

**RESTRICTED**

**TECHNICAL MANUAL** }  
No. 11-351 }

**WAR DEPARTMENT**  
**WASHINGTON, September 22, 1941.**

**TELEGRAPH SETS TG-5 AND TG-5-A**

Prepared under direction of the  
Chief Signal Officer

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**\*This manual supersedes TR 1230-1, April 8, 1936, and TR 1230-2, June 29, 1939.**

SECTION I  
GENERAL

	Paragraph
Use.....	1
Authorization.....	2
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Range.....	4
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1. **Use.**—The telegraph sets TG-5 (stock No. 4A2805) and TG-5-A (stock No. 4A2805A) are portable, open-circuit field sets used for telegraph communication over short lines with few intermediate stations. Several sets may be operated in series but ordinarily not more than three or four should be required to work together on one circuit.

2. **Authorization.**—The sets are authorized for and used by various units of the Infantry, Field Artillery, Coast Artillery Corps, and Signal Corps.

3. **Description.**—*a. Size and weight.*—The telegraph sets are approximately 5½ inches in height, 10 inches in width, and 5½ inches in depth. The TG-5 weighs 6 pounds and the TG-5-A weighs 7 pounds, both including batteries, which weigh 1½ pounds.

*b. Power.*—Two batteries BA-30 in series having a voltage of 1.5 volts per battery, or a total voltage of 3 volts, and one battery BA-2 having a voltage of 22.5 volts supply the power required to operate the set when they are installed in it. Hereafter the former will be called the “local battery,” and the latter will be called the “line

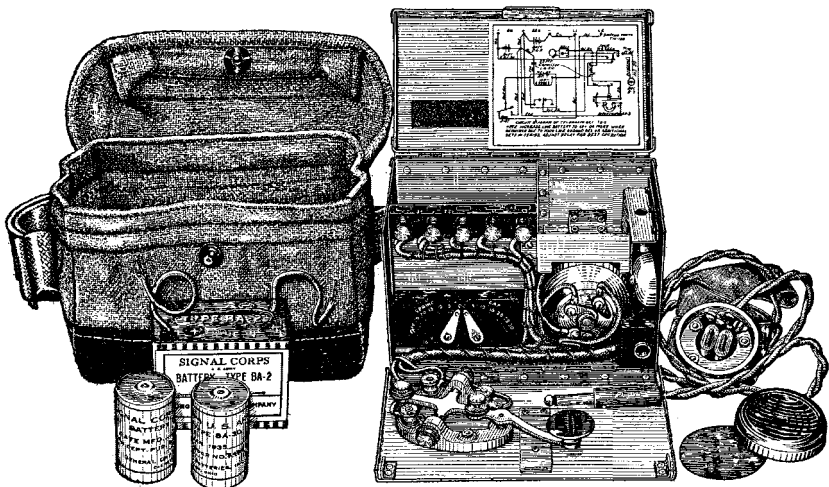


FIGURE 1.—Telegraph set TG-5—component parts and batteries.

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battery." Both are dry batteries. Any external batteries having equivalent voltages may be connected to and used with the set after the internal batteries are removed. (See par. 17.)

c. *Circuits on which installed.*—The set is designed for use in open-circuit telegraph systems. Normally it is used on a ground-return circuit obtained by simplexing a telephone circuit. It can be used on any other ground-return or metallic circuit. (See par. 21.)

4. **Range.**—The set should operate satisfactorily over field circuits of any length likely to be encountered within the infantry division. Where exceptionally long lines or high-resistance grounds are encountered, the range of the set may be increased by the addition of external line battery as indicated in paragraph 23.

5. **Parts.**—Figures 1 and 2 and the list below show the principal components of the set. All batteries for TG-5 are shown in figure 1, but only the line battery for TG-5-A is shown in figure 2. For position of local battery, see figure 3, which applies to both sets. The batteries required are not parts of the sets and must be requisitioned separately. The operating parts are described in section II; for complete information thereon see the Signal Corps General Catalog. The batteries and parts of the sets are listed below:

Stock No.	Part	Quantity	
		TG-5	TG-5-A
3A2	*Battery BA-2-----	1	1
3A30	*Battery BA-30-----	2	2
-----	Box (drawing SC-D-1174-B) } Containing	1	-----
-----	Box (drawing SC-D-2881-C) }		
4Z416	*Bell, Edwards Lungen 13-----	1	1
3Z250	*Binding post TM-150-----	5	3
3Z275	Binding post TM-175-----	-----	2
-----	Burnisher (Western Electric No. 1A or equal)-----	-----	1
3D210	*Capacitor CA-210-----	1	1
-----	Circuit diagram (drawing SC-A-1162-D)-----	1	-----
-----	Circuit diagram (drawing SC-D-2888-A)-----	-----	1
4A920	*Headset HS-20-----	1	1
4Z5005	Interrupter BZ-5-----	1	-----
4Z5007A	Interrupter BZ-7-A-----	-----	1
2Z5535	*Jack JK-35 (Western Electric No. 226-A or equal).	1	1
3Z3441	*Key J-41-----	1	1
4A2007	Relay BK-7-----	1	-----
4A2007A	*Relay BK-7-A-----	-----	1
4A349	Case CS-49-----	1	-----
4A349A	*Case CS-49-A-----	-----	1

\* Only these parts of telegraph set TG-5-A may be used as replacements for similar parts in telegraph set TG-5; remaining parts may not be so used.

