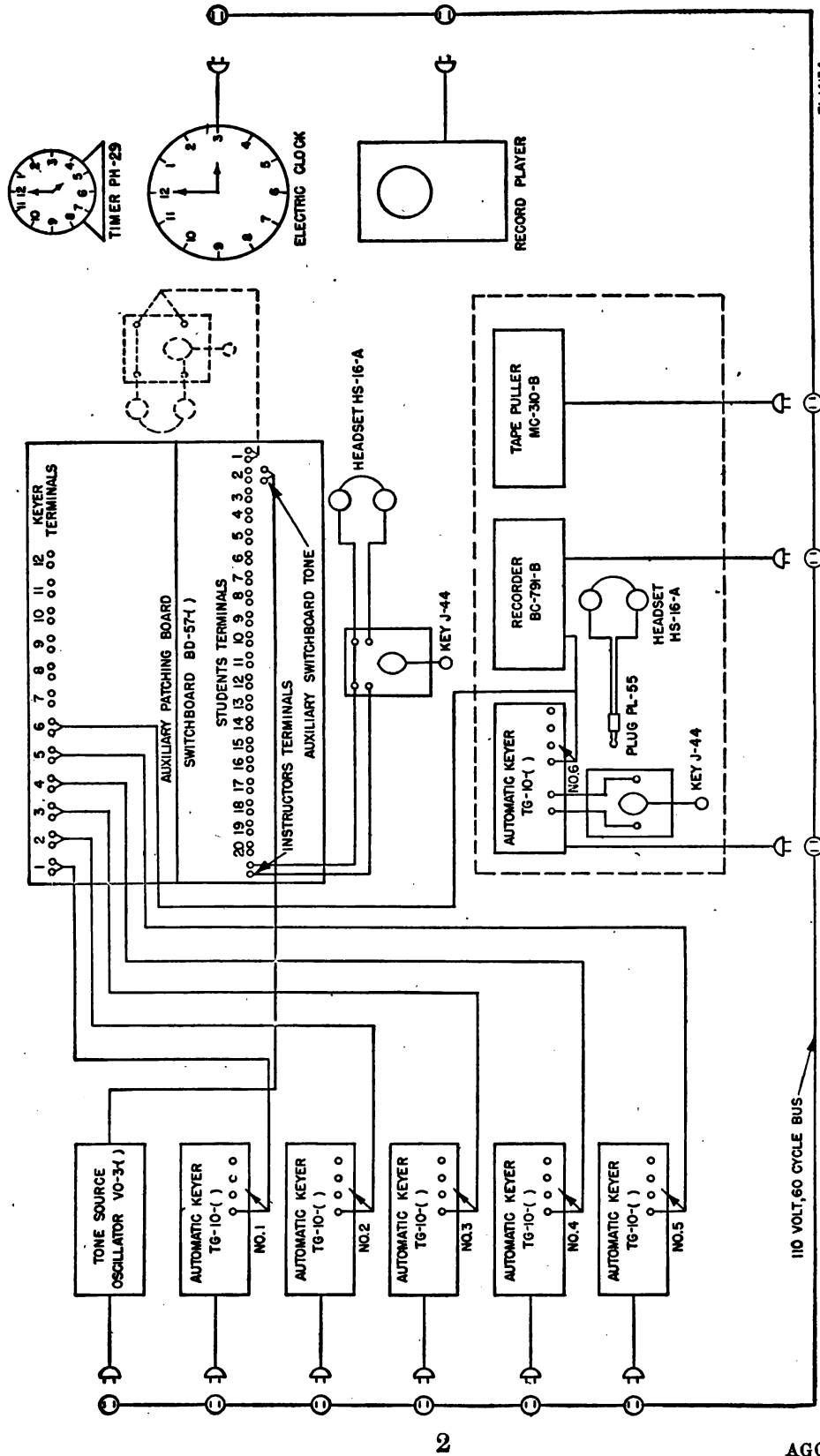
**14.3. Code Practice Equipment EE-95-B (Added).**—On figure 5.3 the solid lines show the wiring of Code Practice Equipment EE-95-B for a 40-man school. The equipment consists of two Switchboards BD-57-( ) with auxiliary patching boards, six Automatic Keyers TG-10-( ), one Oscillator VO-3-( ), one Recorder BC-791-B, one Tape Puller MC-310-B, and various accessories. The physical arrangement of the equipment is similar to that described in paragraph 14.

**14.4. Code Practice Equipment EE-96-B (Added).**—The dotted lines on figure 5.3 show the additional equipment required to convert the EE-95-B to a EE-96-B which is suitable for a 100-man

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Figure 5.1.—Block diagram of Code Practice Equipment EE-94-B for a 20-man school.

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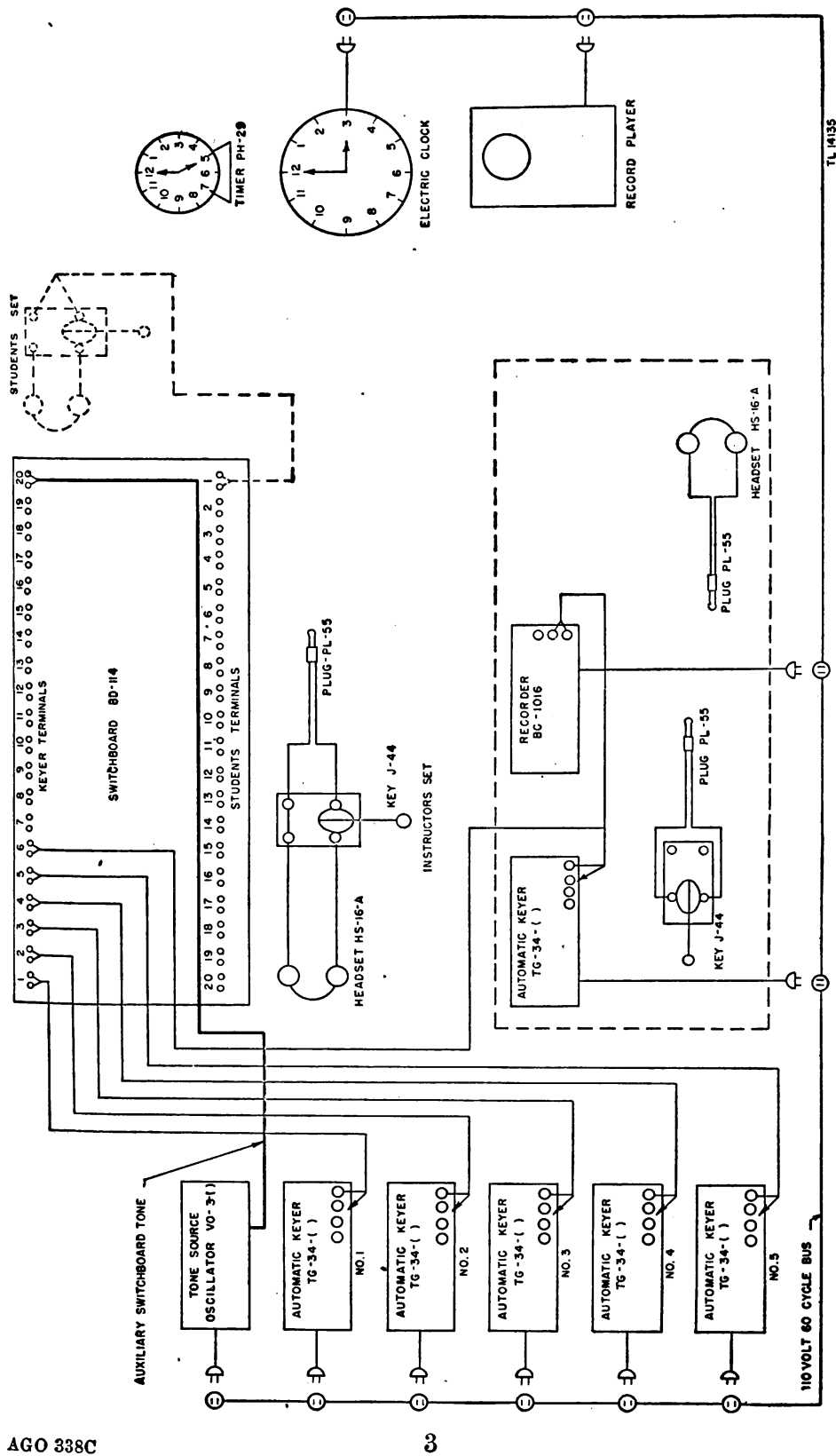


FIGURE 5.2.—Block diagram of Code Practice Equipment EE-94-E for a 20-man school.

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school. The additional equipment required consists of three Switchboards BD-57-( ) with auxiliary patching boards, six Automatic Keyers TG-10-( ), one Oscillator VO-3-( ), two Recorders BC-791-B, two Tape Pullers MC-310-B, and various accessories. The physical arrangement of the equipment is similar to that described in paragraph 14.

NOTE.—When Recorder BC-1016 is used in place of Recorder BC-791-B in any of the above equipments, Tape Puller MC-310-B is not required.

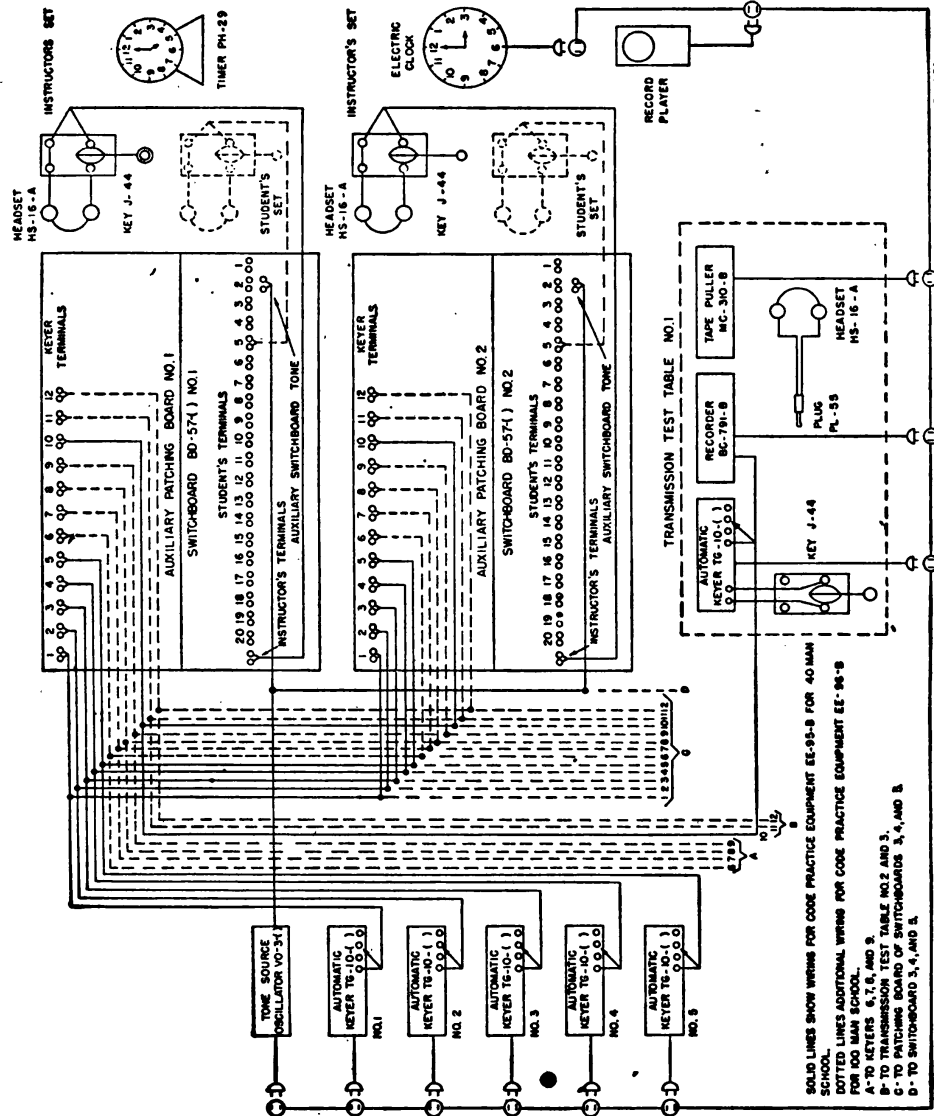


FIGURE 5.3.—Block diagram of Code Practice Equipments EE-95-B and EE-96-B.

38. Automatic Keyer, Lon-Ga-Tone, Type 7.





*b. Maintenance and repair.*—Clean the aperture \* \* \* is exposed thereby. Once a week put 1 drop of Oil, Engine, U. S. Army Spec. No. 2-104B, in the oil ducts of the take-up motor and in the oil hole at the left end of the puller motor. If the exciter \* \* \* to the phototube.

**39. Keyer TG-10-B.**

\* \* \* \* \*  
*b. Maintenance and repair.*—(1) *Lubrication.*—On units which have a worm reduction gear on the motor shaft running in an oil bath, check the oil level weekly and keep the gearcase full of Oil, Engine, U. S. Army Spec. 2-104B. Drain and refill the case once every 3 months.

(2) On units which have an open helical gear on the motor shaft, apply a light coat of Grease, Lubricating, Special, Ordnance Spec. No. AXS-637 at intervals of 1 month or 400 operating hours.

(3) Lubricate all shaft bearings with Oil, Engine, U. S. Army Spec. No. 2-104B at intervals of 1 month or 400 operating hours.

(4) For detailed lubrication instructions, see TM 11-447 which covers this equipment in detail.

Subparagraphs (2) to (6), inclusive, are renumbered (5) to (9), inclusive.

**41. Automatic Keyer, McElroy Model G-813.**

\* \* \* \* \*  
*b. Maintenance and repair.*—Clean the aperture \* \* \* experienced instrument repairman. Once a week place 1 drop of Oil, Lubricating, Preservative, Special, U. S. Army Spec. No. 2-120, in the oil hole located at the top of the rewind. If the exciter \* \* \* soft lead pencil.

**44. Tape Puller, McElroy Model CTP-1300.**

\* \* \* \* \*  
*b. Maintenance and repair.*—Once a day place 1 drop of Oil, Engine, U. S. Army Spec. No. 2-104B in the oil hole on the take-up spindle and in the oil duct leading to the puller wheel bearing. The entrance to \* \* \* the puller wheel.

**46.1. Switchboard BD-57-B (Added).**—*a. Functioning of circuit.*—The complete schematic of this switchboard is shown in figure 47.1. This circuit is the same as the circuit for the BD-57-A (fig. 47) except that the motor alternator, the battery and tone switches, and the terminals for the master key have been omitted; they are not required in code practice equipment. The functioning of the circuit is covered in paragraph 46.

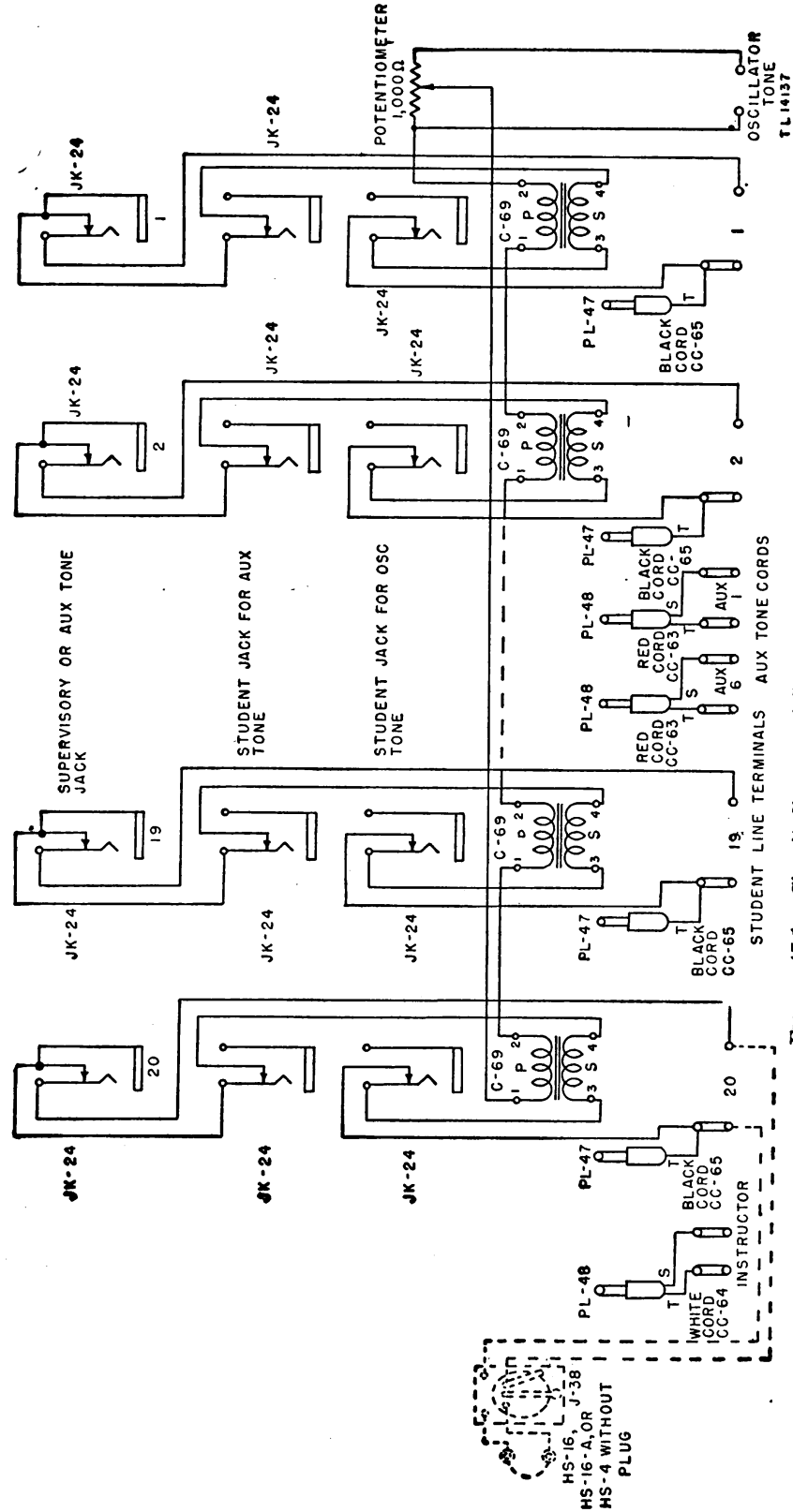
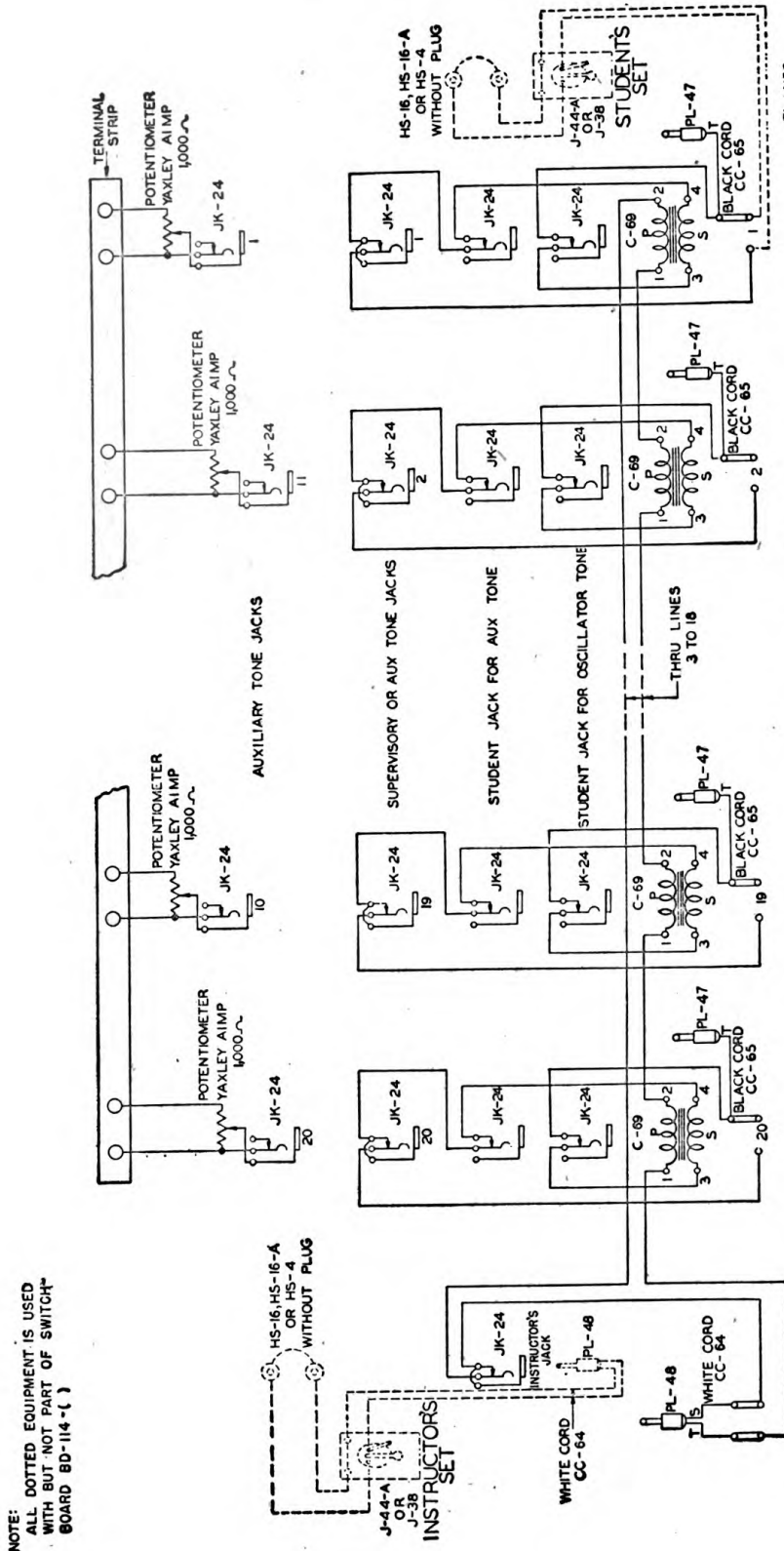


FIGURE 47.1.—Circuit diagram of Switchboard BD-57-B.



NOTE:  
ALL DOTTED EQUIPMENT IS USED  
WITH BUT NOT PART OF SWITCH-  
BOARD BD-114-( )

FIGURE 47.2.—Circuit diagram of Switchboard BD-114-( ).

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*b. Maintenance and repair.*—See paragraph 45*b*.

**46.2. Switchboard BD-114-( ) (Added).**—*a. Functioning of circuit.*—Figure 47.2 shows the complete schematic of this switchboard. The circuit is the same as circuit of the BD-57-B shown in figure 47.1 except for the following points:

(1) A patching board has been incorporated into the switchboard unit. (See par. 2, app. I, for a detailed description of the patching board.)

(2) The potentiometer in the oscillator tone circuit has been eliminated; the same results are obtained by wiring the tone into the terminals of the auxiliary tone jacks. The tone is connected to the primaries of transformers C69 by inserting plug PL-48 of the white cord into the tone jack to which the auxiliary tone is wired. The potentiometer in the auxiliary jack circuit acts as the volume control.

(3) The terminals for the instructor's headset and key are brought out to a jack on the panel. To connect into the circuit, the instructor's key and headset is connected to a plug.

(4) The auxiliary tone cords have been omitted; they are not required when a patching board is used.

*b. Maintenance and repair.*—See paragraph 45*b*.

[AG 300.7 (29 Dec 44)]

BY ORDER OF THE SECRETARY OF WAR:

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*The Adjutant General*

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For explanation of symbols, see FM 21-6.

**CODE PRACTICE EQUIPMENT**

Prepared under direction of the  
Chief Signal Officer

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\*This manual supersedes TR 1215-10, and Instruction Book for Code Practice Equipment for Training Radio Operators, February 10, 1941, and supplements thereto.

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**SECTION I**

**GENERAL**

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**1. Purpose and scope.**—The purpose of this manual is to describe equipment for the training of radio operators in troop and special service schools. There are included a general description of major components of this equipment, detailed instructions for its installation and use, and information as to its functioning, servicing, and repairing.

**2. Basic equipment requirements.**—The basic requirement in any school for training radio operators is an audio-frequency oscillator of sufficient power to supply tone to a headset for each student in the school. Associated with this tone source must be a flexible distribution system whereby the tone supplied to individual headsets or groups of headsets can be isolated from others. The tone supplied to each group of headsets must be capable of being keyed at various speeds. Keying may be accomplished manually, but a great reduction of instructor personnel and more accurate transmissions are possible if equipment is available for automatically keying the tone by means of previously prepared tape. Of great assistance in teaching students to transmit well-formed characters is a recorder by means of which signals transmitted by them are recorded on a tape. Use of this prepared tape on the automatic keyer, retransmitting his own transmissions to the student who prepared the tape, points out his errors emphatically. The equipment described herein fulfills each of the above requirements and is intended for use in Conducting the course of instruction outlined in TM 11-454. Figure 1 shows a typical school for 100 students, using the equipment described in this manual.

**3. Major components.**—The major components of equipment for training radio operators in troop schools are as follows:

*a.* Keyer TG-10-A or TG-10-B. (Tone source and keyer combined.)

*b.* Automatic keyer, Lon-Ga-Tone, type 7. (Tone source and keyer combined.)

**NOTE.**—Keyers TG-10-A and TG-10-B and the Lon-Ga-Tone keyer are made to meet the same general requirements and are interchangeable in their use.

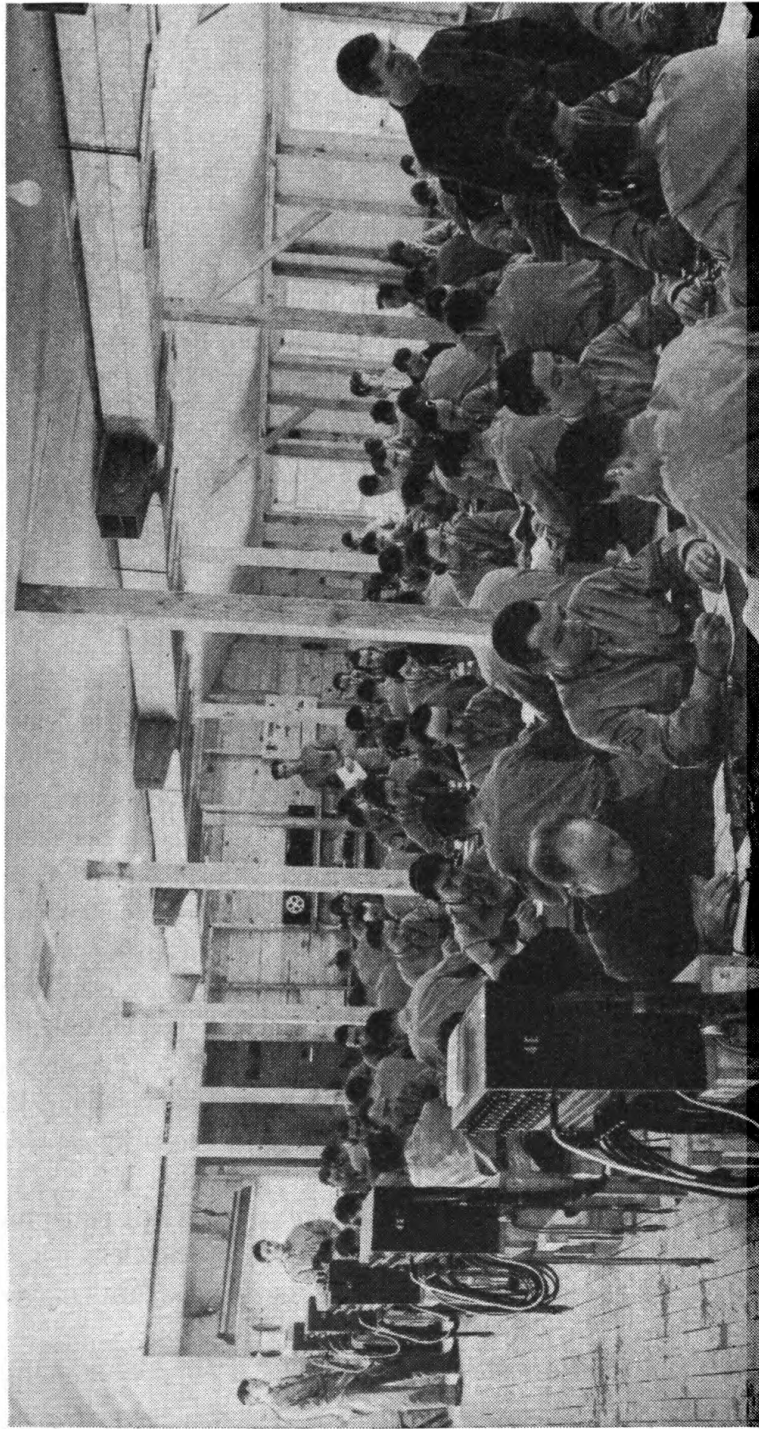


FIGURE 1.—Five 20-man tables, each with switchboard, used in typical school for training of radio operators. (Recorder for making of tapes by students is in far center; automatic keyers in separate room.)

*c.* Automatic keyer, McElroy model G-813, modified. (Tone source and keyer combined.) This is substitute equipment for item *a* or *b*.

*d.* Oscillator-amplifier, Amplifier Company of America, type ACA-10-AO. (Tone source.)



*e.* Automatic keyer, McElroy model G-813. This item in combination with item *d* is equivalent to item *a*, *b*, or *c*.

*f.* Code practice equipment EE-81, less batteries BB-29. (Distributing system.)

*g.* Practice tapes Nos. 1 to 15. (Master copies of practice transmissions, appendix II.)

*h.* Recorder, McElroy model RRD-900.

*i.* Tape puller, McElroy model CTP-1300. (Used with item *h*.)

*j.* Reels, motion picture film, 16-mm, 400 feet. (For holding tape.)

*k.* Record player, for disk records, Columbia model P. (For use with the record set MC-209 (radiotelegraph operator aptitude test); (see TM 11-454).)

**4. Keyer TG-10-A or TG-10-B.**—These keyers are identical both mechanically and electrically except that the TG-10-A is equipped with transformers for 110-volt 25-cycle operation, while the TG-10-B is equipped with transformers for 110-volt 60-cycle operation. Reference will be made hereafter only to the TG-10-B, as comparatively few of the TG-10-A keyers have been manufactured. The keyer TG-10-B closely resembles the Lon-Ga-Tone keyer in over-all characteristics.

**5. Automatic keyer, Lon-Ga-Tone, type 7.**—This keyer combines a tone source and an automatic electronic keying system. The tone source consists of an oscillator-amplifier capable of supplying 10 watts of audio tone at 800 cycles per second  $\pm 10$  percent. This keyer operates from a 110-volt 60-cycle source but satisfactory results can be obtained from a source as low as 90 volts. (See fig. 2.)

**6. Automatic keyer, McElroy model G-813, modified.**—This unit combines a tone source of considerably lower power output (about 1 watt) and an automatic keyer, and may be used as a substitute for the automatic keyer, Lon-Ga-Tone, type 7. Only a limited quantity has been issued.

**7. Oscillator-amplifier, Amplifier Company of America, type ACA-10-A0.**—This tone source is capable of supplying 10 watts of tone at 800 cycles per second  $\pm 10$  percent. This power is adequate for supplying tone to 200 headsets. When the number of student groups being independently keyed on a single tone source exceeds six, some slight cross-talk between individual groups may be noticeable. In general, troop schools of 40 students require 6 automatic keyers (see par. 8) but only one oscillator-amplifier. The oscillator-amplifier operates from a 110-volt 60-cycle source but is capable of maintaining adequate output at input voltages as low as 90 volts.

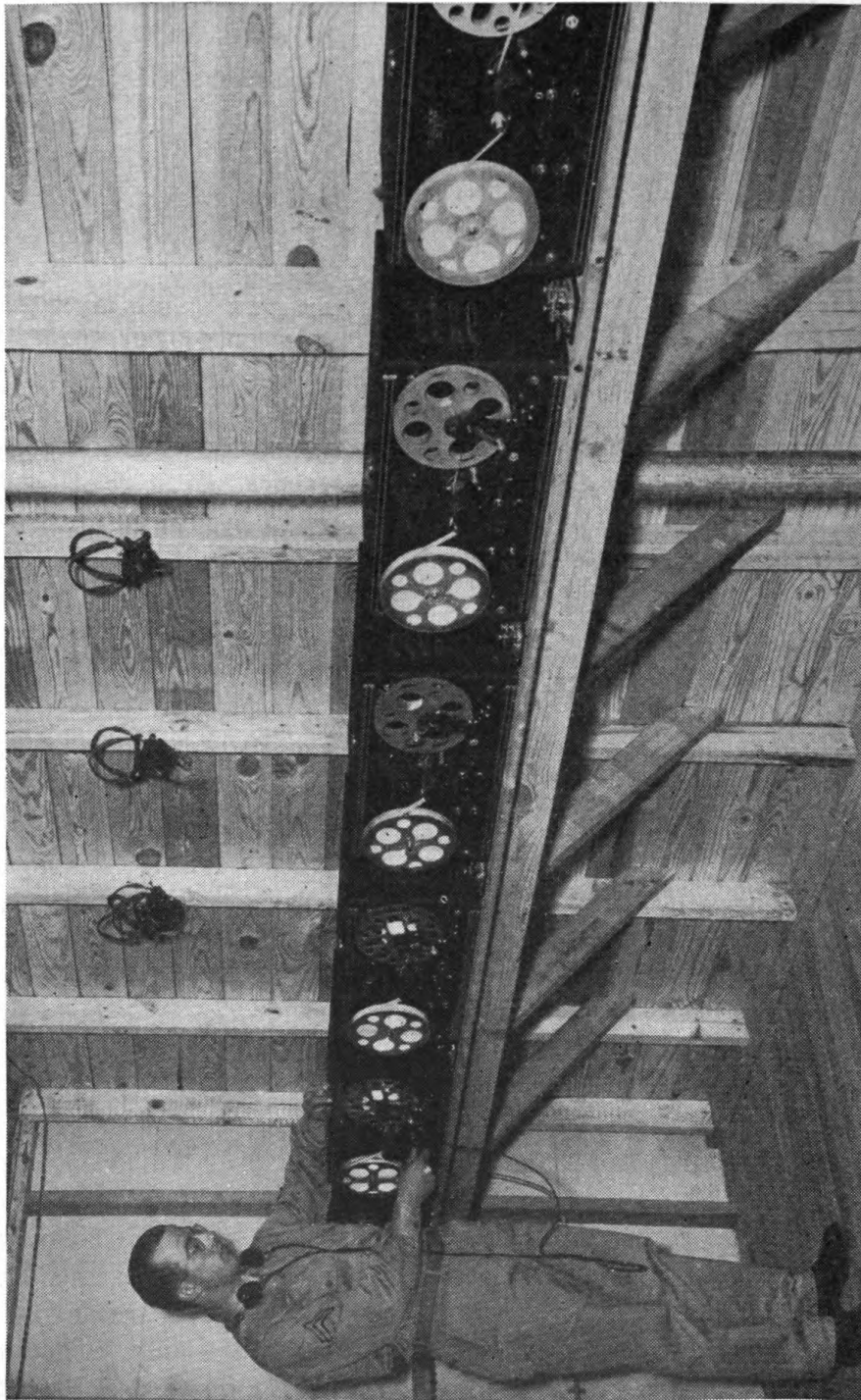


FIGURE 2.—Neat, simple arrangement of Lon-Ga-Tone automatic keyers. (Typical installation readily duplicated in any permanent or temporary building.)

Use of this oscillator-amplifier in installations for which keyer TG-10-B, Lon-Ga-Tone, or McElroy modified model G-813 units are supplied is generally restricted to furnishing constant tone to the switchboard BD-57-A which is part of equipment EE-81.

**8. Automatic keyer, McElroy model G-813.**—This unit is used to key automatically the separate tone source provided by the oscillator-amplifier ACA-10-AO. It can key the tone supplied to *one* and *only one* group of students; hence, for as many groups of students as it is anticipated will be formed at any one time during the process of instruction, just as many keyers are required. Keyers operate from a 110-volt 60-cycle source but are capable of keying satisfactorily at input voltages as low as 90 volts.

**9. Code practice equipment EE-81.**—The equipment EE-81 comprises a switchboard BD-57 or BD-57-A, 22 hand telegraph keys J-38, and 21 double headsets HS-16. Switchboard BD-57-A is a later and improved version of the BD-57. Each unit of equipment is adequate for handling 20 students; for each additional 20 students or portion thereof an additional EE-81 or EE-81-A is required. By means of each switchboard, circuits can be set up which group from 1 to 20 students on a single source of keyed tone, permit the instructor to monitor the transmissions, or permit individuals in the group to transmit to others therein.

**10. Practice tapes.**—A set of 15 master tapes is made available to each school. Used in connection with any of the automatic keyers, these tapes provide for practice transmissions as follows:

Tape No.	Contents	Speed per minute	
		Characters	Words
1.....	Receiving lesson I <sup>1</sup> .....	20	.....
2.....	Receiving lesson II <sup>1</sup> .....	20	.....
3.....	Receiving lesson III <sup>1</sup> .....	20	.....
4.....	Receiving lesson IV <sup>1</sup> .....	20	.....
5.....	Receiving lesson V <sup>1</sup> .....	20	.....
6.....	Letters and numbers in random order.....	25	.....
7.....	do.....	35	.....
8.....	Code groups.....		10
9.....	Field traffic.....		12
10.....	do.....		12
11.....	do.....		15
12.....	do.....		15
13.....	do.....		15
14.....	do.....		20
15.....	do.....		20

<sup>1</sup> See TM 11-454.

These tapes were prepared in such a way, that, regardless of the speed of transmission in words per minute, the actual characters are

transmitted at a speed of 20 words per minute when the tape is running by the photoelectric cell at a constant speed of 12 feet per minute. Thus, on all tapes the speed of the characters is constant but the characters per foot of tape, and hence the words per minute transmitted, vary as indicated in the table above. (See app. II.)

11. **Recorder, McElroy model RRD-900.**—By means of this unit and a separate tone source (oscillator-amplifier ACA-10-AO or the oscillator-amplifier section only of the keyer TG-10-B or of the Lon-Ga-Tone automatic keyer, type 7), practice manual transmissions by a student can be recorded on a blank tape. Use of the automatic keying feature also permits the preparation of additional practice tapes from the master tapes. A switch can be used to facilitate the interconnection of tone source, automatic keyer, manual key, and recorder so as to make the recorder installation most flexible. The recorder operates from a 110-volt 60-cycle source but is capable of satisfactory recording at input voltages as low as 90 volts. Associated with the actual recorder is a tape puller, McElroy model CTP-1300, which pulls the blank tape past the recording stylus. (See fig. 3.)



FIGURE 3.—Recorder position. (On lower shelf are two McElroy recorders with associated tape pullers; on upper shelf are two Lon-Ga-Tone units. Tapes made on recorders can be played back immediately on Lon-Ga-Tone keyers.)

**12. Reels, motion picture film, 16-mm, 400 feet.**—These reels hold the practice tapes and are employed in pairs on each automatic keyer. They are standard film reels and fit the TG-10-B, the automatic keyers G-813 (both models), the Lon-Ga-Tone equipment, and the tape puller used with the recorder.

**13. Record player for disk records, Columbia model P.**—This is a portable phonograph consisting of an electric turntable, a phonograph pick-up, an audio-frequency amplifier, and a loudspeaker. It is used for sonic transmission of the radiotelegraph operator aptitude test from disk records. The speaker can be removed from the unit and mounted in a location more suitable from an acoustical viewpoint to permit sonic transmission of the test to a group of assembled students. The record player operates from a 110-volt 60-cycle source. (See fig. 4.)

Note.—The nomenclature, “code practice equipment EE-94-A” has been assigned to the complete equipment with all accessories except the code practice equipment EE-81 and the record player for a school of 20 students. Similarly “code practice equipment EE-95-A” and “code practice equipment EE-96-A” have been assigned to those for 40 and 100 student schools, respectively.



FIGURE 4.—Record player set-up for transmission of radiotelegraph operator aptitude test: (Speaker (left) is detached from cover of carrying case.)

