

566 Sig

Stebelfon

TB SIG E3

WAR DEPARTMENT TECHNICAL BULLETIN

RADIO OPN SEC 566th SIG

GERMAN RADIO SET

Torn. E. b.

WAR DEPARTMENT

10 FEBRUARY 1944

RESTRICTED

WAR DEPARTMENT,
WASHINGTON 25, D. C., 10 February 1944.

TB SIG E3, German Radio Set Torn. E. b., is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

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

DISTRIBUTION:

Bn and H 1, 2, 4-7, 11, 17, 18, 19, 44(3); IC 11(3).
(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 SET

Torn. E. b.

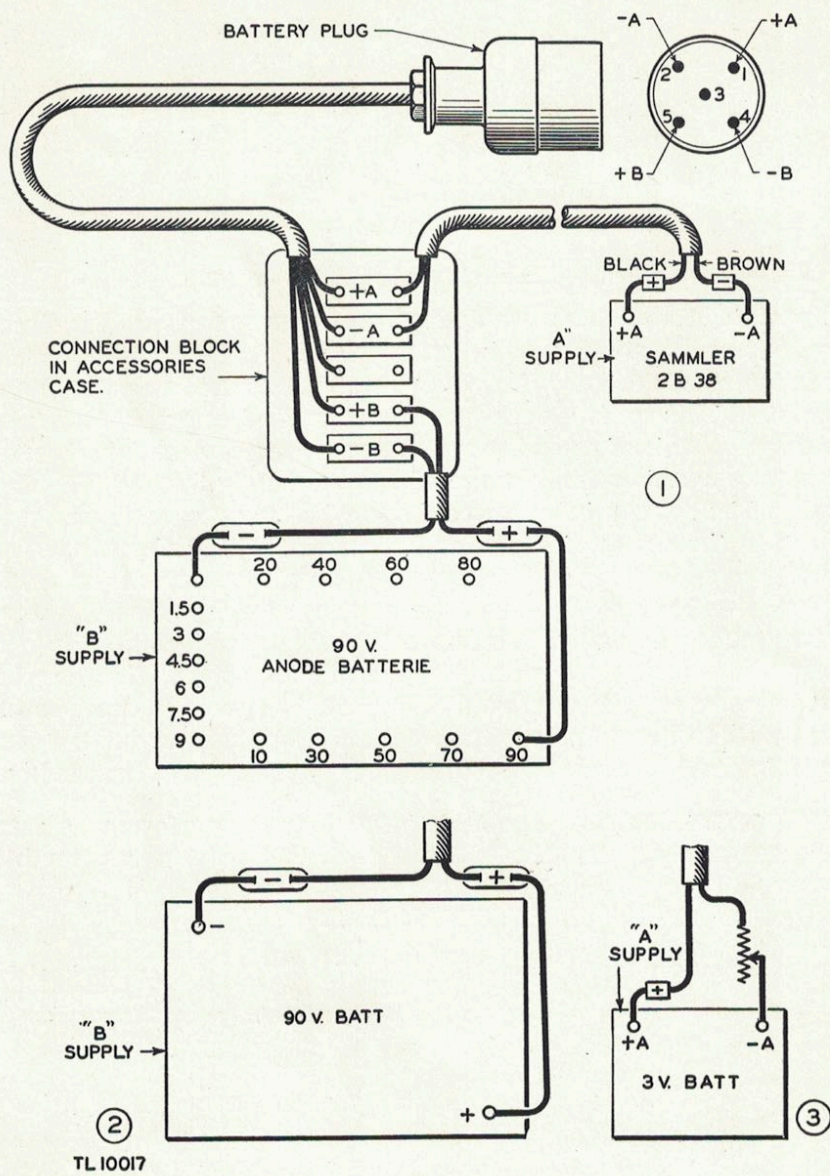
1. DESCRIPTION. The German radio receiver Tornister Empfänger b, abbreviated **Torn. E. b.** (portable receiver b),* was designed for direction-finding installation, to be set up on the ground or in a vehicle as in intercept receiver. The word "set," will be used to refer to the **Torn. E. b.** This set is a pack-type, tuned radio-frequency, four-tube receiver, capable of receiving continuous-wave (c-w) and modulated signals over a frequency range of approximately 97 to 7,095 kilocycles. The set can be operated from a battery power supply contained in the accessories case or **Umformersatz EWc** (vibrator power supply type EWc). The vibrator power supply operates from a 12-volt storage battery. The apparatus and accessories cases are watertight and can be bolted firmly together for transportation by one person. Handles are provided for each section so that they can be carried separately if desired. The **Torn. E. b.** (portable receiver b) can be used in radio nets with American amplitude-modulated sets providing that too great sensitivity and selectivity is not needed.

