TB SIG E6

WAR DEPARTMENT TECHNICAL BULLETIN

S/SGT H. Stebelton 566th Signal

GERMAN RADIO TRANSMITTER 5 W.S./24b-104

WAR DEPARTMENT 13 MARCH 1944

RESTRICTED

WAR DEPARTMENT,
WASHINGTON 25, D. C., 13 March 1944.

TB SIG E6, German Radio Transmitter 5 W.S./24b-104, is published for the information and guidance of all concerned.

[A. G. 300.5 (16 Feb 44).]

BY ORDER OF THE SECRETARY OF WAR:

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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 EXPLOSIVE. 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, fox holes, 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!

GERMAN RADIO TRANSMITTER 5 W.S./24b-104

1. DESCRIPTION. The German radio transmitter **5 W.S./24b-104** (5-watt transmitter)* will hereafter be referred to as "the set" or the **5 W.S.** The nameplate which identifies this equipment is shown in figure 1. The set, a medium-frequency, low-power transmitter,

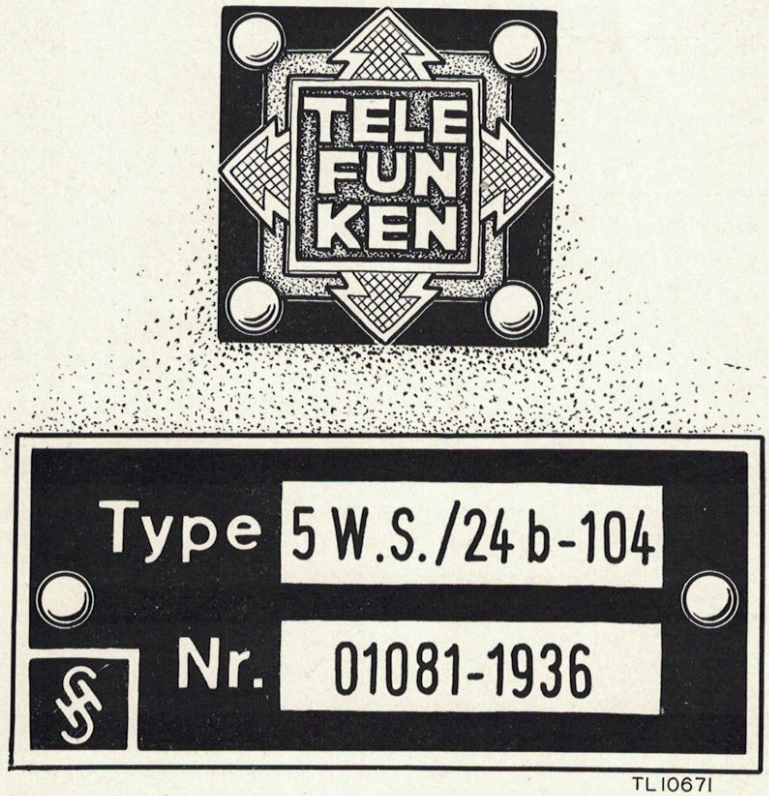

Figure 1. Nameplate of the German radio transmitter **5 W.S./24b-104.**

* In this bulletin the German terms are followed in parentheses by their American military equivalents.

is capable of operation on **Tgr.**, Telegraphie (cw), or **Tfn.**, Telefonie (voice), and can be used in nets with American amplitude-modulated radio sets within the frequency and distance range. This set is commonly used in conjunction with a **Spez.445 b Bs** (portable receiver special 445 b Bs) or a **Torn E. b.** (portable receiver b). The **5 W.S.** is used in the divisional and regimental nets of the German army and may be employed for both vehicular and ground operation. The set can operate from a 12-volt storage battery through a dynamotor **U5a1**, or the set can also be operated from a foot-pedal generator, gasoline-engine-driven generator, or an a-c operated power supply. The transmitter case is made of light metallic alloy material and is provided with a carrying handle on the top, wooden foot rests on the bottom, and hooks and rings at the rear for attaching the harness. The front cover, which is fitted with rubber stripping for waterproofing, is fastened on with four tension clamps. This case contains no accessories.

2. PERFORMANCE DATA. The performance data and general characteristics of the **5 W.S.** are as follows:

PERFORMANCE DATA

Frequency range:	950 to 3,150 kc approximately
Band I	950 to 1,500 kc – blue scale
Band II	1,450 to 2,050 kc – yellow scale
Band III	2,000 to 2,600 kc – red scale
Band IV	2,500 to 3,150 kc – white scale
Preset frequencies	2 (Adjustable mechanical stops limit the rotation of the tuning mechanism.)
Type of transmitter	master oscillator-power amplifier (MOPA)
Type of signals emitted	cw and voice
Distance range:	
Cw	36 miles approximately
Voice	10 miles approximately
Type of modulation	amplitude
Method of modulation	grid
Number of tubes:	2
Master oscillator tube	Telefunken type RS241
Power amplifier tube	Telefunken type RS241
Power output	5 to 7 watts
Sidetone	none available
Calibration	not to be done by operating personnel

Power supply	pedal generator, storage battery and dynamotor, gasoline-engine generator, or a-c operated power supply
Power requirements:	
Filament	3.8 volts at 1.2 amperes
Plate	300 to 330 volts at 0.14 amperes
Antenna types	standard antennas: (1) horizontal wire and counterpoise of 50 feet (2) vehicular rod antenna (3) emergency antenna of uncoated wire, or field cable of 30 to 90 feet, and counterpoise cable of 45 to 60 feet