SECTION II

INSTALLATION FOR SERVICE

	Paragraph
General arrangement of equipment.....	14
Instruction tables.....	15
Total space requirements.....	16
Interconnection of units.....	17
Connecting switchboard BD-57 or BD-57-A.....	18
Input power circuit.....	19
Connecting oscillator-amplifier ACA-10-AO.....	20
Connecting automatic keyer, McElroy model G-813.....	21
Connecting automatic keyer, Lon-Ga-Tone, type 7.....	22
Connecting keyer TG-10-B.....	23
Connecting automatic keyer, McElroy model G-813, modified.....	24
Connecting transmission test table using automatic keying unit, McElroy model G.813.....	25
Connecting transmission test table using Lon-Ga-Tone automatic keyer, type 7.....	26

14. **General arrangement of equipment.**—Figure 5 is a block diagram of a typical equipment lay-out for a school of 40 students, using six McElroy automatic keyers, an ACA-10-AO tone source, a McElroy recorder, two switchboards BD-57-A, and various accessories. Similar arrangements are obviously possible with Lon-Ga-Tone and keyer TG-10-B units. The physical placement of equipment and tables will vary according to building dimensions. The student tables should be arranged to allow proper lighting and sufficient aisle space. The oscillator-amplifier tone source and all automatic keyers are grouped and located with respect to instruction tables so that their operation and adjustment will neither interfere with nor annoy student operators. If space is available, the keyers should be in a separate room. Each unit of the group is placed so as to allow easy access to all connections and to facilitate operation and adjustment of controls. The automatic keyer and the recorder used for making practice records and transmission tests are placed on a table that allows room for the equipment units, table wiring, proper placement of hand key, and comfortable arm space for the student and the instructor. The switchboard preferably is mounted at one end of the table of student positions which it controls. It can be mounted on the table itself or on a switchboard bracket. A suitable method of mounting the switchboard on an instruction table is shown in figure 6. When so placed it must be at sufficient height to prevent the switchboard cords from touching the floor but not so high as to

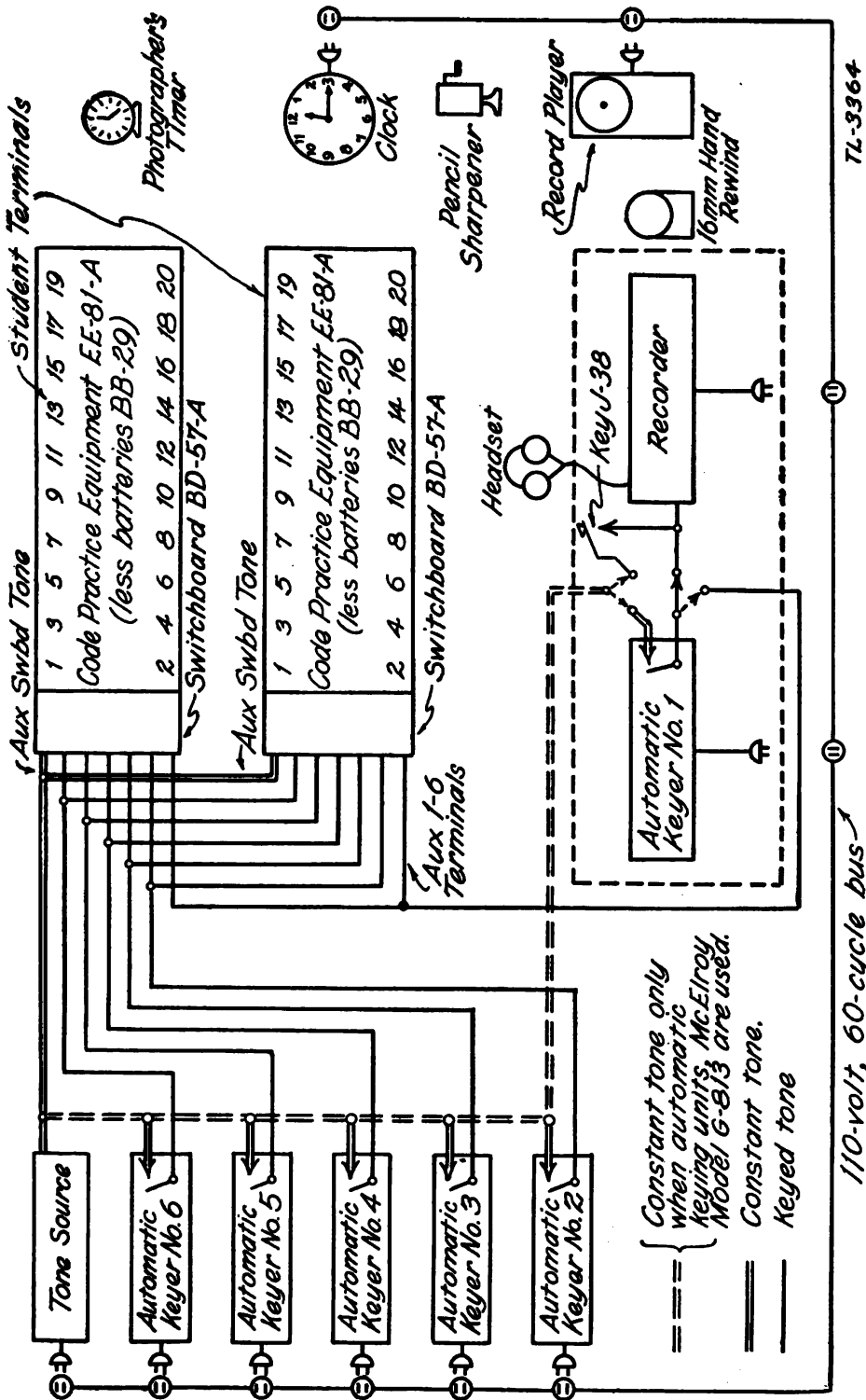


FIGURE 5.—Block diagram of typical school for 40 students.

prevent an instructor, when standing at the switchboard, from seeing all student positions. Other methods for mounting the switchboard are feasible, but regardless of the method used, it should be placed so as to allow easy access to its front for patching circuits and to its rear for making connections, so that external wiring can be brought in through the round hole at its right end (when viewed from the front).

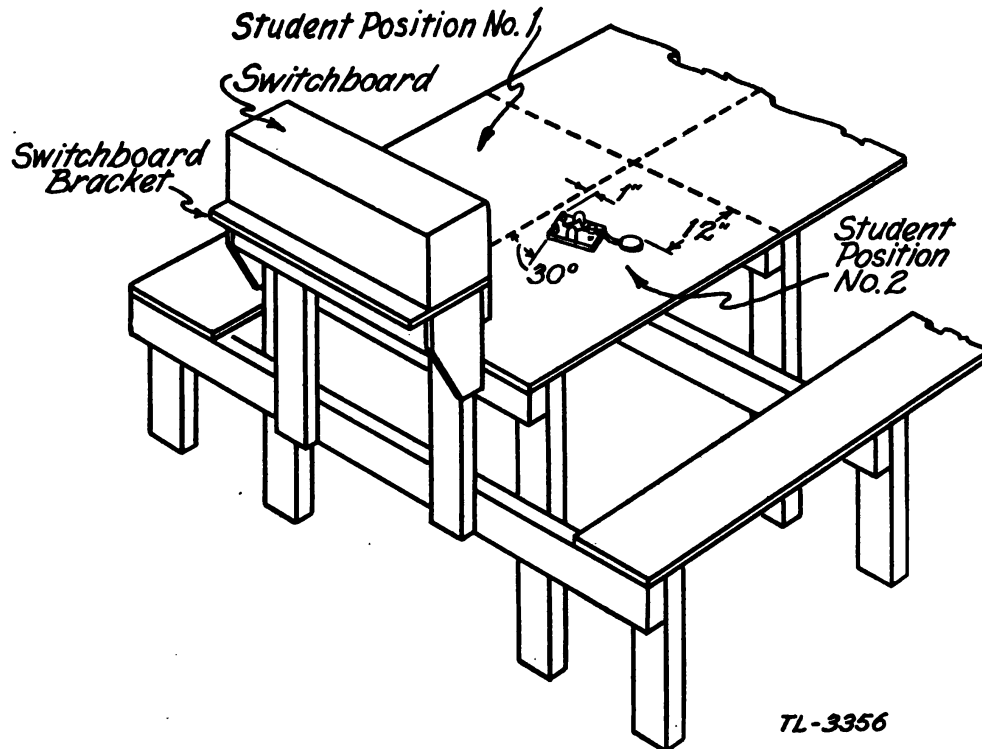


FIGURE 6.—End assembly of instruction table, switchboard bracket, and switchboard.

**15. Instruction tables.**—A mess type table measuring 5 feet 2 inches by 24 feet, including seats, will provide 20 student positions and sufficient space for mounting a switchboard BD-57 or BD-57-A. The table top is preferably covered with  $\frac{3}{16}$ -inch tempered Prestwood, or equal, to insure a good writing surface. Construction drawings are given in figures 7 and 8 for a 10-position instruction table and a switchboard bracket. Standard sizes and lengths of lumber are employed in their construction. Wood screws, with all screw holes countersunk, are employed for the assembly of the table. This construction facilitates assembly and disassembly for moving the table from one room to another or for storage. Two tables can be bolted together to make a 20-student table if space permits. If the 10-position table is used as a unit, only one switchboard bracket for each two

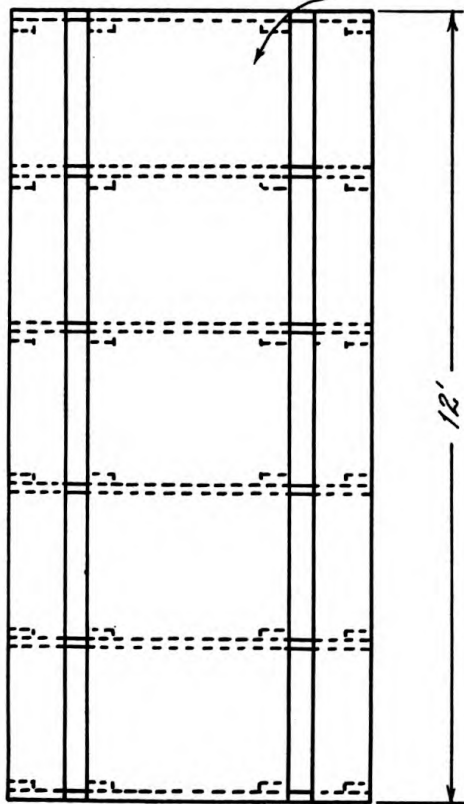


CODE PRACTICE EQUIPMENT

tables is needed. The 20-student positions on the switchboard will then be divided equally between the two tables.

<i>Material:</i>
<i>Pine, Class C, Select, Surfaced four sides. Commercial sizes to be used where possible.</i>
<i>Assembly:</i>
<i>Flathead wood screws will be used to fasten seats and top to table frame.</i>

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Top of table to be covered with 3/16" TEMPERED PRESTWOOD.

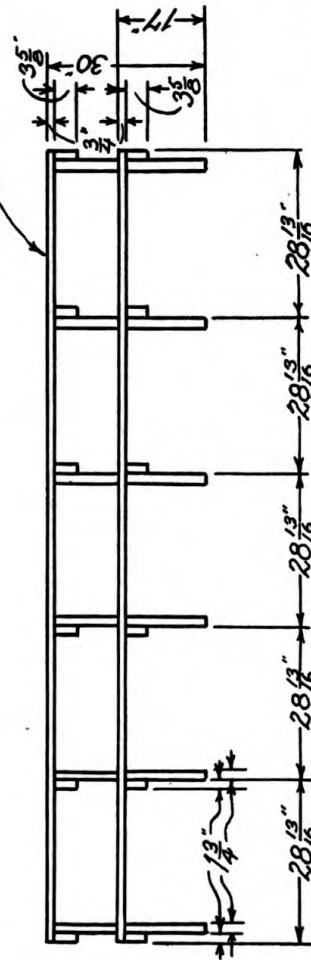
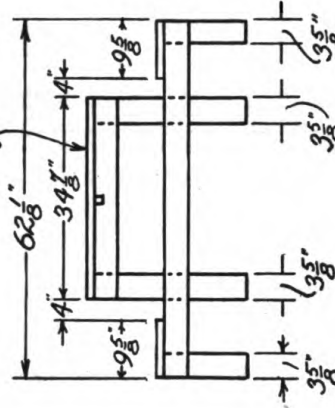


FIGURE 7.—Ten-position instruction table.

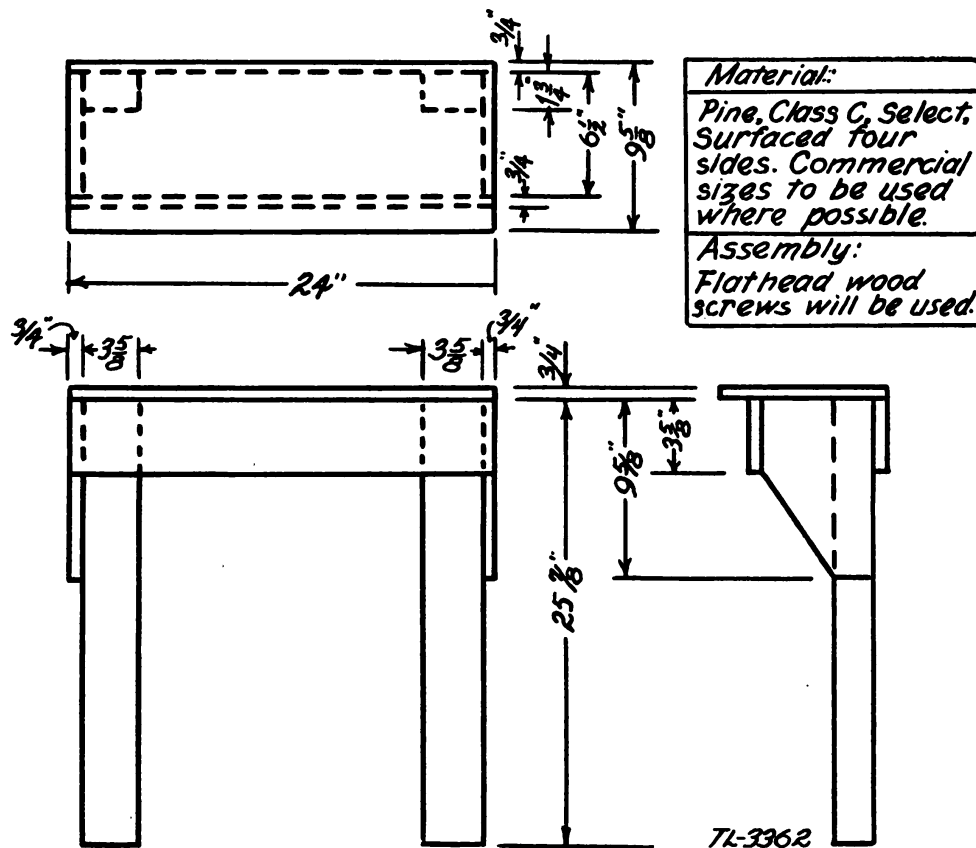


FIGURE 8.—Details of switchboard bracket.

16. **Total space requirements.**—Approximately 260 square feet of floor space are required for each group of 20 students and an additional 12 square feet per keyer, recorder, and oscillator-amplifier. A code room for 100 students should have approximately 1,500 square feet of floor space to provide for aisles. A room less than 20 feet wide is unsatisfactory.

17. **Interconnection of units.**—*a. Switchboard BD-57-A.*—Figures 9 and 10 are block diagrams of an installation for a school of 40 students, using two switchboards BD-57-A as the distributing system. If the McElroy G-813 automatic keyers are furnished, the M and S terminals are all paralleled to the 1 and 2 posts of the ACA-oscillator-amplifier, to the AUX SWBD TONE posts of the switchboards, and across to the transmission test table. If Lon-Ga-Tone, keyer TG-10-B or McElroy modified model G-813 units are furnished, the oscillator-amplifier is connected only to the AUX SWBD TONE posts. Combinations of keyers TG-10-B, McElroy, and Lon-Ga-Tone units can be used without interference.

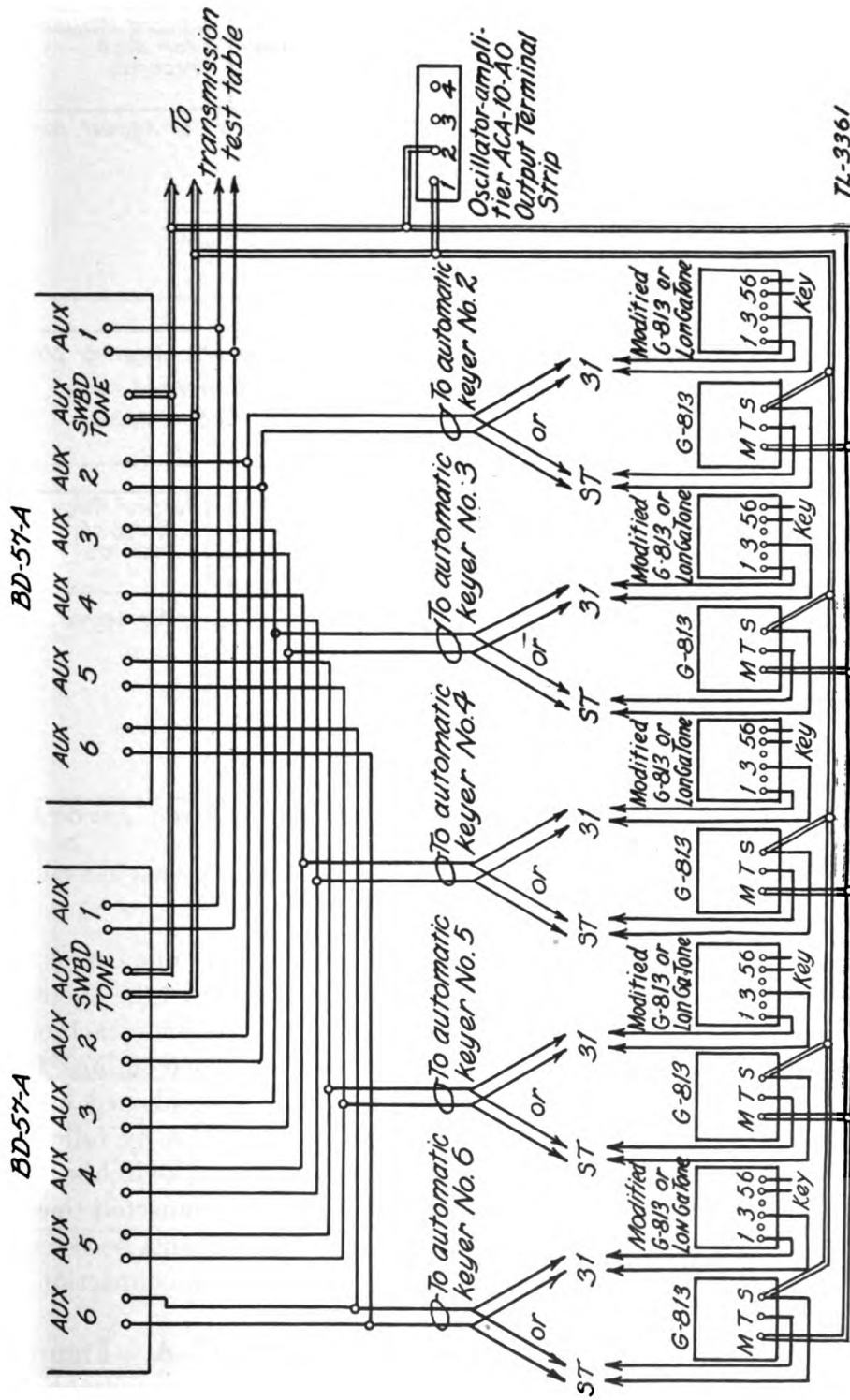
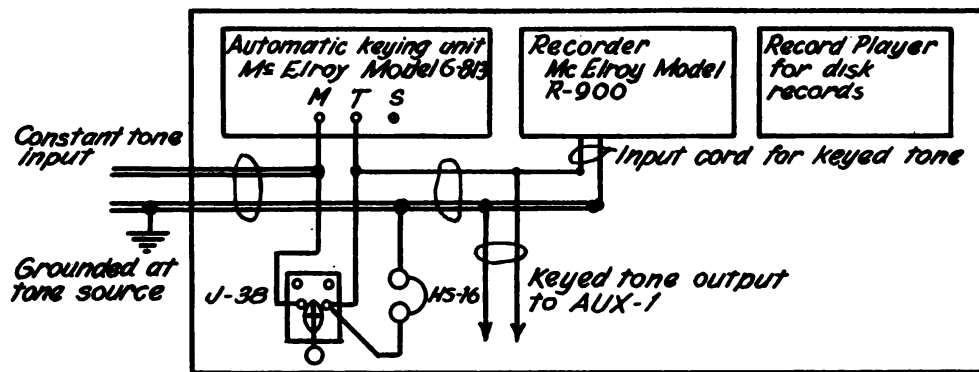
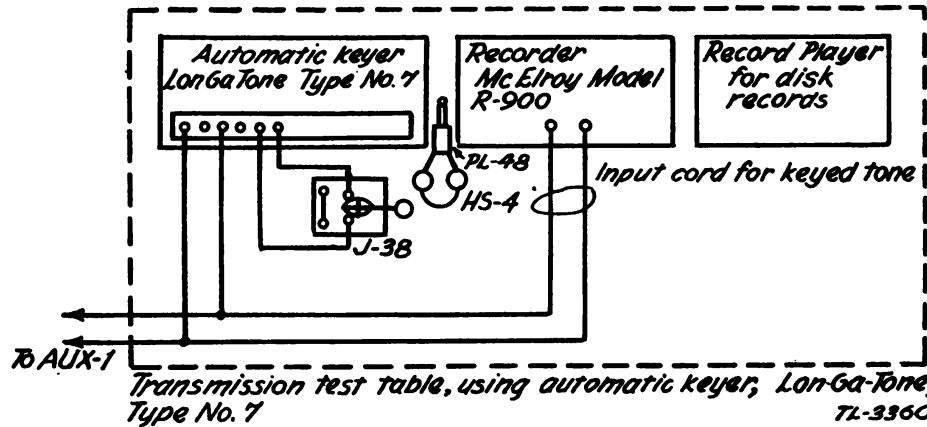


FIGURE 9.—Diagram of typical set-up of code practice equipment for school of 40 students.



Transmission test table, using automatic keying unit, Model 6-813

==== Constant tone  
—— Keyed tone



Transmission test table, using automatic keyer, Lon-Ga-Tone, Type No. 7 TL-3360

FIGURE 10.—Transmission test table diagrams showing use of both McElroy and Lon-Ga-Tone automatic keyers.

b. *Switchboard BD-57.*—This switchboard has only one connection for outside tone source. Therefore, all students must take the same keyed tone, or all must practice sending to themselves or to each other at the same time. This arrangement has serious shortcomings from the standpoint of progressive instruction. The switchboard can be rewired to make it the equivalent of the newer BD-57-A by following the special instructions given in appendix I. If the switchboard is to be used as issued, only one keyer at a time can be connected to each, and students of approximately the same speed ability must be assigned to the respective tables. Figure 11 shows the simple connections of this switchboard.

18. *Connecting switchboard BD-57 or BD-57-A.*—Figure 12 is a schematic diagram of the terminal board on a switchboard BD-57-A. This terminal board is an integral part of the switchboard and is accessible from the rear thereof.

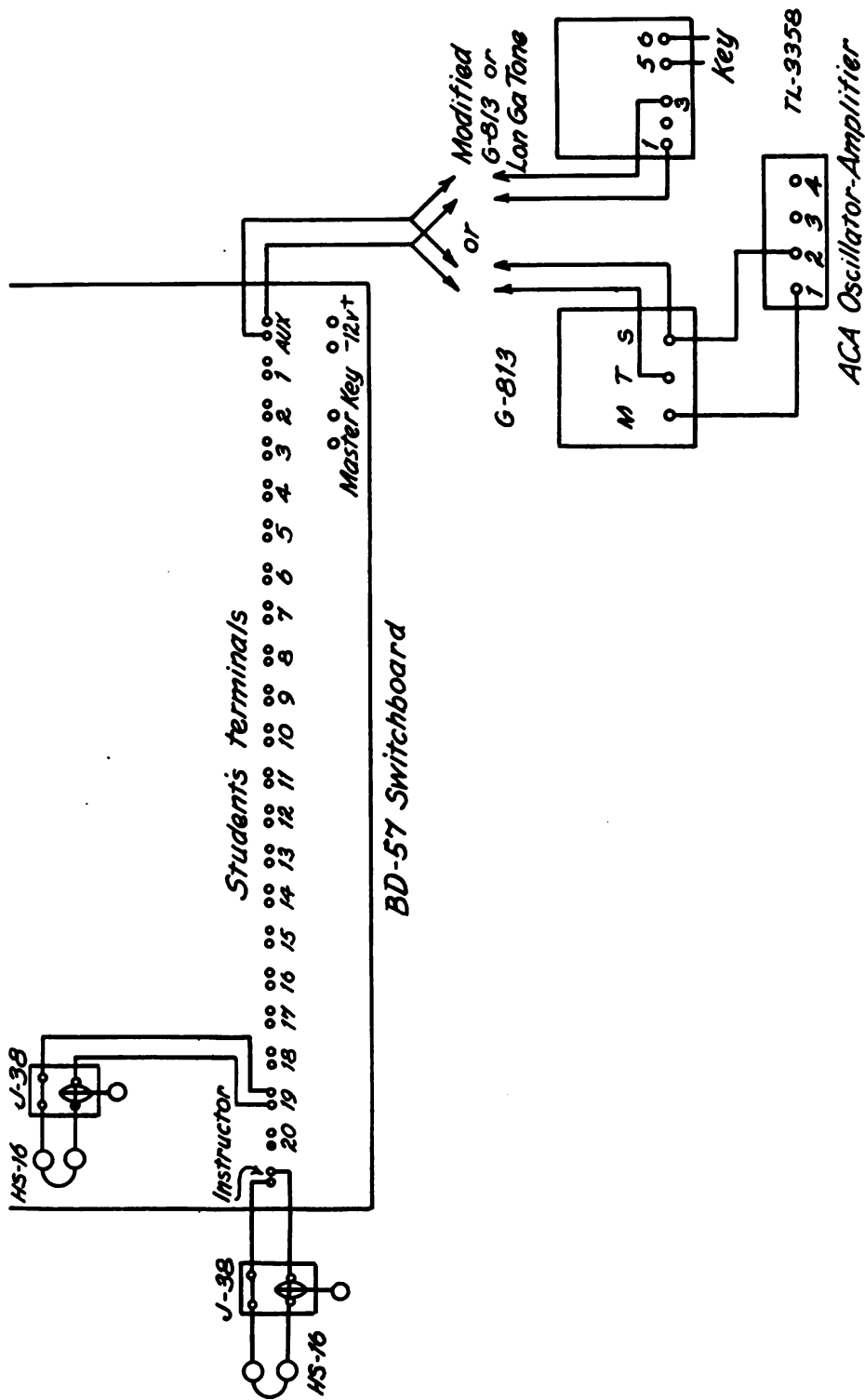


FIGURE 11.—Diagram of switchboard BD-57 used with either McElroy or Lon-Ga-Tone keys. (If more than one switchboard is used with McElroy model G-813 automatic keys, tone source connections are paralleled across as in fig. 9.)

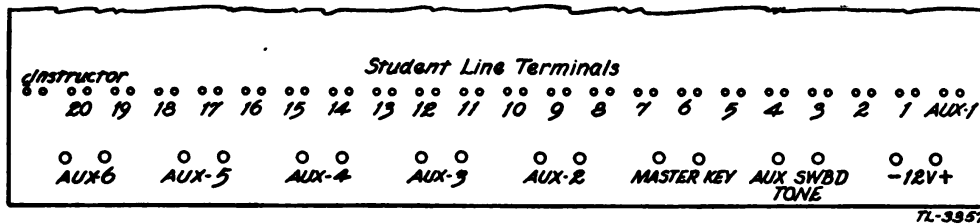


FIGURE 12.—Terminal board of switchboard BD-57-A.

a. *Student positions.*—Mount a key J-38 at each student position as shown in figures 6 and 14. At approximately 1 percent of the student positions mount the key so as to facilitate operation by left-handed operators; that is, 12 inches from the left of the student position and rotated 30° to the left instead of the right. Connect a headset HS-16 to each key J-38, as shown in figure 13. Tie the stay cord on the cord of each headset HS-16 to one of the terminals on each key J-38. Starting at the end of the table nearest the switchboard BD-57-A (see fig. 6) and alternating left and right, connect the student line terminals on the keys J-38 to student line terminals 1 through 20 on the switchboard BD-57-A. Use twisted pair wire W-33, or equal, for all student lines. Run the wire to each student position through a small hole in the top of the instruction table located to the right of the key. Cable the wires or group them in cable hooks under the table. Blake No. 3 insulated staples or equal can be used to support individual pairs until they are picked up in the cable or rings. Run the wires (or cable) through the 1¼-inch square holes in the table braces under the table top as shown in the end view of a 10-position instruction table (fig. 7). Pass the wires (or cable) through the round hole in the right side of the switchboard BD-57-A.

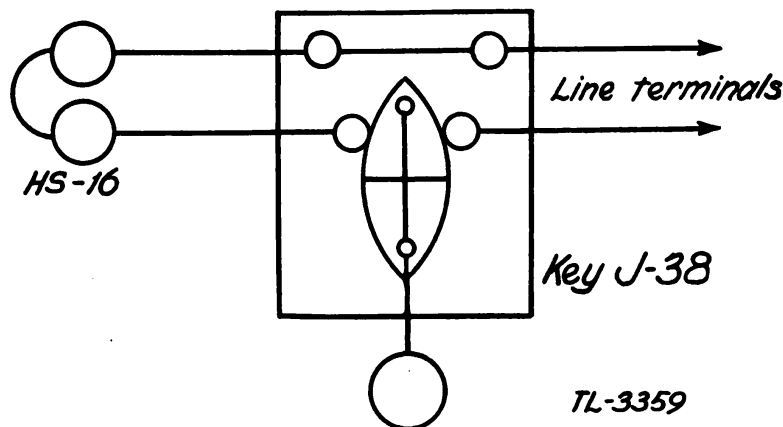


FIGURE 13.—Connections of key and headset at student position.

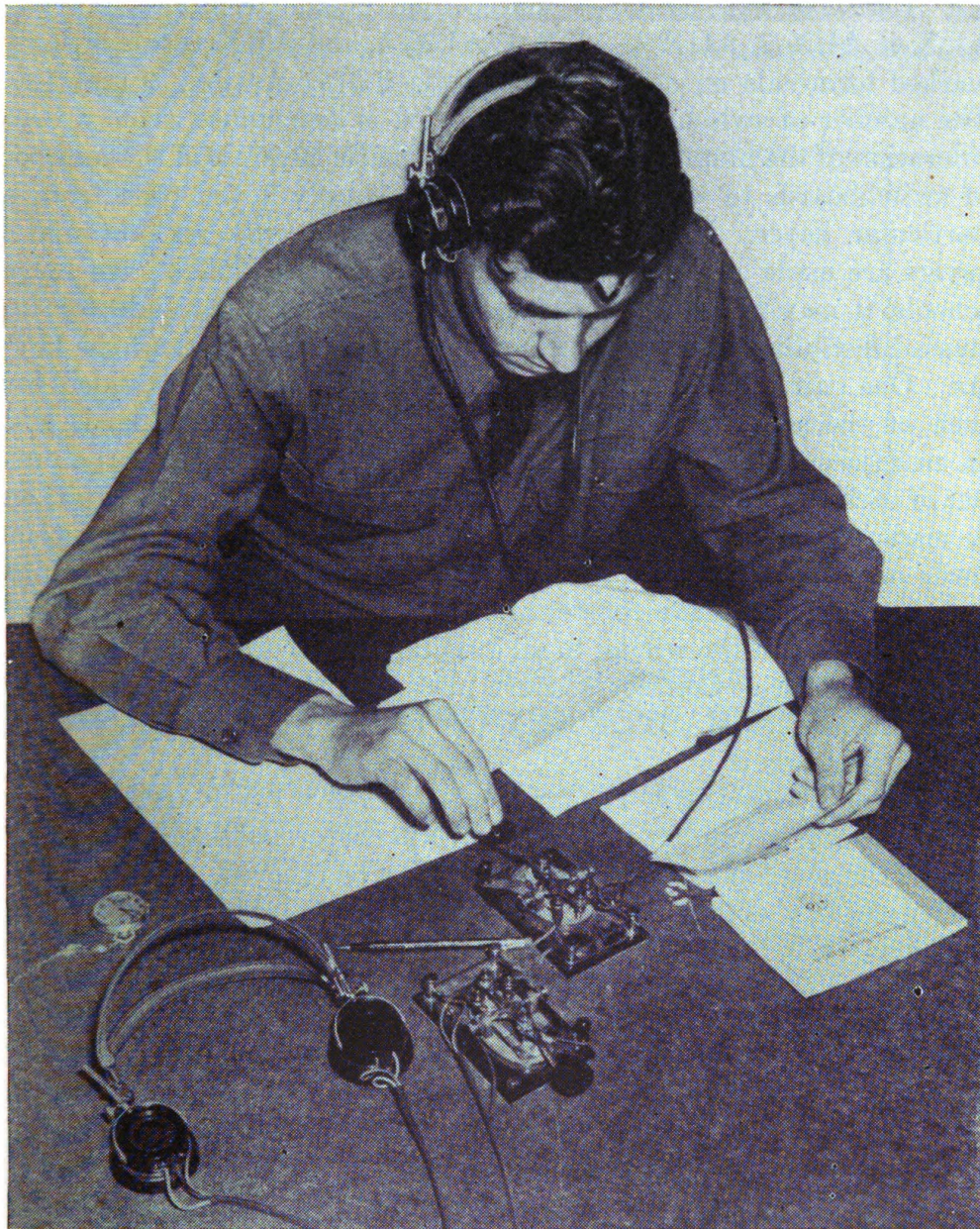


FIGURE 14.—Appearance of facing student positions, with student participating in actual keying practice.

*b. Instructor's key.*—Mount a key J-38 for convenient operation by an instructor at the switchboard BD-57-A. Connect a headset HS-16 thereto as indicated in figure 13. Using twisted pair wire W-33 or equal, connect the line terminals of the key to the terminals marked INSTRUCTOR on the terminal board of the switchboard BD-57-A. This wire can be included in the cable indicated in *a* above.

*c. Auxiliary tone cords.*—Connect each of the terminals marked AUX 1, AUX 2, AUX 3, AUX 4, AUX 5, and AUX 6 to similarly marked terminals on other switchboards BD-57-A (figs. 9 and 12). The number of switchboards so paralleled is determined from a consideration of the number of available automatic keyers and the number of switchboards to which it is desired to supply keyed tone from a particular keyer. In 40-student schools when only six automatic keyers are made available, all switchboards are paralleled. In large schools, it may be advisable to use terminal strips to provide for increased flexibility in the interconnection of switchboards and the keyers. One pair of terminals on a single terminal strip is provided for each of the auxiliary switchboard cords on each switchboard, and on an adjacent strip there is provided a pair of terminals for the output of each automatic keyer. Interconnection between strips can then be made to connect any automatic keyer to any or all auxiliary tone cords on any switchboard. Jack boards with interconnecting plugs may be substituted for the terminal strips. Use twisted pair wire W-33 or equal in the wiring to all auxiliary tone cords.

*d. Master key.*—Connect a short piece of jumper wire across the terminals marked MASTER KEY (see fig. 12). A master key is not used in this circuit.

*e. Battery terminals.*—The terminals marked  $-12V +$  are left open, as no battery is required. The motor-alternator mounted inside the case of the switchboard is not used and may be ignored.

*f. Auxiliary switchboard tone.*—Connect in parallel, using twisted pair wire W-33 or equal, the terminals marked AUX SWBD TONE (fig. 12) on each of the switchboards BD-57-A which are to be supplied constant tone from a single source.

**19. Input power circuit.**—A decision having been reached as to the exact location of each tone source, automatic keyer, recorder, and record player, install a 110-volt 60-cycle bus, so that standard outlets thereon will be readily accessible at the location of each of these units (see fig. 5). Use a wire of sufficient size to insure good voltage regulation over the bus. Each unit requiring power for its operation is equipped with an input power cord with standard plug. If power outlets are already available in the instruction room, their location may influence the location of each of the units mentioned above. In general, it is better to extend the length of the power input cords on individual pieces of equipment than it is to disperse units in accordance with available power outlets.



20. **Connecting oscillator-amplifier ACA-10-AO.**—The terminals of the oscillator-amplifier ACA-10-AO are located on the rear of the chassis and are shown in figure 15.

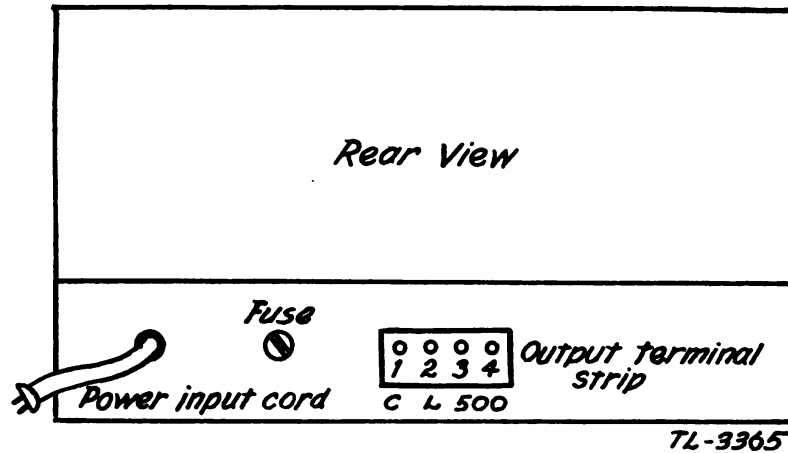


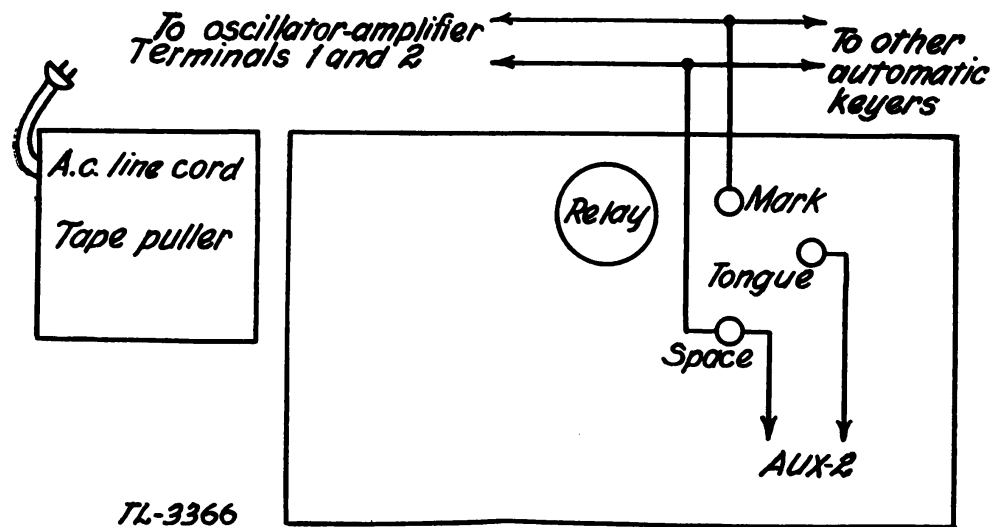
FIGURE 15.—Terminal board of ACA oscillator-amplifier.

a. *Power input cord.*—When ready for operation, plug the power input cord into the available outlet on the 110-volt 60-cycle bus (see par. 18).

b. *Output terminal strip.*—(1) Connect the terminals marked 1 and 2 on the output terminal strip (also marked C and L, respectively) to the terminals marked AUX SWBD TONE on the nearest switchboard BD-57-A. Use twisted pair wire W-33 or equal. This lead connects the constant tone output of the oscillator-amplifier to the primary circuits of the switchboards BD-57-A which were connected parallel as indicated in paragraph 18f. Connect the terminal marked 1, the common terminal, to ground.

(2) Connect a second twisted pair lead from terminals 1 and 2 on the oscillator-amplifier to the proper relay terminals on each of the automatic keying units, McElroy model G-813, which are to key the output of the oscillator-amplifier (see figs. 9 and 16). The relay terminals are not marked as such on the automatic keyer; however, they are properly labeled in figure 1 and the correct wiring is indicated thereon.

21. **Connecting automatic keyer, McElroy model G-813.**—The terminals of the automatic keyer, McElroy model G-813, are located on the top of the chassis to the right rear adjacent to the relay, as shown in figure 16.



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FIGURE 16.—Connections to McElroy keyer, model G-813.

a. *Power input cord.*—When ready for operation, plug the power input cord, located at the left end of the tape puller chassis, into the available outlet on the 110-volt 60-cycle bus. Polarize this plug so that no difference of potential exists between the chassis of the unit and ground. No harm will result when the plug is inserted with either polarization, but with one polarization a slight voltage will exist between chassis and ground which may be annoying to the touch.

b. *Relay terminals.*—(1) *Constant tone input.*—Constant tone input from the oscillator-amplifier is obtained by connecting the lead mentioned in paragraph 20b (2) across the mark and space terminals (see fig. 16).

(2) *Keyed tone output.*—Using twisted pair wire W-33 or equal, connect the tongue and space terminals on successive automatic keying units to successive pairs of terminals marked AUX 2, AUX 3, AUX 4, AUX 5, and AUX 6 on the terminal board of the nearest switchboard BD-57-A (see fig. 9). A systematic numbering of automatic keying units to conform with the numbering of the auxiliary tone cords on the switchboards BD-57-A is desirable. Connection is made to auxiliary tone cords by means of the terminals AUX 2, AUX 3, AUX 4, AUX 5, and AUX 6. When more than six automatic keying units are supplied, the connections described above may be modified as indicated in paragraph 18c.

22. *Connecting automatic keyer, Lon-Ga-Tone, type 7.*—The terminals of automatic keyer, Lon-Ga-Tone, type 7, are located on the rear of the chassis and are as shown in figure 17.

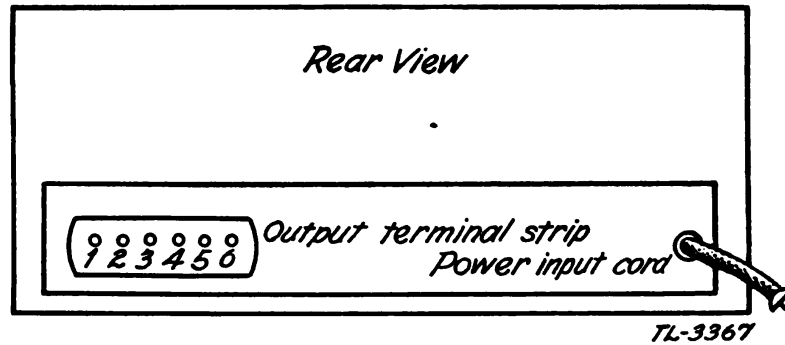


FIGURE 17.—Connections of Lon-Ga-Tone keyer, type 7.