2. PERFORMANCE DATA. The table below lists the performance data and general characteristics of the **Torn. E. b.** (portable receiver b).

PERFORMANCE DATA

Frequency range:	97 to 7,095 kc approximately (covered in 8 overlapping bands). This frequency range is broken up into 8 bands:
	1. 96.6 - 177.8 kc
	2. 171.0 - 313.7 kc
	3. 304.0 - 558.8 kc
	4. 540.0 - 990.0 kc
	5. 955.0 - 1740 kc
	6. 1674 - 3075 kc
	7. 2920 - 4820 kc
	8. 4360 - 7095 kc
Types of signals which may be received: ..	cw, tone, and voice
Type of receiver:	Tuned r-f with regenerative detector

* In this bulletin the German words are followed by their American military equivalent in parentheses.



- ① German battery connections.
- ② Substitute American "B" supply.
- ③ Substitute American "A" supply.

Figure 1. Battery connections for German radio set Torn. E. b.

PERFORMANCE DATA (contd)

Number of tubes:	4
	2 r-f amplifiers type RV2P800
	1 detector type RV2P800
	1 a-f amplifier type RV2P800
Sensitivity:	20 to 100 microvolts for 1 milli-watt output
Power supply:	Battery or vibrator
Battery:	
Filament	2-volt, German type 2B 38 storage cell
Plate	90-volt, German type DIN/VDE 1600 dry battery
Vibrator:	
Filament	12-volt storage battery with dropping resistor built into vibrator pack
Plate	90-volts delivered by vibrator supply
Current consumption:	Filament current approximately 800 milliamperes
	Plate current approximately 12 milliamperes
Antenna:	Long wire or any rod antenna

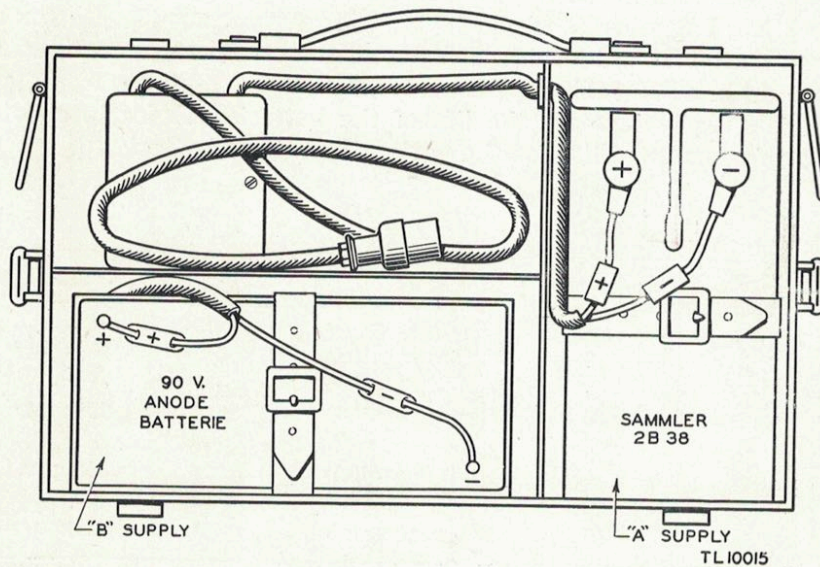


Figure 2. Accessories case of German radio set Torn. E. b.