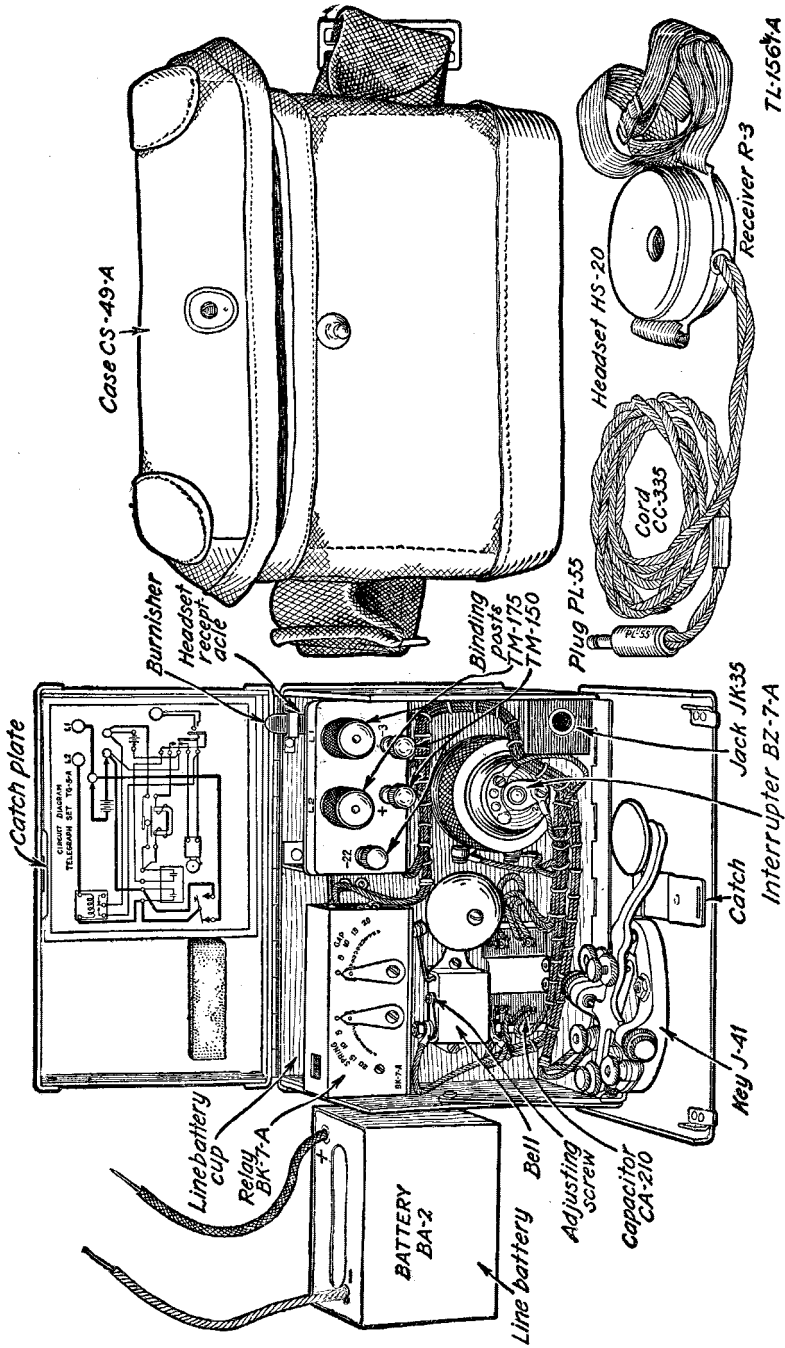


FIGURE 2.—Telegraph set TG-5-A—component parts and line battery.

## SECTION II

## DETAILED DESCRIPTION OF PARTS

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Batteries.....	6
Bell.....	7
Box.....	8
Capacitor CA-210.....	9
Case.....	10
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Jack JK-35 (Western Electric No. 226-A or equal).....	14
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**6. Batteries.**—*a. Battery BA-2.*—The line battery is a standard 22½-volt battery with 6-inch flexible leads. The red and black leads should be connected to the + and - 22-volt binding posts, respectively. A sponge-rubber pad fastened to the top of the case serves to hold the battery firmly in its compartment. If necessary, additional batteries may be placed adjacent to the telegraph set and connected in series with the battery in the set.

*b. Batteries BA-30.*—The local battery consists of two batteries BA-30 in series. These are the same size as commercial flashlight batteries. They operate the 3-volt bell and interrupter circuits. The lid of the rear compartment is properly marked for polarity of the batteries. A spiral spring in the - end of the compartment connects to the base of one battery, and a flat spring contact in the + end connects to the top of the other battery. It is important that the two batteries BA-30 are properly connected in series, that is, the top of one battery making contact with the base of the other. If one of the batteries should be reversed the local circuit will not operate.

**7. Bell.**—The bell is a small one of the vibrator type and is fitted with a 1¼-inch gong. It is adjusted by a small accessible screw. When the headset plug is not in the jack, this bell is in series with the local battery and the relay contacts, and operation of the relay by the key of its set or by the key of a distant set will ring the bell. (See fig. 6, which applies to both sets.) Inserting the plug in the jack breaks this circuit at the jack and the bell cannot ring. The bell is used, therefore, to receive and sound calls from other sets and to test the set of which it is a part. (See sec. III.)

**8. Box.**—The box is made of aluminum alloy and is painted olive

drab. It fits into the case and contains all other parts of the set. Its cover is hinged at the back and has attached to its exterior the name plate of the set. A sponge-rubber pad which holds the line battery in place and a circuit diagram are mounted on the inside of this cover. When the cover is closed, it overlaps and holds the front closed. The front is a tray, hinged at the bottom, with a support on one end which holds the front level with the floor of the box when opened. Mounted on this front is the key J-41. The front is held closed by a catch which engages with a catch plate on the cover and which is released by pressing the spring button on the outside of the front. In addition to the parts mounted in the box and described in succeeding paragraphs, the box contains near its top a line battery cup, a receptacle for the headset, and near the bottom of its back,

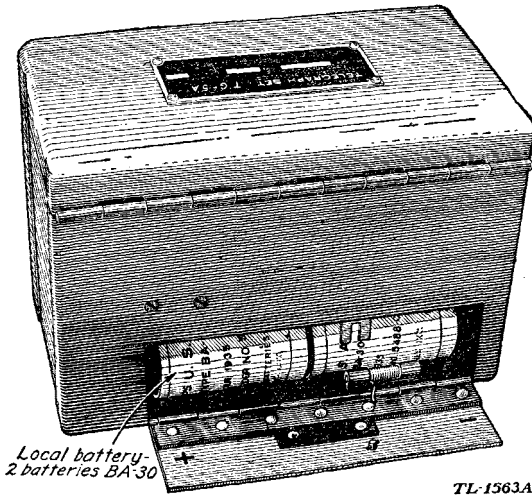


FIGURE 3.—Telegraph sets TG-5 and TG-5-A—local battery housing and its batteries.

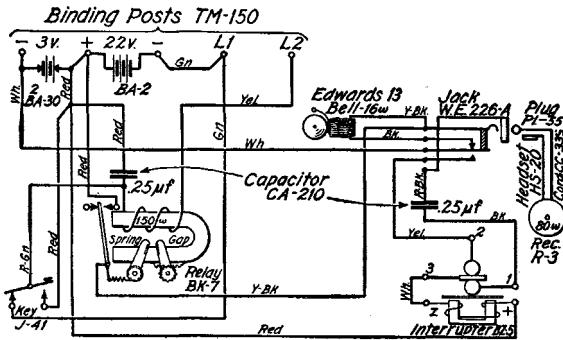
the local battery housing shown in figure 3. This housing is closed by a door marked + at one end and - at the other. The door is so hinged at the bottom that it springs open when the stud-and-pin catch at its top is released by a quarter turn. The local batteries are held in place by a coil spring contact at the - end of the housing, a flat spring contact at the + end, and a phenolic plate attached to the door. The box for telegraph set TG-5-A also contains a burnisher in a leather scabbard.

9. Capacitor CA-210.—The capacitor CA-210 consists of two 0.25-microfarad units inclosed in a metal can. One unit is connected across the front contacts of the key to eliminate key clicks and, when

the plug is in the jack, the other unit is connected in series with the headset to prevent the flow of direct current through the headset windings. (See figs. 4 and 5.)

10. Case.—*a. Case CS-49.*—The case CS-49, part of telegraph set TG-5, is of heavy canvas with its bottom reinforced by leather. Its top is sewed to the case at one side to form a hinge and fastens with a snap when closed. An adjustable web carrying strap is attached to the case.