3. CONTROLS. The controls, meters, and jacks shown on the front panel of the **5 W.S.** (fig. 2) are described briefly below.

a. Voltmeter. This meter normally indicates filament voltage. If the needle is at the red mark on the meter dial, 3.8, the filament voltage is correct. By pressing the blue button marked **360V** the plate voltage can be measured. A reading in the blue portion of the scale indicates that the plate voltage is correct.

b. Antenna Ammeter. This meter is a 500-ma instrument used to indicate current flowing in the antenna circuit.

c. Main Switch. The **Empf.-Aus-Tgr.-Tfn.** (receive-off-cw-voice) switch performs the following functions:

(1) In the **Empf.** (receive) position, the transmitting antenna is switched from the transmitter to the receiver.

(2) In the **Aus** (off) position, all power is removed from the transmitter.

(3) In the **Tgr.** (cw) position, the transmitter is connected for c-w operation.

(4) In the **Tfn.** (voice) position, the transmitter is connected for voice operation.

d. Antenna Tuning. The control marked **Ant.-Fein** (antenna tuning) is used to tune the antenna circuit.

e. Band Switch. The switch marked **Grob-Einst.** (band switch) is used to select any one of the four available frequency ranges.

f. Tuning Control. The control marked **Fein** (tuning control) adjusts the tuning dial.

g. Filament Rheostat. The knob **H** (filament rheostat) is a variable resistor for filament voltage adjustment.

h. Receiver Antenna. The **Empf.-Ant.** ("to receiver antenna") binding post is used for the interconnection of the transmitter and the receiver.

i. Ground. The **Erde** (ground) binding post is used for connecting a ground or counterpoise to the **5 W.S.**

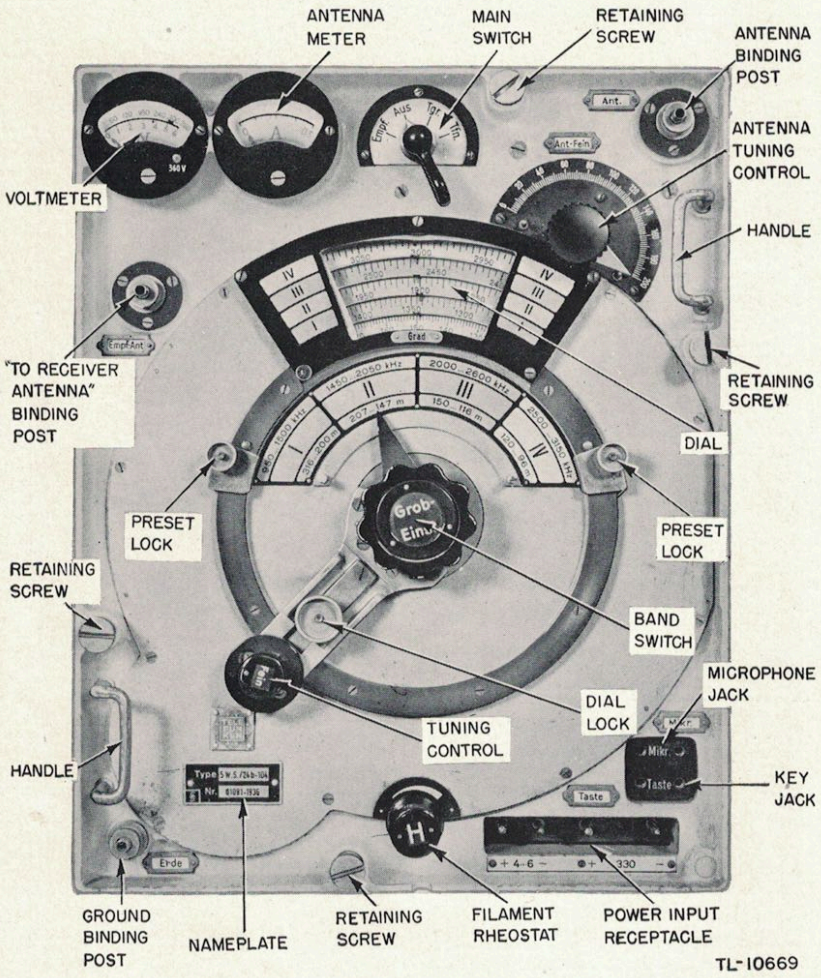

Figure 2. German radio transmitter **5 W.S./24b-104**, *front view.*

j. Antenna. The transmitting antenna is connected to the binding post marked **Ant.** (antenna).

k. Microphone Jack. The jack labeled **Mikr.** (microphone) is used for connecting the microphone to the set.

l. Key Jack. The **Taste** (key) jack is for the insertion of the key plug for c-w operation.

m. Preset Locks. These locks are for fixing the tuning control at two predetermined frequencies.