*a. Power input cord.*—When ready for operation, plug the power input cord into the available outlet on the 110-volt 60-cycle bus (see par. 19).

*b. Output terminal strip.*—(1) *Automatically keyed output.*—Using twisted pair wire W-33 or equal, connect terminals 1 and 3 of the output terminal strip (fig. 17) on successive automatic keyers to successive terminals marked AUX 2, AUX 3, AUX 4, AUX 5, and AUX 6 on the terminal board of the nearest switchboard BD-57-A (see fig. 9). A systematic numbering of automatic keyers to conform with the numbering of the auxiliary tone cords on the switchboards BD-57-A is desirable. Connection is made to auxiliary tone cords by means of the terminals AUX 2, AUX 3, AUX 4, AUX 5, and AUX 6. When more than six automatic keyers are supplied, the connections described above may be modified in a manner indicated in paragraph 18c.

(2) *Manually keyed output.*—If it is desired that a constant tone output from the unit be arranged for manual keying, mount a key J-38 near the automatic keyer, and connect this key to terminals 5 and 6 on the output terminal strip (fig. 17).

**23. Connecting keyer TG-10-B.**—The keyer TG-10-B can be used wherever the use of the Lon-Ga-Tone keyer is indicated in any of the diagrams appearing in this manual. Plug the flexible power input cord into the nearest 110-volt outlet. Take the tape-keyed tone output from the screw binding posts on the right back edge of the chassis. There are four such posts, marked COM, 4, 8, 16. The first is the common secondary connection, and the others represent the different impedance taps. Use the COM post and *one* only of the others, depending on how many student positions are to be fed keyed signals. A few quick trials will determine the best output impedance. To key the tone output of this instrument by

hand, connect a key to the posts on the back of the chassis marked KEY.

24. **Connecting automatic keyer, McElroy model G-813, modified.**—A top view of the chassis, showing the binding posts, is given in figure 18. On the actual instrument, the terminals are not marked at all, but they are identified by numbers as indicated for convenience in establishing external connections. This keyer, having its own tone source, is installed in the same manner as the Lon-Ga-Tone. Where any of the preceding diagrams show terminals 1 and 3, and 5 and 6, of the Lon-Ga-Tone unit, the same connections are used to the correspondingly numbered posts of the modified G-813 unit.

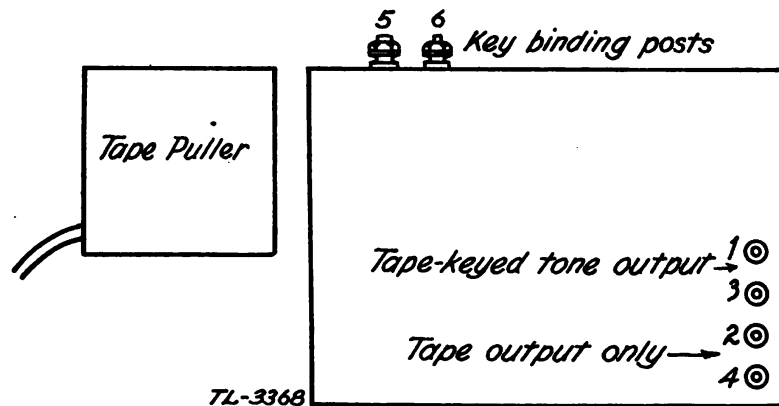


FIGURE 18.—Arrangement of binding posts on McElroy keyer, model G-813, modified. (Tape-keyed tone output is obtained from posts 1 and 3. If it is desired to use keying elements only of this unit to key external tone source (as from ACA oscillator-amplifier), terminals 2 and 4 are employed.)

25. **Connecting transmission test table using automatic keying unit, McElroy model G-813.**—*a. General.*—Figure 10 shows a method of interconnecting the automatic keying unit, McElroy model G-813, a recorder, a manual key, and a headset to provide for transmission tests, for the preparation of additional practice tapes, or for using the keyed tone output of the automatic keying unit on the auxiliary tone cords No. 1 of the switchboards BD-57-A. Note that the input cord for keyed tone and *not* the local keying posts (fig. 19) is used for connecting the keyed tone input to the recorder. Note also that on this particular automatic keying unit the mark and tongue contacts of the relay (fig. 16) are merely connected in series with the constant tone bus and the recorder. This method of connection facilitates the play-back of tapes prepared by students in that no switching is required. The manual key is connected in parallel with the mark and tongue con-

tacts. A headset HS-16 is connected in parallel with the keyed tone input to the recorder. Auxiliary tone cord No. 1 on switchboards BD-57-A may also be connected in parallel with the input to the recorder.

b. *Recorder, McElroy model RD-900.*—Figure 19 indicates the location of the terminals of the recorder, McElroy model RD-900.

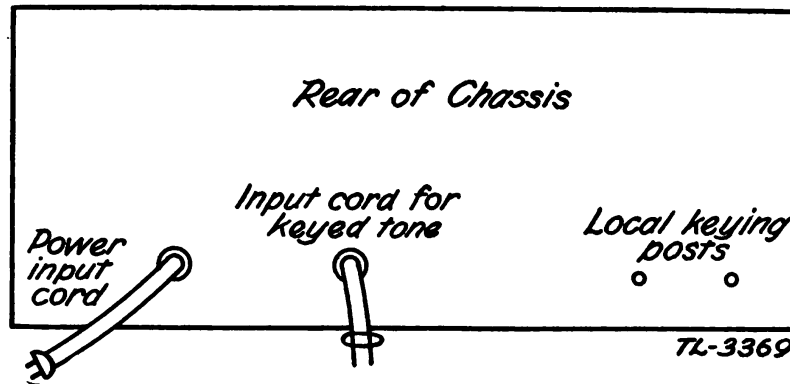


FIGURE 19.—Connections of McElroy recorder.

c. *Tape puller, McElroy model CTP-1300.*—The only connection to this unit is the power input cord located on the left side of the chassis.

d. *Power input cords.*—When ready for operation, plug the power input cords (figs. 16 and 19) into the available outlets on the 110-volt 60-cycle bus. Polarize these plugs so that no difference of potential exists between the chassis of any unit and ground.

**26. Connecting transmission test table using Lon-Ga-Tone automatic keyer, type 7.**—a. *General.*—Figure 10 shows a method of interconnecting a Lon-Ga-Tone automatic keyer, a recorder, a manual key, and a headset to provide for transmission tests, for the preparation of additional practice tapes, or for using the keyed tone output of the automatic keyer on the auxiliary tone cords No. 1 of the switchboards BD-57-A. The input cord for keyed tone on the recorder (fig. 19) is connected directly to terminals 1 and 3 (fig. 17) on the automatic keyer. A manual key is connected to terminals 5 and 6 on the automatic keyer. A headset with standard two-conductor plug inserted in the jack marked MONITOR on the front panel of the automatic keyer permits a student to monitor his transmission and play-back. Terminals 1 and 3 on the automatic keyer also can be connected to the auxiliary tone cords of the switchboards BD-57-A.

b. *Power input cords.*—When ready for operation, plug the power input cords of the automatic keyer, the tape puller, and the recorder

into the available outlets on the 110-volt 60-cycle bus. Polarize the plugs as indicated in paragraph 25*d*.

SECTION III

OPERATION

	Paragraph
Oscillator-amplifier ACA-10-AO.....	27
Automatic keyer, McElroy model G-813.....	28
Automatic keyer, Lon-Ga-Tone, type 7.....	29
Keyer TG-10-B.....	30
Automatic keyer, McElroy model G-813, modified.....	31
Recorder, McElroy model RRD-900.....	32
Record player, Columbia model P.....	33
Switchboard BD-57-A.....	34
Preliminary adjustment of tone level.....	35
Initiating complete operation.....	36

27. Oscillator-amplifier ACA-10-AO.—The controls on this unit are located as shown in figure 20.

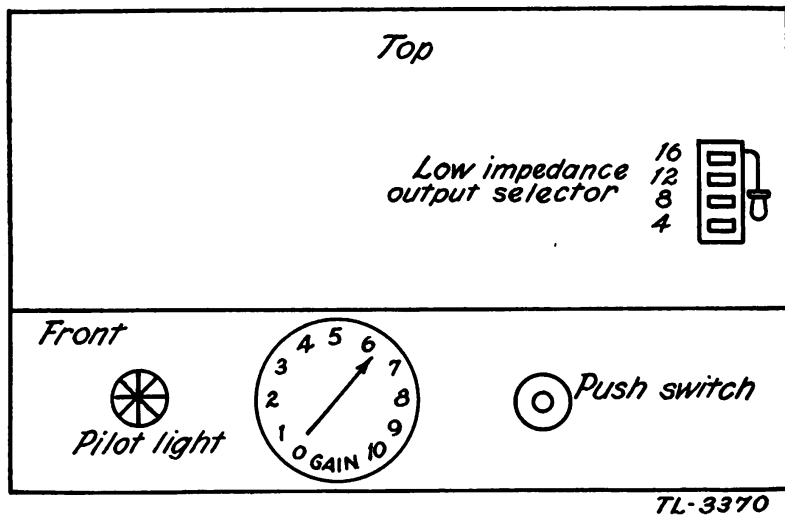


FIGURE 20.—Oscillator-amplifier chassis controls.

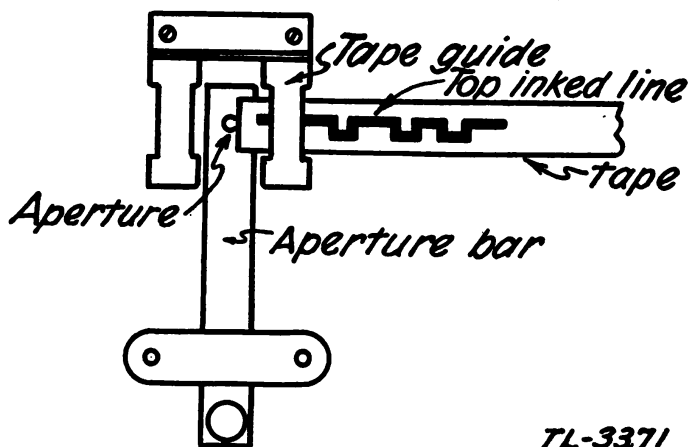
*a. Low impedance output selector.*—Remove the four screws holding the chassis cover in place and lift cover upward off the chassis. The low impedance output selector is located on the right side of the chassis top. Place the pin plug in the connector marked “4” for preliminary tests. Replace the chassis cover.

*b. Push switch.*—The oscillator-amplifier is turned on by pressing in the push switch. When the pilot light is on, the oscillator-amplifier is turned on.

*c. Gain control.*—The control marked GAIN varies the output tone level, increasing the level as the knob is rotated clockwise from 0 to 10.

**28. Automatic keyer, McElroy model G-813.**—The controls on the automatic keying unit, McElroy model G-813, are located as shown in figure 22.

*a. Mounting practice tapes.*—Mount an empty 400-foot reel on the take-up spindle located on the left of the tape puller unit. Mount the desired practice tape on the rewind spindle located on the right front of keying unit so that the tape comes off the bottom of the reel, i. e., the inked side of the tape is up. Lift the lamp house and tape guide upward and lay the tape over the aperture bar and replace the tape guide. Slip the tape toward the practice tape reel until the end of the tape is just to the right of the aperture in the aperture bar (see fig. 21). Move the aperture bar so that the aperture is directly

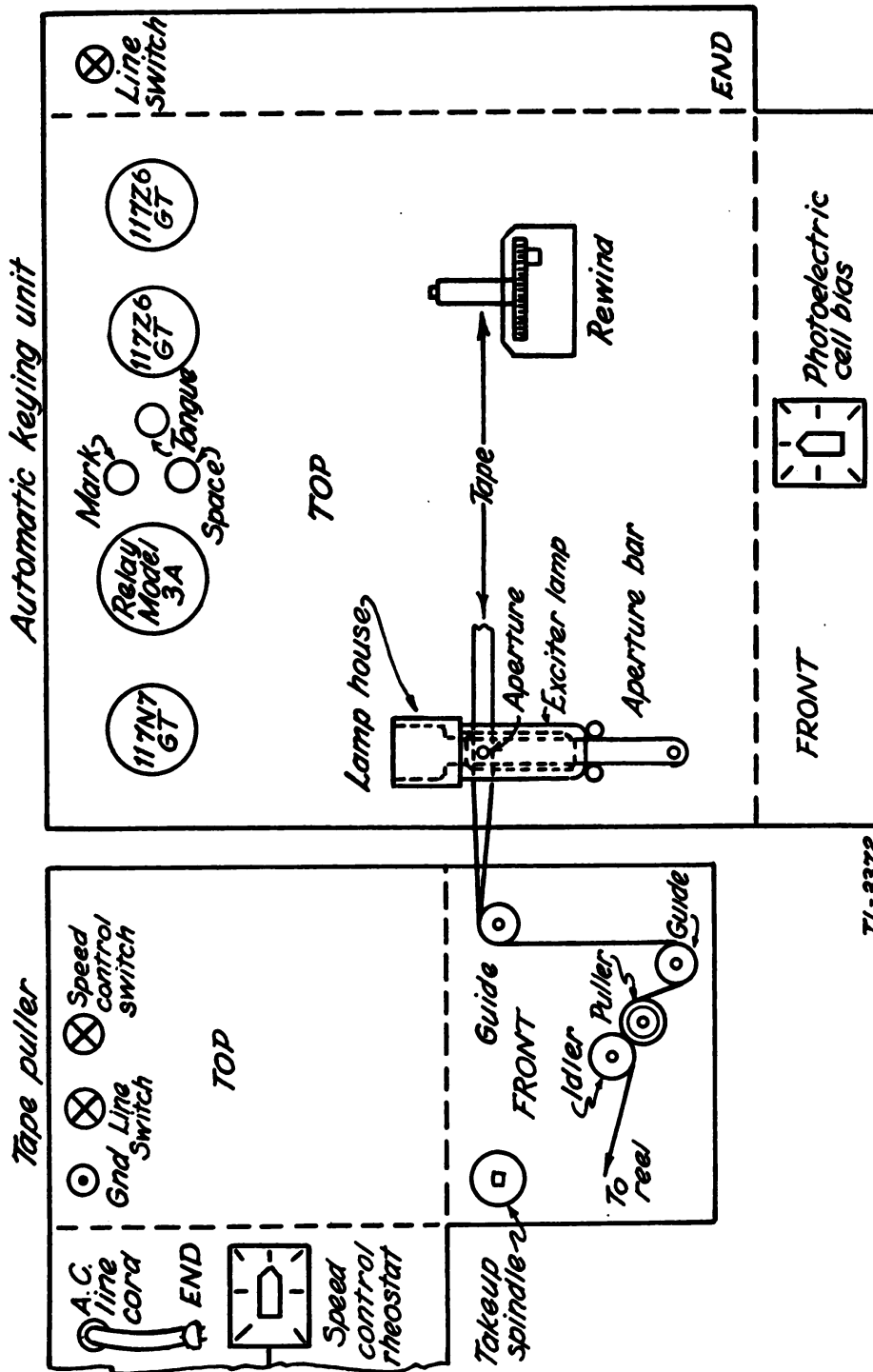


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FIGURE 21.—Adjustment of photoelectric cell aperture on McElroy automatic keyer.

opposite the top inked line where a dot or dash is made. As the tape is drawn over the aperture the light from the exciter lamp is interrupted by the inked dots and dashes. Lower the lamp house into position. Thread the tape around the guide and puller, then onto the take-up reel as shown in figure 22. This tape path gives the best pulling action. No other should be used.

*b. Controls.*—(1) *Keying unit line switch.*—The automatic keying unit is turned on by an upward movement of the toggle switch located near the rear on the right end of the chassis. Operation of this switch turns on the exciter lamp located in the lamp house and supplies power to all vacuum tubes in the unit. This switch should be operated 20 to 30 seconds prior to initiating complete operation of the unit so as to permit tubes therein to warm up.



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FIGURE 22.—Controls of McElroy model G-818 automatic keyer.

(2) *Tape puller line switch.*—The tape puller motor is started by a rearward movement of the toggle switch next to the ground binding post of the tape puller. When starting, the speed control toggle



switch should be in its forward position and the speed control rheostat located on the left end of the tape puller should be set at 5. After the motor has started, throw the speed control toggle switch to the rear and adjust the speed control rheostat for desired speed. A clockwise rotation of the speed control rheostat increases the motor speed. The tape puller motor should be operated for approximately 15 minutes prior to initiating complete operation of the unit so as to allow it to reach a constant speed. The motor should be operated for this period of time prior to insertion of the tape as indicated in *a* above. More constant speeds are obtained with the speed control toggle switch in its rear position. The switch is left in its forward position only for starting and for very high speeds.

(3) *Photoelectric cell bias.*—The knob control marked “photoelectric cell bias” in figure 22 is adjusted to obtain clean keying. Initially set this control between 1 and 4. If the adjustment of the aperture as indicated in *a* above has been incorrectly made there will be no setting of this control which will result in proper keying. If this is the case recheck the aperture adjustment.

*c. Relay model 3A.*—The relay model 3A located at the rear of the keying unit should be adjusted only by experienced instrument repairmen. Under normal operating conditions it should require little attention. If clean keying does not result after proper adjustment of the aperture and photoelectric cell bias, the relay should be examined through its glass cover. If maladjustment is noted remove the relay from its plug-in socket and replace with a spare relay properly adjusted.

**29. Automatic keyer, Lon-Ga-Tone, type 7.**—The controls on the Lon-Ga-Tone automatic keyer, type 7, are located as shown in figure 23.

*a. Mounting practice tapes.*—Mount an empty 400-foot reel on the spindle indicated in figure 23. Mount the desired practice tape reel on the spindle of the rewind located on the right of the front panel. The rewind is hinged to the panel so that it can be moved away from the panel to facilitate the mounting of the reel. This reel is mounted so that the tape leaves the bottom of the reel, for example, so the inked side of the tape is upward. The tape is passed under the guide, through the track in the photoelectric cell house, between the idler and puller wheels, into a slot on the hub of the empty reel mounted as indicated above. To relieve the tension on the tape between the idler and puller wheel, pull out and upward on the knurled knob on the idler wheel shaft. This locks the idler wheel arm in a position that allows the tape to be pulled between the two

wheels for rewind purposes as well as for threading the tape between the wheels. To disengage the idler wheel arm from its raised position, push in on it, and the idler wheel will drop onto the tape into its pulling position.

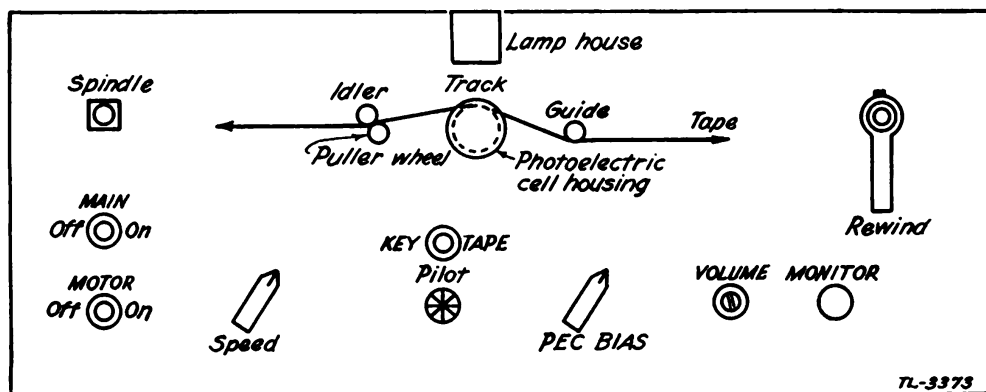


FIGURE 23.—Front-panel controls of Lon-Ga-Tone keyer.

*b. Controls.*—(1) *Main switch.*—The toggle switch marked MAIN controls the 110-volt 60-cycle supply. When the switch is thrown to the ON position, the pilot lamp, the exciter lamp in the lamp house, and all vacuum tubes are turned on.

(2) *Speed control.*—The control knob marked SPEED varies the speed of the tape puller, hence the speed of the tape passing the light beam. A clockwise rotation of the knob gives an increase in speed. The knob is turned so that it points to the letter “S” in the word INCREASE for starting speed. Immediately after the motor switch is turned to the ON position, and the tape reels have started, the speed control is adjusted for the desired keying speed. The puller will not properly start the reels at low tape speed.

(3) *Motor switch.*—The toggle switch marked MOTOR controls the 110-volt 60-cycle supply to the tape puller and take-up motors. This switch is not turned on until the speed control has been adjusted for starting as explained in (2) above.

(4) *Key-tape switch.*—For automatic keying from the tape, the toggle switch is thrown to TAPE position. For manual keying, the toggle switch is thrown to KEY position, and the key J-38 connected as explained in paragraph 22*b* (2) is used.

(5) *Monitor.*—The jack marked MONITOR is used for headset monitoring of the automatic or manual keying. A headset HS-4 with plug PL-48 is used. Plugging into the monitor jack does not affect the output of the automatic keyer.

(6) *Volume control.*—The screw driver control marked VOLUME controls the output level of the keyed tone. A clockwise rotation increases the tone level. Move this control to the left as far as possible, then move clockwise until the screw driver slot is vertical ( $\frac{1}{8}$  to  $\frac{1}{4}$  of a turn) and leave in this position for preliminary tests.

(7) *Photoelectric cell house aperture and PEC BIAS.*—Turn PEC BIAS knob so as to point toward the volume control. Pull the sliding barrel with knurled top outward as far as it will go, then push inward gradually until the small square aperture comes under the lower line of the inked tape as shown in figure 24. It is important to note that while the same practice tapes are used in both the McElroy and Lon-Ga-Tone keyers, the adjustments of the apertures are different. The McElroy unit keys on the *inked* sections of the tape; the Lon-Ga-Tone on the *uninked* sections. This adjust-

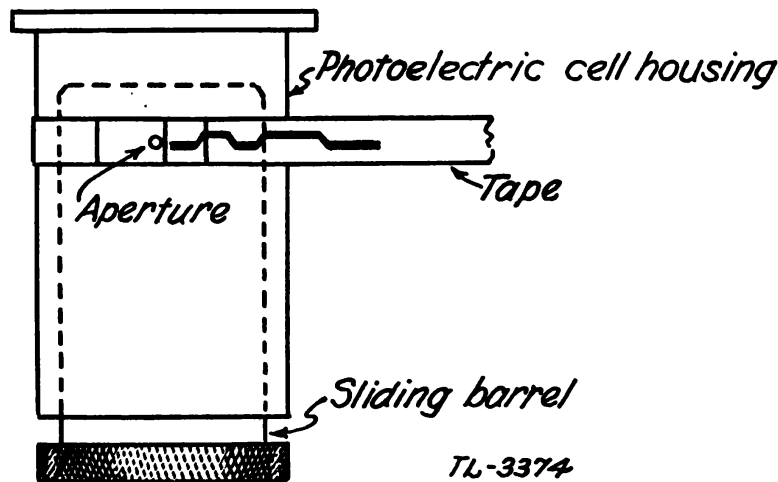


FIGURE 24.—Correct adjustment of tape in relation to aperture of Lon-Ga-Tone keyer.

ment is best accomplished by slipping the tape end to the right of the track and watching the inward motion of the aperture. After threading the tape, throw the main switch to the ON position and, after 30 seconds, the motor switch to the ON position. The PEC BIAS knob is slowly rotated counterclockwise until keying is heard in the monitoring head set. Slight adjustments of the sliding barrel and the PEC BIAS knob will give proper keying.

**30. Keyer TG-10-B.**—The general instructions given for the Lon-Ga-Tone unit apply also to the automatic keyer TG-10-B. To disengage the puller roller, when threading on a tape, push it to the right, and it will stay open. To reengage it, raise the puller idler and the assembly will snap back into position. Figure 25 shows a

general front view of the TG-10-B, with a tape in correct position. Of the front-panel controls, the tape speed, monitor, volume, and bias functions are exactly the same as in the Lon-Ga-Tone. However, the power control is different. This is a three-position rotary switch, with the positions marked OFF, KEY, and TAPE. In the first or OFF position, the entire apparatus is dead. In the second or KEY position, the oscillator-amplifier section is turned on, and the hand key controls the tone output; both the puller motor and the exciter lamp are inoperative. In the third or TAPE position, the motor and the lamp are turned on in addition to the oscillator-amplifier, and the unit then functions as a full automatic tape keyer. The numbers on the tape speed dial indicate the number of feet of tape per minute, not words per minute.

**31. Automatic keyer, McElroy model G-813, modified.—a. General.**—The adjustments and controls of this equipment are shown in figure 26. The model G-813, modified, closely resembles the model G-813 as described in paragraph 28. The identical tape mechanism is used on the keyer itself, and the tape puller differs only in that the auxiliary speed control switch found on the G-813 is not present. All instructions regarding the threading of the tape, the adjustment of the various guides and spindles, as given for the G-813, apply as well to the G-813 modified.

*b. Controls.*—(1) *Line switches.*—The line switch S1, which is mounted on the back of the keyer chassis, is left in the ON position, and the keyer circuits are controlled by switch S2 mounted on the case of the tape puller. As supplied by the manufacturer, the keyer and the tape puller are already wired together, and a single 110-volt plug provides power for both units.

(2) *Bias control.*—This is adjusted as described in paragraph 28b(3).

(3) *Tone frequency control.*—This is located on the back edge of the chassis. Adjust it for a pleasing signal, and then leave it alone.

(4) *Manual keying.*—Two binding posts for a manual key are provided on the back edge of the chassis. Normally, these are kept short-circuited by a brass strap, as there will be little occasion to hand-key the output of the instrument directly at the position at which it is mounted.

(5) *Monitoring.*—A monitoring jack is mounted under the binding posts on the right side of the chassis. A pair of phones can be plugged into it without affecting the keyed output.

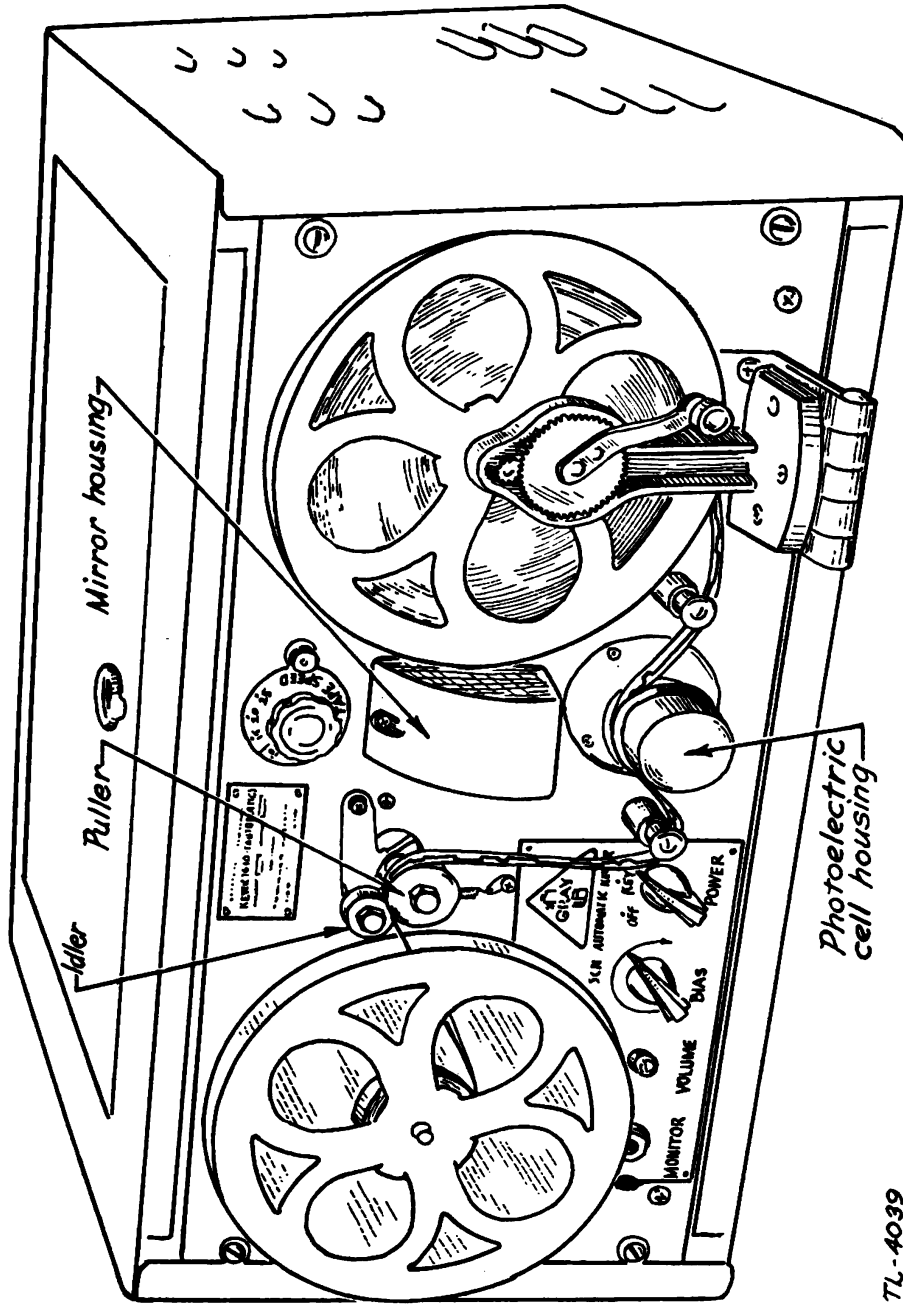
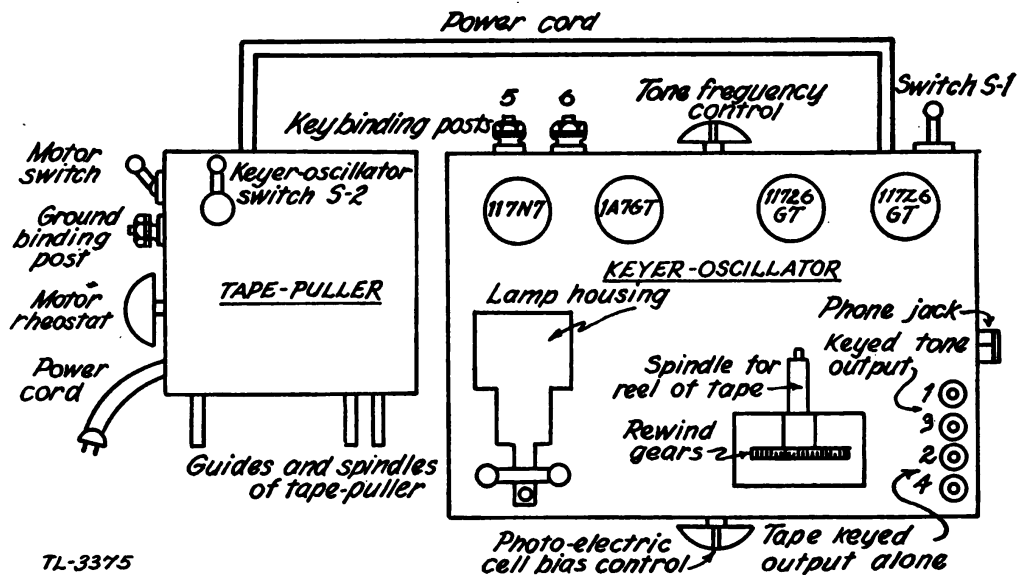


FIGURE 25.—Front view of keyer TG-10-B with tape in position.

TL-4039



TL-3375  
 FIGURE 26.—Arrangement of essential parts and controls of McElroy keyer, model G-813, modified.

(6) *Relay.*—The keying relay is mounted on the underside of the chassis. This is not adjustable, and is not likely to give trouble during the normal life of the equipment.

**32. Recorder, McElroy model RRD-900.**—Adjustments and controls on the recorder, McElroy model RRD-900, are located as shown in figure 27.

*a. Mounting blank tapes.*—Place a standard roll of 3/8-inch un-gummed tape on the tape plate so that the tape will feed to the left from the back of the tape plate. Thread the tape around the back of guide 1, the back of guide 2, the front of the tape roller, and the back of guide 3. Pull enough tape from the roll to reach the tape puller associated with the recorder. This tape puller should be so mounted that guide 3 is lined up vertically and horizontally with the top guide on the tape puller (see fig. 22). Rotate the tape a quarter turn so that the top side of the tape over the latter guide is that on which the stylus of the recorder operates. Thread the tape through the tape puller as shown in figure 22. It is inadvisable to use a take-up reel on the puller while a tape is being prepared, particularly so if the tape puller is mounted adjacent to the recorder. Ink is likely to smear on adjacent turns of tape. Furthermore, if the tape is taken up while recording, a rewind operation is required. A more suitable practice is to allow the inked tape to feed off the puller into a waste basket or other receptacle on the floor, and if required, to rewind the tape therefrom upon completion of a record-

ing. A rewind of a student transmission test tape is seldom required as this short tape may be fed directly into an automatic keying unit.

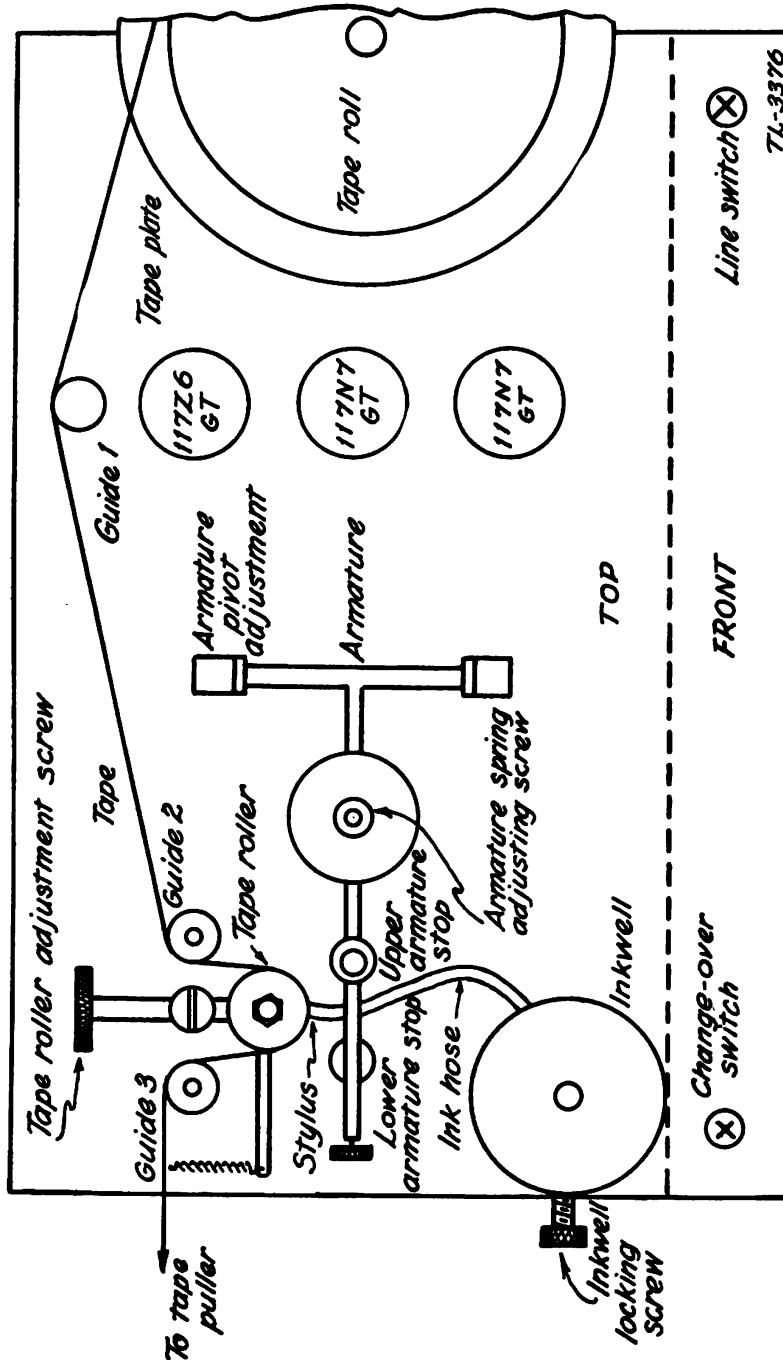


FIGURE 27.—Controls and adjustment on McElroy recorder.

b. Recorder controls.—(1) Line switch.—An upward movement of the toggle switch located on the right front of the chassis supplies power to the recorder. The filaments of the vacuum tubes therein

should light. A flash may be observed within these tubes which is characteristic of the tubes employed. Allow 30 seconds for warming up of tubes prior to initiating operation of the recorder.

(2) *Change-over switch.*—A change-over switch, located on the left front of the chassis, controls the input to the armature coil of the recorder mechanism. Since use of the local keying posts on the rear of the chassis is not recommended, this switch may be used as the off-on switch of the recorder output circuit. An upward movement connects the armature coil to the output of the recorder amplifier. When it is desired to keep the recorder warm but to maintain it in an inoperative condition, leave this switch in its down position.

*c. Ink supply.*—Loosen the inkwell locking screw and lower the inkwell to its lowest position. Remove the top of the inkwell and fill the well about three-fourths full with Higgins Eternal black ink, or equal. Replace the inkwell top.

*d. Adjustments.*—(1) *Lower armature stop.*—Turn the tape roller adjusting screw in a clockwise direction (when viewed from the front of the recorder) until the stylus just leaves the tape. Loosen the lock nut on the lower armature stop. Adjust the stop until the bottom of the stylus is about one-third way up the tape. Tighten the lock nut.

(2) *Upper armature stop.*—Loosen the lock nut on the upper armature stop. Adjust this stop until the travel of the armature between its upper and lower stops is  $\frac{1}{8}$  inch. Tighten the lock nut.

(3) *Armature spring tension.*—Loosen the lock nut on the armature spring adjusting screw. Adjust this screw until the armature is firmly held against the lower armature stop by the tension in the armature spring. Tighten the lock nut. This adjustment is not critical but may require readjustment after operation of the recorder is initiated in order to effect clean keying.

(4) *Ink adjustment.*—Rotate the tape roller adjusting screw in a counterclockwise direction (when viewed from the front of the unit) until the tape just makes contact with the stylus. Loosen the inkwell locking screw and raise the inkwell until the level of the ink therein is about 1 inch above the stylus. Tighten the locking screw. Pull the tape by hand slowly by the stylus. A solid black line should be recorded about one-third of the way up the tape. If this line is not smooth and solid, move the tape roller adjusting screw in a counterclockwise direction so as to increase slightly the pressure between the stylus and the tape roller. If no line is recorded, the stylus may be clogged. If this is the case, lower the ink-



well and remove the ink hose from the stylus. By means of the tape roller adjusting screw, move the tape roller away from the stylus. Insert a fine wire in the ink hose end of the stylus and remove any obstructions therefrom. Replace the ink hose, raise the inkwell to the proper level, and readjust the tape roller against the stylus by means of the tape roller adjusting screw.

**33. Record player, Columbia model P.**—The control marked **VOLUME** should be turned completely to the left prior to plugging the input power cord into a 110-volt 60-cycle outlet. The desired disk record is placed on the turntable, and the 110-volt 60-cycle supply is turned on by turning the knob marked **VOLUME** to the right. The initial movement operates a switch in the 110-volt 60-cycle supply; the remainder of the clockwise rotation increases the speaker volume. The needle held in the pick-up head is lowered gently into the outermost groove in the record. The tone control is adjusted for the reproduction quality desired. When the tone control is turned to the left, bass is accentuated; when turned to the right, treble is accentuated. For use in a large room the speaker compartment is removed by sliding it to the left so as to disengage the hinges. A hook is provided on the speaker compartment for use in hanging the speaker on a wall. The wall gives baffle effect to the speaker, resulting in better tone reproduction and sound direction for large rooms.

**34. Switchboard BD-57-A.**—*a. General.*—Figure 28 shows the jack field and the cords of the switchboard BD-57-A. The red cords indicated thereon are the auxiliary tone cords which furnish the keyed tone output of the automatic keyers for use at the switchboard. The black cords are student cords and hang directly under the student jacks with which they are associated. They are used for interconnecting student positions for various purposes. The white cord is the instructor's cord and is used for monitoring transmissions or for manually keying to students from the switchboard BD-57-A. This switchboard permits the establishment of circuits to its student positions so as to furnish groups of students with the following instruction:

(1) Practice transmissions by each student which are monitored only by that student.

(2) Grouping of all or several of the students into a net so that a transmission by any one of the students is received by all students in the group. This is subsequently referred to as net operation.

(3) Grouping of all or several of the students so as to receive keyed tone from any one of five automatic keyers.

(4) Grouping all or several of the students so as to receive signals from a radio receiver or from the automatic keyer associated with a recorder on the transmission test table.

*b. Individual student keying.*—When constant tone is supplied to the switchboard BD-57-A and none of the plugs is inserted into any jack, every student connected to the switchboard receives constant tone as long as his key J-38 is closed. Opening the switch on his key permits any student to key this tone and to monitor his transmission independently of any other student.