*b. Case CS-49-A.*—The case CS-49-A is part of telegraph set TG-5-A. It is made of hard texture olive-drab duck with molded leather corners and bottom. Its cover is hinged at the back, overlaps the back, front, and sides, and is fastened on the front with a snap fastener. Sewed to the sides of the case is an adjustable shoulder strap 2 inches wide and 85 inches long.



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FIGURE 4.—Telegraph set TG-5—circuit diagram.

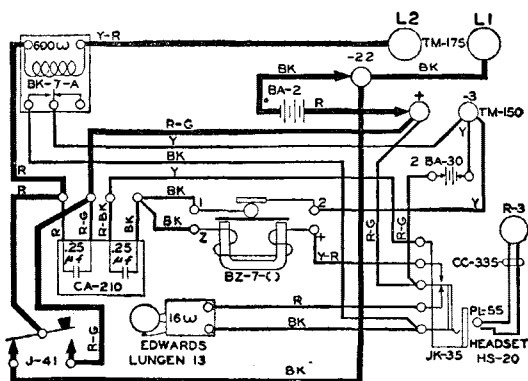
11. Circuit diagram.—*a. Telegraph set TG-5.*—The circuit diagram shown in figure 4 is similar to that mounted on the cover of the box. In this diagram, colors of the wires are abbreviated as YEL, yellow; GN, green; WH, white; BK, black; Y-BK, yellow-black; R-GN, red-green. The note below is shown on the circuit diagrams of both telegraph sets TG-5 and TG-5-A:

NOTE.—Increase line battery to 45 volts or more when required due to poor line, high-ground resistance, or additional sets in series. Adjust relay for best operation.

*b. Telegraph set TG-5-A.*—The circuit diagram shown in figure 5 is a copy of that mounted in the cover of the box. In this diagram, colors of the wires are abbreviated as: BK, black; R, red; R-BK, red-black; R-G, red-green; Y, yellow; Y-R, yellow-red. Interrupter BZ-7-A is shown in this figure as BZ-7-( ).

12. **Headset HS-20.**—Headset HS-20 is an assembly of a receiver R-3, a plug PL-55, and a cord CC-335. The receiver is of the standard watch-case type, with a resistance of 80 ohms, and has a web head band attached to it. The plug fits into the jack and is of the simple tip-sleeve type with a black shell. The cord is flexible, having two tinsel conductors covered with rubber and braid, and twisted together.

13. **Interrupter.**—*a. Interrupter BZ-5* (part of telegraph set TG-5).—The interrupter, sometimes known as the howler, serves as a local tone source for the operator and consists of a double carbon



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FIGURE 5.—Telegraph set TG-5-A—circuit diagram.

button mounted against the diaphragm of a telephone receiver. (See fig. 4.) The local battery (3 volts) connected in series with one carbon button and the receiver winding causes the interrupter to howl continuously at a frequency of approximately 1,000 cycles per second. The interrupter operates in the vertical position only, due to the position of the carbon button. The output of the interrupter is connected to the headset only when the line relay is made operative.

*b. Interrupter BZ-7-A* (part of telegraph set TG-5-A).—Interrupter BZ-7-A is located just to the right of the bell and supplies the tone signal used in the operation of the set. It consists of a single carbon button mounted against the diaphragm of a telephone receiver. The button is in series with the winding and, if the battery is connected to this circuit, the interrupter produces a continuous tone of about 1,000 cycles per second. It will operate properly only if the

set is in the upright position shown in figure 2. When the plug is inserted in the jack, the local battery is connected to the circuit at that point and the interrupter operates continuously, using power from the local battery. A series circuit containing the headset, the interrupter, the relay contacts, and the local battery is normally open at the relay contacts, but when the relay contact is made, this circuit is closed and the tone is heard strongly in the headset. Consequently, while the interrupter produces its tone continuously when the plug is inserted in the jack, the tone is heard strongly in the headset only when the relay is operated by its own key or by that of another set.

**14. Jack JK-35 (Western Electric No. 226-A or equal).**—The jack is of the standard tip-sleeve type with an extra set of contacts equivalent to a single-pole, double-throw switch operated by the tip spring. The bell is normally in series with the battery and relay contact before the plug is inserted. After the plug is inserted, the battery is transferred to the interrupter and the receiver is connected to the relay and series capacitor by means of the extra contacts.

**NOTE.**—Early telegraph sets TG-5 were procured before nomenclature jack JK-35 was assigned to the jack. Therefore the jacks and the circuit labels in these sets did not bear this nomenclature but called for jack, Western Electric No. 226-A. Requisitions should call for Jack JK-35 when replacements are needed. (See figs. 7 and 8.)

**15. Key J-41.**—Key J-41 is an open-circuit operating key of the usual lever type mounted on a molded bakelite base, which in turn is mounted on the inside of the front of the box. In its normal or receiving position, the back contacts connect the relay winding in series with the line but not with the line battery of its set. (See figs. 7 and 8.) In its operating or transmitting position the back contacts are opened, and the front contacts connect the line battery of its set in series with the relay winding and the line. Thus the key operates the relay of its own set and places its line battery on the line to which it is connected. Consequently a set uses its line battery only when its key is operated. Three knurled binding posts are available on the key for making its connections, and it is easily adjustable to suit the operator.

**16. Relay.**—*a. Relay BK-7* (part of telegraph set TG-5).—The relay is contained in a black bakelite housing with two pointers mounted on the front side for adjusting the spring tension on the armature and the air gap between the armature and core ends. The pointers are designated “spring” and “gap,” respectively, and move over graduated scales from 0 to 30. (See fig. 1.) The relay has a

winding resistance of 150 ohms and may be adjusted to operate on a current as low as 1.5 milliamperes. (See par. 22.) Five terminals at one end provide connections to the winding and the break-make contacts. The contact adjusting screws are properly set and sealed at the factory and should not require adjustment. An opening in the top of the relay housing permits cleaning of the relay contacts by the operating personnel. Another opening in the bottom of the housing exposes the armature tension spring and thread.

*b. Relay BK-7-A* (part of telegraph set TG-5-A).—Relay BK-7-A is contained in a black bakelite housing and is located just over the bell. Its armature makes and breaks the relay contacts. On the front of the relay are two pointers marked “spring” and “gap” which move over scales, graduated and marked in steps of 5, from 0 to 20. (See fig. 2.) The controls operated by these pointers are notched for each unit setting, however, and may be set at any unit at or between the scale markings. The spring pointer controls the amount of tension on spring of the armature, and the gap pointer controls the air gap between the armature and the magnet core ends. The relay winding has a resistance of 600 ohms, and the relay may be adjusted to operate on a current as low as 1.0 milliamperes. (See par. 22.) Terminals at one end provide connections to the winding and the contacts. An opening in the top of the housing permits cleaning the relay contacts with the burnisher supplied with the set. Another opening in the bottom of this housing permits access to the tension spring and thread. If the plug is in the jack, the relay contacts connect the local battery in series with the interrupter and the headset; if the plug is not in the jack, the relay contacts connect the local battery in series with the bell. Breaking the relay contacts opens those circuits. In figure 5, the relay contacts are broken.