3. POWER SUPPLY INSTALLATION.

a. Battery Installation. If the proper German batteries are available, they should be connected in the accessories case (fig. 1①). The storage cell, German type 2B 38, will fit into the compartment provided. The **Anode Batterie** (B battery) also fits into a compartment in the lower side of the case (fig. 2).

(1) **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 of approximately 1.25 ohms at 7 watts will have to be connected, as shown in figure 1③.

NOTE: Adjust the value of the dropping resistor, installed when dry cells are used for filament supply, so that the voltmeter on the set reads 2. This will lengthen the life of the tubes by preventing the application of excessive voltage to the tube filaments. However, in some of the later models of the **Torn. E. b.** the voltmeter is omitted from the set. In these models an external meter must be used to assure that the correct voltage will be applied to the filaments.

(2) **PLATE SUPPLY SUBSTITUTES.** When German **Anode Batteries** (B batteries) are not available, B batteries of American manufacture may be substituted, as shown in figure 1②.

(3) **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 and 90 volts for the plate may be used. The batteries listed, however, will give reasonable life for a continuous filament drain of 800 milliamperes and a continuous plate drain of 12 milliamperes. Intermittent use of the set will, of course, greatly increase the life of the batteries. Refer to charts below for expected life for the various substitute batteries.

FILAMENT SUPPLY (A Battery)

Battery type	Number used	Connection	Delivered voltage	Life
BA-23	4	Series-parallel	3 volts	50 hours
	6	Series-parallel	3 volts	110 hours
BA-35	4	Series-parallel	3 volts	35 hours
	6	Series-parallel	3 volts	65 hours
BA-65	2	Series	3 volts	11 hours
	4	Series-parallel	3 volts	35 hours
BA-15A	8	Series-parallel	3 volts	35 hours
	12	Series-parallel	3 volts	65 hours

PLATE SUPPLY (B Battery)

Battery type	Number used	Connection	Delivered voltage	Life
BA-36	2	Series	90 volts	18.5 hours
BA-2	8	Series-parallel	90 volts	17 hours
BA-8	4	Series	90 volts	43 hours