*c. Net operation.*—Assume that it is desired to interconnect the student at position No. 1 with the student at position No. 5 in order that each may transmit to the other. Insert the plug associated

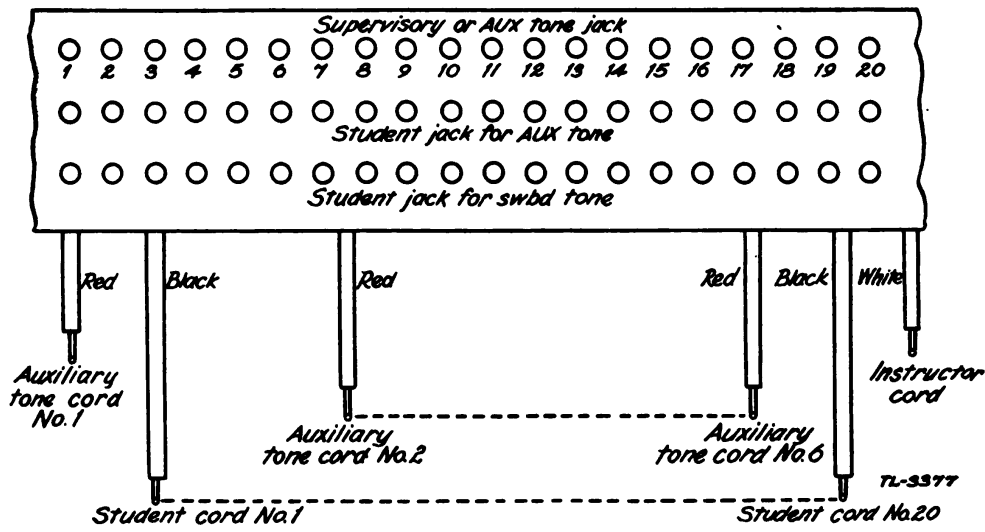


FIGURE 28.—Jack and cord arrangement of switchboard BD-57-A.

with student position No. 1 into jack No. 5 of the row of jacks marked **STUDENT JACK FOR SWBD TONE**. Insert the plug associated with student position No. 5 into jack No. 1 on the row of jacks marked **STUDENT JACK FOR SWBD TONE**. The students at positions Nos. 1 and 5 are now connected in series and either may transmit to the other as long as the other's key is closed. Such a transmission is interrupted when the receiving student opens his key. Assume that it is desired to interconnect all students for net operation. Insert the plug associated with student position No. 1 into jack No. 2 of the row of jacks marked **STUDENT JACK FOR SWBD TONE**. Insert the plug associated with student position No. 2 into jack No. 3 of the row of jacks marked **STUDENT JACK FOR SWBD TONE**. Proceed in a similar manner until the plug

associated with student position No. 19 has been inserted in jack No. 20 of the row of jacks marked STUDENT JACK FOR SWBD TONE. Insert the plug associated with student position No. 20 into jack No. 1 on the row of jacks marked STUDENT JACK FOR SWBD TONE. All students are now connected in series and as long as the keys of all other positions are closed, any student may transmit to all others. If any other key is open, the transmission is interrupted.

*d. Reception of automatically keyed tone.*—Assume that it is desired to furnish the student at position No. 1 with keyed tone from the automatic keyer No. 2 which is associated with the auxiliary tone cord No. 2. Insert the student cord associated with position No. 1 into jack No. 1 on the row of jacks marked STUDENT JACK FOR AUX TONE. Insert auxiliary tone cord No. 2 into jack No. 1 on the row of jacks marked SUPERVISORY OR AUX TONE JACK. The student at position No. 1 will now receive the keyed tone output of automatic keyer No. 2. Assume that it is desired to connect the students at positions Nos. 1 and 5 on the keyed tone output of automatic keyer No. 2. Insert the plug associated with student position No. 1 into jack No. 5 on the row of jacks marked STUDENT JACK FOR AUX TONE. Insert the plug associated with student position No. 5 in jack No. 1 of the row of jacks marked STUDENT JACK FOR AUX TONE. Insert the auxiliary tone cord No. 2 into jack No. 1 or No. 5 on the row of jacks marked SUPERVISORY OR AUX TONE JACK. The students at positions Nos. 1 and 5 may be connected as indicated above, while other students remain interconnected as indicated in *c* above for practice transmissions. Assume that it is desired that all students receive the keyed tone output of automatic keyer No. 3. Insert the plug associated with student position No. 1 into jack No. 2 on the row of jacks marked STUDENT JACK FOR AUX TONE. Insert the plug associated with student position No. 2 into jack No. 3 on the row of jacks marked STUDENT JACK FOR AUX TONE. Proceed in a similar manner until the plug associated with student position No. 19 is inserted in jack No. 20 on the row of jacks marked STUDENT JACK FOR AUX TONE. Insert the plug associated with student position No. 20 into jack No. 1 on the row of jacks marked STUDENT JACK FOR AUX TONE. Plug the auxiliary tone cord No. 3 into any one of the jacks on the row of jacks marked SUPERVISORY OR AUX TONE JACK.

*e. Reception of other signals.*—Auxiliary cord No. 1 may be used

to introduce into the switchboard BD-57-A the output of a radio receiver or the keyed tone output of the automatic keying unit associated with the recorder on the transmission test table. When so used, circuits for receiving the output of these units are set up in a manner identical to that described in *d* above, except that auxiliary switchboard tone cord No. 1 is used.

*f. Monitoring operations.*—When it is desired to monitor the transmission on any student line, insert the instructor's white cord into the jack on the row of jacks marked SUPERVISORY OR AUX TONE JACK which is associated with the student's line. The signal which is present in the line actuates the headset HS-16 associated with the instructor's position at the switchboard BD-57-A. If several students are interconnected for the reception of a single transmission, a jack on the row of jacks marked SUPERVISORY OR AUX TONE JACK which is associated with any one of the student positions may be employed. When the instructor's cord is inserted in a jack, the switch on the key J-38 at the instructor's position should be closed.

*g. Panel controls.*—(1) *Potentiometer.*—Mounted at the right side of the front panel is a potentiometer by means of which the volume level of constant tone which is supplied to students for individual keying or for net operation may be adjusted.

(2) *Battery switch.*—With the equipment described herein the switch marked BATTERY is not used. Leave it in the OFF position.

(3) *Switchboard tone switch.*—The switch marked SWBD TONE as used with the equipment described herein is an off-on switch for the constant tone supplied to the switchboard. When rotated to the right (to AUX), constant tone is supplied to the switchboard from the external oscillator-amplifier. Rotation to the left (to GN-33) opens the constant tone circuit.

**35. Preliminary adjustment of tone level.**—*a. Using automatic keyer, McElroy model G-813.*—(1) Patch a circuit on a switchboard BD-57-A which will permit each student position connected thereto to receive the keyed tone output of automatic keyer No. 2 (see par. 34).

(2) Turn on the oscillator-amplifier ACA-10-AO. Set the control marked GAIN at 5 (see par. 27).

(3) Mount a practice tape on automatic keyer No. 2. Turn on the automatic keyer and adjust for clean keying (see par. 28).

(4) Note the keyed tone level at any one of the student positions.

Adjust the oscillator-amplifier low impedance output selector (fig. 20) by connecting successively to terminals 4, 8, 12, and 16 until a suitable level of keyed tone is noted in a student headset. A suitable level will be produced by an output of 3.5 to 7 volts, as measured at a student position with an output meter. The oscillator-amplifier has a rated audio output of 10 watts, which is more power than is needed for the largest contemplated school; therefore, the choice of terminals on the low impedance output selector will not be critical. The lowest impedance output that will give a comfortable signal under maximum load conditions is used. The 500-ohm termination on the oscillator-amplifier should never be used as it would give a voltage that would cause serious inductive trouble in adjacent circuits.

(5) Mount a blank tape on the recorder, McElroy model RRD-900. Adjust the recorder for proper operation (see par. 32).

(6) Operate the manual key at the transmission test table. The tone level adjustment effected in (4) above should be adequate to effect clean recording. If not, readjust the low impedance output selector on the oscillator-amplifier ACA-10-A0 until satisfactory recording is accomplished.

(7) With a permanent adjustment made as indicated above, adequate variation in tone levels to conform with major load variations is accomplished by means of the control marked GAIN on the oscillator-amplifier.

(8) With the tone level set as indicated above, variation in the level of constant tone supplied to students for individual keying or for net operation may be accomplished by means of the control marked POTENTIOMETER on the switchboard BD-57-A.

*b. Using automatic keyer, Lon-Ga-Tone, type 7.*—(1) Patch a circuit on a switchboard BD-57-A which arranges all student positions for net operation (see par. 34). Set the control marked POTENTIOMETER approximately at the center of its range. Turn the switch marked SWBD TONE to AUX.

(2) Turn on the oscillator-amplifier ACA-10-A0. Set the control marked GAIN at 5 (see par. 27).

(3) Operating a key at a student position, note the keyed tone level in the headset. Adjust the oscillator-amplifier low impedance output selector (fig. 20) by connecting successively to terminals 4, 8, 12, and 16 until a suitable level of keyed tone is noted (see *a*(4) above).

(4) Adjustment of the keyed tone output level from the Lon-Ga-Tone automatic keyers is accomplished individually on each

keyer. Utilizing the output terminals, adequate variation in output level for all major changes in load is accomplished on the control marked VOLUME.

*c. Using keyer TG-10-B.*—Same as for Lon-Ga-Tone, type 7.

*d. Using automatic keyer, McElroy model G-813, modified.*—This unit is employed in the same manner as the Lon-Ga-Tone. However, it contains no volume control of its own, and its full output is used at all times. This will cause no discomfort in the ears of students, as the actual output is very much lower than that of the Lon-Ga-Tone keyer or that of the ACA oscillator-amplifier when the latter is keyed by the G-813 keyer alone.

**36. Initiating complete operation.**—*a. Automatic keyers* (see fig. 9).—(1) Check to see that adjustments on all units have been made as previously indicated.

(2) Turn on all tape puller motors about 15 or 20 minutes prior to the hour at which instruction is to be initiated. A practice tape should be mounted on each Lon-Ga-Tone automatic keyer in order that a load be maintained on the take-up motor.

(3) Patch desired circuits on switchboards BD-57-A.

(4) About 5 minutes prior to the hour instruction is to be initiated, adjust the speed of each tape puller so that 12 feet of tape per minute pass the aperture, that is, the speed of the tape is 12 feet per minute. This is the tape speed which must be maintained in order to transmit the actual characters from all practice tapes at a speed of 20 words per minute. Tape speeds can be checked by counting the number of characters transmitted per minute and comparing the count with data as to the words-per-minute speed which are furnished with these tapes (see par. 10). A more accurate speed determination may be made by a speed measurement with a tachometer equipped with a calibrated wheel. If the latter instrument is not available a map measurer and a stop watch may be substituted.

(5) About 2 minutes prior to the hour instruction is to be initiated, shut off the tape puller motors and rewind all practice tapes used during the warm-up period. Remove the tape from all guides and from the puller wheel during this operation. Also remove the spring belt from the take-up spindle on the McElroy tape pullers.

(6) Mount the desired practice tape on each automatic keyer. Turn on the oscillator-amplifier and all keyers. Check the tape speed.

(7) After instruction is initiated, check tape speed at 5-minute intervals for the first 15 minutes and hourly thereafter.

(8) Each reel of practice tape is designed for about 1 hour of

transmission. When transmission from each tape is completed, rewind tapes as indicated in (3) above, and repeat operations (6) and (7).

*b. Transmission test table* (see fig. 10).—(1) Check that the adjustments on all units have been made as previously indicated.

(2) Turn on tape puller motors about 20 minutes prior to the hour at which recording is to be initiated. About 5 minutes prior to the hour at which recording is to take place, adjust the speed of the tape pullers as indicated in *a*(4) above.

(3) Turn on the line switches on the recorder and on the McElroy automatic keying unit. Shut off the tape pullers. Mount a blank tape and thread it through the recorder and onto the tape puller.

(4) To record a student's practice transmission, start the take puller and allow about 4 feet of tape to feed through the puller. This portion of the tape is used as a leader for subsequent play-back. The student's name and other pertinent data are written in pencil thereon. Throw the change-over switch on the recorder to its up position. If the Lon-Ga-Tone keyer is used, throw the KEY-TAPE switch to KEY. The student now operates the key J-38 and his transmission is recorded on the tape.

(5) While the student is still transmitting, the tape leader can be mounted in the automatic keyer without the use of any feed or take-up reels so that when his transmission is completed play-back may be initiated immediately. However, be sure first that the ink is thoroughly dry.

(6) Upon completion of a student's transmission, stop the tape puller, throw the recorder change-over switch to its off position, and cut the tape to the left of the tape puller. Start the tape puller on the automatic keyer and play back to the student his prepared tape.

(7) To prepare copies of the master tapes, mount the tape to be copied on the automatic keyer. Adjust the automatic keyer to a tape speed of 12 feet per minute. If the Long-Ga-Tone automatic keyer is used, throw the KEY-TAPE switch to TAPE. Start the recorder tape puller and allow about 4 feet of tape to feed through the puller. Throw the recorder change-over switch to its up position. The recorder will record the keyed tone received from the automatic keyer.

SECTION IV

FUNCTIONING OF CIRCUITS; MAINTENANCE AND REPAIR

	Paragraph
General .....	37
Automatic keyer, Lon-Ga-Tone, type 7.....	38
Keyer TG-10-B.....	39
Oscillator-amplifier ACA-10-AO.....	40
Automatic keyer, McElroy model G-813.....	41
Automatic keyer, McElroy model G-813 modified.....	42
Recorder, McElroy model RRD-900 or R-900.....	43
Tape puller, McElroy model CTP-1300 .....	44
Switchboard BD-57.....	45
Switchboard BD-57-A .....	46
Record player, Columbia model P.....	47

**37. General.**—The electrical circuits of the units of code practice equipment described in this manual are rather simple, and most of the individual parts are operated well below their rated maximums. Because of the number of moving parts, maintenance is more of a mechanical than an electrical problem. If the various chassis are kept clean, and the bearing surfaces of the rotating elements well-lubricated, the equipment will give long, trouble-free service. Any necessary repairs can be accomplished by a competent radio repairman.

**38. Automatic keyer, Lon-Ga-Tone, type 7.**—The circuit diagram is shown in figure 29, and the accompanying caption includes a detailed list of parts. The latter are standard radio replacement parts. The outside and inside appearance of the unit is shown in figures 30, 31, and 32. In these illustrations, the parts are numbered to correspond with the markings in the schematic diagram, figure 29.

- |  |  |
|--|--|
| V1..... Type 923 gas photoelectric cell. | R17..... 5,000-ohm resistor.                       |
| V2, V3... Type 6SJ7 tube.                | R18, R19... 1,000-ohm resistor.                    |
| V4, V5... Type 6N7 tube.                 | R20..... 1,000-ohm potentiometer.                  |
| V6, V7... Type 6V6 tube.                 | R21..... 300-ohm potentiometer.                    |
| V8..... Type 5Y4G tube.                  | C1..... Triple 8- $\mu$ f capacitor.               |
| R1..... 50-megohm resistor.              | C2..... 0.00025- $\mu$ f capacitor.                |
| R2..... 500,000-ohm resistor.            | C3..... 0.01- $\mu$ f capacitor.                   |
| R3..... 2-megohm resistor.               | C4..... 0.1- $\mu$ f capacitor.                    |
| R4..... 60,000-ohm resistor.             | C5..... 0.2- $\mu$ f capacitor.                    |
| R5..... 750-ohm resistor.                | C6, C7... 0.1- $\mu$ f capacitor.                  |
| R6, R7... 50,000-ohm resistor.           | S1, S2... D. P. S. T. switch.                      |
| R8..... 25,000-ohm potentiometer.        | S3..... S. P. D. T. switch.                        |
| R9..... 400-ohm resistor.                | T1..... Power transformer.                         |
| R10, R11... 50,000-ohm resistor.         | T2..... Output transformer.                        |
| R12..... 100,000-ohm resistor.           | L1..... 20-henry filter choke.                     |
| R13..... 5,000-ohm resistor.             | L2..... 200-mh choke.                              |
| R14..... 100,000-ohm resistor.           | Exciter lamp, double filament auto headlight bulb. |
| R15..... 200-ohm resistor.               | Pilot light, 6.3 volts.                            |
| R16..... 1,500-ohm resistor.             |  |



CODE PRACTICE EQUIPMENT

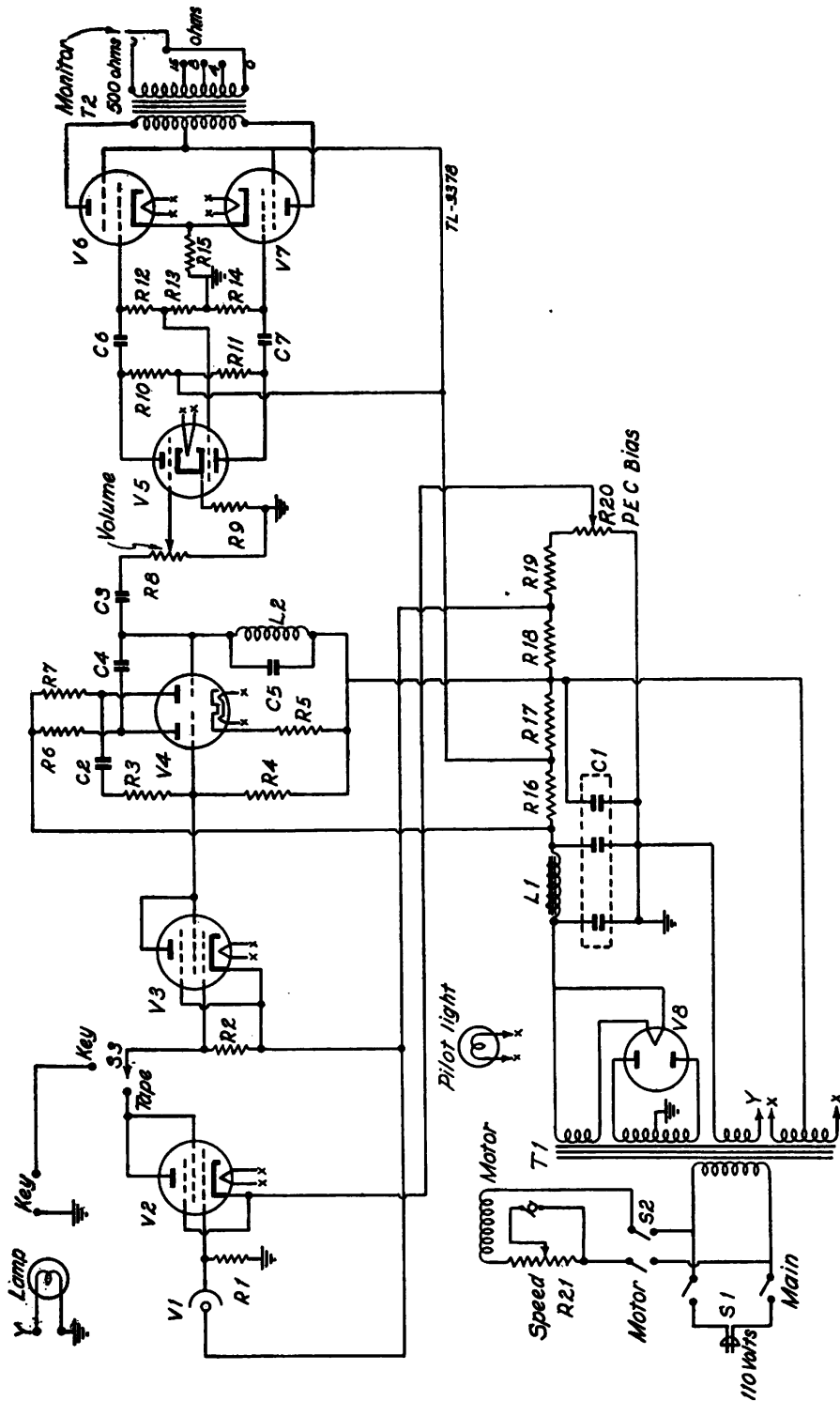


FIGURE 29.—Circuit diagram of Lon-Ga-Tone automatic keyer, type 7.

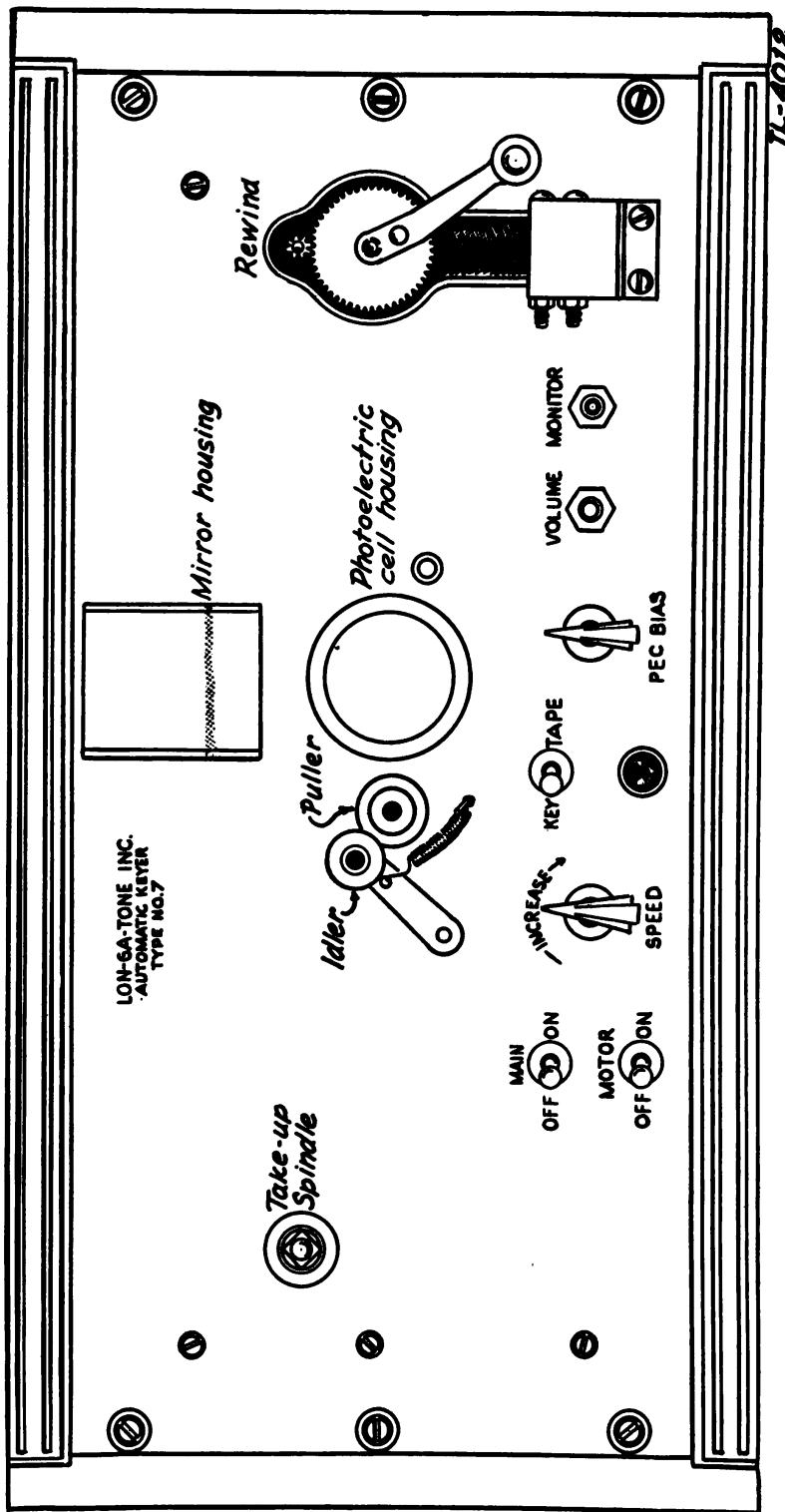


FIGURE 30.—Front panel view of Lon-Ga-Tone automatic keyer unit.

a. *Functioning of circuit.*—Tube V4 is a double triode functioning as the tone oscillator. The frequency of oscillation is determined by the constants of inductor L2 and capacitor C5, which are connected to the grid-cathode circuit of the right-hand section of V4. The plate of the right-hand section of V4 is connected to the grid of the left-hand section through capacitor C2 and resistor R3; the plate of the latter triode section is in turn connected back to the grid circuit of the right-hand section of V4 through the capacitor V4. Thus, in-phase feed

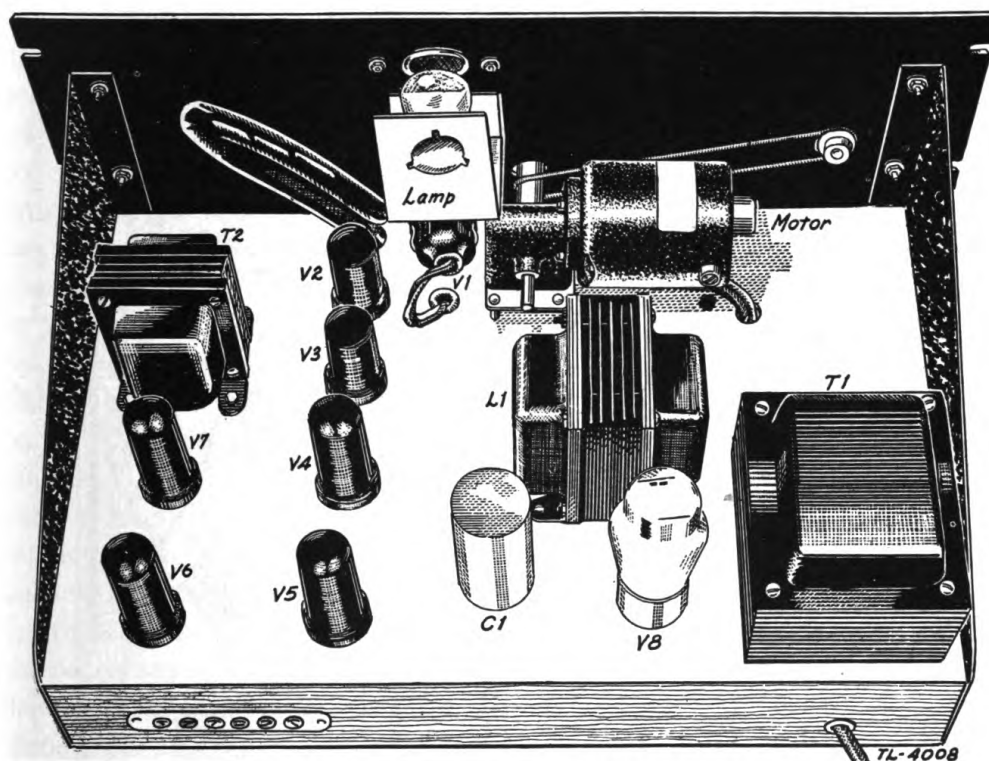


FIGURE 31.—Rear chassis view of Lon-Ga-Tone unit.

back of energy takes place from the left-hand section of the tube to the right-hand section, and oscillation in the L2-C5 circuit is maintained. The output of L2-C5, which is about 800 cycles, is amplified by a two-stage audio-frequency amplifier consisting of the upper half of the double triode V5 and the push-pull output stage using the tubes V6 and V7. The lower triode section of V5 acts as a phase inverter to produce the necessary 180° phase difference between the signals appearing on the grids of V6 and V7, through capacitors C6 and C7, respectively. Tubes V2 and V3 constitute a two-stage direct-coupled amplifier. The voltages applied to the elements of these tubes, and the bias on the photoelectric cell V1, are so adjusted that when no light is

shining into the photoelectric cell the effect of the direct connection of V3 to the left-hand grid of oscillator tube V4 is to block the latter tube completely, thus preventing the oscillator from functioning. This

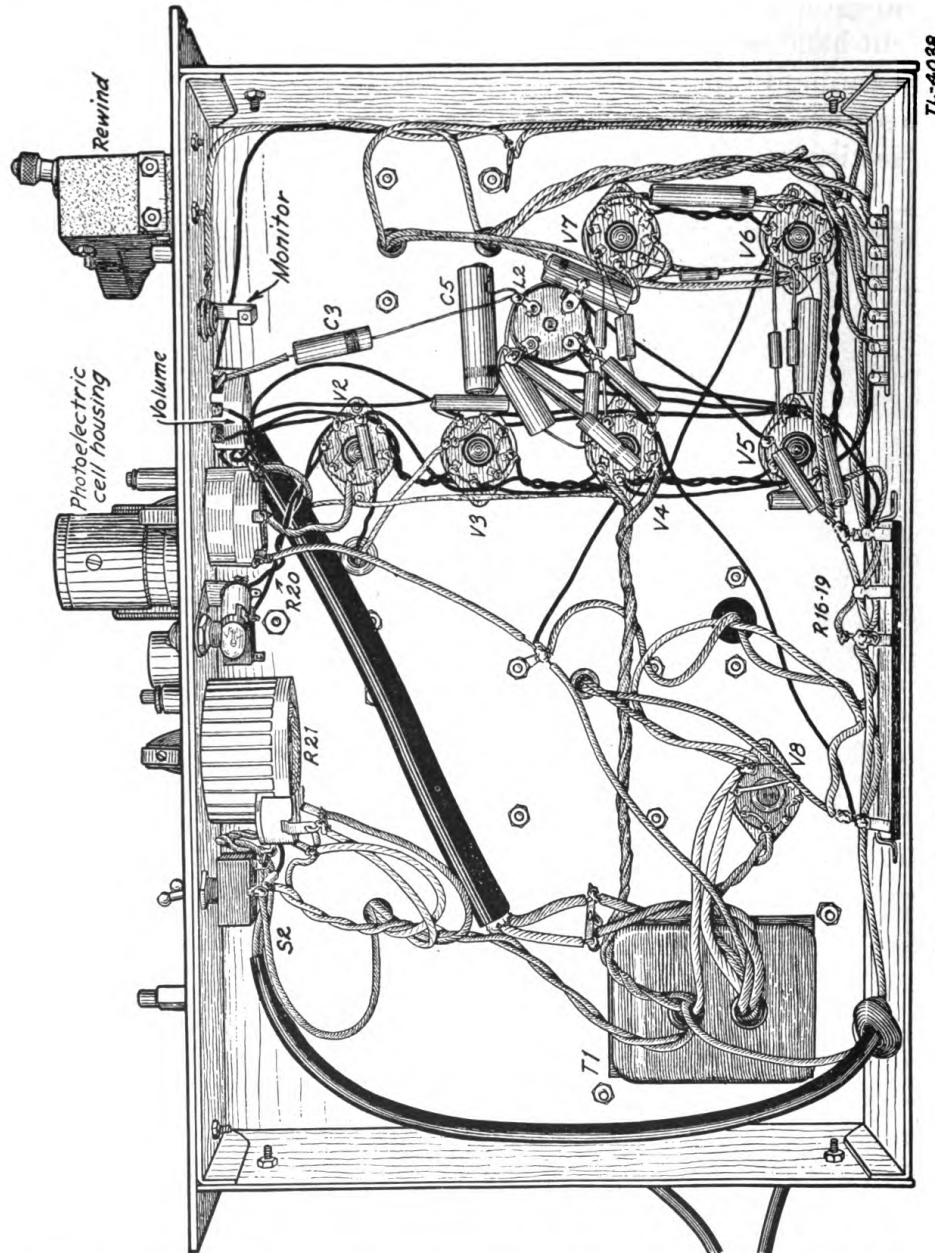


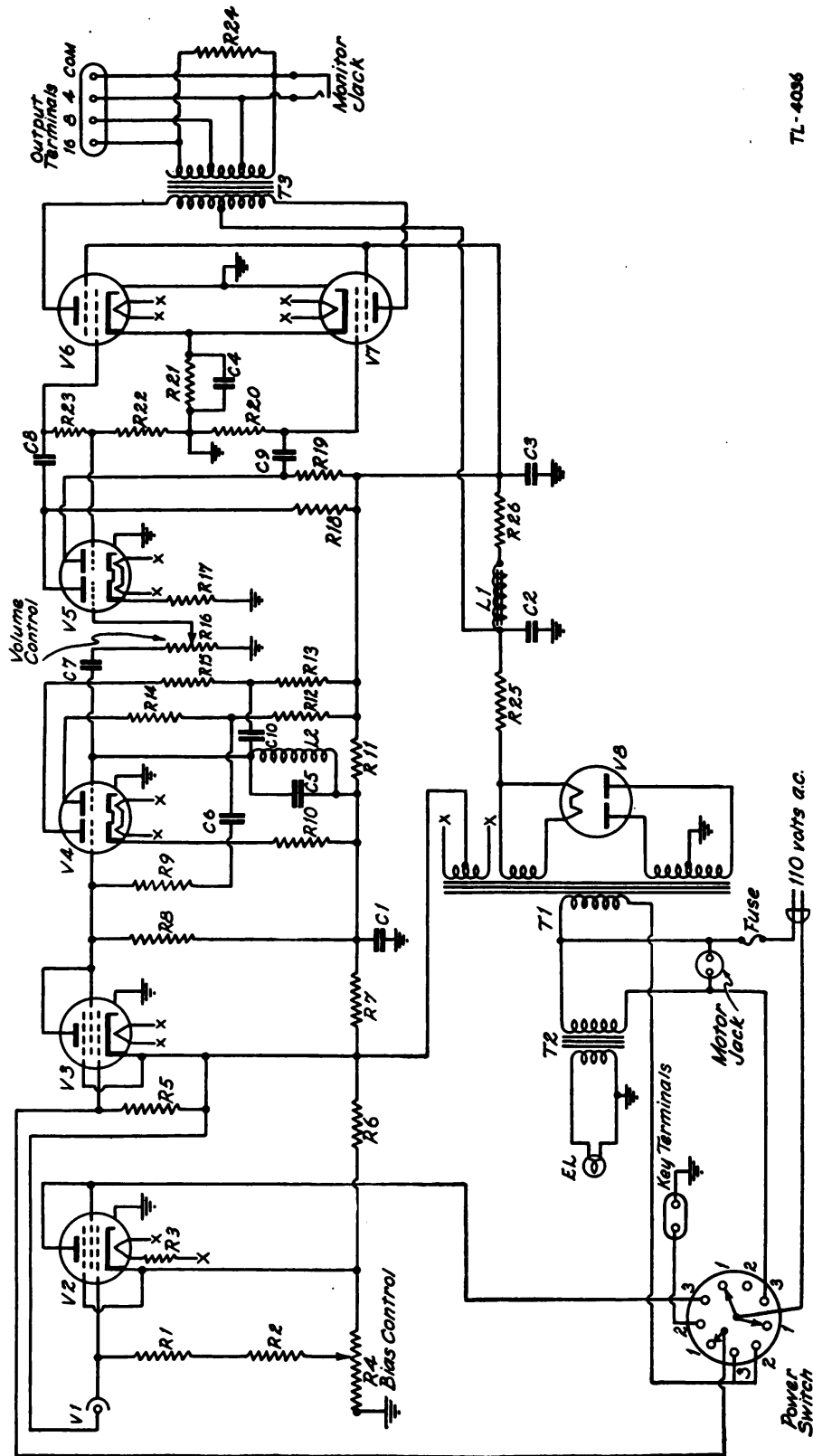
FIGURE 32.—Under view of chassis of Lon-Ga-Tone keyer.

condition exists when a practice tape is properly adjusted so that the bottom black line of the recorded transmission covers the photoelectric cell aperture, as illustrated in figure 24. When the tape is drawn through and light hits the photoelectric cell through an uninked section of tape, the photoelectric cell generates current and the previous

bias conditions are upset to the extent that the left-hand grid of V4 is no longer blocked. Therefore the tone oscillator functions, and a signal is heard in the connected output circuit. This form of electronic keying is very smooth and positive. Manual keying is accomplished by short-circuiting the control grid of V3 to ground. The power supply is entirely conventional, and comprises the transformer T1, the full-wave rectifier V8, the filter L1-C1, and the bleeder resistor network R16 to R20. The speed of the take-up motor is controlled by the potentiometer R21.

*b. Maintenance and repair.*—Clean the aperture in the sliding barrel in the photoelectric cell house thoroughly at least once a day. Dust collecting therein will materially interfere with proper keying. Wipe off the exciter lamp, its reflecting lens, and the exposed surfaces of the concentrating lens daily. About once a week remove the cover of the lamp house and clean the inner surfaces of the concentrating lens and the mirror. About once a week remove the photoelectric cell house by unscrewing the two screws which hold it to the chassis, and clean the envelope of the photoelectric cell which is exposed thereby. Once a week put 1 drop of light oil in oil ducts of the take-up motor and in the oil hole at the left end of the puller motor. If the exciter lamp burns out, replace with a 6-volt 32-32-candlepower No. 1000 automobile headlight bulb. To replace a burned out pilot lamp, remove the chassis from its cabinet, unscrew the pilot lamp from its socket and replace with a 6.3-volt 0.25-ampere miniature base lamp. Replace burned out vacuum tubes with the types indicated for each socket in figure 31. If copies of master practice tapes should tear, always make the necessary splice through a section of the *bottom* of the inked line, using glue, rubber cement, cellulose cement, etc. If the splice is made through a clear section, the double thickness of tape will be opaque enough to prevent light from shining through to the phototube.

**39. Keyer TG-10-B.**—The circuit diagram of this unit appears as figure 33. A back view of the chassis, with the parts marked to correspond with the wiring diagram, follows as figure 34.



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FIGURE 33.—Diagram of keyer TG-10-B.

V1	Type 923 gas photoelectric cell.....	
V2, V3	Type 6SJ7.....	
V4, V5	Type 6N7.....	
V6, V7	Type 6L6.....	
V8	Type 5U4G.....	
R1, R2	20-megohm, ½-w resistor.....	27350
R3	4.7-ohm, 1-w resistor.....	27358
R4	1,000-ohm potentiometer.....	27310
R5	270,000-ohm, ½-w resistor.....	27351
R6, R7	4,700-ohm, 2-w resistor.....	27357
R8	68,000-ohm, ½-w resistor.....	27352
R9	390,000-ohm, ½-w resistor.....	27353
R10	470-ohm, 1-w resistor.....	27359
R11	10,000-ohm, 10-w resistor.....	27363
R12, R13}	27,000-ohm, ½-w resistor.....	27364
R14, R15}		
R16	500,000-ohm potentiometer.....	27311
R17	1,500-ohm, 1-w resistor.....	27360
R18, R19	100,000-ohm, 1-w resistor.....	27356
R20	270,000-ohm, ½-w resistor.....	27351
R21	250-ohm, ½-w resistor.....	27355
R22	9,100-ohm, ½-w resistor.....	27355
R23	270,000-ohm, ½-w resistor.....	27351
R24	100-ohm, 10-w resistor.....	27362
R25	200-ohm, 10-w resistor.....	27364
R26	4,000-ohm, 10-w resistor.....	27365
C1, C2 } C3, C4 }	10-μf capacitor block.....	27304
C5		
C6	0.0005-μf capacitor.....	27300
C7	0.01-μf capacitor.....	27301
C8, C9	0.01-μf capacitor.....	27302
C10	0.1-μf capacitor.....	27303
T1	Power transformer.....	27117
T2	Exciter lamp filament transformer.....	27116
T3	Output transformer.....	27291
EL	Exciter lamp.....	27234
L1	Filter choke.....	27234

a. *Functioning of circuit.*—The circuit of the keyer TG-10-B is virtually the same as that of the Lon-Ga-Tone, type 7, and functions in the same manner. The only important difference is that the exciter lamp in the TG-10-B works off a separate filament lighting transformer. Also, the output tubes are of the 6L6 type, whereas the Lon-Ga-Tone uses the 6V6 type.

b. *Maintenance and repair.*—(1) *Lubrication.*—The worm reduction gear on the motor shaft runs in an oil bath and requires no additional lubrication. Since the speed of the other shafts is very low, they need little attention. A graphite grease is recommended for these bearings and also for the sliding bearings on the speed adjustment mechanism.

(2) *Rollers.*—To replace the rubber portion of the puller roller, remove the acorn nut on the front of the roller and take off the outer washer. Remove the old roller, slide on the new one, and replace the washer and the nut. To replace the drive roller, remove the old one by taking the spring belt from its driving puller and releasing the set

screw holding it to the puller shaft. The entire shaft can now be pulled forward. Roll off the old Neoprene ring and roll on the new one. In reassembling, be careful to set up the pulley to prevent excess end play of the puller shaft. The friction surface driving the take-up reel is identical with that used to drive the puller shaft. It can be rolled off its wheel and a new one rolled into place without otherwise disturbing the mechanism.

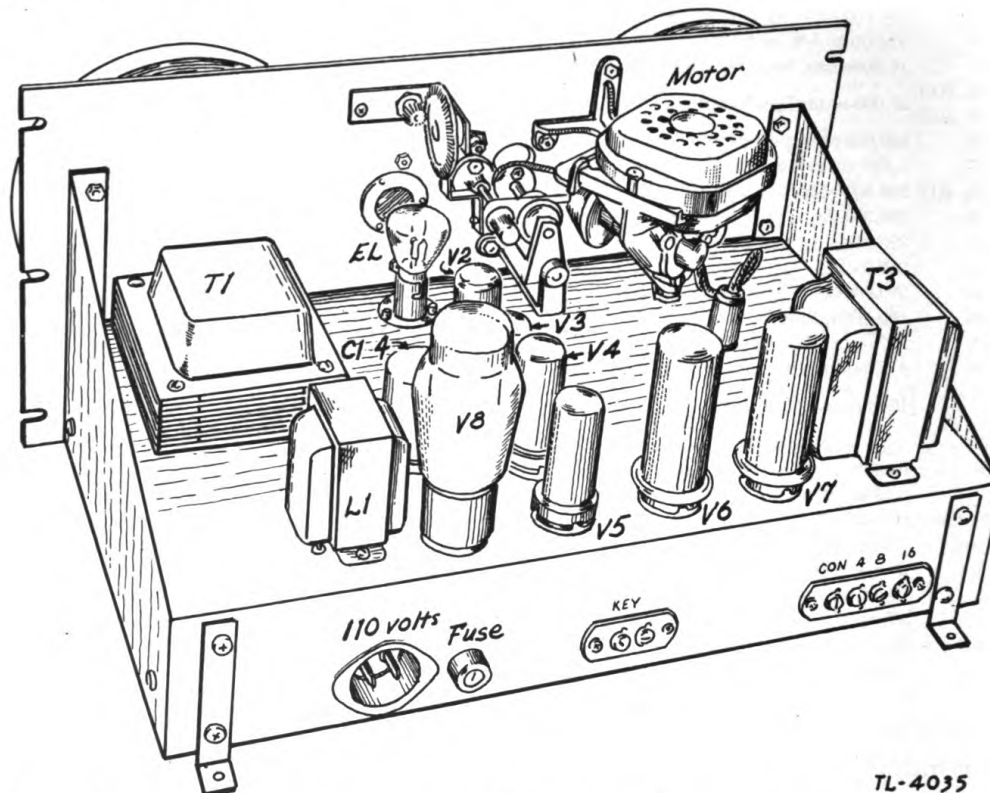


FIGURE 34.—Chassis view of keyer TG-10-B with parts marked to correspond with figure 33.

