

TB SIG E1

WAR DEPARTMENT TECHNICAL BULLETIN

s/sgt H. Stebelton

Radio

GERMAN RADIO SETS

Torn. Fu. bl.

and

Torn. Fu. f.

WAR DEPARTMENT

15 JANUARY 1944

RESTRICTED

WAR DEPARTMENT,
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TB SIG E1, German Radio Sets Torn. Fu. b1. and Torn. Fu. f., is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

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Chief of Staff.

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

WARNING!

THE GERMANS ARE EXPERTS
IN THE USE OF BOOBY TRAPS!
TURNING A DIAL OR SWITCH
MAY DETONATE THE EXPLO-
SIVE. DO NOT HANDLE OR
EXAMINE THEIR EQUIPMENT
UNTIL IT HAS BEEN CLEARED
BY DESIGNATED PERSONNEL!

LOOK OUT!

DESTRUCTION NOTICE

DESTROY THIS SET COMPLETELY! THIS IS VITALLY IMPORTANT!

WHY — THIS IS THE ENEMY'S OWN EQUIPMENT! HE IS ALREADY FAMILIAR WITH ITS OPERATION. HE HAS ADEQUATE SUPPLIES OF REPLACEMENT PARTS. DON'T LET THIS SET FALL INTO HIS HANDS!

WHEN — When ordered to do so by your commander.

- HOW** —
1. Smash — Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools, etc.
 2. Cut — Use axes, handaxes, machetes, etc.
 3. Burn — Use gasoline, kerosene, oil, flame throwers, incendiary grenades, etc.
 4. Explosives — Use firearms, grenades, TNT, etc.
 5. Disposal — Bury in slit trenches, foxholes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

- WHAT** —
1. Smash — Tubes, capacitors, coils, keys, headsets, microphones, panels, frames, antenna mast sections, and other electrical parts.
 2. Cut — All cables, wiring, and cords.
 3. Burn — Diagrams, charts, instruction books, wire.
 4. Bury or scatter — Any or all of the above pieces after destroying them.

DESTROY EVERYTHING!

RESTRICTED

GERMAN RADIO SETS

Torn. Fu. b1. and Torn. Fu. f.

1. DESCRIPTION.

a. The set. In this bulletin the German words are followed in parenthesis by the American military equivalent. The German radio sets Tornister Funkgerät b1 and f, **Torn. Fu. b1.** (portable radio set b1) and **Torn. Fu. f.** (portable radio set f), are identical except for a difference in transmitter frequency range. The word, set, hereafter will be applied to either the **Torn. Fu. b1.** or the **Torn. Fu. f.** The set, a transmitter-receiver combination, is capable of operation on **Tg**, Telegraphie (cw), or **Tn**, Telephonie (voice), and can be used in nets with American amplitude-modulated radio sets within the frequency and distance range. The set is housed in two cases, one containing the transmitter and receiver; the other containing the power supply and accessories.

b. Performance data. The table below lists the performance data of the set.

PERFORMANCE DATA

Frequency range: Receiver	3000 to 6600 kc	approximately
Transmitter Torn. Fu. b1.	3000 to 5000 kc	approximately
Transmitter Torn. Fu. f.	4500 to 6670 kc	approximately
Types of signals emitted.....	Telegraphie, Tg (cw) and Telephonie, Tn (voice) amplitude-modulated	
Types of signals which may be received.....	cw, tone, and voice	
Distance range: Cw	12 miles	approximately
Voice	6 miles	approximately
Type of transmitter:.....	master oscillator-power amplifier (MOPA)	
Number of tubes: Cw	2	
Voice	3	
Master oscillator tube.....	type RV2P800	
Power amplifier tube.....	type RL2P3	
Modulator tube.....	type RV2P800	
Method of calibration	quartz glow tube	
Power output	0.65 watts	

PERFORMANCE DATA (Contd)

Type of receiver:	superheterodyne
Number of tubes	6
	1 r-f amplifier type RV2P800
	1 h-f oscillator type RV2P800
	1 mixer type RV2P800
	1 i-f amplifier type RV2P800
	1 2d detector type RV2P800
	1 a-f amplifier type RV2P800
Intermediate frequency	2000 kc
H-f oscillator frequency	2000 kc above incoming signal
Type of c-w oscillator	regenerative 2d detector
Sidetone in the set	none available
Zero beat transmitter to receiver	impossible
Antenna type	top-loaded rod or long wire
Power supply	batteries
Filament	2-volt storage cell
Plate	125½ volts (dry batteries)
Grid	4½ volts (dry battery)

NOTE: When German batteries are used, the plate and grid use a 130-volt supply which is tapped at 4½ volts.