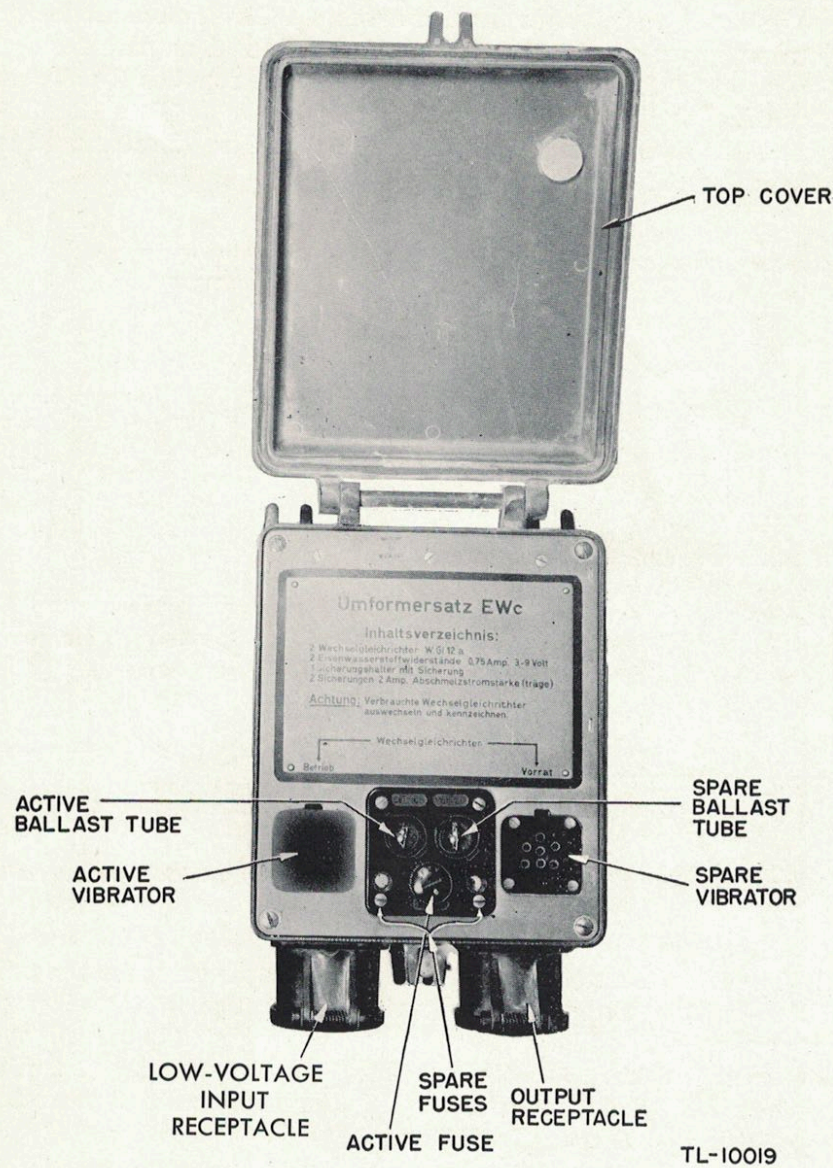


Figure 3. Vibrator power supply for German radio set Torn. E. b., top view with cover opened.

b. Vibrator Power Supply Type EWc. (1) The **Umformersatz EWc** (vibrator power supply type EWc) shown in figure 3, is used when the **Torn. E. b.** (portable receiver b) is operated from a 12-volt storage battery, such as is used in a vehicle. The **Umformersatz EWc** (vibrator power supply type EWc) draws about 1 ampere from a 12-volt storage battery. The output receptacle supplies 2 volts at 0.8 ampere for the filaments, and 90 to 100 volts at 10 to 12 milliamperes for the plates of the tubes in the set. The vibrator used is of the self-rectifying type.

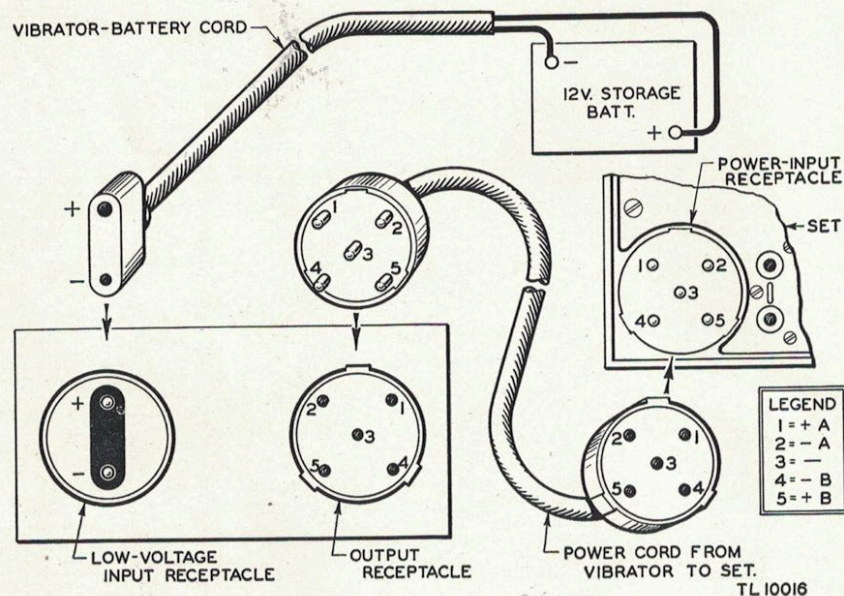


Figure 4. Cording diagram for use of vibrator supply with German radio set **Torn. E. b.**

(2) The 12 volts supplied is reduced to the proper value for the tube filaments by a series-dropping resistor contained in the vibrator power supply. The filament voltage is held to a steady value by an **Eisenwasserstoffwiderstände** (ballast tube) in series with the tube filaments and the dropping resistor. The filament circuit is protected by a **Sicherungen 2 amp.** (fuse, 2 amp).

(3) The cording for use of the vibrator supply is shown in figure 4.

c. Accessories Case. (1) The container is divided into three compartments, as shown in figure 2. Components consist of a 2-volt lead storage cell, a 90-volt plate battery, two headsets, and the battery cable. The batteries are held firmly in place by leather straps.