(3) *Exciter lamp*.—This is a standard six-volt double-filament 32-32 candlepower No. 1000 automobile headlight bulb. When one filament burns out, turn the bulb halfway around in its socket and use the other filament.

(4) *Fuse*.—The keyer is shipped with a fuse in place. This is a standard 3AG automotive fuse, rated at 3 amperes at 250 volts.



(5) *Transformers.*—The power and audio units used in the TG-10-B can be replaced by standard radio replacement parts as follows:

	<i>Thordarson</i>
Power transformer .....	T13R15.
Output transformer .....	T17S11.
Filament transformer .....	T19F98.
Oscillator coil .....	T18C92 (less core).
Filter choke .....	T57C52.

(6) *Voltage readings.*—The following table gives the normal voltage readings between the socket terminal numbers indicated, as measured with a 20,000-ohm-per-volt meter when the line voltage is approximately 115 volts:

Tube	Plate		Filament		Cathode		Screen		Switch position	
	Pins	Volts	Pins	Volts	Pins	Volts	Pins	Volts	Tape	Key
1.....	4-GD	87							x	x
2.....	8-5	26	2-7	4.9	5-GD	14			x	
	8-5	0								x
3.....	8-5	65	2-7	6.2	5-GD	70			x	
	8-5	19								x
4.....	8-3	66	2-7	6.2	8-1	140			x	
	8-3	132								x
	8-6	62							x	
	8-6	58								x
5.....	8-3	145	2-7	6.2	8-1	3.5			x	
	8-3	160								x
	8-6	150							x	
	8-6	162								x
6.....	8-3	370	2-7	6.2	8-1	20	8-4	240	x	x
7.....	8-3	370	2-7	6.2	8-1	20	8-4	240	x	x
8.....	{ Plate to Plate }	760AC	2-8	5.0					x	x

**40. Oscillator-amplifier ACA-10-AO.**—*a. Functioning of circuit.*—Electrically, this unit closely resembles the oscillator-amplifier section of the Lon-Ga-Tone automatic keyer. As shown in figure 35, V1 is the oscillator. Tubes V2, V3, and V4 comprise a two-stage amplifier, with one section of V2 functioning as a phase inverter. No provision is made for internal keying. In installations in which this

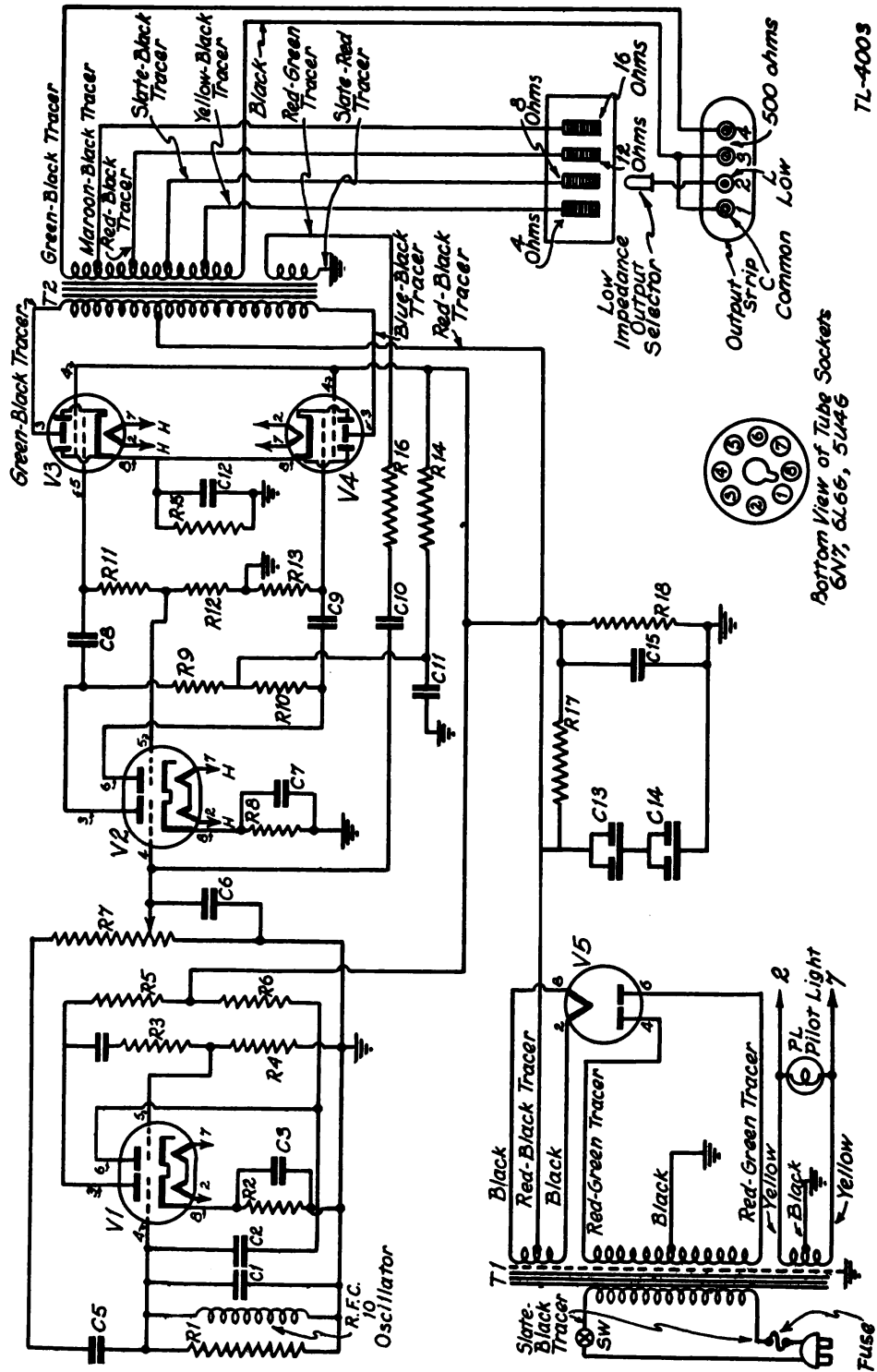


FIGURE 35.—Circuit of ACA amplifier-oscillator.

7L-4003

V1, V2.....	Type 6N7 tube.	R7.....	½-megohm potentiometer.
V3, V4.....	Type 6L6G tube.	R8.....	3,000-ohm, ½-w resistor.
V5.....	Type 5U4G tube.	R9, R10.....	50,000-ohm, ½-w resistor.
C1, C2.....	0.1-μf, 400-v capacitor.	R11.....	100,000-ohm, ½-w resistor.
C3.....	10-10-10μf, 250-v capacitor.	R12.....	6,000-ohm, ½-w resistor.
C4.....	0.1-μf, 400-v capacitor.	R13.....	100,000-ohm, ½-w resistor.
C5.....	0.01-μf, 400-v capacitor.	R14.....	50,000-ohm- ½-w resistor.
C6.....	0.001-μf, 400-v capacitor.	R15.....	250-ohm, 10-w resistor.
C7.....	10-10-10-μf, 400-v capacitor.	R16.....	¼-megohm, ½-w resistor.
C8, C9.....	0.1-μf, 400-v capacitor.	R17.....	5,000-ohm, 10-w resistor.
C10.....	0.0005-μf, 400-v capacitor.	R18.....	25,000-ohm, 20-w resistor.
C11.....	10-10-10-μf, 450-v capacitor.	SW-S. P. S. T.	On-off switch.
C12.....	10-10-10-μf, 450-v capacitor.	FP.....	3 ampere, 250-volt fuse.
C13, C14, C15.....	10-10-μf, 450-v capacitor.	T1.....	Power transformer, manufacturer's type No. L6PT34AO.
R1.....	50,000-ohm, ½-w resistor.	T2.....	Output transformer, manufacturer's type No. L6OT34AO.
R2.....	1,000-ohm, ½-w resistor.	PL.....	6.3-v, ¼-ampere pilot light, miniature screw base.
R3.....	½-megohm, ½-w resistor.	RFC 10.....	Oscillator inductor.
R4.....	6,000 plus 1,000 (7,000)-ohm, ½-w resistor.		
R5, R6.....	50,000-ohm, ½-w resistor.		

oscillator-amplifier is used, keying is performed automatically by a separate McElroy keyer, model G-813, or manually by students.

*b. Maintenance and repair.*—If excessive hum is present in the output circuit, it indicates an unbalance in the output tubes V3 and V4. One or both tubes should be replaced. When the set is turned on, if the pilot lamp does not light, examine the red screw fuse located on the rear of the chassis. Replace with standard 3-ampere fuse if burned out. If not, unscrew the ruby reflector and replace the pilot lamp with

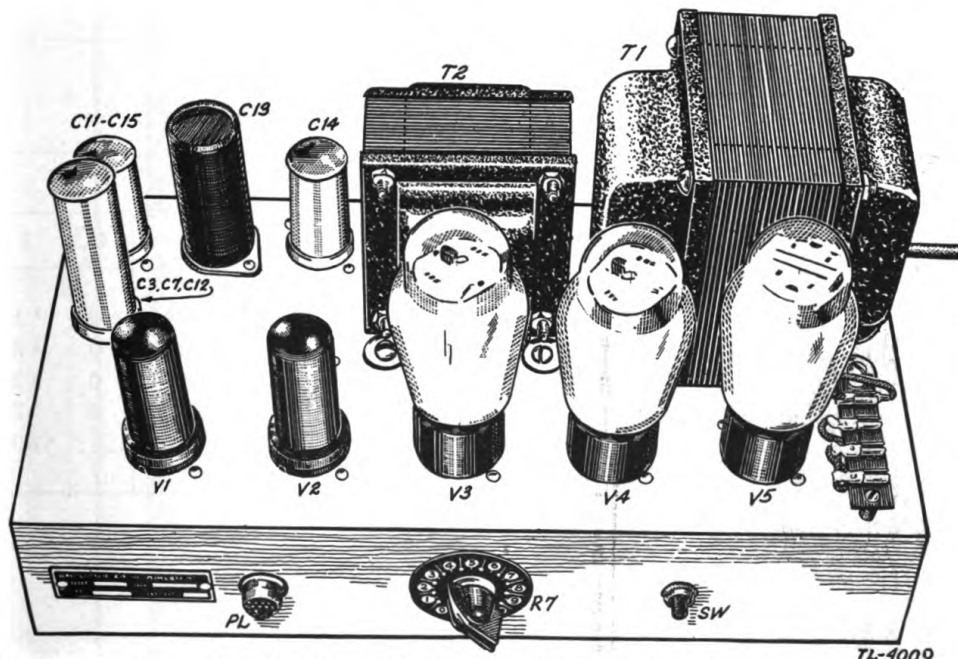


FIGURE 36.—Front view of ACA oscillator-amplifier, with protective screen cover removed to show placement of parts.

a 6.3-volt, 0.25-ampere miniature base lamp. If the oscillations stop, examine the tubes for burned out filaments. Replace tube, if necessary, with the type tube indicated on the socket. A general front view of the oscillator-amplifier chassis is shown in figure 36 and an under view of the chassis in figure 37.

c. *Resistance and voltage chart.*—The following resistance and voltage chart will be of assistance to the radio repairman in tracing troubles that develop in the ACA oscillator-amplifier:

RESISTANCE AND VOLTAGE CHART

Measure direct voltage with 1,000 ohms per volt meter.

Measure alternating voltage with 1,000 ohms per volt meter.

Measure resistance with 0-50,000 and 0-5 megohm ohmmeter ranges (tubes removed).

DIRECT VOLTAGE (measured from ground)\*

Tube No.	Tube type	Prong terminals							
		1	2	3	4	5	6	7	8
V1-----	6N7	0	-----	<sup>3</sup> 190	-----	-----	<sup>3</sup> 180	-----	<sup>4</sup> 4
V2-----	6N7	0	-----	<sup>3</sup> 160	-----	-----	<sup>3</sup> 160	-----	<sup>4</sup> 4
V3-----	6L6G	0	-----	<sup>2</sup> 420	<sup>2</sup> 300	-----	-----	-----	<sup>4</sup> 23.5
V4-----	6L6G	0	-----	<sup>2</sup> 420	<sup>2</sup> 300	-----	-----	-----	<sup>4</sup> 23.5
V5-----	5U4G	0	<sup>2</sup> 420	-----	<sup>1</sup> 360	-----	<sup>1</sup> 360	-----	<sup>2</sup> 420

\*Measured with all controls set at zero.

RESISTANCE (measured from ground)\*\*

Tube No.	Tube type	Prong terminals							
		1	2	3	4	5	6	7	8
V1-----	6N7	0	0	<sup>6</sup> 80M	<sup>5</sup> 7M	<sup>5</sup> 350	<sup>6</sup> 80M	0	<sup>5</sup> 1M
V2-----	6N7	0	0	<sup>6</sup> 150M	<sup>5</sup> 6M	<sup>6</sup> 500M	<sup>6</sup> 150M	0	<sup>5</sup> 3M
V3-----	6L6G	0	0	<sup>6</sup> 30M	<sup>6</sup> 25M	<sup>6</sup> 106M	-----	0	<sup>5</sup> 250
V4-----	6L6G	0	0	<sup>6</sup> 30M	<sup>6</sup> 25M	<sup>6</sup> 100M	-----	0	<sup>5</sup> 250
V5-----	5U4G	0	<sup>6</sup> 30M	-----	<sup>5</sup> 70	-----	<sup>5</sup> 75	-----	<sup>6</sup> 30M

\*\*Measured with all controls on full.

NOTE.—±10 per cent tolerances in all readings are permissible.

<sup>1</sup> 750-volt a-c scale.

<sup>4</sup> 30-volt d-c scale.

<sup>2</sup> 750-volt d-c scale.

<sup>6</sup> 0-50,000-ohm scale.

<sup>3</sup> 300-volt d-c scale.

<sup>6</sup> 0-5-megohm scale.

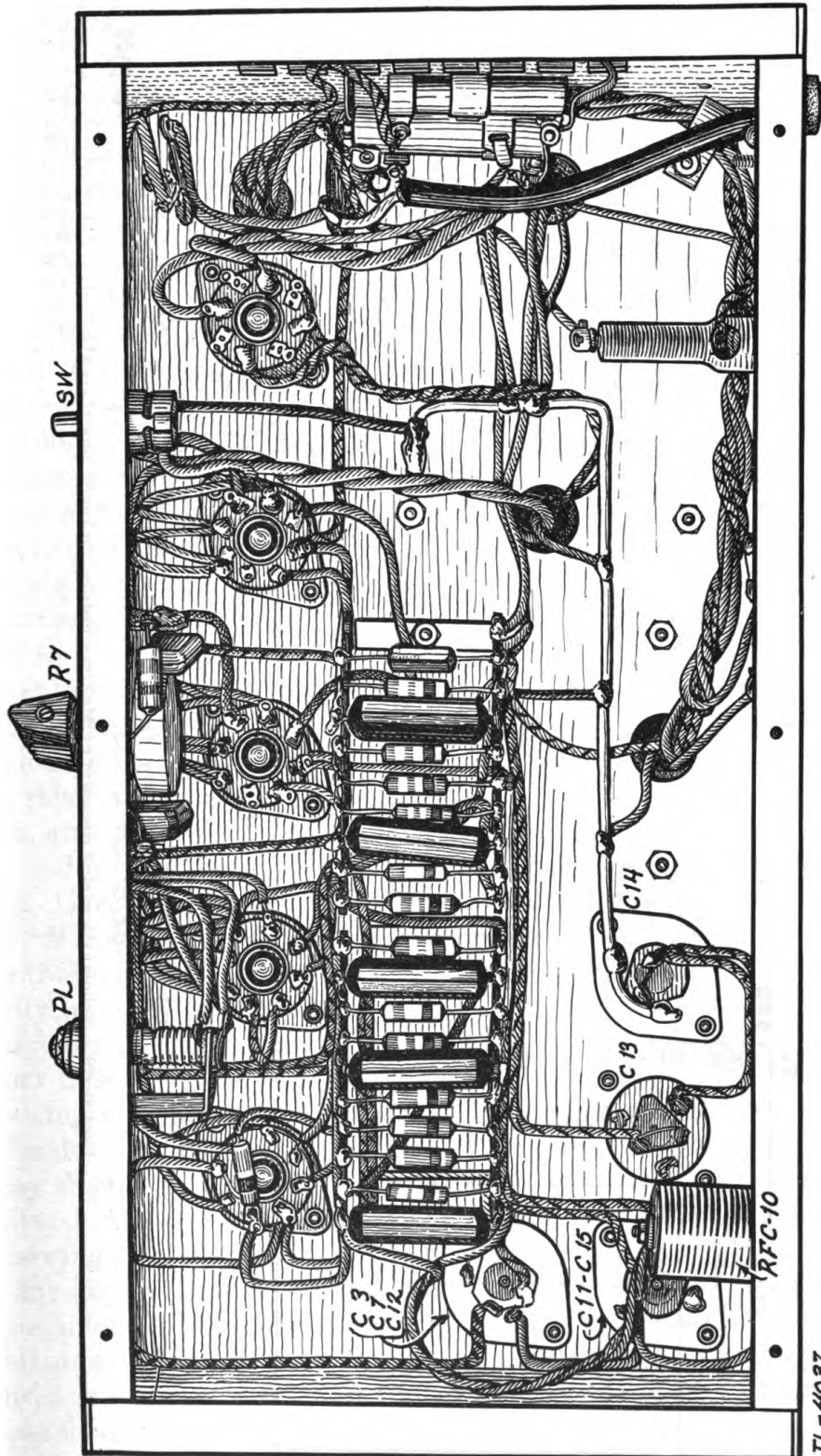
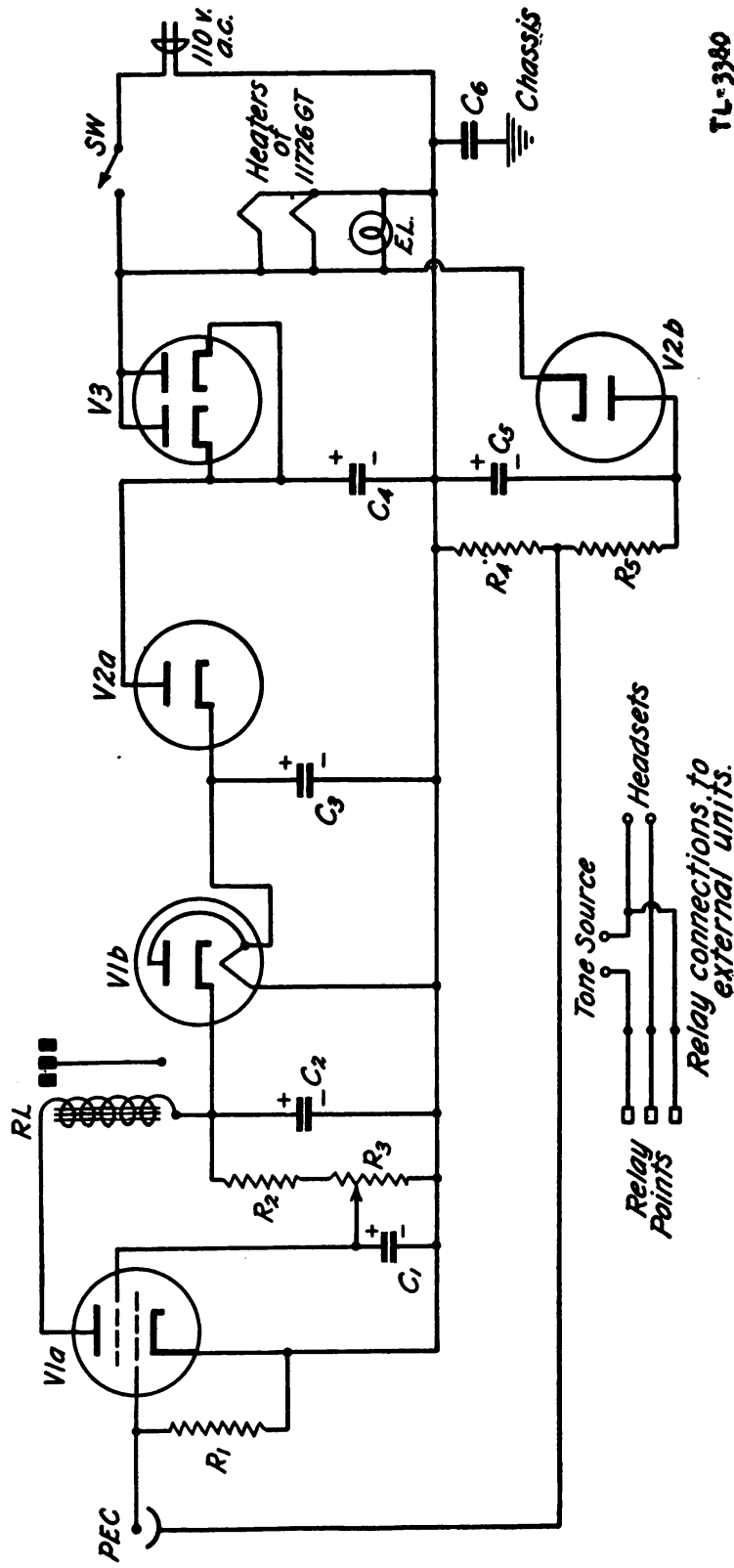


FIGURE 37.—Under view of chassis of the ACA oscillator-amplifier.

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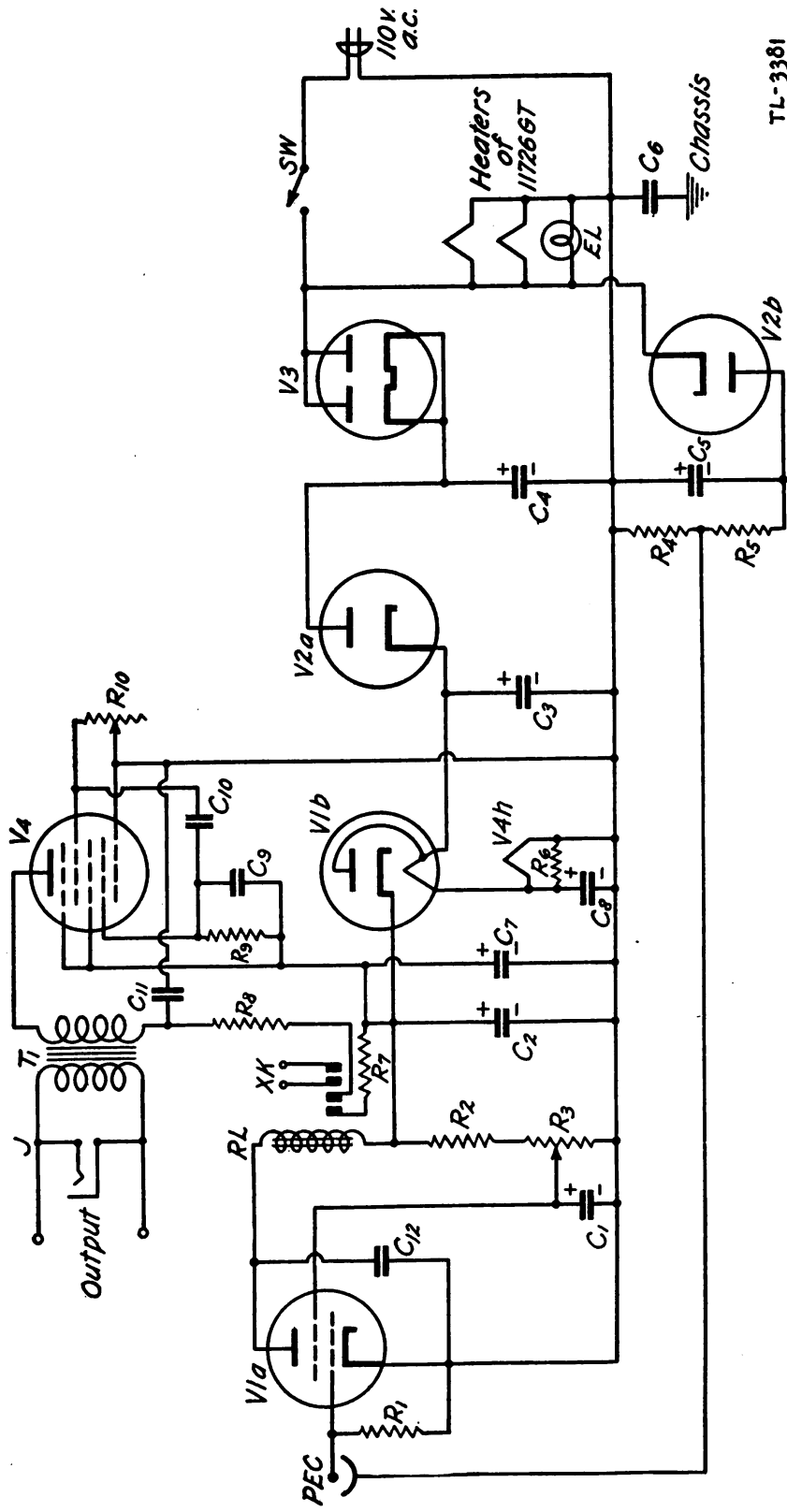
FIGURE 38.—Schematic wiring diagram of McElroy automatic keyer, model G-813.

## CODE PRACTICE EQUIPMENT

V1.....	Type 117N7GT tube.
V2, V3.....	Type 117Z6GT tube.
R1.....	40-megohm, 1-w resistor.
R2.....	35,000-ohm, ½-w resistor.
R3.....	0.1-megohm potentiometer.
R4.....	35,000-ohm, ½-w resistor.
R5.....	20,000-ohm, ½-w resistor.
C1, C2.....	}10-μf, 200-v capacitor.
C3, C4.....	
C5.....	20-μf, 200-v capacitor.
C6.....	0.05-μf, 200-v capacitor.
PEC.....	Type 923 gas photoelectric cell.
RL.....	Relay, Sigma No. 3A.
EL.....	Exciter lamp, 15-watt, 120-volt, intermediate base.
SW.....	Line switch.

**41. Automatic keyer, McElroy model G-813.**—*a. Functioning of circuit.*—The electrical circuit of this keyer is shown in figure 38. Although the unit actually employs only three tubes, these are of the multielement type, and the individual sections are separated in the diagram for the sake of clarity. V1, a type 117N7GT, which consists of a tetrode and a diode in the same envelope, is split up as V1a for the tetrode and V1b for the diode. Note especially that the plate of V1b is *internally* connected to one side of the heater. V2 and V3 are 117Z6GT full-wave rectifiers. The sections of V2 are used separately (as indicated by V2a and V2b, while the sections of V3 are paralleled to form a single half-wave rectifier element. The tetrode V1a acts as a single high-gain amplifier stage for the photoelectric cell PEC, and operates the relay connected in its plate circuit. Plate and screen voltages for V1a, and also heater current for the entire tube V1, are furnished by V2 and V3 in a conventional “transformerless” voltage-doubling circuit. Closing the switch SW actuates the entire keying unit.

*b. Maintenance and repair.*—Clean the aperture in the aperture bar thoroughly at least once a day. Dust collecting therein will materially interfere with proper keying. The photoelectric cell, particularly that portion directly under the aperture bar, must also be free from dust. Whenever needed, clean the contacts of the relay by drawing a strip of bond paper, previously dipped in carbon tetrachloride, through the space between contacts. *Adjustment* of this relay should be accomplished only by an experienced instrument repairman. About once a week place 1 drop of light oil (typewriter or sewing machine oil) in the oil hole located at the top of the rewind. If the exciter lamp burns out replace with a 120-volt 15-watt clear glass, intermediate screw-in base lamp. The photoelectric cell should remain serviceable for very extended periods. The units must be removed from service to effect replacement of this tube. If copies of tapes should tear, always make the necessary splice at a section of the



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FIGURE 39.—Schematic diagram of McElroy automatic keyer, model G-813, modified.



V1.....	Type 117N7GT tube.	C3.....	40- $\mu$ f, 200-v capacitor.
V2, V3.....	Type 117Z6GT tube.	C4.....	10- $\mu$ f, 200-v capacitor.
V4.....	Type 1A7GT tube.	C5.....	20- $\mu$ f, 200-v capacitor.
PEC.....	Type 923 photoelectric cell.	C6.....	0.05- $\mu$ f, 200-v capacitor.
R1.....	40-megohm, 1-w resistor.	C7.....	20- $\mu$ f, 200-v capacitor.
R2.....	35,000-ohm, $\frac{1}{2}$ -w resistor.	C8.....	50- $\mu$ f, 25-v capacitor.
R3.....	0.1-megohm potentiometer.	C9.....	0.01- $\mu$ f, 200-v capacitor.
R4.....	35,000-ohm, $\frac{1}{2}$ -w resistor.	C10.....	0.02- $\mu$ f, 200-v capacitor.
R5.....	20,000-ohm, $\frac{1}{2}$ -w resistor.	C11.....	0.1- $\mu$ f, 200-v capacitor.
R6.....	30-ohm, $\frac{1}{2}$ -w resistor.	RL.....	Relay, guardian No. 27298.
R7, R8.....	5,000-ohm, $\frac{1}{2}$ -w resistor.	XK.....	External keying contacts.
R9.....	7,000-ohm, $\frac{1}{2}$ -w resistor.	T1.....	Output transformer.
R10.....	0.1-megohm potentiometer.	J.....	Single open circuit jack.
C1, C2.....	10- $\mu$ f, 200-v capacitor.	SW.....	Line switch.
		EL.....	Exciter lamp, 15-watt, 110-volt intermediate base.

A general view of this keyer, with its associated tape puller, appears as figure 40.

top inked line. If a small clear space remains after the splice has been made, make the line continuous by using black ink or even a soft lead pencil.

**42. Automatic keyer, McElroy model G-813, modified.—a. Functioning of circuit.**—This unit differs from the model G-813 described in paragraph 41 in that it includes a tone source which is keyed by the automatic keyer. The complete circuit is shown in figure 39. Tube V1 is a 117N7GT, and V2 and V3 are both type 117Z6GT. These are split up into their constituent elements as V1a, V1b, V2a, V2b, and V3, and function exactly as indicated for the model G-813 in paragraph 41. The 1A7GT operates somewhat in the manner of a dynatron oscillator, the frequency of oscillation being controlled by the variable resistor R10. The filament of this tube, which is intended normally for battery operation, is energized by direct current produced by the rectifier system of the unit. This filament is shown separately as V4h and is connected in series with the heater of V1. Because V1 takes 75 milliamperes and V4h takes 50 milliamperes, V4h is shunted by a small resistor R6 to equalize the current distribution in the circuit.

**b. Maintenance and repair.**—The same data given for the model G-813 should be observed for the G-813, modified. However, the relay used in the latter unit does not require adjustment. Also, it is advisable to provide spare oscillator tubes, as the filament life may be expected to be shorter than usual.

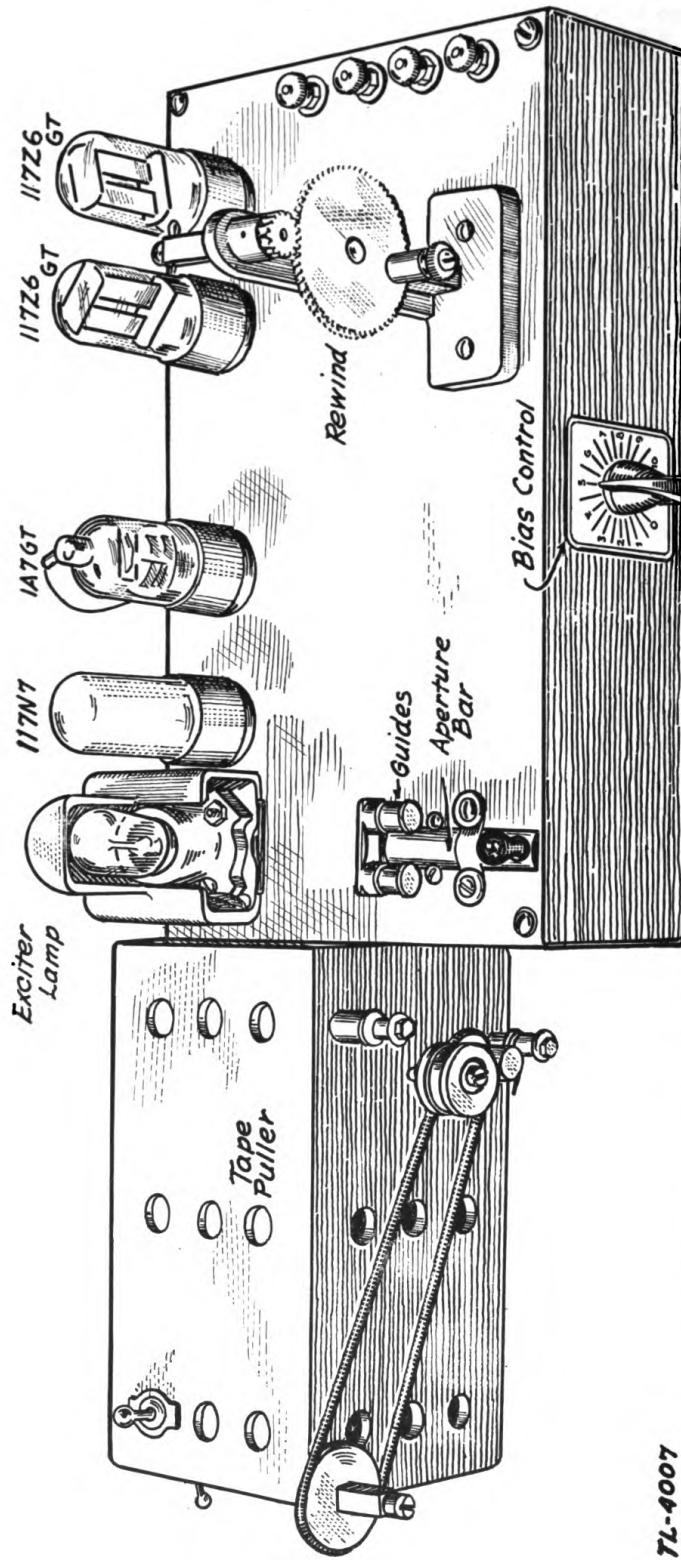


FIGURE 40.—McElroy automatic key, model G-813 modified, with associated tape puller. (Exciter lamp is shown in raised position.)

**43. Recorder, McElroy model RRD-900 or R-900.**—*a. Functioning of circuit.*—Figure 41 shows the complete schematic diagram of the instrument. The tetrode sections of the type 117N7GT tubes, marked V1a and V2a, are connected to form a conventional push-pull amplifier stage. Plate voltage is furnished by a voltage-doubler system similar to that employed in the McElroy automatic keyers. The diode sections of the type 117N7GT tubes, marked V1b and V2b, are part of this power circuit. V3a and V3b are the two diode sections of the type 117Z6GT tube.

The keyed tone signal to be recorded is led into the amplifier at the input posts. The amplified output of T2 is rectified by a full-wave, dry-disk rectifier, and the pulsating direct current from the latter actuates the moving coil element. The latter corresponds to the voice coil of a loudspeaker. To it is attached the ink-bearing stylus, which moves down and across the paper tape in accordance with the keying and the constant pull of the take-up motor.

*b. Maintenance and repair.*—Practically the only routine maintenance on this unit consists in maintaining a smooth, even flow of ink to the recording stylus. A cleaner wire for the stylus and inkwell outlet accompanies each unit as does a replacement ink hose. The stylus should be left solidly against the tape when the recorder is not in use, and the inkwell should be set in its lowest position. After inoperative periods of an hour or longer, the stylus may require cleaning as indicated in paragraph 32. Once a week, the inkwell and ink hose should be removed from the unit and thoroughly cleaned with water. Infrequently, an overnight soaking of the hose is desirable. A gentle milking action will force water through the hose. Frequent dusting of this unit is necessary, as the blank tape in feeding through it leaves an accumulation of paper lint. Two views of the recorder are shown in figures 42 and 43.

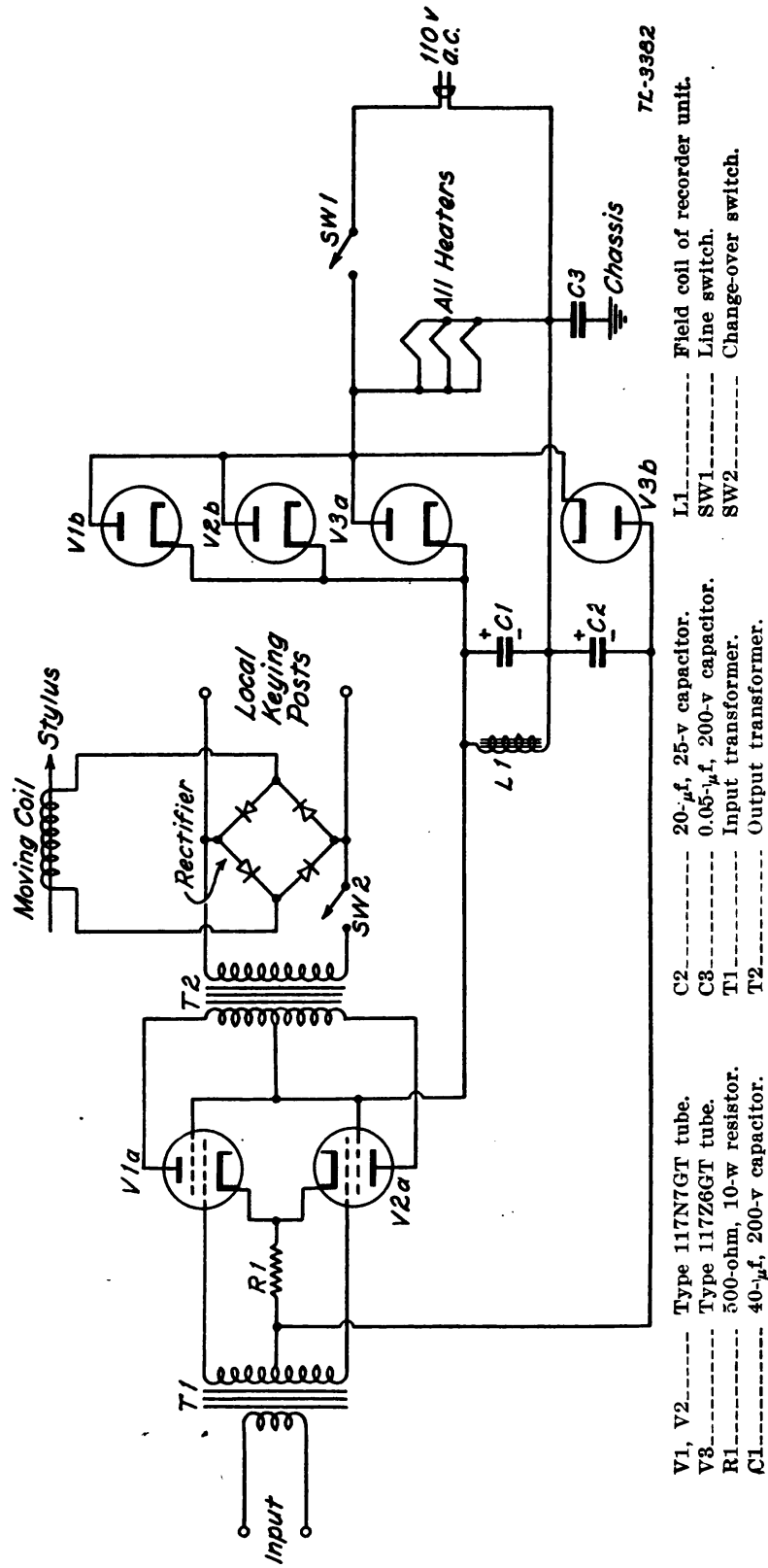


FIGURE 41.—Schematic diagram of McElroy recorder, model RRD-900 or R-900.

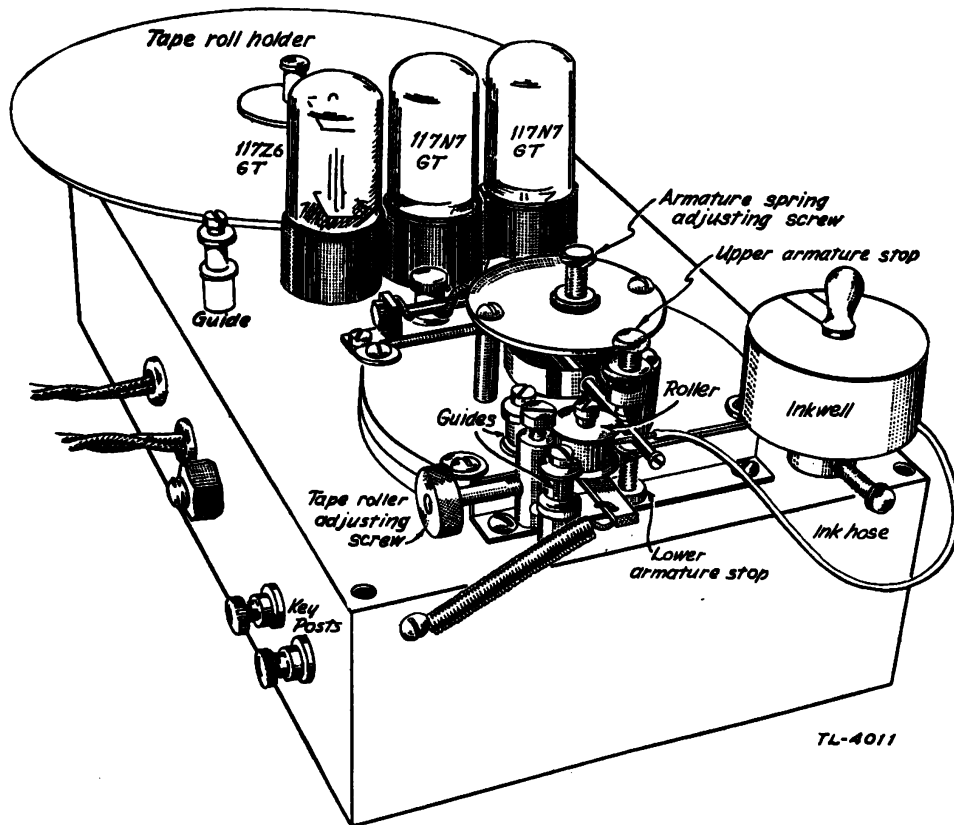


FIGURE 42.—Close-up end view of McElroy recorder. (Once various adjustments have been made, unit will operate for long periods without requiring attention.)