2. INSTALLATION AND OPERATION.

a. Battery installation. If the proper German batteries are available, they should be connected in the accessories case as shown in figure 1. The storage cell, German type 2B38, will fit into a compartment provided. Each of the two **Anode Batteries** (B batteries) also fits into a compartment of the case.

b. Filament supply substitutes. When the German storage cell is unavailable, a 2-volt storage cell of any manufacture may be used. Dry cells of 3 volts may be used in place of the storage cell but a dropping resistor will have to be connected as shown in figure 1. Approximately 1 ohm will be needed in the **Empfang** (receive) position and approximately 0.4 ohms in the **Send. Empf.** (transmit-receive) position.

NOTE: Adjust the value of the dropping resistor, installed when dry cells are used for filament supply, so that the filament voltmeter on the set reads 2 volts (fig. 4). This will lengthen the life of the tubes by preventing the application of excessive voltage to the filaments of the tubes.

c. Plate and grid supply substitutes. When German **Anode Batteries** (B batteries) are not available, B batteries of American manufacture may be substituted as shown in figure 1.

NOTE: A separate C battery must be connected for grid supply when American B batteries are used for plate supply.

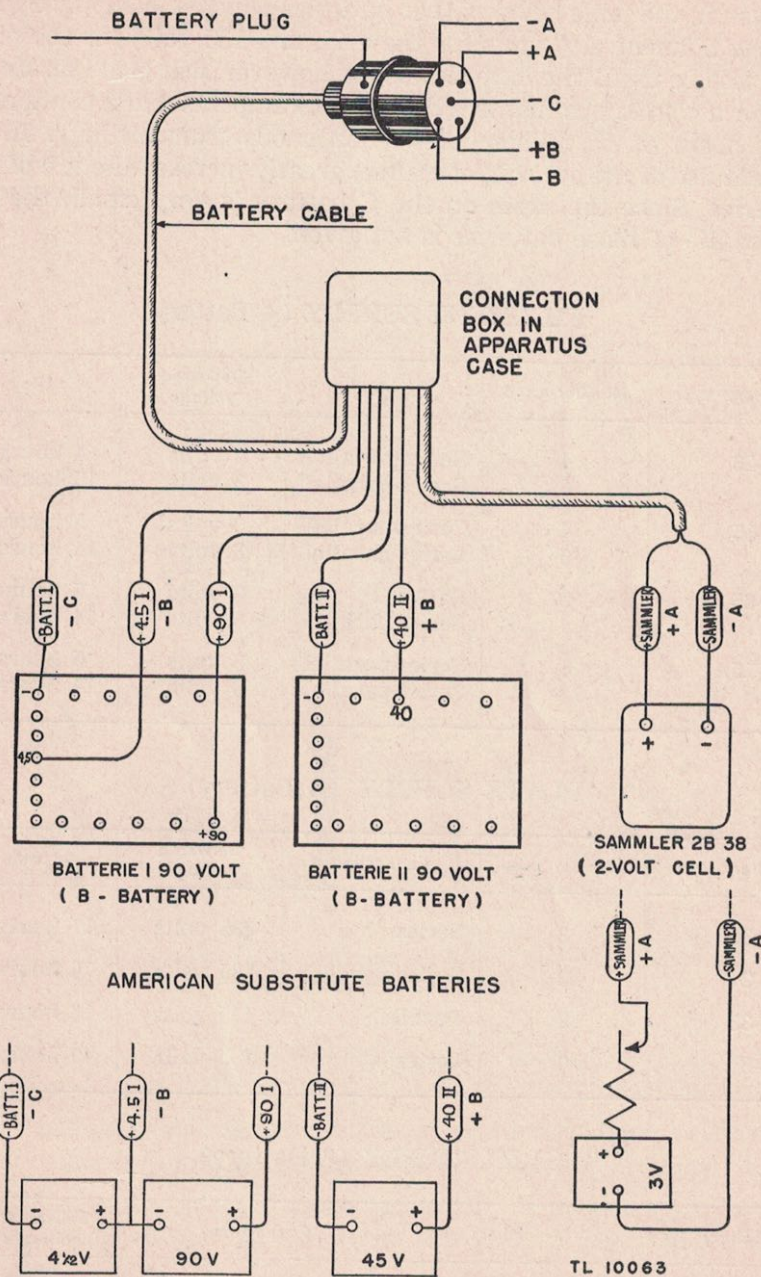


Figure 1. Battery connections for German batteries and American substitutes for German radio sets Torn. Fu. b1. and Torn. Fu. f.