The storage cell is connected to the red (+) and blue (-) lugs of the battery cable. The two conductors from the cable to the plate battery are also labeled (-) and (+) and are connected to the (-) and (+) terminals of the 90-volt battery.

(2) In the front cover of the accessories case is an aperture which permits connection of the cable to the set without removing the cover. The lid which is provided for this opening is closed during transportation.

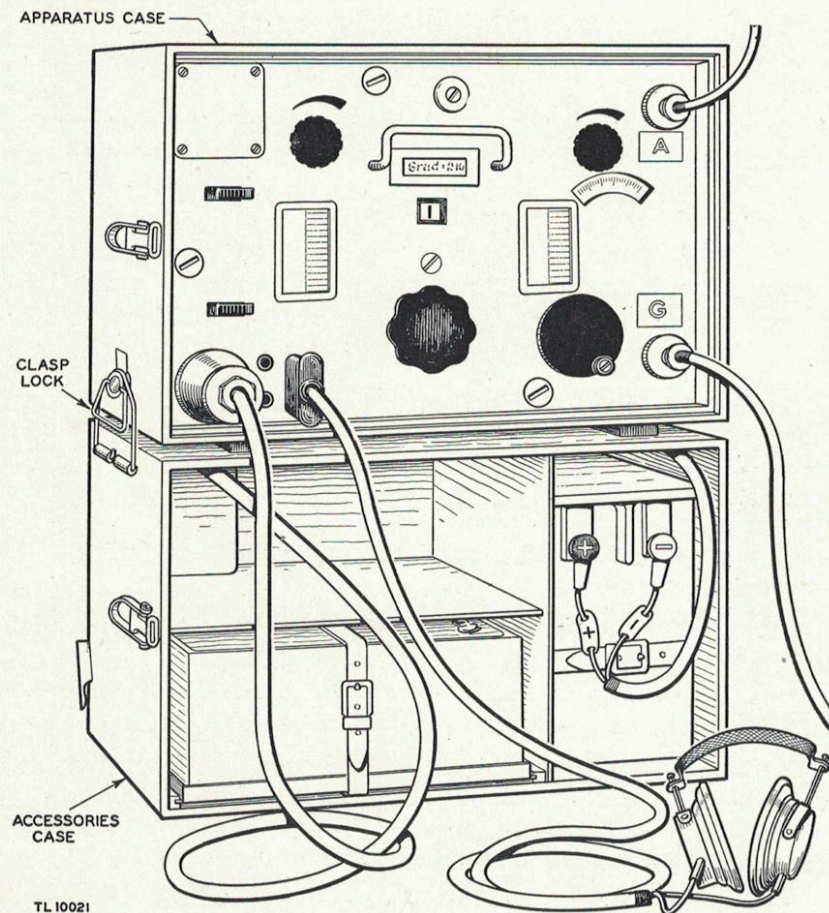


Figure 5. German radio set Torn. E. b., set up for operation.

4. INSTALLATION.

a. Assembly. Place the apparatus case on top of the accessories case, as shown in figure 5. These sections are secured together by

clasp locks on the ends. To lock these sections in place proceed as follows:

- (1) Depress locking lever, grasp the triangular eccentric handle on the apparatus case, and rotate it until the small side of the eccentric is on top.
- (2) Release the triangular eccentric handle on the apparatus case, grasp the loop on the accessories case, and place it over the eccentric on the apparatus case.
- (3) Turn the triangular eccentric handle on the apparatus case a complete half-turn, so that the locking lever snaps into place.
- (4) To unlock, depress locking lever and reverse procedure.

b. Antenna and Ground. Connect antenna to binding post marked **A** (antenna) and the ground or counterpoise to the binding post marked **G** (counterpoise), on the set. The antenna can be a 45-foot length of wire, one end of which may be attached high on a tree. Be sure to keep it insulated from the tree and free from contact with surrounding objects. Vertical rod antennas can also be used. Use a good ground; if one is not available, use a 45- to 65-foot counterpoise cable.

c. Ground Set. The following general instructions are to be used when the **Torn. E. b.** (portable receiver b) is operated from the batteries contained in the accessories case.