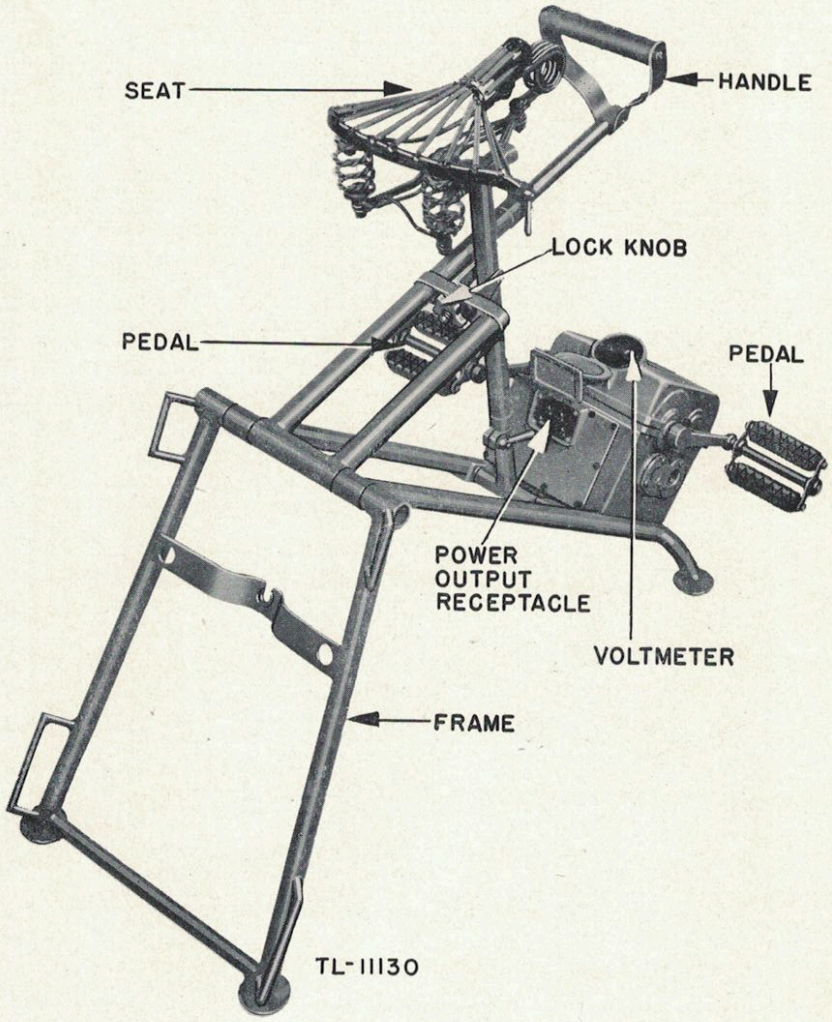

Figure 3. Pedal generator for German radio transmitter **5 W.S./24b-104.**

n. Dial Lock. It locks the tuning control and dial at a desired setting.

o. Retaining Screws. These screws, identified by the red circles, hold the set in the case.

4. POWER SUPPLIES.

CAUTION: The high voltage output of the power equipments used to power the **5 W.S.** is of high enough potential to be dangerous to human life. Extreme care and caution should be observed when working with these units.

a. General. Any power source which will supply the necessary filament and plate voltages and currents may be used to power the **5 W.S.** The German power units described in the following paragraphs are also suitable to power American radio sets whose filament and plate requirements are the same as the voltages and currents supplied by the German equipment.

b. Pedal Generator. The pedal generator (fig. 3) is mounted on a frame similar in design to that of a bicycle. The generator has a low-voltage output for transmitter filament supply, and a high-voltage output of 330 volts at 150 milliamperes for plate supply. A voltmeter on the pedal generator enables the operator to know when he has reached the proper pedaling speed. The height of the seat can be adjusted and the handle lengthened to suit the operator. Figure 8 shows the pedal generator connected to the **5 W.S.** and ready for operation.

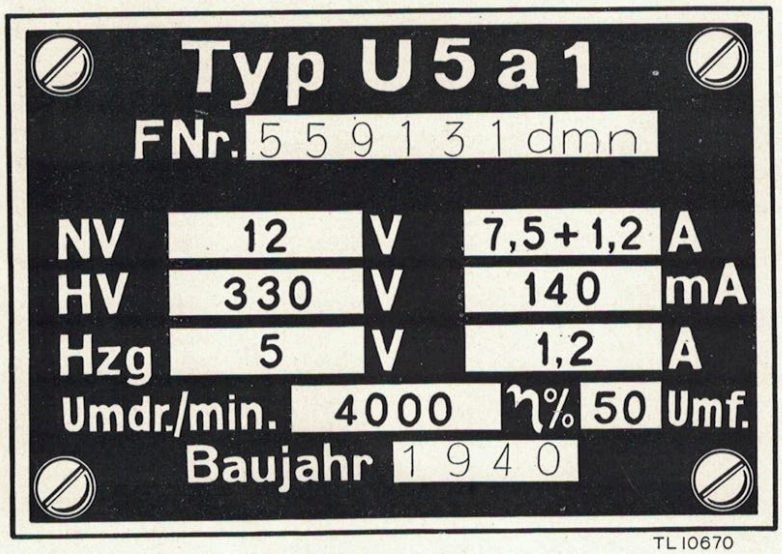

Figure 4. Nameplate of German dynamotor **U5a1**.

c. Dynamotor. The **U5a1** (dynamotor type 5a1) operates from a 12-volt d-c source at a current drain of 7.5 amperes for the dynamotor plus 1.2 amperes for the 5-volt **Heizspannung** (filament voltage) supply. The unit has a high-voltage output of 300 to 330 volts at 140 milliamperes for the plate supply. The low-voltage input

circuit is protected by a 40-ampere fuse located in the base of the unit. Figure 4 is a replica of the nameplate which identifies the unit, and figure 6 is a photograph of the dynamotor **U5a1** and shows the location of the receptacles on the unit. When the set is operated in a vehicle or with a 12-volt storage battery and a **Lademaschine LG650** (battery charger LG650), plug the filament cord from the **5 W.S.** into the pair of jacks marked **Lademaschine** (battery charger). If the operation is from a 12-volt storage battery not under charge while