d. Battery life. The expected life of substitute American batteries is given in the table below. Other batteries which will supply 2 volts for the filament, $4\frac{1}{2}$ volts for the grid, and 135 volts for the plate may also be used. The batteries listed, however, will give reasonable life for a continuous filament drain of 2.5 amperes and a continuous plate drain of 45 milliamperes (continuous transmitting). Intermittent use of the set will, of course, greatly increase the life of the batteries. Since the drain on the C battery is very small, the expected life of those batteries is not given.

FILAMENT SUPPLY (A Battery)

Battery type	Number used	Connection	Delivered voltage	Life
BA-23	4	Series-parallel	3 volts	4 hours
	6	Series-parallel	3 volts	15 hours
BA-35	4	Series-parallel	3 volts	5 hours
	6	Series-parallel	3 volts	14 hours
BA-65	2	Series	3 volts	5 hours
	4	Series-parallel	3 volts	14 hours
BA-15A	8	Series-parallel	3 volts	5 hours
	12	Series-parallel	3 volts	14 hours

PLATE SUPPLY (B Battery)

Battery type	Number used	Connection	Delivered voltage	Life
BA-36	3	Series	135 volts	17 hours
BA-2	12	Series-parallel	135 volts	16 hours
BA-33	2	Parallel	135 volts	16 hours
BA-8	6	Series	135 volts	40 hours

GRID SUPPLY (C Battery)

Battery type	Number used	Connection	Delivered voltage
BA-27	1	Whole battery	$4\frac{1}{2}$ volts
BA-34	1	Tapped at $4\frac{1}{2}$ volts	$4\frac{1}{2}$ volts

e. **General set installation.** (1) Set up the equipment as shown in figure 2 or figure 3, depending on whether the low- or high-rod antenna is to be used. The high-rod antenna will give a longer range than the low-rod antenna. If the rod antennas are not available, attach one end of a wire about 45 feet long to a tree, being sure to keep it insulated from the tree and not touching surrounding objects. Connect the other end of the wire to the set in the **Ant.** (antenna) jack.

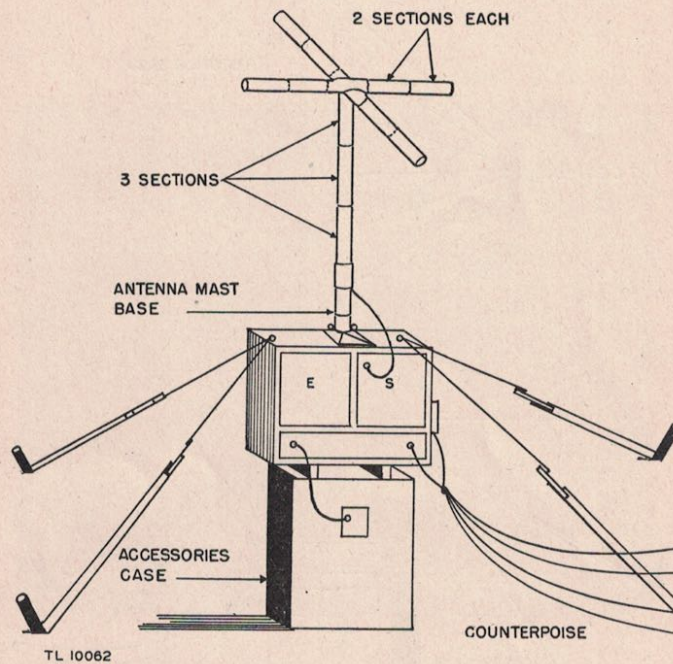


Figure 2. The German radio set, Torn. Fu. b1. or Torn. Fu. f., installed, using low-rod antenna.