- (1) Install and connect batteries as indicated in paragraph 3.
- (2) Connect antenna and ground or counterpoise as indicated in paragraph 4b above.
- (3) Insert battery plug into power input receptacle at lower left front of set.
- (4) Plug the headset into any of the jacks marked **Fernhörer** (headphones). Align plug with white line. Any high-impedance headset is satisfactory. The set is now installed and ready for operation.

NOTE: The set may be installed as a ground set and be operated from the vibrator power and a 12-volt storage battery. Some means for charging the battery should be available.

d. Vehicular Set. When using the **Torn. E. b.** (portable receiver b) as a vehicular set, be sure that the set is firmly secured to the vehicle. The **Umformersatz EWc** (vibrator power supply type EWc), which operates from a 12-volt storage battery, can be used to operate the set.

- (1) Install and connect **Umformersatz EWc** to the storage battery and the set, as shown in figure 4.

- (2) Connect vehicular antenna to **A** (antenna) jack on set.
- (3) Connect a wire between vehicle chassis and **G** (counterpoise) jack of set.
- (4) Plug the headset into any of the jacks marked **Fernhörer** (head-phones). Align plug with white line. Any high-impedance headset is satisfactory. The set is now installed and ready for operation.

NOTE: The **Torn. E. b.** may be installed in a vehicle and operated from the batteries contained in the accessories case.

5. OPERATION.

a. General. After the set is installed it is put in operation as follows (see fig. 6 for location of controls):

- (1) Turn the **Aus-Ein** (off-on) switch on **Ein** (on).
- (2) Test the battery voltages; by reading the voltmeter on the set the pointer should be in the red section of the scale for correct filament voltage. Upon pressing the button on the voltmeter, the plate voltage is read and it should be in the blue section of the scale.

NOTE: On some of the later models of the **Torn. E. b.** this voltmeter is omitted. On these models check the batteries under load at their terminals with an external voltmeter when the receiver sensitivity is low.

- (3) Turn **Frequenzeinstellung Grob** (band switch) to band 6, set the **Frequenzeinstellung Fein** (tuning control) between 80 and 100, and adjust **Anpass** (antenna trimmer) to maximum output. Either a received station or background noise may be used as an indication. This readjustment will only be necessary if the antenna is changed.
- (4) Turn the **Lautst** (volume control) to maximum.
- (5) Turn **Frequenzeinstellung Grob** (band switch) to desired frequency band.
- (6) Set the control marked **Rückkoppl** (regeneration) just below the point of oscillation for voice and tone telegraphy; for cw, set this control so that the detector just begins to oscillate, which is usually indicated by a rushing noise in the headset.

NOTE: On some models of the **Torn. E. b.** the **Rückkoppl** (regeneration control) has a numbered dial to indicate the amount of coupling being used.

- (7) To increase selectivity on c-w signals, place the **Tonsieb** (tone-filter) switch on **Mit** (in). Place switch on **Ohne** (out) for voice or tone reception.
- (8) Slowly turn **Frequenzeinstellung Fein** (tuning control) in search of station to be worked, or set **Frequenzeinstellung Fein** on a previously designated frequency.

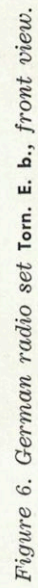


Figure 6. German radio set Torn. E. b., front view.

(9) Decrease the **Lautst** (volume control) to desired level.

(10) Upon completion of reception turn the **Aus-Ein** (off-on) switch to **Aus** (off).

