TM 11-1082

WAR DEPARTMENT TECHNICAL MANUAL

SIGNAL GENERATOR I-222-A

RESTRICTED DISSEMINATION OF RESTRICTED MATTER. The information contained in restricted documents and the essential characteristics of restricted materiel may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also par. 28, AR 380-5, 15 Mar. 1944.)

WAR DEPARTMENT 15 JULY 1944

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WAR DEPARTMENT,
WASHINGTON 25, D. C., 15 July 1944.

TM 11-1082, Signal Generator I-222-A, is published for the information and guidance of all concerned.

[A. G. 300.7 (19 June 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

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

DISTRIBUTION:
IC 11(5)
(For explanation of symbols see FM 21-6.)

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LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (cont.)

DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN — When ordered by your commander.

HOW — 1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut—Use axes, handaxes, machetes.

3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives—Use firearms, grenades, TNT.

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, meters, knobs, panels, switches, crystal case, etc.

2. Cut—Cables, wires, etc.

3. Burn—Technical Manuals, circuit diagrams, etc.

4. Bend—Case, nameplates, etc.

5. Bury or scatter—Any or all of the above pieces after breaking.

DESTROY EVERYTHING

WARNING

HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Operation of this equipment may involve the use of high voltages which are dangerous to human life. Operating personnel must at all times observe all safety regulations.

Do not change tubes or make adjustments inside the equipment with the on-off switch "on".

FIRST AID TREATMENT FOR ELECTRIC SHOCK

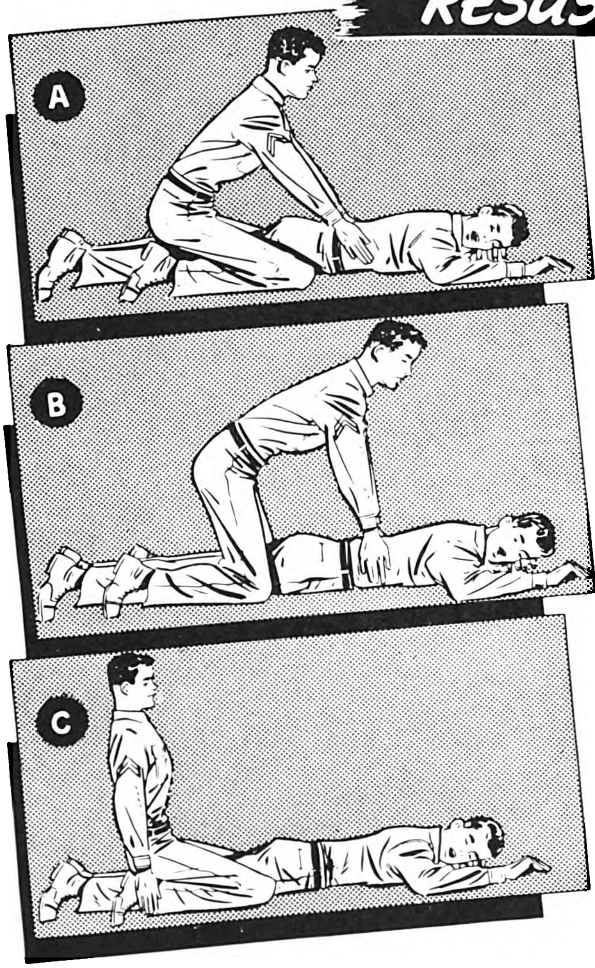
I. FREE THE VICTIM FROM THE CIRCUIT IMMEDIATELY.

Shut off the current. If this is not immediately possible, use a dry nonconductor (rubber gloves, rope, board) to move either the victim or the wire. Avoid contact with the victim. If necessary to cut a live wire, use an axe with a dry wooden handle. Beware of the resulting flash.

II. ATTEND INSTANTLY TO THE VICTIM'S BREATHING.

Begin resuscitation at once on the spot. Do not stop to loosen the victim's clothing. Every moment counts. Keep the patient warm. Wrap him in any covering available. Send for a doctor. Remove false teeth or other obstructions from the victim's mouth.

RESUSCITATION



POSITION

1. Lay the victim on his belly, one arm extended directly overhead, the other arm bent at the elbow, the face turned outward and resting on hand or forearm, so that the nose and mouth are free for breathing (fig. A).