- (2) The low-rod antenna is made up of a vertical portion of three antenna sections and a top portion of eight antenna sections (fig. 2).
- (3) The high-rod antenna is made up of a vertical portion of seven antenna sections and a top portion of four antenna sections (fig. 3).
- (4) The battery plug is connected to the five-contact plug on the lower left of the set. Do not force this plug as it will only plug in one way.
- (5) Plug the microphone, either the throat or hand type, into the jack marked **Mikrofon** (microphone). Any single-button carbon microphone equipped to plug into the jack will work satisfactorily.

(6) Plug the telegraph key into the jack marked **Taste** (key). Any telegraph key will work.

(7) Plug the headset into any of the jacks marked **Fernhörer** (headphones). Any high impedance headset is satisfactory.

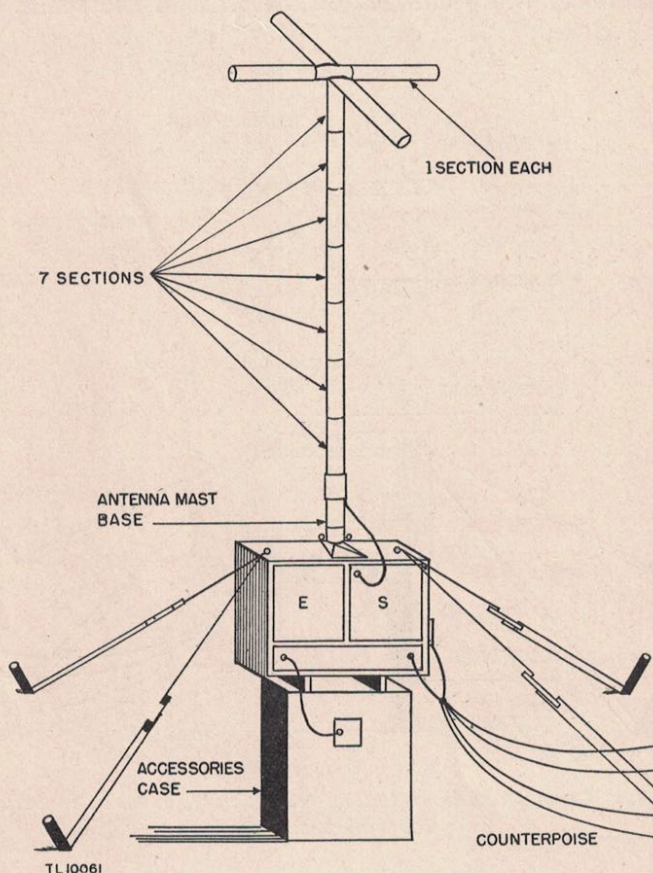


Figure 3. The German radio set, Torn. Fu. b1. or Torn. Fu. f., installed, using high-rod antenna.

(8) The set is now ready for operation. See figure 4 for location of jacks and controls.

f. Operation of the set. After the set is installed, as described above, it is put in operation as follows:

(1) To receive only, turn the power switch on the lower panel to **Empfang** (receive).

(2) To transmit or receive, turn the power switch to the **Send. Empf.** (transmit-receive) position.

(3) To set the frequency of the receiver, turn the control marked **Frequenz Einstellung** (tuning control) on the **E, Empfänger** (receiver), panel of the set until the desired dial reading appears. Frequency in kc=dial readings $\times$ 10.

(4) To receive c-w signals, keep the control marked **Tn-Lautstärke-Tg** (volume) to the right of vertical toward **Tg** (cw).