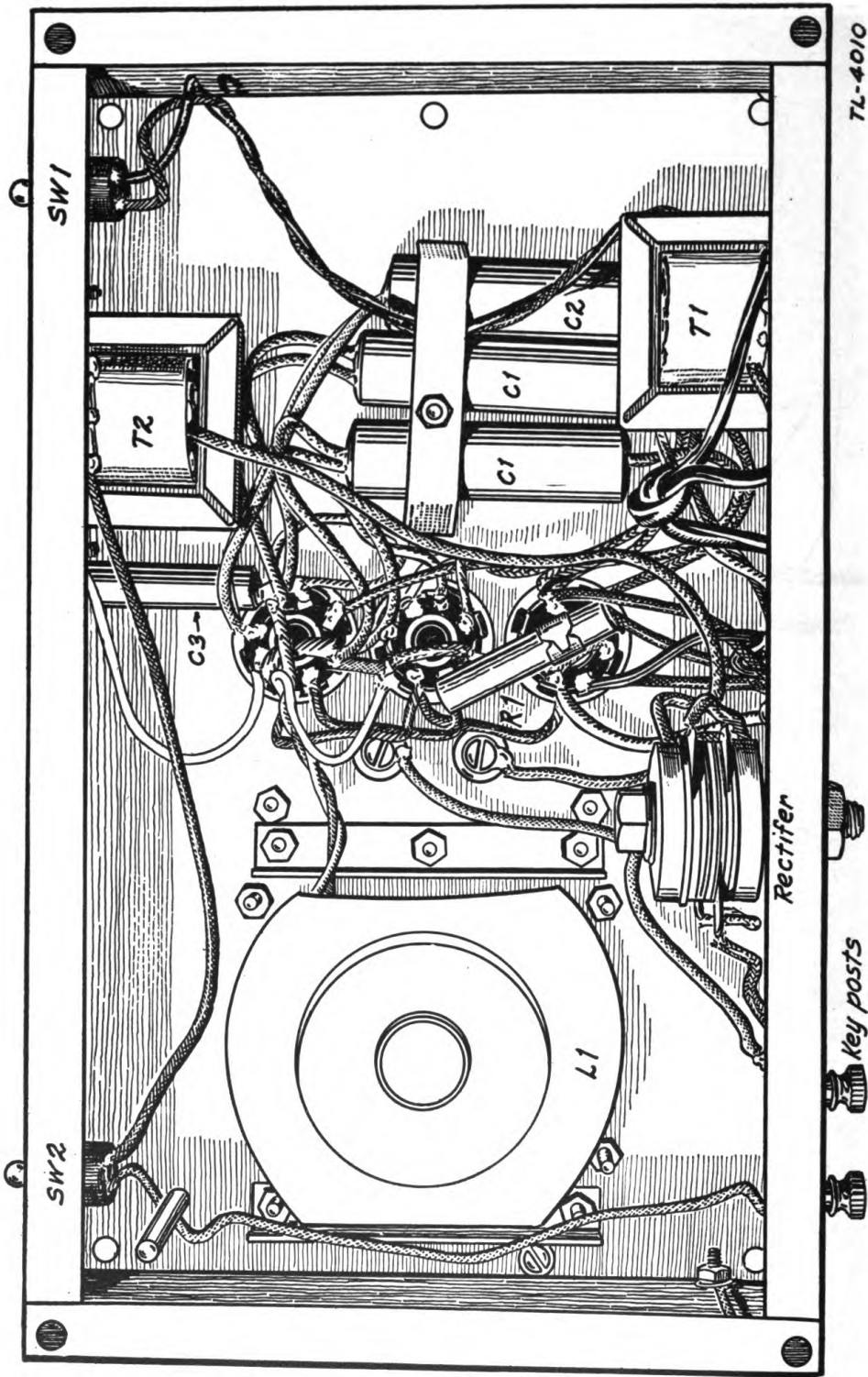
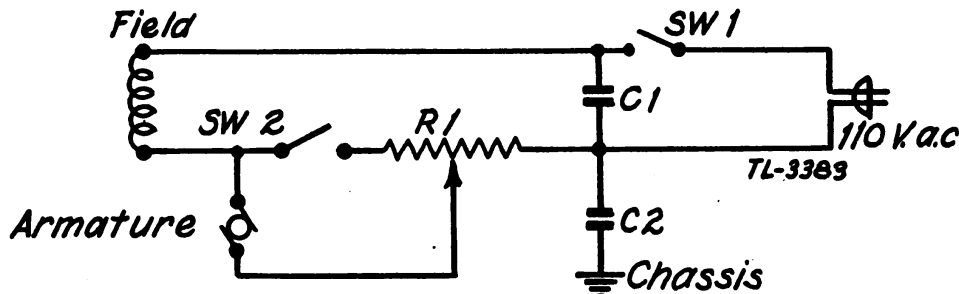


FIGURE 43.—Underview of chassis of recorder. (Parts are marked to correspond with schematic diagram, fig. 41.)

44. Tape puller, McElroy model CTP-1300.—*a. Functioning of circuit.*—The connections of the tape puller are very simple and are given in figure 44.



- |        |       |                                  |
|--------|-------|----------------------------------|
| SW1    | ----- | Line switch.                     |
| SW2    | ----- | Speed-control switch.            |
| C1, C2 | ----- | 0.05- $\mu$ f, 200-v capacitors. |
| R1     | ----- | 300-ohm, 50-w potentiometer.     |

FIGURE 44.—Wiring of McElroy tape puller.

Not all models of this tape puller have the speed control switch SW2. In units in which it is not used, the circuit is equivalent to one with the switch closed. The motor operates as a hybrid shunt type with the armature excitation depending on the voltage drop between the arm of the potentiometer and the junction point of the armature and the field. When switch SW2 is open (corresponding to the forward position mentioned in paragraph 28b (2)) the motor operates as a conventional series type, and R1 acts merely as a series rheostat.

*b. Maintenance and repair.*—Once a day place 1 drop of light machine oil in the oil hole on the take-up spindle and in the oil duct leading to the puller wheel bearing. The entrance to the latter duct is located on top of the unit directly above the puller wheel.

45. Switchboard BD-57.—*a. Functioning of circuit.*—The circuit diagram of the switchboard BD-57, which is part of code practice equipment EE-81, appears as figure 45. A front view of the board with the cords exposed is given as figure 46.

The motor alternator mounted in the switchboard is not used in modern installations of code practice equipment. If the board is employed as issued, the master key terminals are short-circuited, and keyed or steady tone from an external source is fed to the terminals marked AUXILIARY. When the auxiliary plug (red cord) is inserted in the jack marked AUXILIARY, this tone signal goes through the primaries of the twenty-one individual transformers, which are connected in series. The secondary of each transformer is isolated by means of a plug. Tracing out the circuit at any trans-

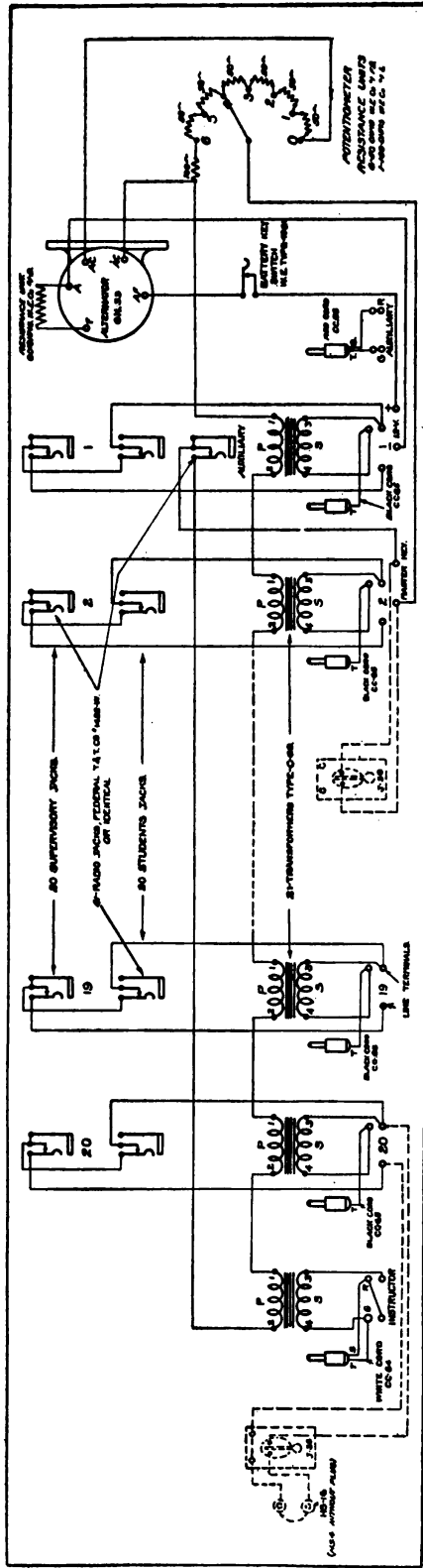


FIGURE 45.—Complete circuit diagram of switchboard BD-57.



former, it will be seen that secondary terminal 4 is connected to the *tip only* of the plug. Therefore, it is necessary to insert the plug into the corresponding "student" jack directly above it, in order

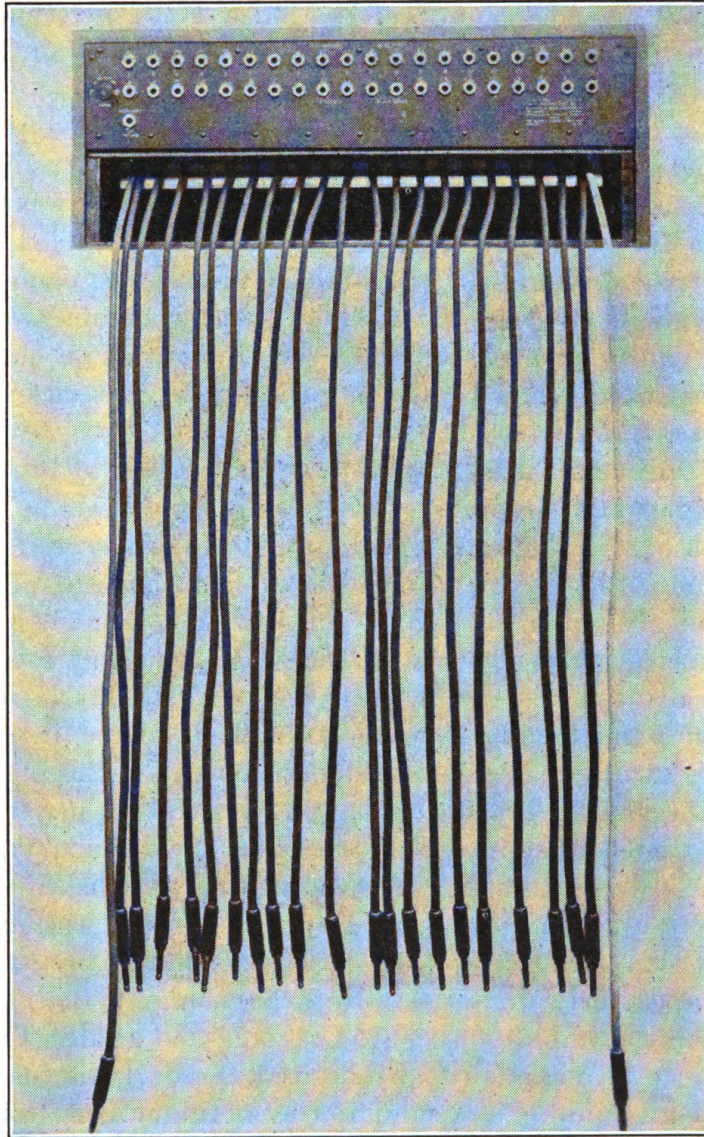


FIGURE 46.—Switchboard BD-57 set up for operation with cords exposed.

for the tone signal to appear in the earphones of the connected student position. If the tone is keyed, the student keeps his key closed. If the tone is steady, the student can open his key and practice sending to himself. The instructor can listen in by plugging the "instructor" plug (white cord) into any of the "supervisory"

jacks along the top of the board, at the same time closing the switch on his key. Each of these jacks is in series with the "student" jack under it. When steady tone is supplied, simulated nets can be set up for groups of students by interchanging their black cords, exactly in the manner described for the BD-57-A. With any type of operation, the potentiometer continues to act as a volume control on the input signals.

*b. Maintenance and repair.*—Very little trouble develops with this board, as the parts are rugged and are subjected to very little strain, either mechanical or electrical. Cords and plugs may wear out after long service but are readily repaired or replaced. The main items to watch are the transformers. Because of their series connection, the entire board will go dead if only one primary becomes open. The faulty unit can be identified quickly with the aid of an ohmmeter or a simple continuity tester consisting of a headset in series with a dry cell and a pair of test prods.

**46. Switchboard BD-57-A.**—*a. Functioning of circuit.*—The complete schematic diagram of this board is shown as figure 47. Comparison of this diagram with figure 46 reveals several important improvements. There are three rows of jacks instead of two, permitting much greater flexibility of student circuit arrangement. The transformer primaries are still in series, but they are connected only to steady tone (through the AUX SWBD TONE posts) for purposes of hand keying by students and simulated net operation. This tone is available at all student positions when the plugs are *not* in any of the jacks. Tracing through the circuit of any transformer and its associated jacks, it will be seen that the secondary terminal 3 goes to one side of the student position through the tip and inner contacts of the bottom jack, which are closed when the jack is idle. Terminal 4 goes back to the other side of the student position through the two upper jacks in series. Note particularly that the frames of the bottom and middle jacks are not connected at all. One student can be fed keyed signals of any desired speed if his black cord is inserted in his middle jack, and if the auxiliary cord connected to the proper keyer is inserted in the top jack. The resultant circuit is a simple series one, with the transformer entirely out of action. Students can be connected in series for keyed signals by cross-connecting plugs in the middle jacks, just as they can be cross-connected for local net operation by means of the plugs and the lower jacks.

*b. Maintenance and repair.*—See paragraph 45*b*.

CODE PRACTICE EQUIPMENT

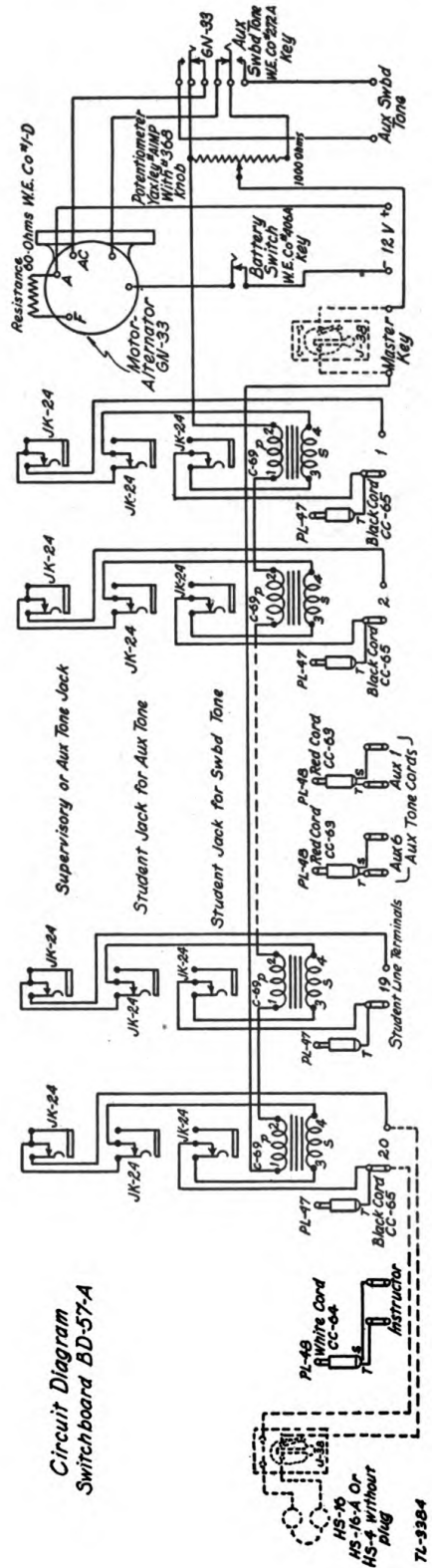


FIGURE 47.—Circuit diagram of switchboard BD-57-A.

47. Record player, Columbia model P.—a. *Functioning of circuit.*—This record player is a very simple unit, consisting merely of a turntable, a crystal pickup, a one-tube amplifier, and a 6-inch permanent magnet loudspeaker. The circuit is shown in figure 48.

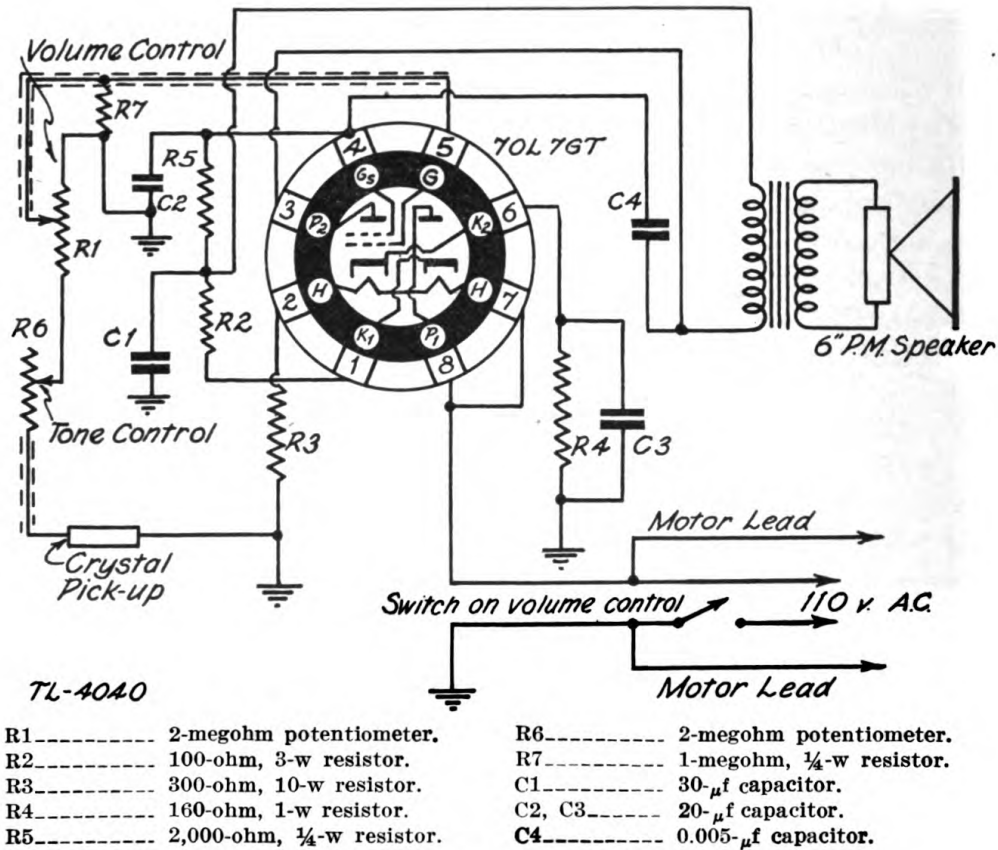


FIGURE 48.—Circuit diagram of record player, Columbia model P.

The 70L7GT tube is a combination diode-tetrode, the diode section functioning as a half-wave rectifier to furnish plate and screen voltage for the tetrode amplifier.

b. *Maintenance and repair.*—The simplicity of this unit makes it practically foolproof. About the only part likely to require replacement is the tube. This is mounted on a small subpanel under the turntable deck. Access to it is had by removing the Phillips head screws that hold the latter in position. The motor is of the self-starting type. It requires no lubrication.

## APPENDIX I

## CHANGES IN SWITCHBOARDS BD-57 AND BD-57-A

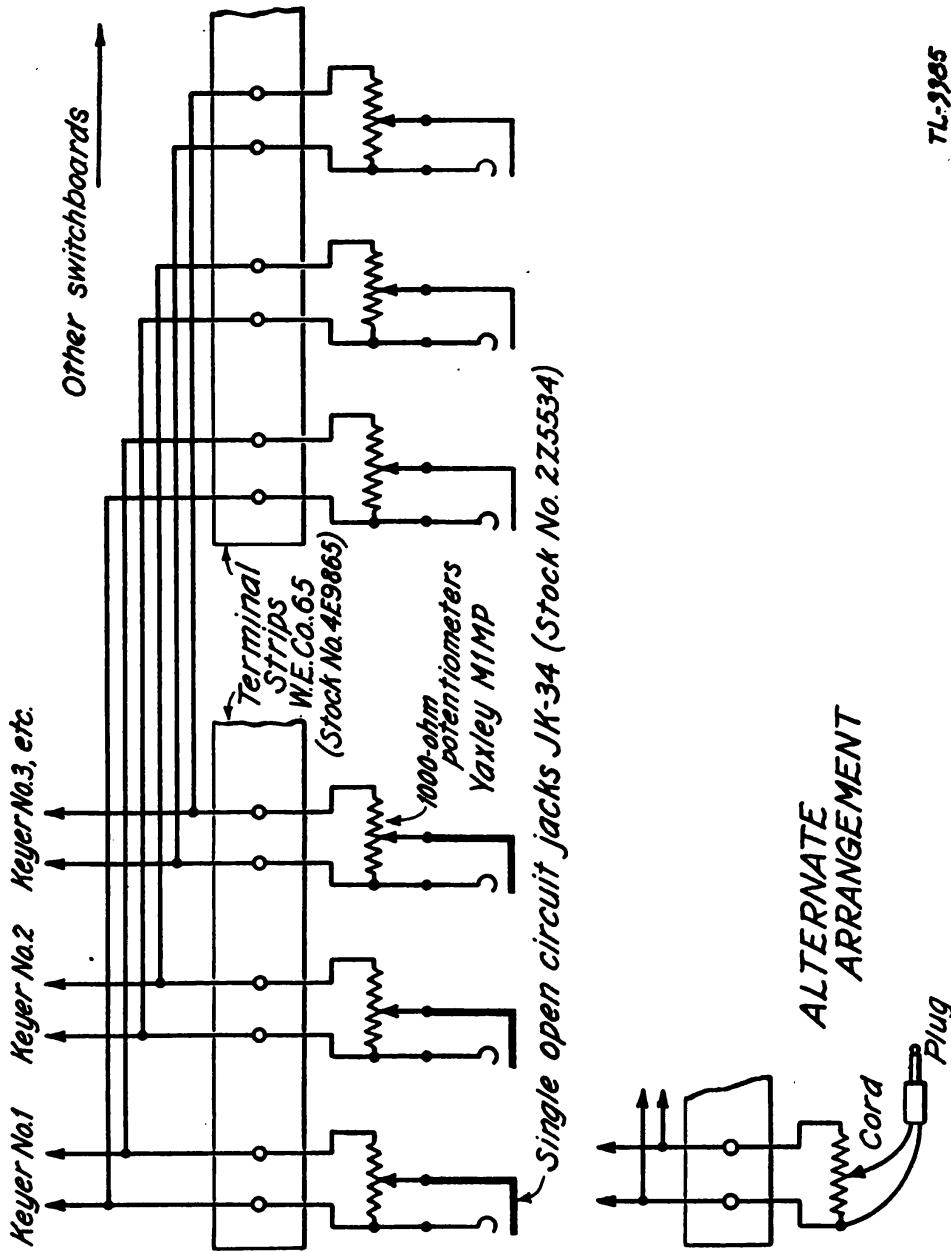
1. **Improving switchboard BD-57.**—As mentioned in paragraph 17*b*, the switchboard BD-57, as issued, does not meet the requirements of modern installations of code practice equipment. However, if training or other funds are available for the purchase of 20 inexpensive single closed circuit telephone jacks, the board can be made the equivalent of the newer BD-57-A by a competent radio repairman. The extra jacks are added in a row under the present row marked STUDENT JACKS, and the wiring is changed to conform to that of the switchboard BD-57-A, as given in figure 47. To allow the connection of more than one keyer, the single red AUXILIARY cord can be supplemented by extra cords fitted with two-connection plugs. If regular patching cords are not available, standard radio plugs and ordinary flexible lamp cord will be found perfectly satisfactory. Extra terminals should be provided on the back of the board for these cords to facilitate connection to the automatic keyers. An alternative arrangement is the use of a separate patching board, described in the following paragraph.

2. **Patching board for switchboard BD-57-A.**—Code practice equipment set up as indicated in figures 5 and 9 will operate quite satisfactorily. However, the use of an extra patching board, containing volume controls for each keying circuit, has been found very convenient. As shown in figure 49, the outputs from the various keyers terminate across the ends of 1,000-ohm potentiometers, instead of at the auxiliary tone cords of the switchboard itself. A single open circuit jack is connected across the arm and one end of each potentiometer. Patching cords, consisting of short lengths of flexible wire with a two-connector phone plug at each end, provide a quick means of transferring the tone signals at any particular keyer jack to any student position. The potentiometers serve a double purpose:

*a.* They allow the signal volume in the students headsets to be adjusted to a comfortable level, or to a low level to simulate poor receiving conditions.

*b.* With the entire resistance connected permanently to the keyer output circuits, a constant load is maintained on the keyers, and the

signals in one switchboard circuit will not change noticeably if changes are made in another switchboard to which the same signals are being piped. With this set-up, the six auxiliary tone cords on the BD-57-A



7L-3985  
 FIGURE 49.—Method of connecting potentiometers and jacks of auxiliary patching board for switchboard BD-57 or BD-57-A.

are not required; in fact, if these cords are removed and the remaining free ends fitted with phone plugs, they make excellent patching cords. Another arrangement is the direct connection of the auxiliary cords to the arm and one end of each potentiometer. While this set-up is

not quite as flexible as the use of full patching cords, it is adequate for small installations where the number of available keys is limited. The number of jacks and potentiometers to be provided on the patching board will depend on the size of the school. Figure 50 shows a

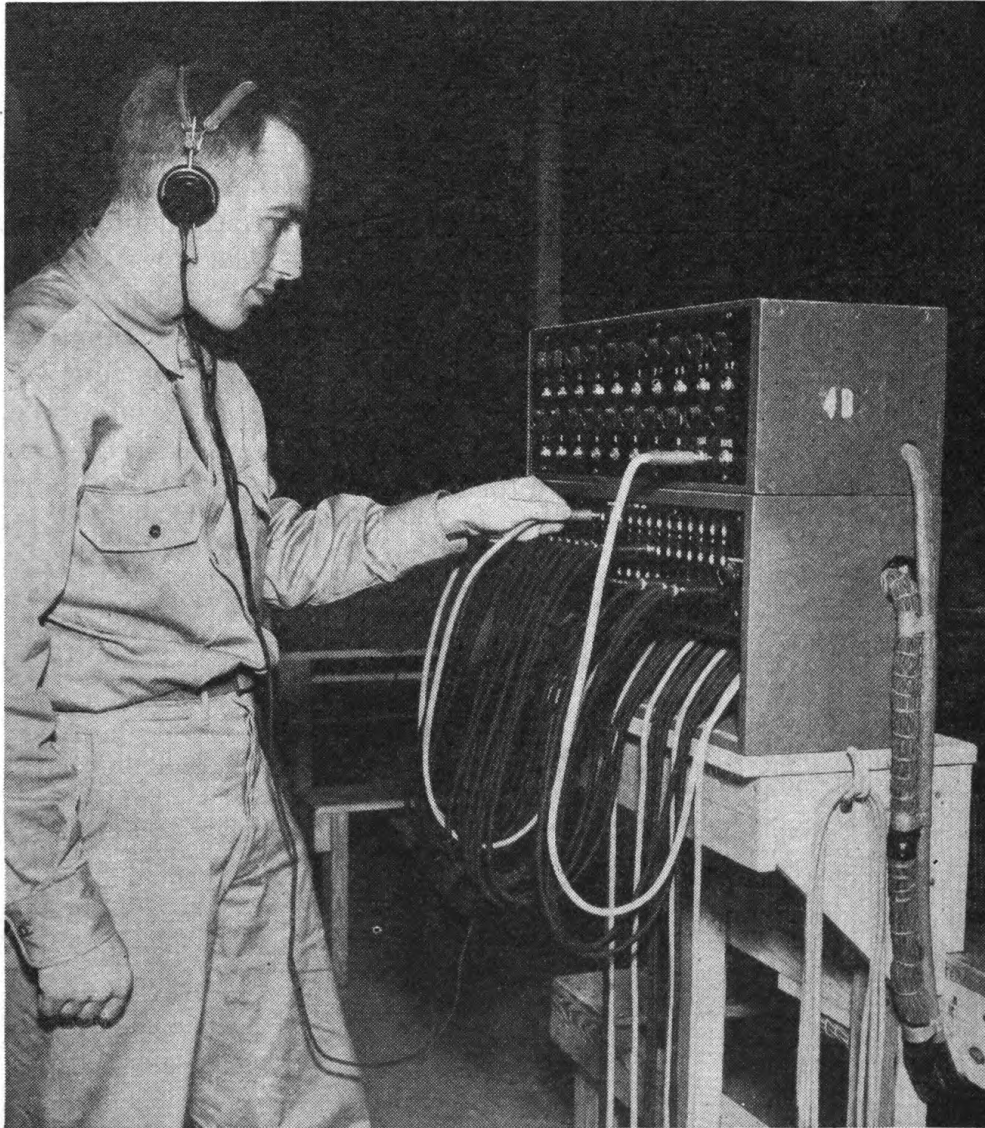


FIGURE 50.—Switchboard BD-57-A with patching board on top.

20-position board mounted on top of a BD-57-A in a large school. This provides outlets for all 15 of the master tapes supplied for the automatic keys, the fixed tone source for local keying, and for signals from several radio receivers. An average of 12 positions is sufficient for most schools. It will be seen from figure 50 that the patching board has been made to match the switchboard in width and depth and general appearance. The front panel may be bakelite, hard rubber;

any of the "pressed wood" boards, or even plywood, as insulation is not particularly a problem. The box is made from scrap shelving. This illustration also shows how the cabled leads are brought into the boards. A hook for the patching cords is provided on the right end of the mounting bracket.

**3. Monitoring board.**—Another convenience in a school using a large number of automatic keyers is a monitoring board. As shown in figure 51, this consists simply of several rows of single open circuit jacks. Each jack is connected to the output terminals of a keyer, paralleling the leads that go to the switchboard or the patching board. The monitoring operator is thus able to check the output of all the keyers from one position in a very short time. Directly above the monitoring board shown in figure 52 are two small permanent magnet loudspeakers, mounted in the wall. These have cords and plugs attached, and either can be left plugged into the jack representing any keyer when the operator wants to make a continuous check on a tape, while he is doing other work around the keyer room. As in the case of the patching board, this monitoring board can use bakelite, hard rubber, pressed wood or plywood for its panel.



FIGURE 51.—Monitoring board used in connection with automatic keyers.



APPENDIX II

MATERIAL CARRIED ON MASTER TAPES

The material carried on the 15 master tapes furnished for the code practice equipment described in this manual is published herewith as an aid to instructors. It should be noted that random errors may occur in the tapes.

*Tape No. 1—20 characters per minute*

(Receiving lesson I, TM 11-454)

F F F F F G G G G G H H H H H M M M M M  
 J J J J J R R R R R U U U U U F F F F F  
 G G G G G H H H H H M M M M M J J J J J  
 R R R R R U U U U U F F F F F G G G G G  
 H H H H H M M M M M J J J J J R R R R R  
 U U U U U F H U R G H M J R U F G M J H  
 F G M H M J H R U F J R J G U M F H R U  
 U F M G H M R H F R R J U G U J H F M J  
 R M F R U G M H F H G R U J J H U F J M  
 R R J F M U M H G J J G H F U R F M H U  
 G J R J F H R G U M H G F U J F H U M R  
 J H R M G F J H H R U M U H F J R M F U  
 J M G J R H F U U J R H H M G M F R F U  
 H R M H G J R F J M U G H U M F G J G F  
 G H M R U M R J F H M J H G R U J F U F  
 H M G R M J H R M F R G J H J U F U F U  
 H M J R H G R H G R F H M J U F U J F U  
 H M H J H U G R J G R F U J M R F F M U  
 J G J R U M M H F J H U F R G R F U H M  
 J R G U J F U M H R J M R F M F H G H U  
 M F U G U H J M J R J R G F F H M H R U  
 M H R U F R R U G U F M H J J F G J H M  
 G F H U J G J M H M G R U H F M F R J U  
 F G J F M H J G M G H J M F U R H F R U  
 M G F J H F G J M U R G M H U F H F U R  
 J M H G F R J U J M G M G J H U F H F R  
 J H R G H U M F J G M H M J F G U F R U  
 J G H R U H U J G M F M H M F R J G U F  
 H G J U R H G J M F H M R F M U F J G U  
 G F U H G H R J H R M F J M U J F G U M  
 G F G H U H H R M F J M F R J M G U F U  
 F F F F F G G G G G H H H H H M M M M M  
 J J J J J R R R R R U U U U U F F F F F  
 G G G G G H H H H H M M M M M J J J J J  
 R R R R R U U U U U F F F F F G G G G G  
 H H H H H M M M M M J J J J J R R R R R

*Tape No. 1—Continued*

U U U U U F U R R G J J H G H H H J J M  
M G F M J J J H G G G F M R J H M R H M  
M M G R F H F G G M H G G F F M M F J R  
R G M M G J H J G U R H J F H R H J U G  
H G R F J M J H R R R J R U G U U F J G  
G R U H H M H U M F G R G U M H H U J U  
F J M H F H U R G U F J M G U H F H J M  
J G U M F H R G H F R U H H H H H R M  
M R J F R R H R G M U J R J J G J M U G  
R H U R H H H G H U F J R H R H M M U M  
G J U F J J J R R U F F G U H U J F M G  
J F H J G H M M J J G M H M G F R H J M  
R J M H F R G J R R U M G U M G M F R F  
H J R G J H U R U M R F R H J J F G H R  
G M F H M J M R J R G G M H G J G M F U  
M R M R J G M H M M F M J J U U H F U H  
H H J M U F R G H U M M G M H R J F R G  
G J F U H M U G H J J R F F J H F H J J  
M F M R U U U J U J F G M R J U M G M F  
J F U U H F F M U J F M J H R F J M F U  
U F R R F H F M R F U G R U J M G F H U  
F H R F G J F U F F H M G F H H F U J F  
F G M H F F M U M R J F U J F U G H J R  
F F H F G J G U J R M J H M F F G U F F  
M H H R H J R U F R U G U F H U J M U R  
U U F F U U U M U U M U U R R U F U M U

*Tape No. 2—20 characters per minute*

(Receiving lesson II, TM 11-454)

B B B B B D D D D K K K K K N N N N  
T T T T T V V V V V Y Y Y Y Y B B B B B  
D D D D D K K K K K N N N N N T T T T T  
V V V V V Y Y Y Y Y B B B B B D D D D D  
K K K K K N N N N N T T T T T V V V V V  
Y Y Y Y Y B F U T V M N H Y N M T G D H  
B Y G F V R D B G Y J T K V H J G V V F  
F K H G Y F M K R B F D V U T F Y T R Y  
J G U M J B G Y N D B Y D Y D N F N V K  
B J H B R D V H Y T K V U N B K G N T K  
D U D M R K M N V D V U T K T B H N D T  
N K R J U K N J T M N Y N T D B V B K T  
K R N B N U V D T R K K T N Y Y J Y D V  
T R U T D Y K G R V V N D D V K F T B Y  
V J V K F N T U B Y D T B B G V D Y B R  
Y M N Y G T N F D K T B B N V U H M K Y  
K H T V F K H D T V D B R K N T D M B J  
B N Y D T G U V K T K J K V D N M D J B

CODE PRACTICE EQUIPMENT

Tape No. 2—Continued

D U B T H V Y N R B M T Y J K U B K N R  
 K Y F M R K J B D H R V Y N D B R N T K  
 N J F G U D M V D G J T K U V D V J Y T  
 T G M H Y B D K H K T R M N Y F B B Y V  
 B K F K U D Y R N F V U K J B T M D B M  
 V N T D G D B V J G Y K D N M V J B U H  
 N T V B T H K U K H N D D Y R H T B D G  
 N V T N K M N J Y M K T F R D V U G R K  
 J Y K N K T K V D G J N T M Y R B J F N  
 T D Y N V M Y U H M D B R V U T F B T N  
 B V T Y H F N M K V J Y U V G T D V K D  
 T Y V N B G J Y B K B H V B U Y R T Y D  
 F Y G T R H D D N K F D B R Y U N K Y B  
 B B B B B D D D D D K K K K N N N N  
 T T T T T V V V V V Y Y Y Y B B B B  
 D D D D D K K K K K N N N N T T T T  
 V V V V V Y Y Y Y Y B B B B D D D D  
 K K K K K N N N N N T T T T V V V V  
 Y Y Y Y Y B F J B D N K T V Y K B D K N  
 T B V B N J T B T F Y K G J U K R R J M  
 H N U Y J G K N T V Y D V Y Y G H U H D  
 R N U V N T Y B F F M F T V T K Y T V G  
 F G M B M J B T K Y V D T M G H K D B N  
 N N Y N T V Y J R R U N D F G F T H R U  
 Y U G T K K V H B R B R F B D K K U Y N  
 T K G V K D B D D H M T M F G H F D M G  
 V M N V K T N H U Y J M D Y B K N K Y N  
 J D U B K Y H N J D G U F D V N B V K R  
 V U J V U M Y D T G R N Y V T T R B D T  
 K R D D H N J K Y D H K B N V Y B D T D  
 M R V Y K V T B H G K F G H M G M V K K  
 M J F B K V N K V D T D K M R J T V Y N  
 K J D J B F N T D Y V U Y K N T B B J T  
 V T R U K D T N B Y H D H K V D U T N T  
 D B B R K Y Y K M K D D F T R U V B Y V  
 U Y N K T N D B N K V J N U N J N Y R M  
 V V B R N H T D B T D Y V G V N D K D V  
 Y B M R D Y U G U Y M J F N K B B Y K V  
 U T N U B D F T V H V R T T Y U T G Y F  
 G H V J F D H D M B R V B M J T U B F D  
 R N G V T N N N B Y T Y M M D K N J B D  
 B B G J B V T K D V R V T D K D B B K B  
 J N T Y Y B U D R F T K Y Y H F Y K K T  
 T V Y R Y J B R K T V M H G K N N D D B

*Tape No. 3—20 characters per minute*

(Receiving lesson III, TM 11-454)

C C C C C E E E E E I I I I I L L L L L  
O O O O O S S S S S W W W W W C C C C C  
E E E E E I I I I I L L L L L O O O O O  
S S S S S W W W W W C C C C C E E E E E  
I I I I I L L L L L O O O O O S S S S S  
W W W W W C F L O I B C Y W E C L O W C  
C E S C I G E W S D E W L V C O L S B E  
I C Y I H S C I U K S O F I E T W O S D  
V E L M L L Y R N O S C G I L S U K W O  
E O J I S O W V L W L E H L O N W C F L  
S I O R Y N T I B S O M E L G C T S S W  
L W S O U N E D O S J W I R V K E O I S  
O T C J V C K W K R C T E J Y I L B D L  
S M I E W N E D U C E M W E L C O E N T  
H S W T I V D B E I C I C O B I F C I O  
W N V I W L Y L I B E H S L E G D B C S  
C Y T C S K O L D O E W G O S H W I K E  
I E L N O K W S L C I L O F M E S L F W  
W S I O I L O E W B Y C L S J W C E O G  
E N D L E S U S I C O R I L I O E S H M  
T B W I W L W W E C E U V S L O C W J S  
C V K S O E S W C S W I L O C Y I S W R  
C L O K F U I W B V U O N S H W L J O S  
H E W G B D G C T L C K W Y C G S I L G  
O E K H S G O I Y W E S W E W O I O I S  
L I F T S L E F C S D Y I H L S I O E M  
I L N W I C Y E R C I L L I M E L C M L  
O W K M E T J I O N O L E S J I V U M H  
C S J C D B M L K L C O R W F W J C L R  
E R W C W B D O S G I N S T U E R C R W  
U V M I E H S W F K S V E W Y C W J W E  
C C C C C E E E E E I I I I I L L L L L  
O O O O O S S S S S W W W W W C C C C C  
E E E E E I I I I I L L L L L O O O O O  
S S S S S W W W W W C C C C C E E E E E  
I I I I I L L L L L O O O O O S S S S S  
W W W W W C I V E S L O S H W C I W E T  
C C H O L I O C E U E C E O I W T M S N  
Y E S N B V L E E I L W S R V S Y L J O  
S C I W V T L I D W K O W K F N K J W M  
C I M I R O J E T I C N O L I S K G H T  
W M C C I I H L S Y U V W I W S O I E W  
O F B S S I E D W E C G S L O N N C N V  
L K K L S L E U D G L C T B B H F E C Y  
W T E K E D Y O W O U W S I G O E Y J M  
D S L W I R V I D W D B L L S E S W W W  
C I F E I L O W O S U N L B O K U E I D