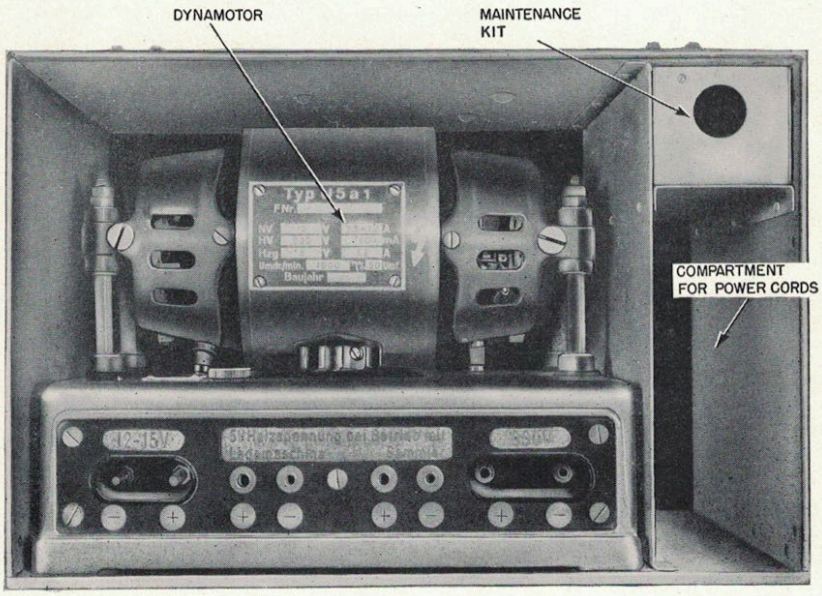

Figure 5. German dynamotor **U5a1**, *front view.*

the set is operating, plug the filament cord from the **5 W.S.** into the pair of jacks marked **Sammler** (storage battery). Series resistors in the base of the unit adjust the **Heizspannung** (filament voltage) to the correct value for the type of operation used. A **Stromrelais** (relay) in the base of the dynamotor **U5a1**, which is in series with the tube filaments in the transmitter, turns the dynamotor on when the main switch on the **5 W.S.** is turned to **Tgr.** (cw) or **Tfn.** (voice). The **Drehknopf** (rheostat) on the base of the unit can be used to vary the high-voltage output of the dynamotor **U5a1** from 300 to 330 volts. Figure 5 shows the location of the maintenance kit which contains spare fuses, low- and high-voltage brushes, and commutator cleaning equipment. The cording for connecting the dynamotor **U5a1** to the **5 W.S.** is shown in a typical set-up in figure 7.

d. Rectifier Supply. The **SGI T-5** (rectifier power supply) can be used to power the **5 W.S.** and also the 10-, 20-, and 30-watt German transmitters. This equipment operates from a 110-, 125-, 155-, or 220-volt, 42- to 60-cycle alternating-current supply and provides a low-voltage output of 6 to 12 volts at 15 to 3.5 amperes for transmitter filament supply, and a high-voltage output of 330 volts at 300 milliamperes for transmitter plate supply.

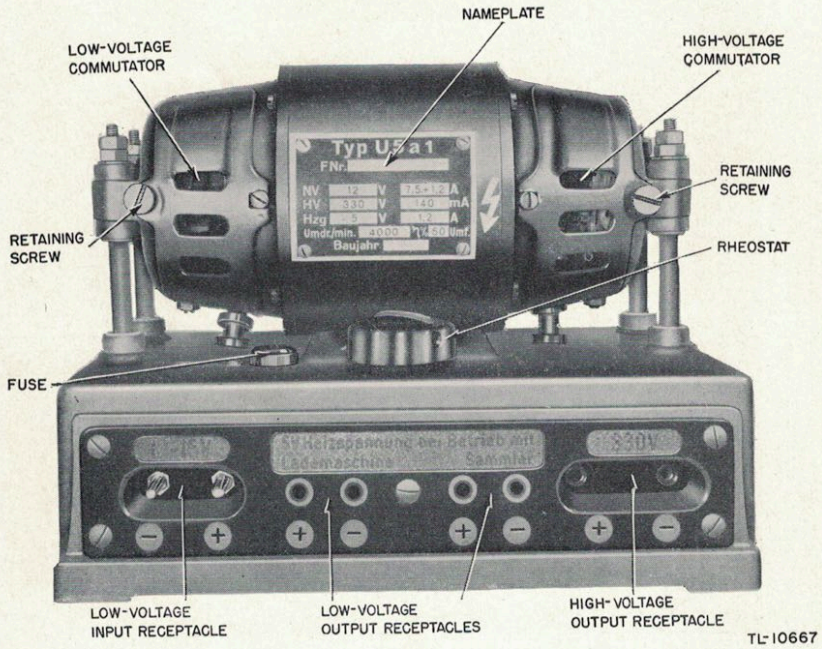

Figure 6. German dynamotor **U5a1** *removed from case, front view.*

5. VEHICULAR INSTALLATION.

a. Preparation. Remove the set from the case by loosening the four retaining screws (encircled in red). Pull the set forward with the aid of the handles on the front panel (fig. 2).

(1) Check the tubes, and be sure that they are seated firmly in their sockets.