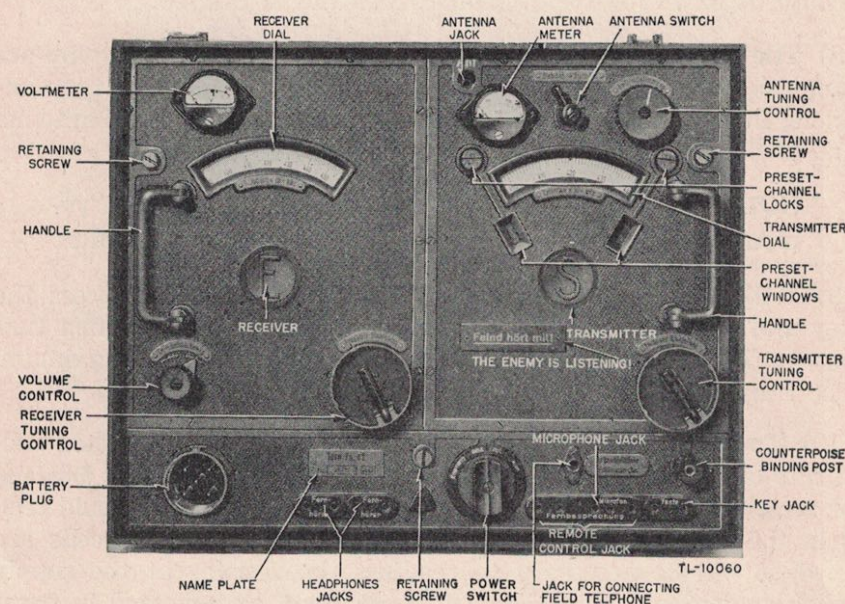


Figure 4. The German radio set, Torn. Fu. b1., front view.

(5) To receive voice or tone-modulated signals keep the volume control to the left of vertical toward **Tn** (voice).

(6) To set the frequency of the transmitter, turn the control marked **Frequenz Einstellung** (tuning control) on the **S, Sender** (transmitter), panel of the set until the dial is set at the desired reading. Frequency in kc=dial readings $\times$ 10.

(7) To preset channels proceed as follows: (a) Turn the transmitter tuning control until the desired channel number, either I or II, appears in its window below the dial. I appears in the preset channel window on the left and II in the one on the right.

- (b) Turn the preset channel lock marked **Fest Lose** (locked unlocked) above the window so that **Lose** (unlocked) is uppermost.
- (c) Turn the transmitter tuning control to the desired frequency.
- (d) Turn the preset channel lock so that **Fest** (locked) is uppermost.
- (e) Now, whenever the channel number preset appears in its window, the transmitter is within 1 kc. of the frequency originally chosen.
- (f) The other preset channel may be set up in the same manner.
- (g) The preset arrangement will also serve as a dial lock even though it is very easy to change frequency if desired.
- (8) The switch marked **Stab-Ant. Draht-Ant.** (rod-antenna wire-antenna) changes the antenna circuit for the use of either type antenna. Place in the **Stab-Ant.** position for a high- or low-rod antenna and in the **Draht-Ant.** position for a wire antenna.

NOTE: If the set is operated with a 15-foot American vehicular antenna, place the switch in the **Draht-Ant.** position.

- (9) With the power switch in the **Send. Empf.** position, press the key and adjust the control marked **Ant.-Abstimmung** (antenna tuning) until the meter marked **mA** (antenna current) reads maximum. The transmitter is now tuned and ready for operation.
- (10) To check the filament cell or to adjust the resistor when substitute dry cells are used, turn the power switch to either **Empfang** or **Send. Empf.** and read the meter marked **V** (volts). It should read 2 in the red portion of the scale. When substitute dry cells are used, it will be necessary to readjust the resistor at the supply when switching from **Empfang** to **Send. Empf.** as indicated in paragraph 2b.
- (11) To check the plate supply, turn the power switch to **Empfang** or **Send. Empf.** and push the blue button on the meter case marked **150V**. The meter should read 130 in the blue portion of the scale. If the meter reads over 130 but less than full scale, the plate batteries are good.
- (12) To operate the transmitter on cw, use the telegraph key; to operate the transmitter on voice, merely press the microphone switch. The necessary circuit changes are taken care of by the relays in the set.
- (13) Due to the set design, it is not possible to zero-beat the transmitter to the receiver or to obtain sidetone in the headset.