CODE PRACTICE EQUIPMENT

*Tape No. 3—Continued*

L W I E C B T Y C R O K S F I D K O W S  
 S R C I B O C B C C S V L W S C N L G K  
 B E S S L O J C E C E E I Y O E W U C E  
 D I O C I S C W O C E M W T M I H W L C  
 R U I O K S Y L L O N V Y L F G H E I E  
 W C S G O L I V L N W W I L E R S E W V  
 I I L L R J E O L O F S L S O S Y E H I  
 S W T W E C E L O G V Y L B E S M J I L  
 C H C W L M J F U Y C O T S N C K I C I  
 G H E W O O Y W G O S E I W E C L L W U  
 W T E L O F D W S C E C I L S I I L V J  
 R W O S O K C S O B E C B I L E S W S J  
 I O O C U C C J W B S W F S I D N I C K  
 F O H J W O L I E C M L R W C E D O L W  
 S L T O S E W G M S R S G S M L H R W E

*Tape No. 4—20 characters per minute*

(Receiving lesson IV, TM 11-454)

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

*Tape No. 4—Continued*

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

*Tape No. 5—20 characters per minute*

(Receiving lesson V, TM 11-454)

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

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Tape No. 5—Continued

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

Tape No. 6—25 characters per minute

(All letters and numbers in random order, 5 words per minute)

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



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*Tape No. 6—Continued*

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

*Tape No. 7—35 characters per minute*

(All letters and numbers in random order, 7 words per minute)

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

Tape No. 7—Continued

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

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Tape No. 7—Continued

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

SIGNAL CORPS:

Tape No. 8—50 characters per minute

(Groups of five letters and numbers, 10 words per minute)

ALTHR POMTR DLSMT WOESX THBUW ZOXIC TUELX QPSIX ZTRMN BPQIR MSIIWL  
ALCIT TUZRO 13597 ZAIQB PRIWS ZIVBC OPQIV MIROW NONES AIMES GKFPQZ  
ICUTY VISLX NIOWZ QPSOT EIPQZ IRVEX PZXBVN MNPOQ RVEMPF TYRIE PXIZO  
WQRPV XI ALE ASCMY 87651 IRYQO PZXXGI MPNOS ZRATP YAMSO QPWXM YRUAV  
IRABU BEZXB MIOQR VDXSG GHRMP PQXET EMIEZ PTWPZ AXCRQ GUMOU EUIRY  
13579 IHYGM NBMMVI ISLXI QPZZY IYHGM NURIZ PQRVE CIMPL YMAXZ TYEYP  
AWQHG HRMLV TPOVM RVQPO 64720 IMXQP WXONA PXINE WHYAR TYEYP AWQHG  
HRMLV TPOVM RVQPO 64720 IMXQP QWXON NIXPE YAWHR YCOMN CRACT IYVOX  
ZTQPZ AXIFE QPOWI ERYTA LSKDJ FHGZM MXNCQ RASTP UTONG HORMO PQRWS  
TYZZL LMHYU UMNOC GQXIX ZAZIE FORMD 01932 WHIXZ ARPHU GUHIL WZXGA  
ILLXT YEISL XIKLW ZHXOC COIES ANDIH THROG EMPUS ZIPI S RPSIX SOGHLA YSOEEL  
HGUEI NSIWL ZHXOC ESAND INTRO GIMPTU ZAEPI SRPSI ZALTH HRPOM TROLS MTWOE  
WLZHX UWZOX ICXRS LXQPS IKZRT MNBFPQ IRNSI WLA AI TUZRO 17362 ZAI PR  
SXTHS BCPPQ IVMRO WNONW SAIME QSPGX UTYVI SLXNI OWZQP SOTIE PZZIR  
IWSZV XBNMO PQRVE NPTYR IETXZ YAMPQ WXMYYR UAVIR ABUBE ZXVMI OQRVD  
HTXPP MOPQR WSTYZ KLMHY UMNOC QPZAF ORMWH PUGHI LWZXG AISLX YEISZ  
XSGHR 67326 YOSHG ELUNS IWZZH XOCAN DIHTR OGIMB USZEP ISR EZ SOGEL HUNSI  
WLZHX PMOTR LDSMT WSEK THRXX VBOCP QVIRM OWNSI IRQSP ZWSTX YMTTPQ  
12089 XLSNI OXQYX PMIYW VAZOX MPTPQ ODHCT NMWXU QPOSA YEISD IYZPN  
TWSYH GZCOT QWMNO RWPQX LUQXF NUGWH WIGSO ZLAYS APDWT ZOTQB 47361  
ITBQW RWLUM WGZAD TWEXD URGNL ZHMOR LDXXWH VQMRZ BOART PLWQR STCCY  
AROYX PQIES BIYQP IEQZX ISXLW IUWEH GRSRP ZAMBA PQOWK LHMGO PURMZ  
QEPWZ ARMQY OARQW BVNMR AIWQP APXCB ZBAIP EXYUW 09873 RQPTD OEKAS  
ZXSTO CEUIP ZHNOV URWPG ABWLU PATBN RSYPI SOUQP LUGML NOUZZ XRTMP  
GAHYW PIQZR LRPWW BBZZX PRWIB ULQGH XRMOL SRHNP WBZZX BCOIU IAGVY  
YHWQP LMNPO 56209 PZBAM ERQLK KPYOU METOL ZCPOK HNMWX PLWTV ZPKIY  
SPIRT WBT LZ NKEID NKIWL HDURH SUHYF KORDS CITHD LAOTY NAEWQ PUDJR

CODE PRACTICE EQUIPMENT

GREOV JDEWQ NASIT JEIGZ FOPTS BOVRI MASP L JDYRU BDZAJ KTRRU KDHRU  
 URYTE OJGRD XIYRA VOURS CJLOD ZKUWR NSEOG S IHIS EEWQP JUTRS 76430 UITYR LIHQW  
 KFGDT SLPEX NKLRU VJIDR XTHFS BALS A WVVPY QGZAP KNTRX JDTRE HAWQE GTUII XWNMT NJJLQ  
 MLLPDY TWEIV TVVDE CYPLD OFERL ZSTVP MLIOS NTHIY EREHT LTDDQ LTRX 00917 VBLAS BTUII XWNMT NJJLQ  
 YSAOI UVXTF IDWKL AWERT FJCBF 74531 LOUIE BGETY NSIGA VPKIS HZAPT GAPSE JUSEW APWER  
 DCOIT SAWQL AVERT IDWKL AWERT FJCBF 74531 LOUIE BGETY NSIGA VPKIS HZAPT GAPSE JUSEW APWER  
 MHGRX WSDGK FJCBF 74531 LOUIE BGETY NSIGA VPKIS HZAPT GAPSE JUSEW APWER  
 GOOLX NUTCA FRIKW FMCIH LNAEQ GROUD FPBRM FJHGF DSAZX ALCWN KKDUO 57390 ULMNS  
 HITZA XWQPL FRIKW FMCIH LNAEQ GROUD FPBRM FJHGF DSAZX ALCWN KKDUO 57390 ULMNS  
 ULMNS VKNSE JDMTT AHXFF LGFPV CUVJC WUKDC RXARW TEWRA LSHQD MUOQN ETGYL XNNBN  
 BGNLB NVVGG JOMTT QZTSI LUMUU EDASD AXYAS 61908 TSKN DASKN LNAWW LSHQD MUOQN ETGYL XNNBN  
 VKNST JOMTT QZTSI LUMUU EDASD AXYAS 61908 TSKN DASKN LNAWW LSHQD MUOQN ETGYL XNNBN  
 WPXEE WITLT PERBT VIUDW SAYVL ETDT S DASKN LNAWW LSHQD MUOQN ETGYL XNNBN  
 JFBCA CMORS VHNLC ADWSJ HJXSN TGBCV 50133 CNZXC LSHQD MUOQN ETGYL XNNBN  
 OMDRH VHNLC ADWSJ HJXSN TGBCV 50133 CNZXC LSHQD MUOQN ETGYL XNNBN  
 QJAST GKUJW VURSR RUVXA HNRZP DBJBM 11468 WOXJY TYCNJ JEUID AMATA AJRRW BNTRX VDPHW  
 WASOW NNLS E RUVXA HNRZP DBJBM 11468 WOXJY TYCNJ JEUID AMATA AJRRW BNTRX VDPHW  
 HWLEY TEBVF PVCLM AGXUY HLNEJ WWOJX XWFTN JEUIMB AXYS 0937 QWXA YHATI VATMX TISYD ZQELF 10828  
 NDWCV DWJOG NOYWN ZLWDC 89753 XWFTN JEUIMB AXYS 0937 QWXA YHATI VATMX TISYD ZQELF 10828  
 VOUL NEPZI LWQPV NMJIQ LTQZX OXSDM 10937 QWXA YHATI VATMX TISYD ZQELF 10828  
 SAVCL LZOJC PUCXZ TMNLQ OXSDM 10937 QWXA YHATI VATMX TISYD ZQELF 10828  
 BELLS YAWCL EAI ST TVSPL VSDGR RSJYK YHATI VATMX TISYD ZQELF 10828  
 OJJE DOTJH SOUNA DIOQH SWMEW HARWD AQMPV RRALN TJNDA DEXNL SIJXS TYWNB  
 QGNSV CLSRX SNLYL QRACV NVJXT MPOAC QRMIN AAZIY ZARLQ CNSXD XMLMA IAWIN  
 XOVTV 74523 GDOWS RANWX HASSR NTNWC PATXD RUMBA DELEV XISPV SWIRP OQIAZ 76541  
 NVKTY QNOFM RANWX HASSR NTNWC PATXD RUMBA DELEV XISPV SWIRP OQIAZ 76541  
 MITFK MPRPS DELCO RHTLA SENON NBXZP XEWRI 15578 YMC SA ELAIX PVRPQ OXIXT EIDTT  
 WSEOW TMSLD RMOPT RHTLA SENON NBXZP XEWRI 15578 YMC SA ELAIX PVRPQ OXIXT EIDTT  
 PRZUT IICLA LWISN OPPNM IGXZP OQYRI 15578 YMC SA ELAIX PVRPQ OXIXT EIDTT  
 AQPOG SLMIA SONPM IGXZP OQYRI 15578 YMC SA ELAIX PVRPQ OXIXT EIDTT  
 PMEVE TEXQP PMHRG GSXDV RQOIM VXEZEB URZRI FVURY MXWPPQ OSAMY PTARZ  
 DTCZQ ISLXI IVMBN MGYHA TRIGH UOMUG UAVXZ ZPWTQ XEIME OPQVR MVOPT

NOTE.—On tapes Nos. 9 to 12, inclusive, some of the recordings terminate before the end of the material given herein. The material on the tape is continuous as given herein to the point where the tape ends.

SIGNAL CORPS

*Tape No. 9—60 characters per minute*

(Tactical traffic, 12 words per minute)

WZ1 V WX3 NR1 P GR19 NINTH BT  
 NR1 CD MHNBT NJIUY MSHGT NNBGP QPIUY MNVXS WEIPT IPRTY  
 MNSXT TIWPG MANTP MNTOC VCPQW PIQWX MNGPQ QPOWY I I I I  
 WZ1 V WX3 NR2 GR21 NINTH BT  
 NR3 CD MPORT IOEQP MNOWL KNQPA STHGC DHGST IEMHS YMTOZ  
 MAXCV BCFQR ONTOZ MNTAS LDDAP SHIES OTILM BOMTE NATMA ZXMYV  
 I I I I  
 WZ1 V WX3 NR3 GR14 NINTH BT  
 NR5 CD MNTPE ALNDD KLKLL OPQWT SDHNG HKNSA SLTIO NEPAD  
 NORMD SNDPQ WIRSE I I I I  
 WZ1 V WX3 NR4 Y P GR12 NINTH BT  
 I INFANTRY TROOPS ENCAMPED ON OUR LEFT FLANK MACHINE GUNS NECESSARY  
 EXECUTE I I I I  
 WZ1 V WX3 NR5 I I WZ1 V XL7 GR21 NINTH BT  
 NR6 DFCT1 NHTY MEOE MAME KJHT HJNH HNMK ZXSE REQ  
 MNIP QWEC XZVG HUIN QWPY UNBY MNQP EXCV MNPY SHIE  
 I I I I  
 WZ1 V WX3 NR6 P GR24 NINTH BT  
 NR8 CD MNTOP SOPRT EIPAT PQIRE PTIAT XCPTY UIMNP QPRIY  
 MAOEC VCOPT QPRUM KCZBV PUWYT MEPTO QPEIT MANTI AUTIK DLKRB  
 MATNA EMTYU CVZXS I I I I  
 WZ1 V WX3 NR7 NITE GR18 NINTH BT  
 NR10 CD SPRIT MENTI SH TIP NMJRU QWPOJ NBVER EIPQI METIP  
 NJTYU NHGZX ASWEP PONMO SSLKU OUTYE WPOWX I I I I

CODE PRACTICE EQUIPMENT

WZ1 V WX3 NR8 Y P GR25 NINTH BT  
 NR12 CD OMERC WZAST MEOTO HGNBW QPOUN FHTYU KJMNT EINJT  
 MNZXE WTEQP QPZMA LAQPM MSKLD KNHGU NJGUT NGSER EIPTH HBNT O  
 NSOEP NAOEP QYURS TMA TE 119P II II  
 WZ1 V WX3 NR9 Y P GR16 NINTH BT  
 NR15 CD MUTYE HGBNI WESDN HNXCE OJU IO MNHSH WR TYU NOQP U  
 MAPTD APR TM NQWUR MAPTE SDHEI 121P II II  
 WZ1 V WX3 NR10 GR20 NINTH BT  
 NR13 CD KNPQR MARST INEAU RYTUN AQWPO MNKIT TYHBG ZXSOP  
 NJPER NCXVB QWCVY EIMXT APKLD HGTYD TYDKR AIGHT NBVZX 12 5P II II  
 WZ1 V WX3 NR11 G Y O GR19 NINTH BT  
 NR15 CD MNOFQ QPLAN RYGH B QIJHX ZAQWE RTNGB EPQPE EIMBV  
 NQQRK KLTOX XOMTE MADVO DSSHS DDIRT NDITE QWURP 127P II II  
 WZ1 V WX3 NR12 P GR23 NINTH BT  
 NR16 CD MENTP EPEID NOWRS EIMVS OPWEP NCOSG SGOHT TMWTA  
 MAPRT ZXVYP SNDAL DICT MXCV P QMDT EIDMG QPODK AMDKP ASKPL  
 NDPQU URSPT 128P II II  
 WZ1 V WX3 NR13 I I WZ1 V DO9 NITE GR14 NINTH BT  
 NR18 CD NRIOR DEOU WPE TA DSAPR SIVCP EIPET UEIMS NAPET  
 MANDO NAPRO NEOPQ 129P II II  
 WZ1 V WX3 NR14 G P GR7 NINTH BT  
 ENEMY CAVALRY ROUTED DRIVE SUCCESSFUL HERE 131P II II  
 WZ1 V WX3 NR15 P GR27 NINTH BT  
 NR19 CD MENT I AONER NAPRQ MTOPR GHTMH EOTPE PQIRT MEOTP  
 MNTZX WOTH D GHKLD AKDLS DNWOJ JKKLD DALSN EPMTU MSOLK GHTYR  
 MATIR MSOET XFHPQ SORMH DMSTK STAMX 134P II II

Tape No. 9—Continued

WZ1 V WX3 NR16 NR16 F F GR21 NINTH NINTH BT BT  
 NR21 NR21 CD CD GIESS GIESS MSPRG MSPRG QPWEB QPWEB EIRMT EIRMT  
 OWDHT OWDHT WWMKJ WWMKJ SJLKT SJLKT APRJL APRJL NDEMT NDEMT  
 TMASS TMASS SLKER SLKER MTEMJ MTEMJ JKLQP JKLQP DMTRJ DMTRJ  
 KLSTS KLSTS ISLES ISLES NDJDK NDJDK SLTSE SLTSE 134P 134P VA VA  
 I I I I  
 WZ1 V WX3 NR17 NITE GR20 NINTH BT  
 NR22 CD EIGHT MSFKT SHBDK SGTIM SOEPE MAXNV OTOMD SOPEM  
 DMSTE SPETD KANEI SNDIT AJDKM DKTIO SMDKT SKDLS EIRYY 138P I I I I  
 WZ1 V WX3 NR18 T XD1 V WX3 G NITE GR31 NINTH BT  
 NR25 DFCT1 EIMG HOLD HARS DKMG DMSI EIHN SLNS SLPR  
 MSJD SPEI XNCX MSTO QPRM MAPE XMVN QWOP SLPN SPMN  
 NPEM DOWP WORU STON SNDF ASEN QPRY TSLT MADT PEEN  
 139P I I I I  
 WZ1 V WX3 NR19 GR20 NINTH BT  
 NR27 CD MSTOP NSORI NXPET SORMN VCIEI SMSOP NDOEN SPARN I I I I  
 MAPXG YUROG HJIPC VOTAL COMPT MSPTS SORIE SJHND DNOTC 142P I I I I  
 WZ1 V WX3 NR20 NITE GR18 NINTH BT  
 NR29 CD DOPSX SRIDH JRNXD LKSRW QPRYR UMONZ WOELX SIRNS  
 NDGEI ZDCIP DNIPD FESNP DNSIP EIGHN SITEM 145P I I I I  
 WZ1 V WX3 NR21 NR21 F F GR19 NINTH NINTH BT BT  
 NR31 NR31 CD CD SPEUM SPEUM TIMSX TIMSX SIOXK SIOXK DKAPL DKAPL  
 SNDOP SNDOP QPRUR QPRUR THSMD THSMD MADND MADND MSNDL MSNDL  
 SNDIP SNDIP SMDKL SMDKL NDISL NDISL KYRUS KYRUS NSMHD NSMHD  
 SMDAL SMDAL DOPQU DOPQU 147P 147P VA VA I I I I  
 WZ1 V WX3 NR22 O GR12 NINTH BT  
 LOST HILL TWO SIX SUFFERING HEAVY LOSSES NEEDED SUPPLIES AND  
 AMMUNITION 151P I I I I

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CODE PRACTICE EQUIPMENT

WZ1 V WX3 NR23 P GR23 NINTH BT  
 NR34 CD SNDIN SIPEI SMNDP XDCVC IDMSL MDTRC DPEIT MSTND  
 JGHTY DKJFU AKNCV AWERD MBNB J HGFRT DTBCV EHDK SLNDI KCZWE  
 DPEIT URYUN 153P II II  
 WZ1 V WX3 NR24 G NITE GR21 NINTH BT  
 NR26 CD SDDJK SNDKL EIMXL SBGHT NCMKW WOPKD NMLPA NVBEQ  
 MDNPE UOYJK LDGBV SMEMT YURST MXOMD QWADK LJUYR HDNBX TYUNB  
 155P II II  
 WZ1 V WX3 NR25 T XD5 V WX3 NITE GR29 NINTH BT  
 NR41 CD DKIEH MNHTI MNVKS EUTYH NBVFG RUIMK SIEHD SMDHX  
 MNDJH SMKDI TNDDSN DIEY MSJDH SJDIP UTYQV BDGKI 158P II II  
 WZ1 V WX3 NR26 Y P GR20 NINTH BT  
 NR43 CD MSJUT NSITY SMKSL DKITH SKSLK DNTIX SMDKT SKJNC  
 MSPEI QPEIR MSNBK SRTYU MSNEP EIMXL XCNDK DILET MSKSY 159P II II  
 WZ1 V WX3 NR27 GR15 NINTH BT  
 NR45 CD MSKLS KDIHT KDNSK DKUTH SKKID MIJTK SLITH XFKMC  
 MSITH SLPKP QURYT SKMDO 159P II II  
 WZ1 V WX3 NR28 P GR19 NINTH BT  
 NR49 DFCT1 EIMD SIMG NJDN DKPE MDJS NXOS IPQI MDMX  
 MDNS SMDP QPIE MSND MSKD MEKT IENT NJUT 202P II II  
 WZ1 WZ1 V WX3 NR29 NR29 F F NITE GR22 NINTH NINTH BT BT  
 NR51 NR51 CD CD MSIRD MSIRD IPSJK STHNB STHNB DISMD DISMD ISMDI  
 ISMDI  
 TIMEL TIMEL SMXSP MSOED MSOED MSNDX MSNDX VICEO VICEO SNXCP  
 SNXCP  
 QURYT QURYT MXDKP MXDKP DMXPE DMXPE XHHZD XHHZD KLJEL KLJEL DISND  
 DISND  
 ADJEP ADJEP DISXH DISXH 203P 203P VA VA II II

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*Tape No. 9—Continued*

WZ1 V WX3 NR8Ø GR15 NINTH BT  
 NR58 CD UIKLO FWSDX ZAQSW JFHGY DHFGT CGFTR KFHGJ  
 GGBCN EYBTF WXADS GTYFH HVGSK 2Ø4P II II

*Tape No. 10—60 characters per minute*

(Tactical traffic, 12 words per minute)

FQ1 V XL7 NR1 G O GR18 EIGHTH BT  
 NR11 CD OWYRI UONHV JKLSA NCEBT UBZXS QMNCB HLKDF NJOPQ  
 HAYTG SPOIL NYTGE QUOET GHKDA ERYQP HUI TS 112P II II

FQ1 V XL7 NR2 GR12 EIGHTH BT  
 MORALE OF THE MEN LOWERED CONSIDERABLY BY ENEMY ATTACKS FROM  
 AIR 114P II II

Ⓕ FQ1 V XL7 NR3 O GR25 EIGHTH BT  
 NR21 CD QAZXC RFVBN UJM LP OKMNB YGV CZ ESZAQ WSXDR TGBHU  
 I JNH Y TFCDE WAQWA RFTYG UJKIO PLKJH YGFDS QASDF QWSDC RTGHB  
 MNHGR BVFDW ASCVT JUNHV 118P II II

FQ1 V XL7 NR4 P GR8 EIGHTH BT  
 ENEMY TANKS THIS SECTION HAZARDOUS FOOT SOLDIERS HELPLESS  
 AGAINST  
 119P II II

FQ1 V XL7 NR6 T FU1 V XL7 Y GR19 EIGHTH BT  
 NR31 CD QOWOW UNIKL UIRYT SIELV NVMZK SITUE SIQPY DJITY  
 MSITL SLITR SITHD NBYEI SLAPQ NGYTJ SLEYT SKITY 121P II II

FQ1 V XL7 NR6 G GR22 EIGHTH BT  
 NR41 CD DFHJU EISLR KIOUY BCHJK MKTRE XSDVG BNF GH NMJUI  
 MBVDE ZXCVB HGFDS UIYBV NTR ED MKJYC VFDSI OPIUN MJBVC HYDRC  
 VHJUT 125P II II

CODE PRACTICE EQUIPMENT

FQ1 V XL7 NR7 GR17 EIGHTH BT  
 NR51 CD INCJS IEOHG MOESZ OJGVC BFWAM OIUXS BRJKI MHTRD ZSTYN  
 MKLOI NJRFB BHYTG KIEXC NJWAS 127P II II  
 FQ1 V XL7 NR8 GR19 EIGHTH BT  
 NR61 CD NIEYT MCJAL CBNGS PZIET CIESL WHTRA VHAKL INTOT  
 KUYRS SDALE LITCK SCGBA NJHRT MJARY REWAA NINTP 129P II II  
 FQ1 V XL7 NR9 O GR16 EIGHTH BT  
 NR71 CD QPALZ MALQP IEURY RIOER NAITO EOTIE KELSB NUTHE  
 TOUTY HJ DZN JSOTU SLIET NKELT 132P II II  
 FQ1 V XL7 NR10 GR25 EIGHTH BT  
 NR81 CD WORIO SKELT LROTU SOELT SLETTU SLEIT ALSIE SLEIT  
 TIEKL EOTHR EILZX NNELE ELTIT DKFJG DLLSY KKEIT GHTUE DKWMZ  
 EEOUU J JAKE LELTI UTYRW 134P II II  
 FQ1 FQ1 V XL7 NR11 NR11 F F NITE NITE GR19 GR19 EIGHTH EIGHTH BT  
 BT  
 NR91 NR91 CD CD OLIKU OLIKU JHYTG JHYTG FRED S FRED S WAQWA WAQWA  
 AZSX D AZXS D  
 CFVGB CFVGB HNJK HNJK LPOLP LPOLP QWEAS QWEAS RTYFD RTYFD  
 UIOHG UIOHG  
 OPLKJ OPLKJ ZXCFCG ZXCFCG VBNHJ VBNHJ MKLOP MKLOP YGUJH YGUJH 135P  
 135P  
 VA VA  
 FQ1 V XL7 NR12 O GR17 EIGHTH BT  
 NR12 CD QWOET EILTO EOTJS IJNBH UHBVG TFCDR EDCFR OLIKJ  
 OPQWZ ITUEI KSMTU EOTUR KDLEN IIKEO 137P II II  
 FQ1 V XL7 NR19 G GR21 EIGHTH BT  
 NR72 OD UIEOE PPIOT OSITY RONCL ZSLAO OLEHI ROQIR APZOD  
 SOTYF LKIYT SOTLD ELUTY SITYQ LSITY OTOWI SLPRY TUQPE GHSKL  
 155P II II

Tape No. 10—Continued

FQ1 V XL7 NR20 T PQ9 V XL7 P GR16 E IGH TH BT  
 NR82 CD RUBIR SLEIT TUIPQ ISUTY EOUTN FHALD SLEIY EILSI  
 NTURP ELUTL IEOTQ SKELY 202P II II  
 FQ1 V XL7 NR21 GR16 E IGH TH BT  
 NR92 CD I TYHE UTHAL ENOTP ISQPR ALZNC SLIQQ UTYRA EITYQ  
 UTHLC MALRY SIELT ALTYQ ALITY 204P II II  
 FQ1 V XL7 NR22 Y GR21 E IGH TH BT  
 NR13 CD TOQPW SLTUR SIELT LEIAL NEZL ENGLS ZELAI TNAL E  
 NALDI ELTUA NKEFD SLENF NSKEL NEUTY SMALL UTAL E EJALI HURYT  
 206P II II  
 FQ1 V XL7 NR23 G P GR19 E IGH TH BT  
 NR23 CD NVLSK ALIRT NSLZL MAIEL MENTL SITYE ZLCXN SLEIP II II  
 UQOSP TYSLX CMXLZ SLEIT NSITY MAOPR EOTYH MEIGH 208P II II  
 FQ1 V XL7 NR24 Y NITE GR14 E IGH TH BT  
 NR33 CD AEIOU EOITH LEITH MAITY HLEIT MELTI SLEIQ  
 YSLPQ MEPRD FGHAL'EMTHA 210P II II  
 FQ1 V XL7 NR25 Y O GR6 E IGH TH BT  
 FO2 NR7 FIFTEENTH 1146P II II  
 FQ1 FQ1 V XL7 NR26 NR26 F F GR26 GR26 E IGH TH E IGH TH BT BT  
 NR43 NR43 DFCT1 DFCT1 QPWO EIRU EIRU TYGH TYGH FJDK FJDK SLAP  
 SLAP  
 ZIMX ZIMX JFUR JFUR LAUT LAUT ZWXE ZWXE CRVT CRVT BYNU BYNU MIKO MIKO  
 LPJI LPJI BNTR BNTR DEWQ DEWQ XDSA XDSA ZGRY ZGRY KUOY KUOY QPNC QPNC  
 ZXCV ZXCV JKLO JKLO UIOP UIOP QAZS QAZS 214P VA VA II II  
 FQ1 V XL7 NR27 P GR17 E IGH TH BT  
 NR63 CD MCJKD LEITS MELTY SIELT SLEIT EIOPT TOSIE NEUTL  
 MAUTY ENKTTU SLEIT LSEIH NEITB NNUTH 21 6P II II

CODE PRACTICE EQUIPMENT

FQ1 V XL7 NR28 O GR19 EIGHTH BT  
 NR63 CD EIORY EOMEI SKALU LEIAY DKEIA NCKEL ETCHE EELIS  
 QPPAO EOTUN EILTI TIELT SLEIU EITLS MAUGJ ELITY 217P II II  
 FQ1 V XL7 NR29 Y NITE GR22 EIGHTH BT  
 NR73 CD QPOEI ITUEJ SLEIT LIUTY EITAY ZLHNV LEITH HHALE  
 LEIAL TMEKT THIEL TMEIT FIEKT MMEIT AAZXC SOOKX MEITH NELTY  
 ALLOK 218P II II  
 FQ1 V XL7 NR30 II FQ1 V K9P G GR16 EIGHTH BT  
 NR83 CD ABFUX NAMMA ELTIE POIUR SLEIT NNELT LSITY MEKTL  
 UXNDK DKELU TIELA MEKTL QPSOI 219P II II

*Tape No. 11—60 characters per minute*

(Tactical traffic, 12 words per minute)

97 FU1 V FZ2 NR1 P GR16 TENTH BT  
 NR10 CD JHNYT BNHGT BGFRE BGFDE CVFTY VGYUI NHTRE KLFRE  
 WUYRE BGUWE BZXCO INHYT NGBDR 112P II II  
 FU1 V FZ2 NR2 GR18 TENTH BT  
 NR11 CD NHGTR VGFCX CDEWQ ZXCEW DSUTN HGTRW NMHGI NVCZY  
 PGZIW NBFXA CXEYH MNBGR FVDEW BXCDT BGFRE 113P II II  
 FU1 V FZ2 NR3 T WZ1 V FZ2 GR18 TENTH BT  
 NR12 CD MNBVZ CDYUI BGFVW CVDFG HGTR E DCBGT MKJLU OTYBG  
 MJNFB GVDSSZ XDWAS RDFTY BHFG R BMNDT BVDWQ 114P II II  
 FU1 V FZ2 NR4 G Y O GR22 TENTH BT  
 NR13 CD XZSDE FGVCR HGBVT GHYUI MNKJY HGBJI LKMHN KMDFW  
 OUIJN BHGTR FDEWS ZXSDR VGFBH NJKMG JNBFBV CGRFE VGHYT UIOPL  
 MVGED 115P II II

432514° — 42 — 7

Tape No. 11—Continued

FU1 V FZ2 NR5 P GR17 TENTH BT  
 NR14 CD OJKYH BGFTR VDFRE BVFGR HGCKZ MHJKY MNEIP VDXZW  
 P I O U T Y I U R T V S W W Q A S D F R S D F G T K J H G R 1 1 6 P I I  
 FU1 V FZ2 NR6 Y NITE GR15 TENTH BT  
 NR15 CD MNBHG BVFDS XCFGT HBFVC VFDES XCDFT VGFRY BGFHR  
 MNHGB BVFDC CDSAX IUHGT 118P I I  
 FU1 V FZ2 NR7 G P GR17 TENTH BT  
 NR16 CD MNBHG HYTGF GFRTF FDREW KMNGH BVFDC VCFDE MHNTI  
 DLCMF ANSHD BVGFR VDUJT BHGRE OISHE 119P I I  
 FU1 V FZ2 NR8 G NITE GR19 TENTH BT  
 NR17 CD MNBVG JHGFTHGFDH MKLJI KJHUY JHGYT HJGNB BVGFR  
 MNJHK JHGUT NBHGY HGYTR BGHFT MNBJR FSCXD ZXCES 111P I I  
 ∞ FU1 V FZ2 NR9 T XU1 V FZ2 Y GR18 TENTH BT  
 NR18 DFCT1 NJNH NJYT BVGFBVGF VCRE ZXPO NJHU GYTR  
 MKLI KJIU JHUY HRTF GFRE BCFE DWSA 120P I I  
 FU1 V FZ2 NR10 GR17 TENTH BT  
 NR19 CD NMJKI HJTYU FGERT CVXZD CFDRF FGYTR MNKLLJ BFYSZ  
 P I O U J J K L Y U J G Y T R V D G H R V C X Z S N M J L U 1 2 1 P I I  
 FU1 V FZ2 NR11 Y P GR19 TENTH BT  
 NR20 CD IUHJK JGYTR ZXCSD SADEW SREDF FDTGR SQWEA ZCXDR  
 I J K H Y N B G H R B G F V R C F D E W S D T R F B V G F T H G U Y J L K I O U 1 2 2 P I I  
 FU1 V FZ2 NR120 GR24 TENTH BT  
 NR21 CD IUJHY NBHGT FXZEC FDEWA BVGFT KFNBH CVDRZ SDWAZ  
 NBHGF VFCDX CFDTR GYTHB NMJKO KLJUY HJNBG GTRFD FREDW FDRWS  
 NBVGU BFDCI VCXSA 123P I I

CODE PRACTICE EQUIPMENT

FU1 V FZ2 NR13 Y GR16 TENTH BT  
 NR22 CD IJKGT XSDEW ZXSR E VGFDZ CVBNJ MNHUY KLYHU BFGRS  
 LJMNT GVFRW CSFDR VCGRU 124P II  
 FU1 V FZ2 NR14 NITE GR18 TENTH BT  
 NR23 CD MNJGY HVFTR VGDFE BVHGU IOJUY HGYRT GVFFDC CDSXA  
 MKLGY BNJHU JHYTG HGFRE DFRT E NBHGR XZCSW II  
 FU1 V FZ2 NR15 T WZ1 V FZ2 G Y NITE GR17 TENTH BT  
 NR24 CD XZESD FDRREF GFTRY BGHYT GFRED CFDXA ZXDV C BGHJU  
 MVBFR FGDC F VCFDE SXDZX VBCVF HFGDR 126P II  
 FU1 FU1 V FZ2 FZ2 NR16 NR16 F P P GR23 GR23 TENTH TENTH BT BT  
 NR25 NR25 CD CD MNKJU MNKJU KJHYT KJHYT GHTRF GHTRF VBGFT VBGFT  
 FDRED FDRED CXDSZ CXDSZ ZXASZ ZXASZ BVPXT BVPXT MNJKT MNJKT GHVBR  
 GHVBR FVCDT FVCDT VGBFC VGBFC CVDWS CVDWS VCFDT VCFDT GYUIO GYUIO  
 PKLIJ PKLIJ KJUYYT KJUYYT BHGRX BHGRX BVGFR BVGFR FVCEQ FVCEQ 127P  
 127P VA VA II II

FU1 V FZ2 NR17 G P GR17 TENTH BT  
 NR26 CD NHJGY BCXKZ XSDRE GFVTR GFVCD FUYTG BHGIU JNVDC  
 NVBFD CVFDE CXZSD CFVRE VGHBN NJHMB 129P II  
 FU1 V FZ2 NR18 GR20 TENTH BT  
 ENEMY ADVANCING ON ALL SIDES PLEASE LET US KNOW BY PIGEON  
 WHETHER YOU CAN SUPPORT US AT THIS TIME 130P II  
 FU1 V FZ2 NR19 Y O GR17 TENTH BT  
 NR28 CD NHJYG HGBFT GFRDE BGHVF DCFIO MKJUY HJUYYT BGF EW  
 MKLDC VCFRE FDCYU BGHTW CXDSE JKRTQ 131P II  
 FU1 V FZ2 NR20 P GR16 TENTH BT  
 NR29 CD MNHDR VCDWA SREFT BCXZE QWEDS FGDRE BVGFT MNKYI  
 POIUH JKLOI NBVGF VCFDS BVCXZ 132P II

Tape No. 11—Continued

FU1 V FZ2 NR21 NITE GR18 TENTH BT  
 NR30 CD PILKO KJIUY JHUYT NBHJU JHGYT HGBVF VBGFT VCFXZ  
 BVGFR FDCSE SCDFT GFVBH YTRFG NBJHU XDSZA 133P I I  
 FU1 V FZ2 NR22 P GR16 TENTH BT  
 NR31 CD NBVGF GFVFR GHYRF BVGHY NBJHU HGYTH BVFDS CXDSE  
 MNJHY HGBVF GVFD R CVFDE DSXCA 134P I I  
 FU1 FU1 V FZ2 NR23 NR23 F F O GR17 TENTH TENTH BT BT  
 NR32 NR32 CD CD BVCFR BVCFR FVCDE FVCDE CFDTG CFDTG BHGYT BHGYT  
 NJHUI NJHUI MNJUY MNJUY HGTYB HGTYB CXZSW CXZSW KEYVX KEYVX  
 BVGFT BVGFT FHGUK FHGUK LHKGE LHKGE VSYTN VSYTN NBGHR NBGHR  
 135P 135P VA VA I I I I  
 FU1 V FZ2 NR24 T LC1 V FZ2 P GR18 TENTH BT  
 NR33 CD BVCXZ ASDFG HYTGR FDTRE BVGFW XZSAW DSFRD FDGTR  
 MJBF C AXFVH NGYRF VCFDR SDEWA BVGSX BSAZX 136P I I  
 FU1 FU1 V FZ2 NR25 NR25 F F GR19 TENTH TENTH BT BT  
 NR34 NR34 DFCT1 DFCT1 JHUT JHUT BVGR BVGR CFDE CFDE CVFG CVFG  
 BHGY BHGY MNUY MNUY SXHG SXHG GFVT GFVT TRFG TRFG HYTG HYTG  
 NJHU NJHU YGTF YGTF VBDF VBDF CXZS CXZS SXCZ SXCZ GWSA GWSA  
 138P 138P VA VA I I I I  
 FU1 V FZ2 HR26 T LC2 V FQ1 Y GR22 TENTH BT  
 NR35 CD TFGTE VCDFFE DSXAZ CXDFG GFHJK HJKLO IUJKL BSKFJ  
 MNBHJ HGYRT GFVBH GVCDE XCSEQ BVGFR GFDET GYGUT UIOPJ MNHJK  
 CFDET 139P I I  
 FU1 V FZ2 NR27 P GR16 TENTH BT  
 NR36 CD XZCVG VCFDR YTGHU NHJUY HBGER DFTVD CVEGY HJUOI  
 LKMJU NHUTG NHGFR BVFED VFCXZ 140P I I



CODE PRACTICE EQUIPMENT

FU1 V FZ2 NR28 Y GR17 TENTH BT  
 NR37 CD NBHGF VCFDE CDFEW BVGHY JNBHG BHGYT GFTRE BVGFR  
 NJHGY BVGFR CFFDE DXCSA ZXSEW LMNJY 141P II  
 FU1 V FZ2 MR29 GR18 TENTH BT  
 NR38 CD MNJUT ZXCVB OIJKU BHGTR FDEWQ ASZXD PQALG BVFFDE  
 JHYTF VCFED CGVHB NBHFR DSXAW BVGFR FDCXS 142P II  
 FU1 V FZ2 NR30 P GR17 TENTH BT  
 NR39 CD FGRDF FDESW FDTYR BHGFT JHUIO KJIUY PLKIU KJYHT  
 JHGTR ZXCDS CXDFR GFTRE BVHGT NBHJY 143P II

*Tape No. 12—75 characters per minute*

(Tactical traffic, 15 words per minute)

KX7 V KZ3 NR1 P GR10 FOURTH BT  
 NR6 CD TYRSD GHOIY MKLRO BHTRY OPYCG NMURG LIJHK 1100A II II  
 KX7 V KZ3 NR2 P GR15 FOURTH BT  
 NR8 CD MKIOP MKLSH IPYTS BSHDT ISPHS MOPGD KLPYQ MNVXS  
 UISDG MJOIY SETYD FOOEY 100A II II  
 KX7 V KZ3 NR3 GR20 FOURTH BT  
 NR19 CD MOIJH PUYTQ MJKHD PETYD LFLFL OMOIN TYQWI PKLJH  
 UDFTS MNBCK YQUQY MNKLI PUYES MJHGF ASDFG LFJKD OIURS 1144P IIBII  
 KX7 V KZ3 NR4 NITE GR9 FOURTH BT  
 NR13 CD TYREW NGFTW PUYTV VBHSF OUAAL MPOWS 800A II II  
 KX7 V KZ3 NR5 P GR19 FOURTH BT  
 NR15 CD LFHJI EABCD MNHST GRTOP GOOTY MKLFG BNGER PITYQ  
 HSDRT BVGFL QYUIT LPRST KJLHG EPTRS ADGKP MOIYT 745P II II

Tape No. 12—Continued

KX7 V KZ3 NR6 GR21 FOURTH BT  
 NR19 CD LOIUY JHTRS KHBGD MLFGH PIOYT DWTRP MDGFS QYTUE  
 TYREW GHSEDE SSHST MABVC PUTYE MKLFH OYTHR CGFTS ABCDF THOPR  
 950 I I

KX7 V KZ3 NR7 O GR26 FOURTH BT  
 NR22 CD TRSRE MNBVC CYOIT PLKUT EDFRS MJHGT WDMNX ZMOIP  
 BHGFI OMPQW MBVCZ JYTHW PUYTS DETRS LKJHG DGFSA ABVCM ABWSU  
 RWQOP GHDES BNCXZ GHROY LHGJD 855P I I

KX7 V KZ3 NR8 GR21 FOURTH BT  
 NR25 CD TYPIU DEPHL MHGTW EDFRT PUMNB VDBFG QBWTE MHGFT  
 BVCFG MKLLTY ERTYU QWERT GHTYP MHYTR EFLGH QYRTS MERTS GHRTA  
 855A I I

10  
 NR27 V KZ3 NR9 Y GR27 FOURTH BT  
 NR27 CD KODZS OPYHG MNBVC TYREW SDFHK PUYWQ MGTWS PIUYT  
 VHGF D KDLJG PUYEW BVCHD PYGWS SEGHF ITERS HSPYT MGHFT BHGTP  
 GHRYS PIUHR SHETR MFGHL LFITE GHBNC 111P I I