**17. Terminals.**—*a.* Telegraph set TG-5 uses five binding posts TM-150 for line, line battery, and emergency battery connections. These are designated as: 3V, - and +, 22V, - and + (the +3V terminal is the same as the -22V terminal), L1 and L2. The 3V terminals are used for emergency connections of an external local battery when batteries BA-30 are not available. The 22V terminals are used for connecting the line battery BA-2 to the set, and may be used for connecting external sources of voltage when batteries BA-2 are not available, or for increasing the line battery voltage when necessary. (See par. 23.) Always remove the local battery from the case when using external local battery. Always connect batteries with proper polarity.

*b.* Telegraph set TG-5-A has five binding posts which have the same markings and the same purposes as those in TG-5. Binding posts TM-175, which are larger than binding posts TM-150, are used for the L1 and L2 connections.

SECTION III

EMPLOYMENT

	Paragraph
Preparing set for installation.....	18
Testing calling circuit.....	19
Testing transmitting and receiving circuits.....	20
Installing set.....	21
Adjusting relay.....	22
Additional line battery.....	23
Operating set.....	24

**18. Preparing set for installation.**—*a.* Remove the box from the case.

*b.* Open the local battery housing and install two batteries BA-30 as indicated in figure 3, being sure that the top of the right-hand one is in contact with the bottom of the left-hand one. Close and secure the door. If batteries BA-30 are not available, see instructions in *e* below. If the bell rings, open the box and set the spring and gap pointers at 0. If it continues to ring, increase the spring pointer setting one-notch at a time until the ringing stops.

*c.* Remove the headset from the box but do *not* insert the plug in the jack at this time.

*d.* Adjust the key but do not screw the back contact down so far that both it and the front contact are closed at the same time because, if that is done, the line battery will be short-circuited and probably ruined and the key contacts may be damaged by a heavy arc across them. After the line battery is installed, always disconnect one of its terminals from the set before adjusting the key.

*e.* Place a battery BA-2 in its cup on the left and connect its positive (red) lead to the + binding post and its negative (black) lead to the - 22 binding post. If a battery BA-2 is not available, similarly connect any other battery of 22.5 volts. If batteries BA-30 are not available for installation as in *b* above, connect the positive and negative terminals of any other battery of three volts to the + and - 3 binding posts, respectively, being sure that the polarities are correct and that the local battery housing is empty.

19. Testing calling circuit (fig. 6).—If the set has been prepared as directed in paragraph 18, test the calling circuit by short-circuiting the L1 and L2 binding posts and pressing the key. The bell should ring; if it does not, it is probable that the local battery is not properly connected, its voltage is too low, or the relay is not adjusted. If it is known that the fault is not in the battery, increase the gap pointer setting one notch at a time beginning with 0 until the bell rings when the key is depressed. Release the key. If the

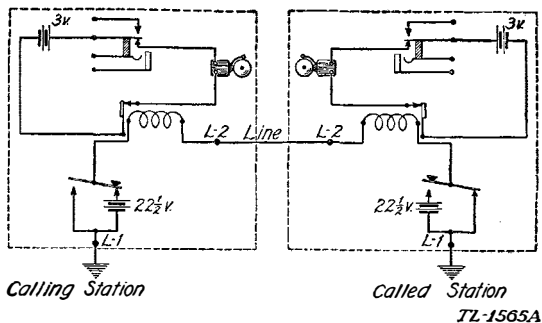


FIGURE 6.—Telegraph sets TG-5 and TG-5-A—calling circuit with plugs not in jacks.

bell continues to ring, increase the spring pointer setting one notch at a time until the ringing stops. Remove the short circuit from L1 and L2.

20. Testing transmitting and receiving circuits (figs. 7 and 8).—Having completed the actions directed in paragraphs 18 and 19, test the transmitting and receiving circuits as follows:

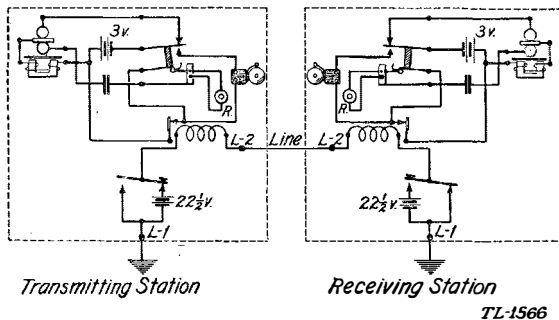


FIGURE 7.—Telegraph set TG-5—transmitting and receiving circuits.

a. Insert the plug in the jack. The interrupter should produce a tone which may be heard faintly. If the box is in an upright position and if the tone is not heard at all, it is probable that the local battery is not connected properly or its voltage is too low.

b. If the test in *a* above is satisfactory, adjust the headset to the ear. The tone should be heard only very faintly, if at all, in the headset. If it is heard strongly without operation of the key, set the spring and gap pointers at 0. If it continues strongly, increase the spring pointer, setting one notch at a time until the strong tone stops.

c. Short circuit L1 and L2 and press the key. The tone should be heard strongly in the headset. If the tone is not heard when the key is depressed, increase the gap pointer setting one notch at a time beginning with 0 until the tone is heard strongly when the key is depressed. Release the key. If the strong tone continues, increase the spring pointer setting one notch at a time until it stops. If this test is satisfactory, remove the short circuit from L1 and L2.

21. **Installing set.**—The instructions which follow are based on the assumption that the actions directed in paragraphs 18, 19, and 20 have been satisfactorily completed. Each of the binding posts

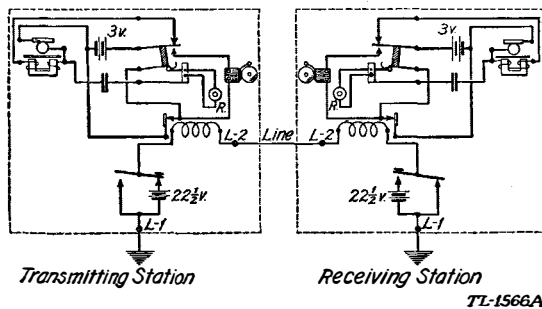


FIGURE 8.—Telegraph set TG-5-A—transmitting and receiving circuits.