3. MAINTENANCE. Detailed maintenance instructions on this set are not included. Simple operating precautions should be observed when the set fails to operate, as follows:

- a. Check the condition of the batteries with the voltmeter on the panel.
- b. Check all cords, plugs, and connections. Much of the trouble will be in cording and connections.

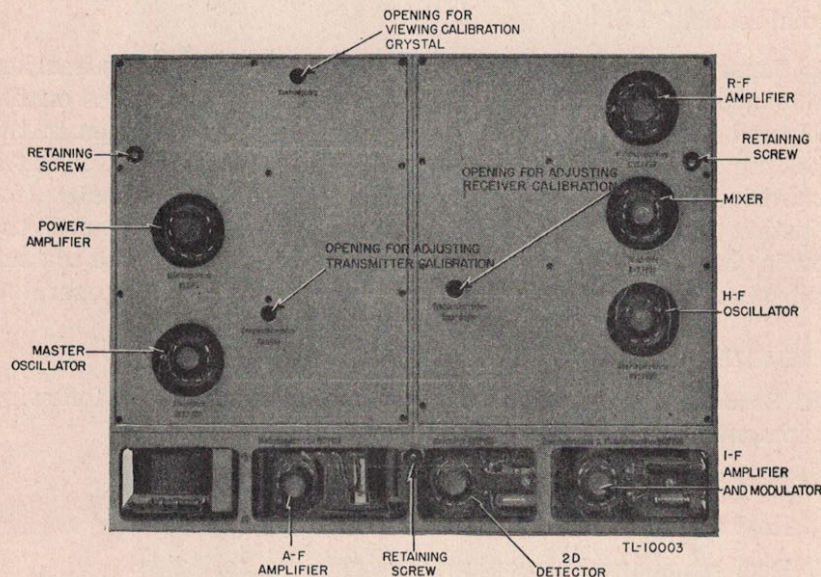


Figure 5. The German radio set, Torn. Fu. b1., removed from case, rear view.

c. Replace the tubes in order, starting with the antenna and progressing toward the master oscillator in the transmitter. In the receiver, start with the a-f amplifier and work to the r-f amplifier. To change the tubes, it is necessary to remove the set from its case. Do this by loosening the three retaining screws which are on the front panel of the set (fig. 4). Then lift the set from the case by the two handles on the front. Figure 5 shows the rear of the set after it has been removed from its case and the position of all of the tubes.

NOTE: The i-f amplifier of the receiver and the modulator of the transmitter is the same tube; therefore, if the set is satisfactory in one or the other of its functions, the trouble is probably not in this tube.

d. If the simple procedures outlined above do not make the set operate, send it back to a signal depot. The components may be used to repair other sets. WE CAN USE THE GERMAN PARTS TO FIX OUR OWN OR OTHER GERMAN SETS.

4. **CALIBRATION.** In order to calibrate the transmitter, it is necessary to remove the set from its case.

a. Set up the transmitter for operation on cw.

b. Set the transmitter dial to the red line, located approximately at dial reading 468.

c. Press the key and look in either of the openings marked **Kontrollquarz** (calibration crystal). One of these openings is on the back and the other at the top of the set. If a glow is seen in the tube, the set is correctly calibrated. If there is no glow, insert a screwdriver in the opening marked **Frequenzkorrektur Sender** (for adjusting transmitter calibration) and adjust the screw until the glow is observed. The transmitter dial is now assumed to be correct. Calibration of the receiver should not be attempted by the operator.

5. REMOTE OPERATION.

a. **General.** The set includes a case which contains the following equipment for remote voice operation (fig. 6).

- (1) Reel containing 50 meters (165 feet) of cable.
- (2) Reel axle for winding and unwinding reel.
- (3) Reel crank used in conjunction with the reel axle.
- (4) Control switch box used at the transmitter location.
- (5) Remote telephone handset.

b. **Installation.** (1) The control switch box is located at the transmitter and is connected to the five-contact jack on the set marked **Fernbesprechung** (remote control jack) by the five-contact plug on the switch box.

(2) Plug the microphone (hand or throat type) into the jack marked **Mikrofon** (microphone) on the switch box.

(3) Plug the headset into the jack marked **Fernhörer** (headphones) on the switch box.