(2) Securely tighten the tube locks (fig. 9).

(3) Inspect the wiring in the set for broken connections.

(4) Replace the set in the case and tighten the retaining screws.

b. Antennas. For vehicular installation of the **5 W.S.**, a whip or rod antenna can be used.

(1) Connect the transmitting antenna to the binding post marked **Ant.** (antenna).

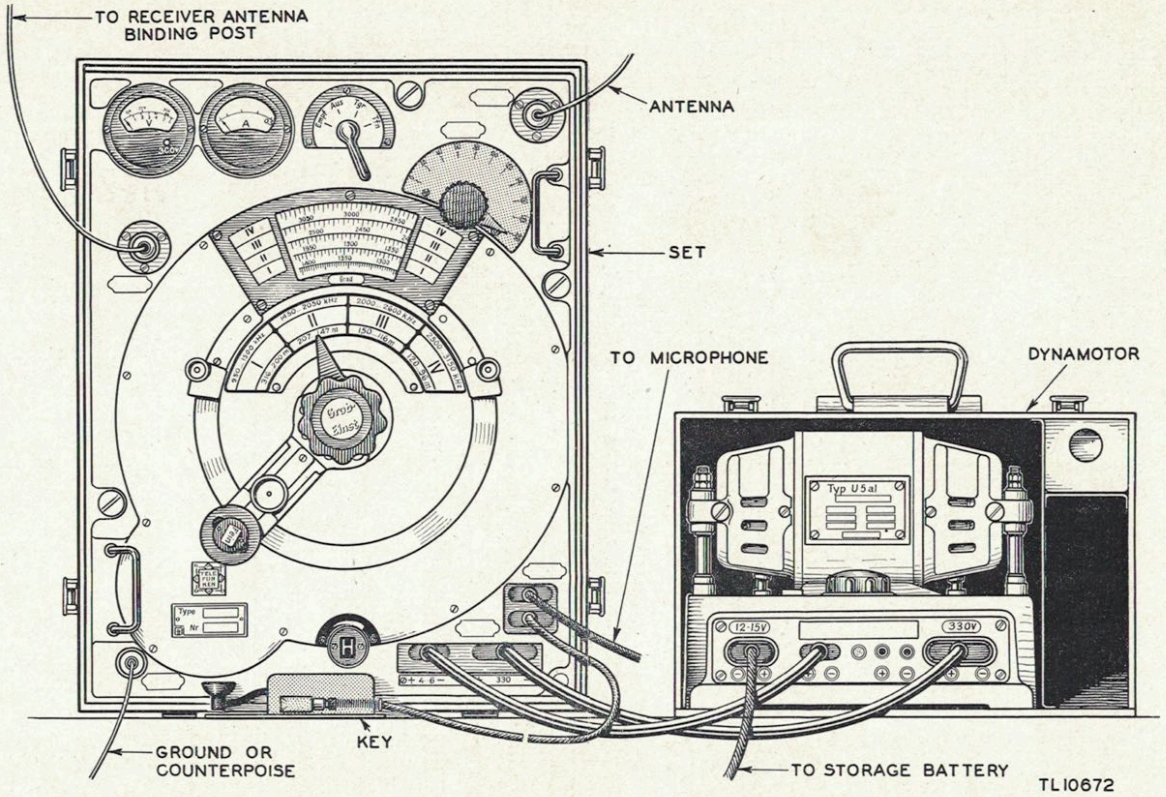

Figure 7. German radio transmitter **5 W.S./24b-104** *and German dynamotor* **U5a1**, *set up for operation.*

(2) Connect the **Erde** (ground) binding post to the vehicle chassis.

(3) Connect the antenna lead from the receiver antenna binding post, to the binding post on the **5 W.S.** labeled **Empf.-Ant.** ("to receiver antenna").

c. Dynamotor U5a1. For vehicular operation the **5 W.S.** is used in conjunction with the dynamotor **U5a1**, which will operate on the power supplied by the storage battery. The **5 W.S.** and the dynamotor **U5a1** should be secured firmly to the vehicle to avoid damaging the equipment. Steps to be taken prior to operation of the set are listed below:

(1) Set the main switch to the **Aus** (off) position.

(2) Connect the **12-15V** input terminals on the dynamotor **U5a1** to the 12-volt storage battery.

(3) Connect the filament cord from the **5 W.S.** to the pair of jacks on the dynamotor **U5a1** marked **Lademaschine** (battery charger). (Refer to fig. 7.)

(4) Connect the high-voltage cord from the **5 W.S.** to the **330V** receptacle on dynamotor **U5a1**.

NOTE: Do not force the connections as they will only go in one way. The receptacles and plugs are polarized.

(5) Turn the **Drehknopf** (rheostat) on the dynamotor **U5a1** all the way counterclockwise.

(6) Turn the **H** (filament rheostat) knob on the **5 W.S.** all the way counterclockwise.

(7) Plug the transmitting key into the **Taste** (key) jack. Any telegraph key may be used.

(8) If operation is to be on **Tfn.** (voice), plug the microphone into the **Mikr.** (microphone) jack on the **5 W.S.** Any single-button carbon microphone which fits into the jack is satisfactory. The set is now ready for operation.

6. GROUND-SET INSTALLATION.

a. Preparation. Proceed as directed in paragraph **5a.**

b. Antennas. For ground-set operation of the **5 W.S.**, either a vertical rod antenna or a horizontal wire and counterpoise combination of about 50 feet may be used. Alternatively, one end of a 45-foot length of wire may be connected to a tree. When using this method, be sure to keep the wire insulated from the tree and free from contact with surrounding objects.