L1 and L2 must be connected to a wire which forms part of the circuit on which the set is to be installed. Both of these wires may be part of a line but usually one is part of a line and the other leads to a ground near the set. In all terminal stations shown in figures 6 to 10, inclusive, L1 is connected to the ground and L2 to the line. If those connections are reversed, however, the operation of the sets will not be affected.

a. *As a terminal station on ground-return circuit.*—(1) *Ground connection.*—In the usual case in which a ground-return circuit is used, a good, low-resistance ground connection is necessary for each terminal station not only to insure sufficient operating current but also to prevent interference with neighboring telegraph circuits. It

is almost always possible to obtain a good ground but, if not, it may become necessary to use a metallic circuit. (See *c* below.) Having prepared a good ground, connect it to either L1 or L2. To obtain a good ground connection—

(a) Drive a metal ground rod about 2 feet in length well into the ground where it is moist. Use a longer rod if one is necessary and available. Usually the ground near the roots of a shrub, cactus, or other vegetation is moist. Under some conditions it may be found advantageous to drive the ground rod (or a large spike with ground wire firmly connected) directly into the tap root of a cactus, sapling, or other vegetation. If only dry ground is available, wet it thoroughly and pack it down around the rod.

(b) Use a separate ground for each telegraph set or other equipment and keep separate grounds at least 15 feet apart.

(c) Use two or more ground rods at least 15 feet apart connected

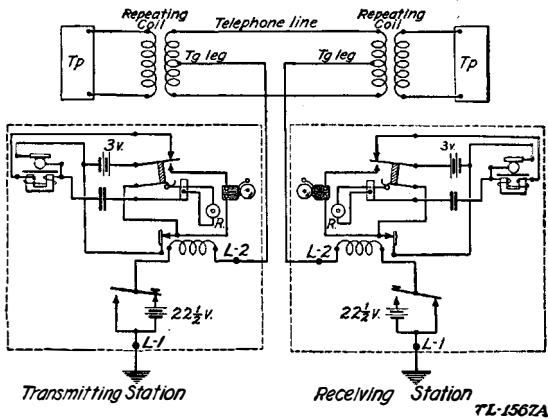


FIGURE 9.—Telegraph set TG-5-A—two terminal stations connected to a simplex telephone circuit.

together as a ground for a single set if one ground rod will not suffice.

(d) Keep the wire leading from the ground rod to the set as short as possible, but do not hesitate to use a wire several hundred yards long if necessary to reach moist ground, such as a stream bed.

(2) *Line connection.*—If the ground has been connected to L1, connect the line to L2. This line may be a wire which is to be used exclusively for telegraph, in which case the two terminal stations are connected as shown in figures 7 and 8. Usually, however, this line will be the telegraph leg of a simplex telephone circuit, in which case the two terminal stations are connected as shown in figure 9.

*b. As intermediate station on ground-return circuit.*—No ground connection is necessary at an intermediate station. Connect the line leading to one terminal station to L1 and the line leading to the other terminal station to L2. As in *a*(2) above, these lines may be either lines which are to be used exclusively for telegraph or they may be telegraph legs of simplex telephone circuits. Figure 10 shows three stations, two of which are terminal stations and one an intermediate station, connected to a simplex telephone circuit containing two terminal telephones and one intermediate telephone.

*c. As terminal station on metallic circuit.*—When a ground-return circuit is impracticable, a metallic return may be used instead. In this case, either or both of the lines in the metallic circuit may be lines used exclusively for telegraph or they may be telegraph legs of simplex telephone circuits. Connect one of the lines to L1 and the other to L2.

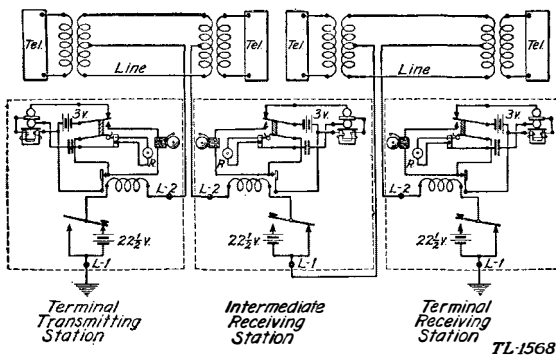


FIGURE 10.—Telegraph set TG-5—three stations connected to a simplex telephone circuit.

*d. As intermediate station on metallic circuit.*—At an intermediate station, cross-connect one of the wires leading to one terminal station to one of the wires leading to the other terminal station. Connect the other two wires to L1 and L2 as in *b* above. This places the intermediate set in series with the circuit and not across it. If the set is connected improperly, or across the circuit, the sets on the circuit will not operate satisfactorily. (See fig. 10.)

**22. Adjusting relay.**—*a. General.*—(1) Since the resistance of the relay is fixed, it is necessary to adjust the armature so that it will make and break its contacts properly with various values of current flowing through the relay winding. The resistance of the

external circuit connected to L1 and L2 largely determines the value of this current, and this resistance varies widely. Consequently the relay must always be adjusted for the circuit over which the set is to operate, and may need to be adjusted frequently as the resistance of that circuit changes or as stations are added to or removed from that circuit. The adjustments prescribed in *c* below will always be made when a set has been removed from a line and installed at a different location on that line.

(2) When the pointers described in paragraph 20 are set at 0, the armature spring tension is least and the air gap is smallest. In this condition, a current of approximately 1.0 to 1.5 milliamperes is required to operate the relay, but if a strong current flows through the relay winding, the spring will not be strong enough to break the contact quickly after the current ceases to flow. The adjustment consists of properly balancing the pull of the spring on the armature against the pull of the magnetizing current in the relay. The best adjustment for any conditions is that which gives satisfactory operation with the smallest values of gap and spring pointer settings. For all adjustments, therefore, obtain the lowest setting of the gap pointer which will permit the relay to operate with the current from the most distant set, then obtain the lowest setting of the spring pointer which will open the relay contacts sharply. With the normal line battery installed in the set, there is a limit to the possible adjustment, and if that limit is reached without obtaining satisfactory operation, it may be necessary to increase the voltage of the line battery as indicated in paragraph 23.

*b. Before installation.*—As a final check of the operation of the set before it is installed, connect a resistance of about 2,000 ohms, such as a headset P-11, to L1 and L2. With the set connected to this artificial line, make the tests and adjustments indicated in paragraphs 19 and 20.

*c. During installation.*—When the relay has been adjusted as in *b* above and the set has been installed on the line, proceed as follows:

(1) Before transmitting, make sure that other stations are not using the line. To do this, first listen for a signal in the headset. If none is heard, remove the plug from the jack, place its tip on the binding post marked L1 and its sleeve on the binding post marked L2. If other stations are using the line, clicks will be heard in the headset. Do not break in on them.

(2) Test the transmitting circuit by inserting the plug in the jack, pressing the key, and listening in the headset. If the strong tone is not heard—

(a) Increase the gap pointer setting one notch at a time beginning with 0 until the strong tone is heard. It may be necessary to repeat this adjustment several times to obtain the proper setting.

(b) Release the key. If the strong tone continues in the headset, increase the spring pointer setting until the strong tone stops.

(3) Call the most distant station on the line and request it to transmit for a test.

(4) See that the signals are being received in the headset. If not, proceed as indicated in paragraph 23.

(5) Remove the plug from the jack and see that the bell is receiving the signals from the distant station. If not, adjust the bell by varying its adjusting screw.