6. FREQUENCY SELECTION.

a. General. A scale marked 0 to 100 degrees is fixed to the main tuning capacitor which is operated by the **Frequenzeinstellung Fein** (tuning control) knob. A large disk is attached to a coil drum which is operated by the **Frequenzeinstellung Grob** (band switch) knob, and the frequency corresponding to the capacitor dial scale reading is marked on the drum. Two windows in the panel show the tuning dial calibration tables for each band as the drum is rotated. A third window indicates the number of **kHz** (kc) per division on the tuning dial.

b. Approximate Interpolation. It may sometimes be necessary to calculate the frequency of a point between two listed calibrated frequencies. To aid in calculating the proper dial setting or measured frequency corresponding to these intermediate points, the following method should be used. The interpolation described below is the more accurate, but the over-all **kHz** (kilocycles) per **Grad** (dial division) as seen in the band graduation indicator may be used for quick calculations. For example: On band 1, one **Grad** (dial division) is equal to **0.8 kHz** (0.8 kc). In order to calculate the frequency of an incoming signal at a dial setting of 37, proceed as follows:

Dial divisions	Kilocycles
37	X unknown frequency
<u>-35</u>	<u>119.4</u> known frequency
2	
2 (dial divisions) 0.8 kHz (kc) = 1.6 kc	
Frequency = 119.4 + 1.6 or 121 kc	

To calculate the dial setting for 121 kc proceed as follows:

	Dial divisions	Kilocycles
unknown dial setting	X	121.0
known dial setting	<u>35</u>	<u>-119.4</u>
		1.6

$1.6 \text{ kc} \div 0.8 \text{ kHz (kc)} = 2 \text{ dial divisions}$

Dial setting = $35 + 2$, or 37, the dial setting for 121 kc.

To determine the frequency of the dial setting 37 on band 1 more accurately proceed as follows:

Known dial setting 37.

Unknown frequency X.

	Dial divisions	Kilocycles
	40	124.0
	<u>35</u>	<u>119.4</u>
Difference	5	4.6
		$4.6 \div 5 = .92$ kc per division
		$37 - 35 = 2$ dial divisions
		$.92 \times 2 = 1.84$ kc
		Frequency = $1.84 + 119.4$ or 121.24 kc

The difference between the two calibration chart frequency values is 4.6 kc and corresponds to 5 dial divisions. The frequency in kHz (kc) per dial division is then found by dividing the 4.6 kc by 5 dial divisions, and is 0.92. The difference between the observed dial setting and the calibration chart value dial setting for the lesser frequency is 2 dial divisions. The frequency which this difference represents is then the product of the difference and the kilocycles per division: 0.92×2 , or 1.84 kc. This is then added to the lesser frequency: $119.4 + 1.84$, giving 121.24 kc, the frequency corresponding to the 37 dial setting. Conversely, if it is desired to adjust the receiver to a given frequency between the two calibration chart values, it will again be necessary to make an interpolation to determine the exact dial setting to be used. For example, it is desired that the receiver be adjusted to 121.24 kilocycles. The necessary calculations follow:

Unknown dial setting X.

Known frequency 121.24 kc

	Dial divisions	Kilocycles
	40	124.0
	<u>35</u>	<u>119.4</u>
Difference	5	4.6
		Difference between known frequency and lesser calibrated frequency = 1.84 kc
		$5 \div 4.6 = 1.09$ dial divisions per kc
		$1.09 \times 1.84 = 2$ dial divisions
		Dial setting = $35 + 2$ or 37

The difference between the two calibration chart frequency values is 4.6 kc and corresponds to 5 dial divisions. The number of dial

divisions per kilocycles is then found by dividing the 5 divisions by the 4.6 kc. The difference between the desired frequency and the lesser calibration chart frequency is 1.84 kc. The number of dial divisions that this frequency represents is then the product of the difference and the number of dial divisions per kilocycles: 1.09×1.84 , or 2 dial divisions. This is then added to the lesser calibration chart dial divisions: $35 + 2$, giving 37 divisions, the dial setting required for a frequency of 121.24 kc.