(4) Plug the cable from the reel into the five-contact plug provided on the control switch box.

(5) Using the reel axle and crank, unwind the cable on the reel and place the reel at the remote location.

(6) Plug the three-contact plug of the remote telephone handset into the jack on the reel drum marked **Mikrofon** (microphone).

(7) Plug the two-contact plug of the remote telephone handset into the jack on the reel-drum marked **Fernhörer** (headphones).

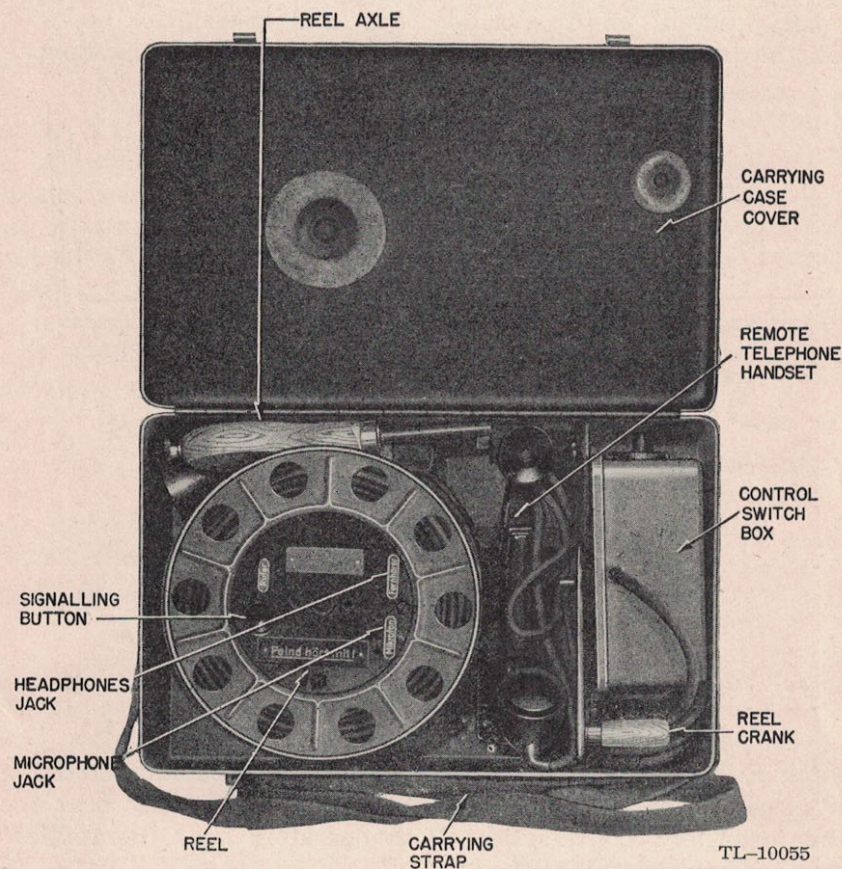


Figure 6. Remote operation equipment for German radio sets, **Torn. Fu. b1.** and **Torn. Fu. f.**, packed in case.

NOTE: A microphone and headset may be used instead of the remote telephone handset as long as they are plugged into the correct jacks. The remote telephone handset may be used at the transmitter instead of the microphone and headset.

(8) The installation is now complete and ready for operation.

c. **Operation.** (1) Set up the equipment as indicated in paragraphs 2e and 5b.

(2) The control switch box is equipped with a switch which selects any one of three types of operation (fig. 7).

(3) For operation of the transmitter from the transmitter location, place the selector switch of the control switch box on **Ortsbespr.** (local) position. In this position, the local transmitter operator puts the transmitter carrier on when he presses his microphone