(6) Usually a set which has been adjusted properly for the most distant station will operate satisfactorily with all other stations. Nevertheless, repeat the above procedure with other stations.

(7) Once the spring pointer setting has been properly made, subsequent adjustments can usually be made by varying the gap pointer setting only.

**23. Additional line battery.**—*a. When needed.*—If, by placing the tip and sleeve of the plug on L1 and L2, it is determined that a distant station is transmitting and the relay cannot be adjusted as directed in paragraph 22 to give satisfactory reception, proceed as follows:

(1) Add another battery BA-2 in series with the line battery.

(2) Call the other station, inform it that the line battery has been increased to 45 volts, request it to increase its line battery to the same value, and to transmit for a further test.

(3) Adjust the relay as directed in paragraph 22*c*.

(4) Add more line batteries if necessary, but see *b* below.

*b. Amount.*—It is possible to cause serious damage to the set by adding an excessive amount of line battery. (See fig. 10.) If the keys of two or more sets are depressed simultaneously, the combined voltage of the line batteries of all these sets may be impressed upon the series circuit containing all of the relays. Although the relay winding will withstand relatively high voltages without injury, keep the line current as low as practicable because the relay works much better at lower current values, interference troubles are less, and interception is more difficult. Add only enough voltage to assure satisfactory operation, and no more.

**24. Operating set.**—*a. Transmitting.*—Use the key as in any other telegraph instrument. If minor adjustments of the relay become necessary, make them before the transmission of messages.

*b. Receiving.*—The connection made by the back contacts of the key is an essential part of the receiving circuit. Do not operate the key while receiving except as indicated in *c* below.

*c. Breaking in.*—If during reception it is desired to break in on the transmitting operator, attract his attention by operating the key slowly. The faulty operation of the transmitting set relay caused by this action is immediately detected in the transmitting operator's headset and is recognized by him as a break-in signal.

*d. Continuous operation.*—If the set is to be operated continuously, keep the plug in the jack. Call signals are then received only in the headset which must be worn in order not to miss a call.

*e. Stand-by operation.*—Since the set continuously uses power from the local battery while the plug is in the jack, keep the plug habitually out of the jack when the set is not in use. Call signals are then sounded by the bell.

SECTION IV

MAINTENANCE

Care and repair.....	Paragraph 25
Removal from service.....	26

**25. Care and repair.**—*a.* Keep the set in the case when it is not in use, and keep the cover and the local battery housing door of the box closed to protect the set when it is in use.

*b.* Test the headset occasionally and replace the receiver, head band, cord, or plug when necessary, but do not disassemble the receiver to any greater extent than is necessary to replace the cord.

*c.* When unserviceable, replace the batteries, bell, capacitor, interrupter, jack, key, relay, or the case. The contact adjusting screws of the relay are set properly at the factory. Repairs to the interrupter and the relay and changes in the contact adjusting screws of the relay will be made only at regularly established Signal Corps repair shops and not elsewhere.

*d.* Inspect and keep the contacts of the bell, jack, key, and relay clean. The relay contacts are accessible through the opening in the top of the relay housing. To clean these contacts, insert the burnisher between them, press them together slightly, and draw the burnisher across them. If the burnisher is not supplied with the set, use in its stead a piece of smooth steel or a piece of unglazed bond or other paper which will not leave lint on the contacts. Paper such as the vellum in the back of the message book M-105-A is suitable for this purpose. Similarly clean other contacts.

**26. Removal from service.**—When removing the set from service for a period exceeding 2 days, remove all batteries from the set.  
 [A. G. O 62.11 (4-18-41).]

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DISTRIBUTION:

IC and H 4, 6, 7, 17 (3); Bn 11 (5); IC 11 (5).  
 (For explanation of symbols see FM 21-6.)



**TECHNICAL MANUAL**

**TELEGRAPH SETS TG-5, TG-5-A, AND TG-5-B**

CHANGES }  
No. 2 }

WAR DEPARTMENT,  
WASHINGTON 25, D. C., 22 July 1943.

TM 11-351, 22 September 1941, is changed as follows :

The title of this manual is changed to read "Technical Manual, Telegraph Sets **TG-5, TG-5-A, and TG-5-B.**"

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

**1. Use.**—The telegraph sets TG-5 (stock No. 4A2805), TG-5-A (stock No. 4A2805A), and **TG-5-B (stock No. 4A2805B)** are portable, open-circuit field sets used for telegraph communication over short lines with few intermediate stations. Several sets may \* \* \* on one circuit.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

**3. Description.**—*a. Size and weight.*—The telegraph sets \* \* \* inches in depth. The TG-5 weighs 6 pounds and the TG-5-A and **TG-5-B weigh 7 pounds, all including batteries, which weigh 1½ pounds.**

\* \* \* \* \*

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

**5. Parts. (Superseded.)**—Figures 1, 2, and 2.1 and the list below show the principal components of the set. All batteries for TG-5 are shown in figure 1, but only the line battery for TG-5-A and TG-5-B is shown in figures 2 and 2.1. For position of local battery, see figure 3, which applies to all sets. The batteries required are not parts of the sets and must be requisitioned separately. The operating parts are described in section II; for complete information

thereon see the Signal Corps General Catalog. The batteries and parts of the sets are listed below :

Stock No.	Part	Quantity		
		TG-5	TG-5-A	TG-5-B
3A2	Battery BA-2 <sup>1 2</sup>	1	1	1
3A30	Battery BA-30 <sup>1 2</sup>	2	2	2
4A2805A/2	Box (drawing SC-D-1174-B)	1	1	-----
4A2805A	Box (drawing SC-D-2881-C)			
4A2805A	Box (drawing SC-D-2881-F)	-----	-----	1
4Z416	Bell, Edwards Lungen 13 <sup>1 2</sup>	1	1	1
3Z250	Binding post TM-150 <sup>1 2</sup>	5	3	3
3Z275	Binding post TM-175 <sup>2</sup>	-----	2	2
4A2805A/5	Burnisher (Western Electric No. 1A or equal). <sup>2</sup>	-----	1	1
3D210	Capacitor CA-210 <sup>1 2</sup>	1	1	1
4A2805/3	Circuit diagram (drawing SC-A-1162-D)	1	-----	-----
4A2805A/3	Circuit diagram (drawing SC-D-2888-A)	-----	1	-----
	Circuit diagram (drawing SC-D-2888-B)	-----	-----	1
4A920	Headset HS-20 <sup>1 2</sup>	1	1	1
4Z5005	Interrupter BZ-5	1	-----	-----
4Z5007A	Interrupter BZ-7-A <sup>2</sup>	-----	1	-----
4Z5007N	Interrupter BZ-7-N <sup>2</sup>	-----	-----	1
2Z5535	Jack JK-35 (Western Electric No. 226-A or equal). <sup>1 2</sup>	1	1	1
3Z441	Key J-41 <sup>1</sup>	1	1	-----
3Z3441A	Key J-41-A <sup>2</sup>	-----	-----	1
4A2007	Relay BK-7	1	-----	-----
4A2007A	Relay BK-7-A <sup>1</sup>	-----	1	-----
4A2007B	Relay BK-7-B <sup>2</sup>	-----	-----	1
4A349	Case CS-49	1	-----	-----
4A349A	Case CS-49-A <sup>1 2</sup>	-----	1	1

<sup>1</sup> Only these parts of telegraph set TG-5-A may be used as replacements for similar parts in telegraph set TG-5; remaining parts may not be so used.