(1) Connect the transmitting antenna to the binding post marked **Ant.** (antenna).

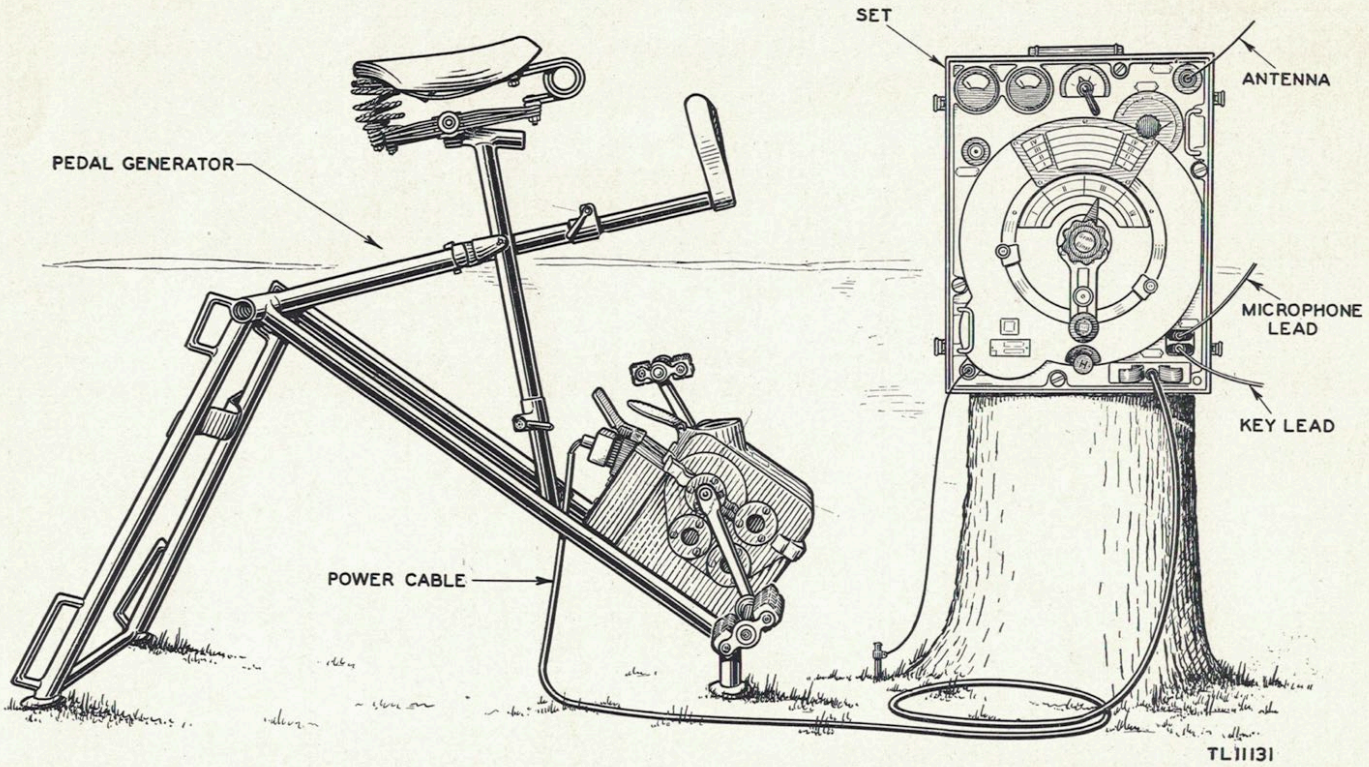

Figure 8. German radio transmitter **5 W.S./24b-104**, *set up for operation from the pedal generator.*

(2) Connect a good ground or counterpoise to the **Erde** (ground) binding post.

(3) Connect the antenna lead from the receiver antenna binding post to the binding post on the **5 W.S.** labeled **Empf.-Ant.** ("to receiver antenna").

c. Pedal Generator. For ground-set operation, power is usually supplied for the **5 W.S.** from a pedal generator (fig. 3). Set up the pedal generator and the set as shown in figure 8. When using it in a ground installation, proceed as follows:

(1) Set the main switch to the **Aus** (off) position.

(2) Connect the power cable from the **5 W.S.** to the power output receptacle on the pedal generator.

(3) Raise the meter cover on the pedal generator so the voltmeter can be observed during operation.

(4) Proceed as directed in paragraph **5c**, steps (6) to (8) inclusive.

d. Dynamotor U5a1. The dynamotor **U5a1** can be used to provide the power for the **5 W.S.** in a ground-set installation when used in conjunction with a 12-volt storage battery. Proceed with installation as directed in the following steps:

(1) Remove the set from the case (par. **5a**).

(2) Proceed as directed in paragraphs **6b** and **6c**(1).

(3) Connect the **12-15V** input terminals on the dynamotor **U5a1** to the 12-volt storage battery.

(4) If the set is to be operated from a 12-volt storage battery not under charge, connect the filament cord from the **5 W.S.** to the pair of jacks on the dynamotor **U5a1** marked **Sammler** (storage battery). If the set is to be operated from a 12-volt storage battery which is under charge, connect the filament cord from the **5 W.S.** to the pair of jacks on the dynamotor **U5a1** marked **Lademaschine** (battery charger) (fig. 7). The **Lademaschine LG650** (battery charger LG650) is the type battery charger commonly used by the Germans.