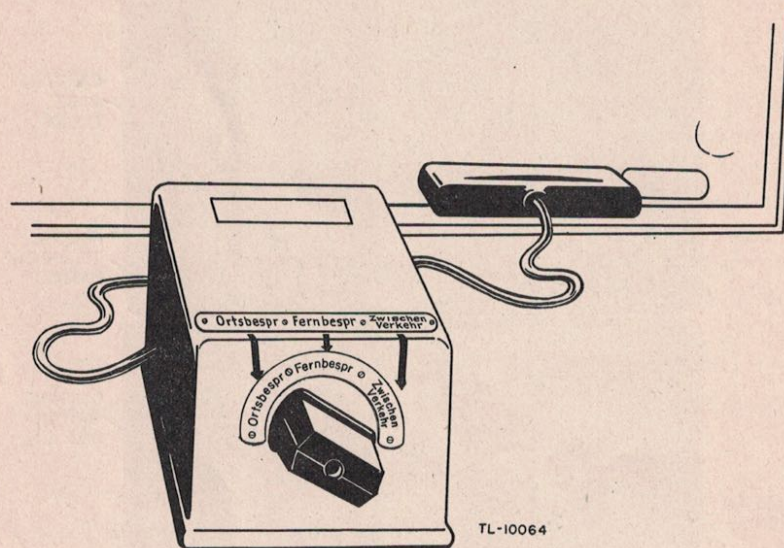


Figure 7. Control switch box for remote operation of German radio sets Torn. Fu. b1. and Torn. Fu. f.

switch. Either the local or remote operator may modulate the transmitter when the carrier is on and either operator may hear the other operator's conversation. Both operators hear the receiver when the transmitter is off.

(4) For operation of the transmitter from the remote location, place the selector switch on the control switch box on **Fernbespr.** (remote) position. In this position, the remote operator puts the transmitter carrier on when he presses his microphone switch. Either operator may modulate the transmitter when the carrier is on and either operator may hear the other operator's conversation. Both operators hear the receiver when the transmitter is off.

(5) When it is desired to have the transmitter operator and the remote operator converse over the cable without putting the transmitter carrier on, place the selector switch on the control switch

box in the **Zwischen Verkehr** (telephone) position. Operation of either microphone switch does not put the transmitter carrier on. Both operators hear the receiver at all times in this position.

6. FIELD TELEPHONE OPERATION. It is also possible to modulate the transmitter over an ordinary field telephone line. Satisfactory operation may be obtained over about 1½ miles of field wire. The line is connected to a plug which will fit into the jack on the set marked **Zur AnschluBklinke f. Feldfernsprecher** (for connecting the field telephone) and a field telephone is connected across the line at the transmitter. It is possible to converse with the operator at the remote location over the field wire line. It is also possible for the remote operator to modulate the transmitter provided the transmitter operator has pressed his microphone switch to put the transmitter carrier on and prepare it for modulation. The remote operator will hear the receiver when the transmitter is off.

7. GLOSSARY OF TERMS. The German terms on the set and their American military equivalent are as follows:

<u>German</u>	<u>American</u>
Ant. (Antenne)	antenna
Ant.-Abstimmung	antenna tuning
Audionröhre	2d detector tube
Aus	off
Draht-Ant.	wire antenna
E, Empf., Empfang, Empfänger	receiver
Feind hört mit!	The enemy is listening!
Fernbesprechung	remote operation
Fernhörer	headset or headphones
Fest	locked
Frequenz Einstellung	tuning control
Frequenzkorrektur	calibration adjustment
Funkgerät, Fu	radio set
G, Gegengewicht	counterpoise
Hochfrequenzröhre	r-f amplifier tube
Lautstärke	volume
Leistungröhre	power amplifier tube
Lose	unlocked
mA	milliamperes (antenna)

GLOSSARY OF TERMS (Contd)

Mikrofon	microphone
Mischröhre	mixer tube
Modulationsröhre	modulator tube
Niederfrequenzröhre	a-f amplifier tube
Ortsbespr., Ortsbesprechung	local operation
Röhre	tube
S, Send, Sender	transmitter
Stab-Ant.	rod antenna
Steuerröhre	master oscillator tube
Taste	key
Teilstrich $\times 10 = \text{kHz}$	dial divisions $\times 10 = \text{kilo-cycles}$
Tg, Telegraphie	cw or telegraphy
Tn, Telephonie	voice or telephony
Tornister, Torn.	portable
Überlagerröhre	h-f oscillator tube
Zur AnschluBklinke f. Feldfernsprecher	for connecting the field telephone line
Zwischenfrequenz u Modulationsröhre	i-f amplifier and modulator tube
Zwischen Verkehr	telephone operation