<sup>2</sup> Only these parts of telegraph set TG-5-B may be used as replacements for similar parts in telegraph set TG-5-A; other parts may not be so used.

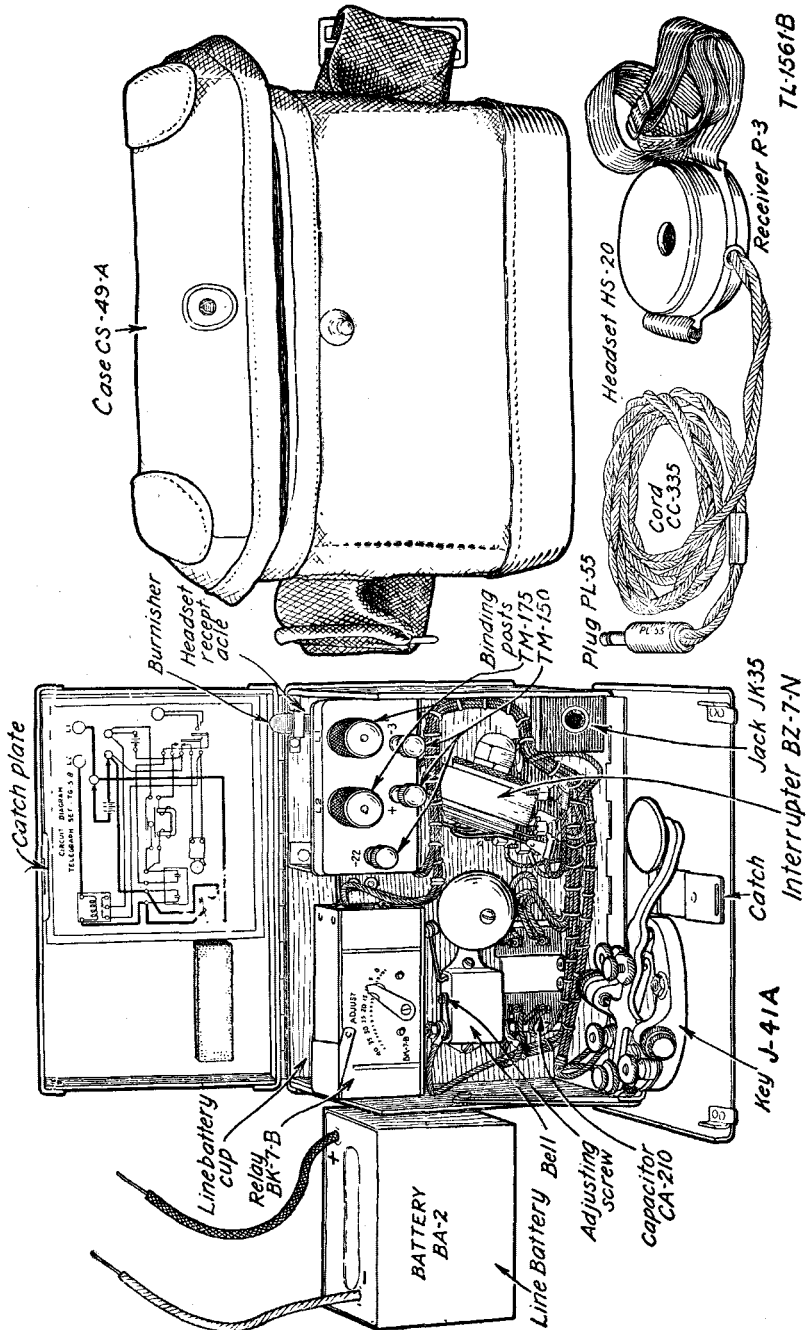


FIGURE 2.1.—Telegraph set TG-5-B—component parts and line battery.  
 [A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

8. Box.—The boxes for TG-5 and TG-5-A are made of aluminum alloy while the box for TG-5-B is made of steel. These boxes are painted an olive drab color. The box fits into the case and contains all other parts of the set. Its cover is \* \* \* box when opened. Mounted on this front is the key J-41 or J-41-A. The front is \* \* \* attached to the door. The box for each telegraph set TG-5-A and TG-5-B also contains a burnisher in a leather scabbard.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

10. Case.

\* \* \* \* \*

b. Case CS-49-A.—The case CS-49-A is part of telegraph sets TG-5-A and TG-5-B. It is made \* \* \* 85 inches long.

11. Circuit diagram.

\* \* \* \* \*

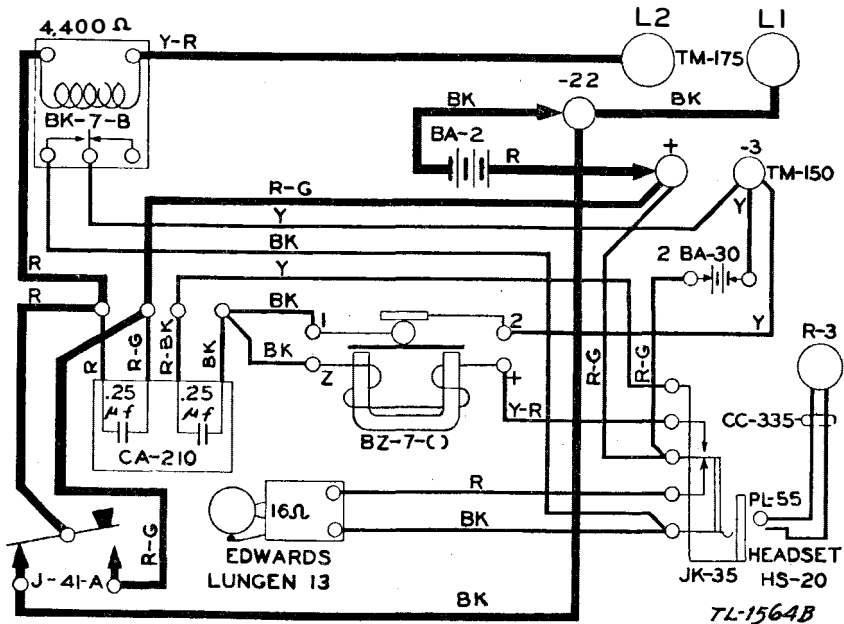


FIGURE 4.1.—Telegraph set TG-5-B—circuit diagram.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

c. (Added.) Telegraph set TG-5-B.—The circuit diagram shown in figure 4.1 is a copy of that mounted in the cover of the box. In this diagram, the same abbreviations are used for colors of the wires as are

used in the diagram of the TG-5-A. The note shown in paragraph 11a is also applicable to the TG-5-B.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

**13. Interrupter.**

\* \* \* \* \*

c. (Added.) *Interrupter BZ-7-N* (part of telegraph set TG-5-B).— This interrupter is electrically similar to interrupter BZ-7-A although it is somewhat smaller in dimensions. However, they are interchangeable since identical mounting holes have been provided.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

**15. Key J-41 and key J-41-A.**—a. Key J-41 part of telegraph sets TG-5 and TG-5-A) is an open-circuit operating key of the usual lever type mounted on a molded bakelite base, which in turn is mounted on the inside of the front of the box. In its normal \* \* \* suit the operator.

b. (Added.) Key J-41-A (part of telegraph set TG-5-B) is similar to key J-41 except that it has a raised platform underneath the rear contact. This is to prevent dust particles from creeping underneath the rear contact, separating the contacts and thereby opening the line.