(5) Proceed as directed in paragraph **5c**, steps (4) to (8) inclusive.

7. OPERATION.

a. C-w Operation. The step-by-step procedure for setting up the **5 W.S.** for c-w operation is as follows:

(1) Set up the equipment for operation as described in paragraph **5** or **6**, depending upon type of installation.

(2) Turn the **Grob-Einst.** (band switch) knob to the desired frequency range.

(3) With the **Fein** (tuning) control, set the tuning dial to the selected frequency.

(4) Set the main switch to the **Tgr.** (cw) position.

(5) Start the pedal generator, if used. The voltmeter reading on the pedal generator should be within the red section on the voltmeter dial.

(6) Advance the **H** (filament rheostat) knob until the filament voltage reads 3.8 volts, indicated by the **V** (voltmeter) meter dial.

> **NOTE:** If the filament voltage is being supplied by the pedal generator, adjust the **H** (filament rheostat) knob so that the average value of the filament voltage is 4 volts. If the filament voltage is being supplied by batteries, adjust the filament voltage as the battery voltage lowers.

(7) Press the transmitting key and the blue button on the **V** (voltmeter) meter marked **360V.** Turn the **Drehknopf** (rheostat) on the dynamotor **U5a1** all the way clockwise. The **V** (voltmeter) meter on the **5 W.S.** should then read somewhere between 300 and 330 volts.

> **NOTE:** If the transmitter is used with a supplementary interference-eliminating dynamotor, a lower voltage will be indicated because of the resistance of the interference-eliminating elements.

(8) Adjust the control marked **Ant.-Fein** (antenna tuning) for maximum reading on the **A** (antenna) meter. If the antenna current goes over 0.5 ampere, change the main switch to the **Tfn.** (voice) position, and complete the antenna tuning. To operate on cw, turn the main switch to the **Tgr.** (cw) position and leave it there.

> **NOTE:** For certain settings of the **Fein** (tuning) control as indicated by the **A** (antenna) meter, the antenna circuit is tuneable without an antenna, ground, or counterpoise connected. Examine the antenna, counterpoise, and ground carefully to insure perfect connections.

(9) Lock the **Fein** (tuning) control in place by means of the dial lock.

b. Voice Operation. The additional steps required for setting up the **5 W.S.** for voice operation are given below:

(1) Adjust the **5 W.S.** as in paragraph **a** above.

(2) Set the main switch to the **Tfn.** (voice) position.

(3) Speak into the microphone. The antenna current should rise slightly and then fall off after speaking. Frequently this modulation will not show on the **A** (antenna) meter. In such cases, test with a known good receiver to determine if the **5 W.S.** is being modulated.

8. CALIBRATION. The tuning dial has a graduated scale of 0 to 200 and 4 scale divisions calibrated in **kHz** (kilocycles) whose color codes agree with those of the band switch. This set has a fairly stable oscillator and normally will hold its calibration. If the dial

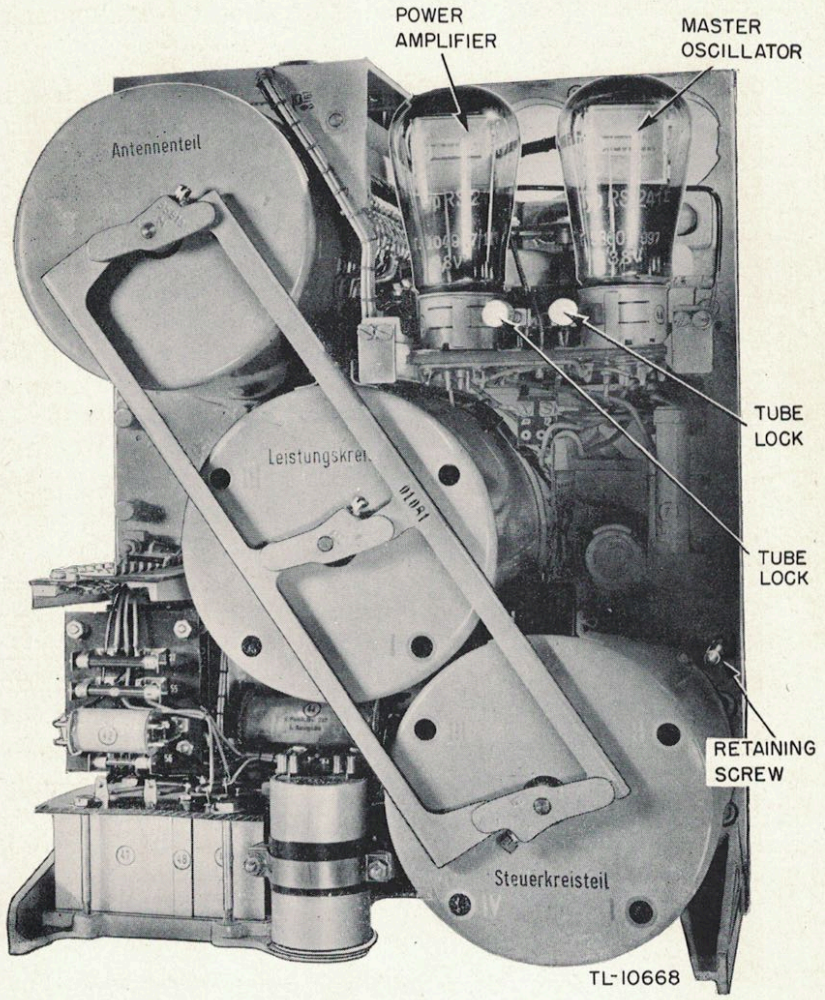

Figure 9. German radio transmitter **5 W.S./24b-104** *removed from case, rear view.*

calibration is off, do not attempt to correct it, but merely set the **5 W.S.** on the desired channel with a frequency meter, such as Frequency Meter SCR–211–(&)*, or zero-beat it to a receiver which has been accurately tuned to the net control station.