KX7 V KZ3 NR10 P GR22 FOURTH BT  
 NR19 CD TYPRE MHS DG FLKJH REWQY YQRTS PIOYT MENKL ERTYU  
 AFGRQ MGHTY SHIPE MNHKE THYRE GHTYW WDFHG KJHFG MEPIE MNSLG  
 MNHGT 625A I I

KX7 V KZ3 NR11 G P GR27 FOURTH BT  
 NR19 CD TYPRE MHSDF FLKJH RRWQY YQTRS PIOYT MENKL ERTYU  
 AFGRQ MGHTY SHIPE MNHKKI THYRE GHTYW WDFHG TYERS LKJHO EIGHY  
 GHRYS PIUHR SHETR MFGHL LFITE GHBNC 111P I I

KX7 V KZ3 NR12 P GR23 FOURTH BT  
 NR46 CD FGHJY QWRTY QUIOE GHTYR HNGTQ QYPI T MEFGT PTYRS  
 MAHSG MNVGF PTYWQ AMSNL MERTY RTYWE MGHTP BHGJS DCVBF BVDRH  
 OITYR TYQWE 1100P I I

CODE PRACTICE EQUIPMENT

KX7 V KZ3 NR13 O GR18 FOURTH BT  
 NR4 CD FGHJK BETRS METRS GHBNT PTYUE MASDF GHSDF METGH  
 QWERT TYUIO DFGER MASTY METYU GHRWA ADSFD 835A II II  
 KX7 V KZ3 NR14 Y GR7 FOURTH BT  
 NR7 ATTACK AT DAWN REINFORCEMENTS FOLLOW 1050A II II  
 KX7 V KZ3 NR15 Y GR17 FOURTH BT  
 NR12 CD GHRES METYU UDJKP GHRET MQOPE NEKLS ADFKL MENIP  
 NRGHU IERPO MELSE MENZK ZYRTX NTHRY 1010P II II  
 KX7 V KZ3 NR16 P GR24 FOURTH BT  
 NR34 CD RETYS ZCXVB SLPIT FGTKL TNPOZ ZFGTY MLSKJ GHREW  
 ALPEX MLDKJ DEOIF MSLPE MANLT MENPE DEZCY MLSQI MLLPYJ QTRYU  
 ANKEP IOKJE MEPII 900A II II  
 KX7 V KZ3 NR17 GR20 FOURTH BT  
 NR15 DFCT1 THIE SPIL NEKL THIP MLKJ MKLS QRTS MLSH  
 NOIU QERT MLHK MGHT MLHJ RSTY GHTU WERS MPOR 455P II II  
 KX7 V KZ3 NR18 GR21 FOURTH BT  
 NR14 CD TPOIG CVBNM ANMLE THIU Y QYFGL ALFGJ MKLST MLSHR  
 NOIKP MNDKS ADHKL NMLKJ MNYAN THOIS SHIEP MLKHP ERTYG MLAPW  
 1012P II II  
 KX7 V KZ3 NR19 GR8 FOURTH BT  
 NR8 MACHINE GUN NEST CAPTURED NO LOSSES 125P II II  
 KX7 V KZ3 NR20 GR24 FOURTH BT  
 NR11 CD KLIQ NKLQW MANYD GHTYU ARETZ XCVBN MNAL E QRTYU  
 NKLA E TPOIW NKLST MEITY QPOIS NOIUR SDFGH HSIET MLPAR IOSHE  
 RTYUI QWRTS NKLSE 950A II II  
 KX7 V KZ3 NR21 GR21 FOURTH BT  
 NR5 CD THOPS IOZ YU MJKHT SLSEB MFLFK TYQWD DOIPA MLKPW  
 NATGH HYRES TRYUP QWYPO OMKOU NAFGH ALPRY CMLAR POITY CVBNV  
 1010A II II

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Tape No. 12—Continued

KX7 V KZ3 NR22 O GR24 FOURTH BT  
 NR67 CD QWUIT FOOME SPOET GHVVB ASDHG POIEN LKASD THGSR  
 QWTYU UDFGH AILNK QRYVH VVDUI GHWEY YQTS DMPONT MLSKJ  
 QTYUP VCDVD GHTVB SHOPE 1245A II II  
 KX7 V KZ3 NR23 P GR7 FOURTH BT  
 NR10 OBJECTIVE REACHED AWAIT FURTHER ORDERS 250A II II  
 KX7 V KZ3 NR24 G GR17 FOURTH BT  
 NR25 CD THIO P ERGTS NOIR T NGHTW WDFGH QPOTU QYTF L NHBGJ  
 THEYER FHTOP OMOJM SOTHW WVGHT BVVFE 145P II II  
 KX7 V KZ3 NR25 GR21 FOURTH BT  
 NR25 DFC T1 MOMO THYR WEDT MNBV VDFT WDRT GHRY VBMN  
 QWRT TOMT JOMJ RTHY AMLE GHRE WSHI ALOP PHOM SLOT  
 255P II II  
 KX7 V KZ3 NR26 G GR25 FOURTH BT  
 NR23 CD GOIUY SDFGH APOET GNMVB BBBTB RTRRW CYCTI APOID  
 ABHVF PIOUS WTRFG HSI EG METRY YQWYR REDGF FLDGH POOPO GHURD  
 ANHVT TETY T TOIT GH CDC 100P II II  
 KX7 V KZ3 NR27 O GR21 FOURTH BT  
 NR13 CD VBNMS RTYUI FHVBE ALPER VBETR ISOIT MLALF ENTRE  
 NOETD DDDKD NLSLF GOETD NODKD NOPER MLARE EPTIZ ZZNKZ WRTYS  
 910A II II  
 KX7 V KZ3 NR28 P GR8 FOURTH BT  
 NR50 ADVANCED TEN KILOMETERS SEND SUPPLIES REINFORCEMENTS  
 200P II II  
 KX7 V KZ3 NR29 GR19 FOURTH BT  
 NR45 CD GHIUR QWRDF FLASK GHINT SLPEO ALSKT MENTH RETYA  
 NALRT TREWY SNKLD GHYYI WNLET GHBNV FVTYV WETVB 755A II II

CODE PRACTICE EQUIPMENT

KX7 V KZ3 NR30 GR22 FOURTH BT  
 NR22 CD GHTYU WRETF FLFLE EGHFF FTYHG QWRTU AMLST MKOTE  
 NLORT WEFGH SETRS NLETD DODD NKLWE FGHLT MERET NKLPS THYRS  
 NSDSI 700A II II  
 KX7 V KZ3 NR31 GR20 FOURTH BT  
 NR24 CD TOTPO METUJ JEPET BNHGT WESWT MDGTY MELPR SDFGH  
 NPEOR TRESO EIMLP NLKET SLSLS METRY SLPOE MSLTE NOIET 1100P II II  
 KX7 V KZ3 NR32 O GR8 FOURTH BT  
 NR78 BARBED WIRE ENTANGLEMENTS HOLDING OUR ADVANCE 836A II II  
 KX7 V KZ3 NR33 G O GR21 FOURTH BT  
 NR77 CD BHGRE MPOEN SLKEK GHWER RETTR NLPOO MOTOE NKLS E  
 NKLSE EITZS ZYEQT MLSPE MALSG NKSTZ XXDIX NLTEX AZAGZ NPETO  
 756P II II  
 KX7 V KZ3 NR34 G P GR17 FOURTH BT  
 NR42 DFCT1 INGR TRKA DHUT NCNX AGHI YEWS OPYT  
 REDX EWPU NHKLL RESA FTOP NRPV YHVZ 849P II II  
 KX7 V KZ3 NR35 NITE GR22 FOURTH BT  
 NR53 CD YRQNP JITWC THEMA NGKLA NOPIT JKLAS ASFUX MKHFS  
 EQPMZ ZITBV OAFSL LHS GH NOVAM RIYHA JLDAN MRQYW TQPMZ FHS LA  
 RQINX 853P II II

*Tape No. 13—75 characters per minute*

(Tactical traffic, 15 words per minute)

FL2 V FQ3 NR1 GR16 FIRST BT  
 NR6 CD XEIRT PITUR NFWOV QITGB CIPXS ORHAM QINHF PNVAD  
 PRWYL KFJOS YROMS TOMKE TPNH 831A II II

Tape No. 13—Continued

FL2 FQ3 NR2 GR14 FIRST BT  
 PROCEED ON ROAD ROUTE R4 AT A SPEED OF TWENTY MILES PER HOUR 120A  
 II II

FL2 V FQ3 NR3 GR21 FIRST BT  
 NR28 CD MLUVF VFGUT HGDAL VTNUM VFEXP OLESONJTRC NYIOE  
 SDCVT BHGRZ TEUBR AIRFC HUTGB RIPVA QYETC TPMHA FBXRRH NJSKL  
 844A II II

FL2 V FQ3 NR4 GR17 FIRST BT  
 NR37 CD HETDA NITCM HGNKA RQOPA NHRE J MFDCZ TNKSL HLOPT  
 GADWN RPQNB VCDGJ URYWA EBSOH QOPRD 848A II II

FL2 V FQ3 NR5 P GR18 FIRST BT  
 NR42 DFCT1 INGR TRKA DHUT MCCX AGHI YEWS OPYT BGJI  
 REDX EWPU NHKL RESA FTOP NRPV YHVZ 849A II II

FL2 V FQ3 NR6 G GR22 FIRST BT  
 NR53 CD YRPQN JITWC THEMA NGLKA NOPI T KJLAS ASFUX MKHFS  
 EQPMZ ZITBV OAFSL LHS GH NOVAM RIYHA JLDAN MRQYW TQPMZ FHSLA  
 RQINX 903A II II

FL2 V FQ3 NR7 O GR16 FIRST BT  
 NR29 CD JREPQ TRNKS LEKAD TADCK QOOTD TNALD RNIA P RDKAL  
 TOAKS EOCBN ZIRPQ NHGSD NAOTA 907A II II

FL2 V FQ3 NR8 GR23 FIRST BT  
 NR18 DFCT1 PQRX DTLL FOPU HIJK AXDD HBNM GEIT IENN  
 NBVJ WERZ MERL IBTX LIXJ KIOP POPP TELE PONK MLPE  
 VTNU MITF 910A II II

FL2 V FQ3 NR9 NITE GR19 FIRST BT  
 NR43 CD HREFQ QWENT HAKLE TCXMA ZMXNC XNCBF TROPQ FKLAG  
 QMPZY NORDC HRIRT GEIMP WNOXG UMRKA YTHFS JKLAS 917A II II

CODE PRACTICE EQUIPMENT

FL2 V FQ3 NR10 GR12 FIRST BT  
 MUSTARD GAS DEPOSITS IN THIS AREA THICK ADVISE  
 DISPOSITION OF SUPPLIES 265P II II  
 FL2 V FQ3 NR11 P GR26 FIRST BT  
 NR74 CD QNZSE PLMKO QUAZP TROPE NOITA NKLED HMBAX ROPAN  
 NAUTD KLAHN IEATP SUSPA NUMTD KJASL SLTYP NPETZ HAJHS ZXASW  
 POKLM ANSIE NAKEL TMEIS 925A II II  
 FL2 V FQ3 NR12 GR17 FIRST BT  
 NR29 DFCT7 QPZM OWNX FOEO TAILS TIAL KFEL AIRE FHJK  
 FHLA SJDK ROAO ISSM THAK KAND 929A II II  
 FL2 V FQ3 NR13 P GR18 FIRST BT  
 NR37 CD PQIOT NORKS TOAIGNAITE MAIRT SKLEG ALTJD DJAHF  
 MAOPE NUTYQ MEFFT ANOYHMLKAS NTAGS NRAPK 932P II II  
 FL2 V FQ3 NR14 O GR20 FIRST BT  
 NR28 CD TRAI O MEFER SLEAL MATIY PQMZH AILTA MOTNH PAHSL  
 MJAKL LEAIT MATYD NJTIQ JKEQR YPQMZ XNVAC ORYUW NAKTU 936A II II  
 FL2 V FQ3 NR15 GR15 FIRST BT  
 NR49 CD WQPRT YAPER MITBZ SHALF ALEIT PQALS MAITY RAIGH  
 MATHA JANGD FCVZS MJNKL 937A II II  
 FL2 V FQ3 NR16 Y GR24 FIRST BT  
 NR12 DFCT1 TRAY NJKL RITH TWDC AIRO SIEL AIEP MAIT  
 AGSF ALDK QPWO RQIP THRT MZNX BAJD HARI QMPZ KALG  
 QMZP WONV CPAT 942A II II  
 FL2 V FQ3 NR17 P GR17 FIRST BT  
 NR13 CD TOPEB NAITJ AMTOP KLAGJ ELAIT APTQC MAPTB NAKLR  
 ATITY AMTAP NAPTE EOPTW QPNMC TRWYP 946A II II

Tape No. 13—Continued

FL2 V FQ3 NR18 GR19 FIRST BT  
 NR14 CD UIPTH JAPRY MAPEN TWPZM JK LAD FALKE MPQUT RPWNV  
 HAKLS LEPTTE PQLTY YQPYQ HAPGL RPQUT ALTIR MNCXZ 948A II II  
 FL2 V FQ3 NR19 G GR18 FIRST BT  
 NR15 CD PQIOT AITPR JALKE EMTIP TOAPE AIOPR TOPQV TPAIK  
 TAPRU AORPQ AMP TU MNVZX APCVN AIMNZ APTXM 951A II II  
 FL2 V FQ3 NR20 P GR15 FIRST BT  
 NR16 DFCT1 TPQE APET HYTB YHAP IRPM PBVZ XNJG KLHF  
 APR I OQMZ HAKT LAP T 955A II II  
 FL2 V FQ3 NR21 O GR17 FIRST BT  
 NR17 CD ASDFV LKJHB QPWOE LKJHY TREWS UIOPH WERTG OUUYG  
 MNBVF ZXC VG IFNBG RFVGH UHBVF BHUIO 1004A II II  
 FL2 V FQ3 NR22 P GR18 FIRST BT  
 NR18 CD QWERF OKMNH IJNBG UHBVF YGVCD TFCXS RDXXA QAZXD  
 WSXCF EDCVG RFVBH UQHBV YWGV C IJNMK OKMLP 1006A II II  
 FL2 V FQ3 NR23 G GR24 FIRST BT  
 NR19 CD REWSD TYUHG UIOKJ LKJNU KJHBY HGFRC QPOWY HJKUY  
 REDFV JIONM CDERT BGT YU NJIOP MJUYT VFREW QWEDC YUJMN IJMKU  
 HYFRD HUBTQ ZCBML 1008A II II  
 FL2 V FQ3 NR24 Y GR18 FIRST BT  
 NR2 CD UIYTR KJHGF HJKLO IJNDL LIGHTD WDYBH IYTBV NOPQR  
 PQYTR NJIOK HNUIR PTNKY MAORT NAHVJ NIPQT 1009A II II  
 FL2 V FQ3 NR25 Y GR21 FIRST BT  
 NR3 DFCT1 QPWC EIRU TYGH ALSK DJFH EICN MEIX NOQM  
 ZMXN AONV ASHJ EIOT MOTY QPMC NRYT QPTO MIKL HJGF  
 1012A II II

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CODE PRACTICE EQUIPMENT

FL2 V FQ3 NR26 P GR14 FIRST BT  
 FOUR REPLACEMENTS DUE YOUR COMMAND POST THIS AFTERNOON RADIO  
 TIME OF THEIR ARRIVAL 1015A II II  
 FL2 V FQ3 NR27 GR18 FIRST BT  
 NR4 CD ETUPQ PAITM AOUTL NUBYR HBOUT MAUYT JALKE MJHBV  
 JAMCH CVZNA HQPQY MAITY QYRWP HJKLA HFGTE 1017A II II  
 FL2 V FQ3 NR28 O GR25 FIRST BT  
 NR6 CD WROUY APTJ MAIYR HLKDA KPQMN XAORP TURA E MAPRY  
 HALFK AMELS EKLAO ALEPE HEPT E AOEYT QPTYR AMOTY APRVB CZLAM  
 RQPUT YAHGS AMOEP NVBCZ 1018A II II  
 FL2 V FQ3 NR29 GR17 FIRST BT  
 NR8 CD RTPOY AORPE RIQNC MAOTR HGJKL LKAI E AKEIT EKATY  
 MAPTY HGNVB NVKDL LKHS D ZXMAT TORPD 1019A II II  
 FL2 V FQ3 NR30 GR23 FIRST BT  
 NR32 DFC T1 RTEY UITP MITY AORP RYAL HDLF NJEO MEPE  
 NAIT GHJD KELE LEIT AOTP ALEP MAUT YTLS LEIT KJDH  
 EPQW QWXZ 1021A II II  
 FL2 V FQ3 NR31 GR16 FIRST BT  
 NR41 CD QPWOE NAIT Y MEOP E NITYH MAITY NEJKL CNALD THOJF  
 WPOTM UNKJF CXZBN MAORY HSKDA 1023A II II  
 FL2 V FQ3 NR32 GR18 FIRST BT  
 NR5 CD REQYT AOTPE OPELT NJIUY BHYTR GVBHJ MKJNH BHGVF  
 VGBHY NURTY NAIT Y ZASXD CFDER VFGRT UQNZM 1025A II II  
 FL2 V FQ3 NR33 GR13 FIRST BT  
 RATIONS RUNNING LOW CUT OFF FROM DEPOT BY LINE OF  
 INFANTRY CAVALRY 1028A II II

Tape No. 13—Continued

FL2 V FQ3 NR34 GR24 FIRST BT  
 NR10 CD QPWOT YIROE JHDLF NAKDL NKTUI NUTYA CUI TH SNUTB  
 MAOPR HJKLA MAKEL MACBZ NAI TH MRTNH JNLAI NREQI AKSDF JAPRB  
 JRHTY CHUIT FANTE 1030A II II  
 FL2 V FQ3 NR35 GR19 FIRST BT  
 NR91 CD MARIT NAKFL RTAIF AKJHG HSLDK AKLEP MEITY HADSG  
 NAKRP AMEOI NAITU ROPEL MARUQ FNAJB HALRE TEGHU 1032A II II

Tape No. 14—100 characters per minute

(Tactical traffic, 20 words per minute)

LX1 V LX8 NR1 GR19 SEVENTH BT  
 NR2 CD KOXNT BHTRM NMGHT PEXXN HCVZM CBNET FOTZQ XEETO  
 NN EIU IHOIB BUOBE EBMOE IZCMX PXEXQ MEBIT NOTEQ 901A II II  
 LX1 V LX8 NR2 GR15 SEVENTH BT  
 NR3 CD DFCTJ IORYT OEXMT ERRSH EINMT DESCN BHNJO LOTYH  
 ZKIEP QPOGC YCEXN ZEXIN 902A II II  
 LX1 V LX8 NR3 P GR21 SEVENTH BT  
 NR4 CD NEISL INUTY XVFHG MNBYT KJIEK EXCBH MITHY EEDSA  
 ADIMA EXITN OPOOE EEDSA IMHTM ADOHO VIRCB EECEN NOTPH NENOM  
 903A II II  
 LX1 V LX8 NR4 GR22 SEVENTH BT  
 NR4 CD NKEME AEOEI AVENN QEWRT WERTY ERTYU RTYUI UIOPA  
 ASDFG SDFGH DFGHK AQWEX NOTES ENEQT FOXEN ZEXIN PMENT HQHPD II II  
 II II  
 MNBYT 904A

CODE PRACTICE EQUIPMENT

LX1 V LX8 NR5 GR19 SEVENTH BT  
 NR5 DFCT1 NRJH ERIS IENM THNI CSED JHEN KYOY YUHJ  
 BZX SSI E SXXE QOPQ EIKZ ZXIT UIOK BENT 905A II II  
 LX1 V LX8 NR6 GR14 SEVENTH BT  
 REQUEST PLANES SENT ON HARRASSING DETAIL TO ENEMYS SOUTHERN LINES  
 GROUND STRAFING POSSIBLE 906A II II  
 LX1 V LX8 NR7 GR24 SEVENTH BT  
 NR56 CD FOPPN NUQES SIEMF FTMNV HFDCQ EPDKN KDBCL REWGX  
 FNSTH TFPDE PQNCK CGLXN NQRTY NESTP QWERT RUNJN NESTZ FEKNT  
 JELNT HQSPD NIXNT 906A II II  
 LX1 V LX8 NR8 GR25 SEVENTH BT  
 NR71 CD BNGFG KEUBV KEING KXEU A IERGH BOVWI I LKJN AVCRN  
 IEBGN XKEIT KEIEE CDXJN XKEOT AASNT EIMNT XNSIP EKFOE CNJMT  
 YZTGM BAYKE OJPAN RUIXT 907A II II  
 LX1 V LX8 NR9 GR17 SEVENTH BT  
 NR8 DFCT1 URGS IHIV EXCL YZTG BYAK OJPA OKKD RIUX  
 JANW NYIM NHIM USDT USDT IHTEF 908A II II  
 LX1 V LX8 NR10 GR19 SEVENTH BT  
 NR9 DFCT1 ETBL AXMZ DYKV KUOG KOYA INIY YUKA OMGF  
 INIY YUKA OMGF OFRZ OVDG JUAC AWRT UHMG 906A  
 LX1 V LX8 NR11 GR20 SEVENTH BT  
 NR10 CD XORMO HDBAT SAARN XOVEN GOUKT SMANI IBTEN UI LOR  
 ISOGN ICKYN FYDOT EMDZC IEIRN OLITP ETBNC HQHPD NIXTU 909A II II  
 LX1 V LX8 NR12 G O Y GR20 SEVENTH BT  
 NR69 CD NEOXT IMCEN IUDJH UODAN EIONT KSOAN CNDJW EOTNE  
 NITFO MNTON LWQNT WIEIT NOCIO PAKSK ALSLD DJGHK NOTUN 1010P II II

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Tape No. 14—Continued

LX1 V LX8 NR13 GR22 SEVENTH BT  
 NR11 CD DFCTJ KUNHN HYVYO ZEZEQ WERTNP FEXON FERTY INOPT  
 NYGDN NENTP FERTY EOTNK KPTON WERTY QUION WERNR HRNTH FERMN  
 I PINT 1110P II II  
 LX1 V LX8 NR14 GR23 SEVENTH BT  
 NR110 CD FINIT LOTNK ERTYN ESAYY NESTO FOFTE XEZEN NUTTY  
 NIXTN FOXET TSTNT EASNT TESTN FERTN QUINN WEPTN FIXFJ J I J S J  
 LOJNT ASNSK 555P II II  
 LX1 V LX8 NR15 GR5 SEVENTH BT  
 KX8 NR41 SEVENTH 444P 449P II II  
 LX1 V LX8 NR16 GR25 SEVENTH BT  
 NR19 CD TITEN FEQTY POINM MOENTE FERTP ZEXEN CMNGD HRNOW  
 EANTH FIFTP BEONT SHIEH FEINT ERORQ POTNT OITNQ ERTYJ JNRJN  
 VEMEN ZXCVM QWERJ F I I S E 948P II II  
 LX1 V LX8 NR17 GR26 SEVENTH BT  
 NR21 CD ONATP QUIRT WERNJ FERTM ASSAN SASSN DIDQJ FOOFN  
 O I S I O J J K M N B I S N T E R T O Y F E M T N N I X O N F E M N T I O T N M X I X I N E M M N A  
 H Q H P N H R N E W N T E M T Q S T M N Z Z A N M 941A II II  
 LX1 V LX8 NR18 GR16 SEVENTH BT  
 NR121 DFCT1 WANT FINT POTN MANT EANT QRTY FIXN NOTM  
 S I S N E A I J J I K L L N T P M E N T 749A II II  
 LX1 V LX8 NR19 GR17 SEVENTH BT  
 NR222 CD FINJY OOPEN FIMEN HQDHN ENETM FONTA WENTJ HRNEW  
 E O J O P F E M N T L P W N T A L S K N A J K N E N E M N T 933A II II

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CODE PRACTICE EQUIPMENT

LX1 V LX8 NR20 GR22 SEVENTH BT  
 NR99 CD QUINT WERTP EASNT RUMPO TESNT YUMAN UNIET IOPNT  
 TNIMN POINT OMANT EFENT KEEIP IMNIO MENTL ZEJQN FENTP EASTM  
 QUIOP 333P II II  
 LX1 V LX8 NR21 GR15 SEVENTH BT  
 NR889 DFCT1 ENTY FINP POKY FEMN QUIT WEAN MEIT OLKN  
 EMNT PETY FERZ NIME 832P II II  
 LX1 V LX8 NR22 GR11 SEVENTH BT  
 TROOPS CONCENTRATION EAST OF RIVER PROVING EFFECTIVE FURTHER  
 DETAILS LATER 931A II II  
 LX1 V LX8 NR23 GR18 SEVENTH BT  
 NR44 DFCT1 QJJY WKKN EAET PENT SENK FINP LOSN MEQN  
 QPWO EORI RUTY ALSK KDFJ GHZM NIPT 335A II II  
 LX1 V LX8 NR24 GR19 SEVENTH BT  
 NR41 CD PEMNT HMAST EMNTY FISNT LOANT EMENT HHHHE EIIEN  
 LOTZE EANAT EMETP FINTH HIEEM MENTJ EMDJK LINTP 456P II II  
 LX1 V LX8 NR25 GR20 SEVENTH BT  
 NR100 CD NOWIT EMENT WIEMT POZON ZEMNT HUTEN MINIE GHLID  
 EMETO HIEN TESHET FINTP LITIE HEEQ JKHGN NITOP ZEXLN 649A II II  
 LX1 V LX8 NR26 P GR21 SEVENTH BT  
 NR13 CD FINTO LOTNT HIEN T QPOTN MENTA KINTO HHNET LIENT  
 MESSE EASJY MINTO LINTP HENZQ LITME HEQNT EFITP HIEMT LPOIN  
 949A II II  
 LX1 V LX8 NR27 GR16 SEVENTH BT  
 NR922 CD HIMET LOPEN QITNT PEMTP HRIOP ZEMIT HIEMT LOANT  
 GUEJN JITNP EATOP SIXEN GEMET 848A II II

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Tape No. 14—Continued

LX1 V LX8 NR28 GR25 SEVENTH BT  
 NR29 CD ENJUS IHHIT PEMTP EMNTO LIQNT FEMTZ HIEN T LIOTN  
 MESSE SSIS JUMNT HIQNT LOTAN JUMTN QUENT FIENT LOAJJ WJWMT  
 AWJAJ EISHT MONTA EEMTY 934A II II  
 LX1 V LX8 NR29 GR21 SEVENTH BT  
 NR31 DFCT1 EAMN EITN LOAN MENT FUNT LIAK EANT LUNT  
 HIST EANT FOEX LOAT MENT NOTA LOAT JFEN LQON LILA 847A II II  
 LX1 V LX8 NR30 O GR12 SEVENTH BT  
 THREE REPLACEMENTS THIS UNIT ARRIVED YESTERDAY AM ONE SERGANT  
 TWO CORPORALS II II  
 LX1 V LX8 NR31 GR22 SEVENTH BT  
 NR44 DFCT1 EMEM LOAT FIN T EAST ENNWHENTN LOAT MENT  
 EO AQ HIKN NITO POET METO MAST EATT HQNT MOTN FIXT  
 MEST 125A II II  
 LX1 V LX8 NR32 P GR17 SEVENTH BT  
 NR141 CD NETOL FIN TO FITON LEASN SENTA MINTO HQHET FINTO  
 MYNTA KINLO QITON MESTO HANTO MENTA 847A II II  
 LX1 V LX8 NR33 GR17 SEVENTH BT  
 NR12 CD HENTA NINAS FERTY AUINT MENTA LIANT HETOP FERNT  
 ZENTO LAXTO MENTA MENTA EFNTA MANTA 846A II II  
 LX1 V LX8 NR34 GR19 SEVENTH BT  
 NR118 CD FENTO LASTO MENTA FERT HASON MANTO KIKEN FENTA  
 MENTA FERMT LISTO PERTO HIEST MENTA FEROZ LLSTO 443A II II  
 LX1 V LX8 NR35 GR19 SEVENTH BT  
 NR119 CD QUINT FERTO LITON MENTA FERTO XERON ZELAT EMATO  
 PIOHN VNTTN MNXXNT XZNTO WIPOT MENTO HISTO KEENT 441A II II

CODE PRACTICE EQUIPMENT

LX1 V LX8 NR36 GR23 SEVENTH BT  
 NR118 CD QITON FENTN LISTO MENTA NOTAL HISTO KENTA POTOL  
 MENTA MENTA FISON HERON NOTAP MENTA WIZIZ ZXVNO ZCNTO VNBBN  
 EPOJH GHJDN 223A II II  
 LX1 V LX8 NR37 GR27 SEVENTH BT  
 NR1 CD QUITO WESTO EASTN MENTA RUNTA YIYEN YIENT UOONN  
 EXONT MENTA MENTA LOSTN MENTAL ZCXNM ZSNYT LONTA MENTA PIOTA  
 MENTA METAL ZSILA VETZX WOTET EANTA 221P II II  
 LX1 V LX8 NR38 GR16 SEVENTH BT  
 NR333 DFCT1 EATM MENT MOTN QITO EANT FIN T MOTN MENT  
 HOTN QOIT MENT HOTA IEAN 449P II II  
 LX1 V LX8 NR39 GR17 SEVENTH BT  
 NR190 CD MENTA FERTO LITIO QITAN SESON SASAN DGDHGH JKLA  
 LADPN NEEAT ZXCNM CNTOP MENTA EATOP 444P II II  
 LX1 V LX8 NR40 G O Y GR22 SEVENTH BT  
 NR2 CD ASNTA LOSTN MENTA MENTW EASTM FETTO OKOMN NOTAL  
 SESIS FERNT LOATN NOTAP HISTO JKGNH QJAST NOATO NATIO ALANT  
 ENDAN 758A II II

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*Tape No. 15—100 characters per minute*

(Tactical traffic, 20 words per minute)

FR1 V FR3 NR1 G GR17 SECOND BT  
 NR11 CD SEXTA IRTOB JUGBC VOVYD CSJYE QUGYF CERXW WAICR  
 YZBIA HETEI ZIGUT GHTEG MVOPL EFVJQ 112P II II  
 FR1 V FR3 NR2 T CD3 V BC2 G Y O GR20 SECOND BT  
 NR6 CD SIIVA JELLO DUGTN AMQIB UBIXZ NATSE FOKIA GRALB  
 EOPAN TOANC DOMTA IUPAM KWONG TYRWP LQB CD INGWQ OELNS 910A II II

Tape No. 15—Continued

FR1 V FR3 NR3 GR20 SECOND BT  
 NR7 CD OFGAL YTRAN WOBOK QUSON KAUNT ELENI JLAEO IOGNY  
 WPO TN THWON TONWQ THOWA VKARU XOAMI PWRAM LANGQ MAPMZ 921A II II  
 FR1 V FR3 NR4 G O GR23 SECOND BT  
 NR9 CD MUYRQ THOWQ MAYWQ AQISP WOTRN MEIGM JYTFW QPBZX  
 PWOAM WOAND ALENS DONWI EHTMA DWOSM THAPZ TNWTV ONLUD KAWLC  
 OXBUV MAORW 924A II II  
 FR1 V FR3 NR5 P GR19 SECOND BT  
 NR10 DFCT1 WOBO OLKO SYAP WOFK WUWE SYAP EZRS HAQY II II  
 WAHU MERI ZULP TAXA AHPY DEPD CYBE FENY 930A II II  
 FR1 V FR3 NR6 GR13 SECOND BT  
 ENEMY TANKS HAVE BEEN ROUTED WERE LAST SEEN IN VICINITY  
 OF ARNEYTOWN 823A II II  
 FR1 V FR3 NR7 GR25 SECOND BT  
 NR6 CD CYKMX JELAS EUYCA ERRAO CYYFT WAHYU AMQIF UMAHH  
 IGOHG CYMKX AHPHN YJMJK LANDK ONLYR ALPEM HOISW ALPZS KWA·CF  
 EMAQP NYTND MAOTR MAOFW 935A II II  
 FR1 V FR3 NR8 GR15 SECOND BT  
 NR8 CD KLYTR MAONF APMWY CIWHI HNBJK CYSTJ TUXGC WVAJK  
 EMZAL NUQWS KINDS QSUDK 921A II II  
 FR1 V FR3 NR9 P GR16 SECOND BT  
 NR19 CD HNBJK JMCIK LJOER VWZIL RTVER MKPFG DQHKA BZCUO  
 GSLDM DOXGL FHMLT RSPHD UTHKJ 925A II II  
 FR1 V FR3 NR10 T CD3 V BC2 G Y O GR18 SECOND BT  
 NR22 CD JALNM LANKE ALSSM ALDNI ALDMS ALRWQ PNEWK MAOLQ  
 WPAMW OWACV PWTYE AMONE AMPEW UDXSZ IUPOQ 829A II II



CODE PRACTICE EQUIPMENT

FR1 V FR3 NR11 GR15 SECOND BT  
 NR37 CD YEPOT MAOND MAOWX AGNVB WEKJI GHDJ A EUIKJ QESZX  
 MCHAU TUJVM OWEPM TPEWY 930A II II  
 FR1 V FR3 NR12 GR16 SECOND BT  
 MAIN BODY OF SUPPLIES LOCATED AT PUMPKINPATCH JUNCTION SEND BACK  
 GUARD TO MAINTAIN ORDERLY DISTRIBUTION 931A II II  
 FR1 V FR3 NR13 Y P GR14 SECOND BT  
 NR23 CD XMZJK JIMEF CUMLC YMOAE FIMVC MXDOF JKJWZ CMUTM  
 QMONE IRTYU PWRIU 1010A II II  
 FR1 V FR3 NR14 GR15 SECOND BT  
 NR9 CD MJCHF NCJDH GDYEI DGERI LADWM ANOWE QPUOE MAOTD  
 MAOTE CXWQZ QPWX WTEIV 947A II II  
 FR1 V FR3 NR15 P GR18 SECOND BT  
 NR34 DFC T1 NJUM YIUK WQED ASDE WERF ERTG RYTH YUIK  
 117 YCSZ BH TO OPKB MFKW KLIH CZXX JAWQ 948A II II  
 FR1 V FR3 NR16 P GR17 SECOND BT  
 NR2 CD XMJZK JINEF CMUCL YJOAE FIMVK XMCOF MQCEA CTUMN  
 AONES MAOWW VKMIF JISEQ XMFOC KQLWU 958A II II  
 FR1 V FR3 NR17 NITE GR19 SECOND BT  
 NR7 CD MAOEN TRPME OEMPS MEONA XQYRO PRWMN MWHTZ OMESW  
 ENSDX MWORN OTUTM TPWMO WQRSK MWOND OEZXY PWQVT 936A II II  
 FR1 V FR3 NR18 GR22 SECOND BT  
 NR38 CD MOWXZ NEOWN ETHWN OEWAM WYRND AJAWH ALIRN OWNAW  
 OWNAL OENIE QWEOP IUYTQ OISDG LKDDH HJKAS WBNCD AFDSG LJKDH  
 MNOVX 939A II II  
 FR1 V FR3 NR19 Y GR19 SECOND BT  
 NR39 CD LKJMN HGFVC IOFUY FDSEER MJKHB FDREW JHBCV WFFJUY  
 OUIYF HCBSR WUORU EJHDW QOEMC WKDNC QLSIE WJDNV 1017A II II

Tape No. 15—Continued

FR1 V FR3 NR20 GR20 SECOND BT  
 NR40 CD WKSJD FUCWN WQDSG KDXZM ASZXM QPWJX RKSNC WKLDH  
 QODJV WHDCM QHASC WODNX DLKAM WHDOV ZSWGHWIOFJ KONES 1018A II II

FR1 V FR3 NR21 GR16 SECOND BT  
 NR41 CD ALSKF WURVS WOFBZ QODNC DUWZX OENSV OENAL YSLCM  
 ONSAM ALEND MIEQD QPROX IEWQZ 1020A II II

FR1 V FR3 NR22 P GR17 SECOND BT  
 NR43 CD WHDSV ALEHD OIEUT WPCXZ JFNMS OQEIU ZXMEY OPETD  
 UHFRW ETUOG MVBUDU RGBJI OKNGF WSXCF 1039A II II

FR1 V FR3 NR23 G GR18 SECOND BT  
 NR44 CD PLKJY IHYTR HGFRE HJNBV DTJVZ IEKAN QPSOC WIUHD  
 QKSJC BHDOP JIUYE JNXZC MKGEY LNMGH DFTES 1039A II II

FR1 V FR3 NR24 G Y O GR24 SECOND BT  
 NR42 DFCT1 GOWI ALKD DNMC WIOR WJKC AHKJ WOXZ LKUI  
 LKYU GFTR EWSD JKSI ONSE REOP HGМК ALDJ EIOZ WDKJ  
 NFGD NK SJ OZXV 1031A II II

FR1 V FR3 NR25 GR17 SECOND BT  
 NR43 CD MCCIK JINER OIOXD ONETY APEMC NOEAL QJLSF LOEAN  
 JAOEN SCXPE ALWON ZENCA PANEQ ZICQV 1032A II II

FR1 V FR3 NR26 GR20 SECOND BT  
 NR44 CD NKJVS QACEM OANSW ZWQYT OENSL ETRIN ONEAN EATON  
 SHDRL UAITM APNEM WTEUY UITYE WORIV AJDHG SLDKG ZNCME 1033A II II

FR1 V FR3 NR27 GR15 SECOND BT  
 NR45 CD WQIUC ALDNG AIEND AIEWQ QOEHC SLRLX WICNG WORND  
 QPALZ SHFKE EIFND WNKZV 1034A II II

CODE PRACTICE EQUIPMENT

FR1 V FR3 NR28 N I T E G R 16 S E C O N D B T  
 NR47 C D N B H G F G H T Y R J K H U Y G F D S E C N V B G D K G J H W O R J V K L H J F  
 J K U I Y H G T R E D H G J L H B V F D H U Y F E 1035A I I I I  
 FR1 V FR3 NR29 P G R 17 S E C O N D B T  
 NR49 C D M J K H G J H G F D I U Y D R N G J H T F G K N B C X Z S D S I S E Z J D V C M  
 J S G C B W I O F G J F D H T D K C N G U Y G R D H T F R S 1037A I I I I  
 FR1 V FR3 NR30 G R 19 S E C O N D B T  
 NR51 C D J H N G F H Y R T D H J U O I S L F E R Z X C D E G F T E R I G R E E G H K J L  
 J H G F C V B H R T W Q A G O J H G D F Q O F H T Y F V B R E Y R T D O H V D F 1038A I I I I  
 FR1 V FR3 NR31 G R 18 S E C O N D B T  
 NR52 C D U Y R F G I U H G F I H V Z X R E W Q A G Z X S E H G C V B F T E S D O T F J H  
 O Y H V F G J H F V W T Y D F G H U T Y F H G V X I Y F O Y G B D Z X 1039A I I I I  
 FR1 V FR3 NR32 G R 24 S E C O N D B T  
 NR54 C D W J N B F H Y R T D F G R Y T H F G T S C X Z S W B V G D F J G Y H R F G J H D  
 F S X C V G F H J I H G T Y R P D G H R W Q A D F H K J L G J G B N H J D H T Y F W E Z X F B G D F  
 K L J G H B F H G T C D E W S 1024A I I I I  
 FR1 V FR3 NR33 P G R 22 S E C O N D B T  
 NR55 C D J H G T Y G H R T E F G R T D H J K L N B N H G E J K U I G J K H F T E R Y T F  
 H B N G F D F H G J B C V N M Q W R E T Y R F G H B H G F R F H G J U H D F G R G K J B B Z C X V E  
 W A S Q R 1025A I I I I  
 FR1 V FR3 NR34 G R 17 S E C O N D B T  
 NR57 C D F G T R E F H G Y T G H T Y R G H D X Z Z X C V B J H G T Y F G R T D W A S Q W  
 L J K H G G H K C V B V G F D G H T E D B H F F T J K N M Y 1027A I I I I  
 FR1 V FR3 NR35 G R 14 S E C O N D B T  
 ENEMY ADVANCING ON OUR LEFT FLANK MACHINE NOT EFFECTIVE SUFFERING  
 HEAVY LOSSES ADVISE 1028A I I I I  
 FR1 V FR3 NR36 G R 18 S E C O N D B T  
 NR59 C D J H F G T H G F D S D V D R E M J H J Y H G T Y F R D C X Z X W R E D G H G T R  
 K L C E W X C V D I G T D K N I E U S H G H Y D V J B H F T G J B X W 1029A I I I I

Tape No. 15—Continued

FR1 V FR3 NR37 GR17 SECOND BT  
 NR60 CD HUSUI BFHRT GDVCE ZXCWE FHGFD FTEHM FHKBV XCBZV  
 BDTEJ GKHNF EUVDT AZXWW NZCWO IGBEF 1030A II II  
 FR1 V FR3 NR38 GR18 SECOND BT  
 NR61 CD AFDSE DFRSW DCXVR NVGHR CHRTE GDFES LKIJM DXWOH  
 XSIHN GJFFR DGTVC SUTMR FCEJY CUFVE ZWQLB 1032A II II  
 FR1 V FR3 NR39 GR19 SECOND BT  
 NR63 CD FDREW CGFDR BFKCU IUSTV VFTRR DHDY JHBFV GHYTF  
 MBNGH FTUIO BVFGE GFRDW HKYUB BHJTY GJHRT IGKWP 1033A II II  
 FR1 V FR3 NR40 P GR22 SECOND BT  
 NR64 CD JNHFG HFGRE FGTRD JUYIG KNMGR GFHYG BDGER FGHRT  
 JKYUI FXWRC NBVFG GFDEW ASWER DFRTG GHTYF GHYUM JHBNF XCDEW  
 ZERCX 1032A II II

CODE PRACTICE EQUIPMENT

[A. G. 062.11 (11-19-41).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

E. S. ADAMS,  
*Major General,*  
*The Adjutant General.*

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