**16. Relay.**

\* \* \* \* \*

c. (Added.) *Relay BK-7-B* (part of telegraph set TG-5-B).—(1) Relay BK-7-B is contained in a black bakelite housing and is located just over the bell. Its armature makes and breaks the relay contacts. On the front of the relay is a movable pointer marked ADJUST which moves over a scale, graduated from 0 to 40 and marked in steps of 5. The control operated by this pointer is notched for each unit setting, however, and may be set at any unit at or between scale markings. The ADJUST pointer controls the amount of tension on the spring of the armature. The air gap between the armature and the magnet core ends is fixed and can be varied only by readjusting the contact adjusting screws. The relay contact adjusting screws are properly set at the factory and should not be adjusted in the field. If readjustment of these screws is required, it should be done only by competent Signal Corps repair personnel.

(2) The relay winding has a resistance of 4,400 ohms and the relay may be adjusted to operate on a current as low as 0.2 milliampere. Terminals at one end provide connections to the winding and to the contacts. An opening in the top of the housing, protected by a snap cover, affords access to the relay contacts so that they may

be cleaned with the burnisher supplied with the set. Another opening in the bottom of this housing gives access to the tension spring and thread. If the plug is in the jack, the relay contacts connect the local battery in series with the interrupter and the headset; if the plug is not in the jack, the relay contacts connect the local battery in series with the bell. Breaking the relay contacts opens both of these circuits. The circuit diagram shows the relay contacts in the broken position.

**17. Terminals.**

\* \* \* \* \*

*b.* Telegraph sets **TG-5-A** and **TG-5-B** have five binding posts which have the same markings and the same purposes as those in **TG-5**. Binding posts **TM-175**, which are larger than binding posts **TM-150**, are used for the **L1** and **L2** connections.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

**18. Preparing set for installation.**

\* \* \* \* \*

*b.* Open the local \* \* \* instructions in *e* below. **On telegraph sets TG-5 and TG-5-A**, if the bell rings, open the box and set the spring and gap pointers at 0. If it continues to ring, increase the spring pointer setting one notch at a time until the ringing stops. **On telegraph set TG-5-B**, if the bell rings, open the box and increase spring tension by moving the **ADJUST** pointer to a higher number until the ringing stops.

\* \* \* \* \*

**19. Testing calling circuit (fig. 6).**—*a. Telegraph sets TG-5 and TG-5-A.*—If the set \* \* \* short circuit from **L1** and **L2**.

*b.* (Added.) *Telegraph set TG-5-B.*—If the set has been prepared as directed in paragraph 18, test the calling circuit by short-circuiting the **L1** and **L2** binding posts and pressing the key. The bell should ring; if it does not, it is probable that the local battery is not properly connected, that its voltage is too low, or that the relay is not adjusted correctly. If it is known that the fault is not in the battery, decrease the **ADJUST** pointer setting one notch at a time until the bell rings. Release the key. Remove the short circuit from **L1** and **L2**.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

**FIGURE 6.**—Telegraph sets **TG-5**, **TG-5-A**, and **TG-5-B**—calling circuit with plugs *not* in jacks.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

20. Testing transmitting and receiving circuits (figs. 7 and 8).

\* \* \* \* \*

b. If the test in *a* above is satisfactory, adjust the headset to the ear. The tone should be heard only very faintly, if at all, in the headset. On sets **TG-5** and **TG-5-A**, if it is heard strongly without operation of the key, set the spring and gap pointers at 0. If it continues strongly, increase the spring pointer, setting one notch at a time until the strong tone stops. On set **TG-5-B**, if the tone is heard strongly without operation of the key, increase the **ADJUST** pointer setting one notch at a time until the strong tone stops.

c. Short circuit **L1** and **L2** and press the key. The tone should be heard strongly in the headset. On sets **TG-5** and **TG-5-A**, if the tone \* \* \* from **L1** and **L2**. On set **TG-5-B**, if the tone is not heard when the key is depressed, decrease the **ADJUST** pointer setting one notch at a time until a tone is heard in the headset. Intermittent pressing of the key should produce a corresponding tone in the headset. If this test is satisfactory, remove the short circuit from **L1** and **L2**.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

FIGURE 8.—Telegraph sets **TG-5-A** and **TG-5-B**—transmitting and receiving circuits.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

FIGURE 9.—Telegraph sets **TG-5-A** and **TG-5-B**—two terminal stations connected to a simplex telephone circuit.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

22. Adjusting relay.—*a. General.*

\* \* \* \* \*

(2) (a) **Telegraph sets TG-5 and TG-5-A**.—When the pointers \* \* \* in paragraph 23.

(b) (Added.) **Telegraph set TG-5-B**.—When the **ADJUST** pointer is set at 0, the armature spring tension is at the minimum. In this condition, a current of approximately 0.2 milliamperes is required to operate the relay, but if a strong current flows through the relay winding, the spring will not be strong enough to break the contact quickly after the current ceases to flow. The adjustment consists of properly balancing the pull of the spring on the armature against the pull of the magnetizing current in the relay. If the spring setting is too weak, the armature may lag, respond to any possible crossfire, or, on a very wet line, respond to a capacitive discharge through the relay. This will cause an extra click to be heard in the headset. If the spring setting is too strong, the armature may not respond to very fast keying. For all line conditions, the **ADJUST**

pointer should be moved to the position which will open and close the relay contacts as sharply as possible.

\* \* \* \* \*

c. *During installation.*

\* \* \* \* \*

(2) Test the transmitting \* \* \* is not heard—

(a) On sets **TG-5** and **TG-5-A**, increase the gap pointer setting one notch at a time beginning with 0 until the strong tone is heard. It may be necessary to repeat this adjustment several times to obtain the proper setting.

\* \* \* \* \*

(c) (Added.) On set **TG-5-B**, decrease the **ADJUST** pointer setting one notch at a time until a strong tone is heard. When the key is alternately pressed and released, interrupter tone heard in the headset should correspond to the keying. It may be necessary to repeat this adjustment several times to obtain the proper setting.

[A. G. 300.7 (26 May 43).] (C 2, 22 Jul 43.)

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