* Frequency Meter SCR–211–(&) refers to any model of the SCR–211.

9. PRESET FREQUENCIES. In order to change more easily and quickly between two preset frequencies, both positions of the **Fein** (tuning control) knob are locked by means of clamping devices (fig. 2). When changing frequency the **Fein** control must be changed from one tuning position to the other, and the control marked **Grob-Einst.** (band switch) set. Check the control marked **Ant.-Fein** (antenna tuning) for maximum output on the **A** (antenna meter) for each change in frequency.

10. MAINTENANCE.

a. General. Although detailed maintenance instructions for the **5 W.S.** are not included in this manual, the following simple operating precautions should be observed. In the paragraphs below, certain information is given on preventive maintenance, as well as a few hints on what to do when the set fails to operate.

b. Preventing Failures. (1) Make sure that all connections are made correctly. Check all the installation steps described in paragraph **5**. Make certain that the transmitting antenna is connected to the **Ant.** (antenna) binding post and not to the **Empf.-Ant.** ("to receiver antenna") binding post.

(2) When replacing tubes, always retighten the tube locks around the tube sockets; otherwise the tubes will gradually loosen in their holders and fall out during transportation.

(3) Be sure that the main switch snaps into place when set.

c. Testing. (1) With the voltmeter on the panel, check the filament voltage. If no filament voltage is present, one of the following troubles is indicated:

(*a*) Defective cords, plugs, and connections. Much of the trouble met with will be found in the cording and connections.

(*b*) Defective 40-ampere fuse in dynamotor **U5a1** low-voltage input circuit, if dynamotor is used.

(*c*) Defective or discharged battery, if used.

(*d*) Defective low-voltage winding on pedal generator, if used.

(*e*) Defective brushes on low-voltage side of pedal generator, or dirty low-voltage commutator. Replace with spare brushes furnished with unit on under side of top cover.

(2) Check the high-voltage plate supply by pressing the blue button on the voltmeter marked **360V**. If no high-voltage or re-

duced high-voltage output is indicated, the trouble may be one of the following:

(*a*) Defective cords, plugs, and connections.

(*b*) Defective high-voltage winding on dynamotor **U5a1** or pedal generator.

(*c*) Defective high-voltage brushes in dynamotor **U5a1** or pedal generator. Spare high-voltage brushes for the dynamotor **U5a1** are contained in the maintenance kit supplied with the unit. Spare high-voltage brushes for the pedal generator are contained in a small metal box mounted in a clip on the inside of the pedal-generator case.

(*d*) The dynamotor **U5a1** maintenance kit has cleaning equipment for cleaning the commutators.

(3) If the r-f output of the set is low, the cause may be defective tubes. To replace the tubes it is necessary to remove the set from the case. Loosen the four retaining screws (fig. 2) and pull the set forward by the handles on the front panel of the set. Figure 9 shows the rear view of the **5 W.S.** after it has been removed from the case. Loosen the tube locks, remove the tubes, and replace with known good tubes. Secure the tube locks and replace the set in the case. Tighten the retaining screws.

(4) If the simple procedures given 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 AS WELL AS GERMAN RADIO SETS.

11. GLOSSARY OF TERMS. The German words or terms on the set and their American military equivalents are as follows:

German	American
Ant.	antenna
Antennenteil	antenna tuning assembly
Ant.-Fein	antenna tuning
Aus	off
Baujahr	year built
bei	for
Betrieb	operation
Drehknopf	rheostat

GLOSSARY OF TERMS (contd)

German	American
Empf.	receive
Empf.-Ant.	receiver antenna
Erde	ground
Fein	tuning control
F Nr.	serial number
Grad	graduations
Grob-Einst.	band switch
H, Heizregler	filament rheostat
Hzg, Heizspannung	filament voltage
HV, Hoch Voltspannung	high voltage
kHz	kilocycles
Lademaschine	battery charger
Leistungskreisteil	power-amplifier tank assembly
m	meters
Mikr.	microphone
NV, Nieder Voltspannung	low voltage
Sammler	storage battery
Steuerkreisteil	master-oscillator tuning assembly
Stromrelais	relay
Taste	key
Tfn., Telefonie	voice
Tgr., Telegraphie	cw
Umdr./min.	rpm, revolutions per minute
U, Umformer	dynamotor
Vorsicht	caution
5 W.S.	5-watt transmitter

502—Ft. Monmouth—3-13-44—33,800—PA

WANTED:

UNCOMMON RADIOS WITH A GOOD STORY

Brian Harrison KN4R

briankn4r@gmail.com
704 657-8910 cell

9625 Island Point Road
Sherrills Ford NC 28673
kn4r.com or qrz.com/db/kn4r

WANTED:

WWII German or Japanese radios and parts

Pre-WWII civilian aviation radios - air or ground

National HROs and earlier radios

Any radio with an interesting data plate

Suitcase and clandestine radios

Rack-mount speakers (single or dual)