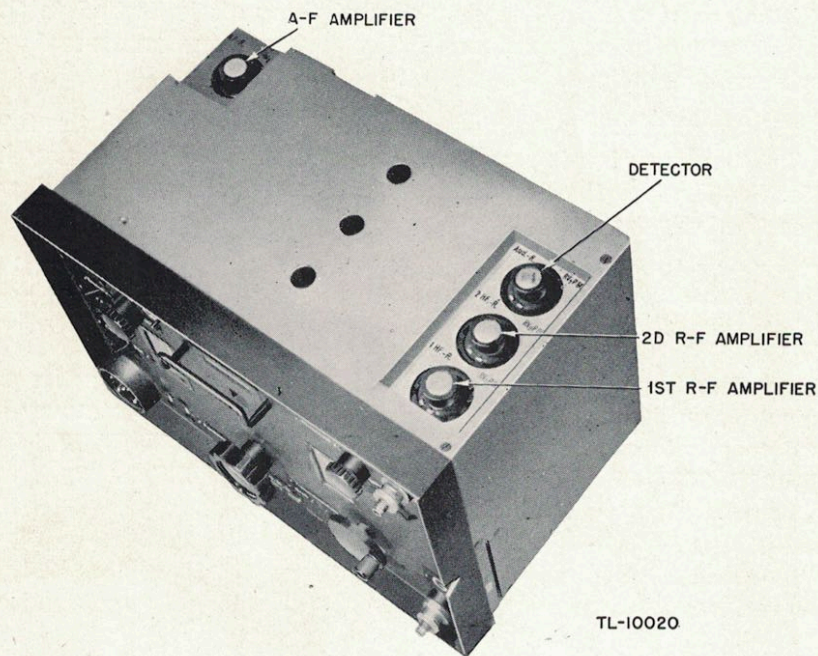


Figure 7. German radio set Torn. E. b., removed from case, top view.

7. MAINTENANCE.

a. **Torn. E. b.** Detailed maintenance instructions on this set are not included. The following simple operating precautions should be observed when the set fails to operate:

(1) Check the condition of the batteries with the voltmeter on the panel. In sets which have the voltmeter omitted use an external voltmeter, or if no voltmeter is available substitute known good batteries for those in the receiver. Voltage must lie between the following figures:

Filament voltage	1.8 to 2.2 volts
Plate voltage	80 to 100 volts

(2) Check all cords, plugs, and connections. Much of the trouble encountered is caused by defective cording and connections.

(3) Replace the tubes in order starting with the a-f amplifier and work to the r-f amplifier. To change tubes it is necessary to remove the set from the apparatus case. To remove the set from the apparatus case, loosen the three retaining screws which are on the front panel of the set (fig. 6). Figure 7 shows the set removed from the case, and the positions of all the tubes.

b. Umformersatz EWc. The servicing of this unit is limited to the replacement of vibrators, fuses, ballast tubes, plugs, and repair of cords and connections.

(1) If the vibrator is working and the set is inoperative, the fuse in the filament circuit may be open, or the ballast tube may be defective. Replace the fuse first, and if the trouble is not fixed, replace the ballast tube.

(2) If set is inoperative and the vibrator is not making a buzzing noise, the vibrator may be defective. Try placing the spare vibrator in the active socket.

(3) If the simple procedures outlined above do not make the set operate, send it back to the signal depot. The components may be used to repair other sets. WE CAN USE GERMAN PARTS TO REPAIR OUR OWN AS WELL AS GERMAN SETS.

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

<u>German</u>	<u>American</u>
A (Antenne)	antenna
Anpass	antenna trimmer
Aud.-R	detector
Aus	off
Betrieb	active
Ein	on
Eisenwasserstoffwiderstände	ballast tube
E, Empfänger	receiver
Fernhörer	headset or headphones
Frequenzeinstellung Fein	tuning control
Frequenzeinstellung Grob	band switch
G	counterpoise, ground
Grad	graduations
1 HF.-R., 1 Hochfrequenzröhre	1st r-f amplifier
2 HF.-R., 2 Hochfrequenzröhre	2d r-f amplifier
kHz	kilocycles
Lautst	volume control
Mit	in
N.F.-R., Neiderfrequenzröhre	a-f amplifier
Ohne	out
Rückkoppl	regeneration control
Sicherungen	fuse
Sicherungshalter	fuse holder
Tonsieb	tone filter
Umformersatz	vibrator power supply
Vorrat	spare
Wechselgleichrichter	vibrator
Gerät ohne Meßinstrument betriebsklar	This wireless set without voltmeter