2. Straddle the patient's thighs, or one leg, with your knees placed far enough from his hip bones to allow you to assume the position shown in figure A.

3. Place your hands, with thumbs and fingers in a natural position, so that your palms are on the small of his back, and your little fingers just touch his lowest ribs (fig. A).

FIRST MOVEMENT

4. With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the victim. Your shoulders should be directly over the heels of your hands at the end of the forward swing (fig. B). Do not bend your elbows. The first movement should take about 2 seconds.

SECOND MOVEMENT

5. Now immediately swing backward, to remove the pressure completely (fig. C).

6. After 2 seconds, swing forward again. Repeat this pressure-and-release cycle 12 to 15 times a minute. A complete cycle should require 4 or 5 seconds.

CONTINUED TREATMENT

7. Continue treatment until breathing is restored or until there is no hope of the victim's recovery. Do not give up easily. Remember that at times the process must be kept up for hours.

8. During artificial respiration, have someone loosen the victim's clothing. Wrap the victim warmly; apply hot bricks, stones, etc. Do not give the victim liquids until he is fully conscious. If the victim must be moved, keep up treatment while he is being moved.

9. At the first sign of breathing, withhold artificial respiration. If natural breathing does not continue, immediately resume artificial respiration.

10. If operators must be changed, the relief operator kneels behind the person giving artificial respiration. The relief takes the operator's place as the original operator releases the pressure.

11. Do not allow the revived patient to sit or stand. Keep him quiet. Give hot coffee or tea, or other internal stimulants.

HOLD RESUSCITATION DRILLS REGULARLY

TL-34765

Figure 1. Signal Generator I-222-A.

SIGNAL GENERATOR I-222-A
SECTION I
GENERAL DESCRIPTION

1. GENERAL INTRODUCTION. Signal Generator I-222-A (fig. 1) is a combination signal generator and heterodyne type wavemeter. It consists of a 5-megacycle crystal-controlled oscillator, used as a frequency standard calibrator, a variable two-range oscillator, an untuned detector with two stages of audio amplification, a set of headphones, one r-f and one i-f cable, a sliding-rod quarter-wave antenna, a rough pi-type attenuator, and a power supply.

> **CAUTION:** Although extremely high voltages are not prevalent in Signal Generator I-222-A, the operator should observe all safety regulations to avoid shock which might be dangerous to life. It should also be observed that other apparatus, in conjunction with which the signal generator is used, often does contain high voltages. This is particularly true of transmitters monitored by Signal Generator I-222-A. Every precaution should therefore always be observed.

2. PURPOSE. The main purpose of signal generators and frequency meters is to provide an accurate and reliable method of checking the frequency of radio equipment. They are indispensable for checking the frequency output of transmitters (monitoring) and for aligning receivers.

3. COMPONENTS. Signal Generator I-222-A consists of the following components:

a. One signal generator.
b. One set of six operating vacuum tubes.
c. One quarter-wave sliding-rod antenna.
d. One r-f coaxial output cable.
e. One i-f coaxial output cable.
f. One set of headphones with phone cord and jack.
g. One frequency calibration chart.

4. POWER SUPPLY RATING AND FREQUENCY RANGE. Signal Generator I-222-A has been designed to operate from a 117.5-volt, 60-cycle line. Its power consumption is 40 watts. The frequency coverage of the test oscillator on the low-frequency range setting is from 8-15 megacycles; the high-frequency range coil yields from 45-76+ megacycles and, since the third harmonic is utilized, this gives a coverage of from 135-230 megacycles approximately. The calibrating crystal-controlled oscillator has a fundamental of 5 megacycles; the second and third harmonics are utilized in calibrating the low-frequency range of the test oscillator; the ninth to fifteenth in calibrating the high-frequency range.

5. DIMENSIONS AND WEIGHT. Consult the following table:

TABLE I

TABLE OF DIMENSIONS AND WEIGHT

		Weight
Signal generator cabinet		
Width	19½″	
Height	12″	50 lbs.
Depth	7½″	
Antenna		
Maximum length	10¾″	
Power cord.	8′ in length	
R-f cable.	5′ in length (CD-1104)	
I-f cable.	33″ in length (CD-1103)	
Phone cord.	5′ in length	

6. VACUUM TUBES. Signal Generator I-222-A uses a total of six tubes. A list of these tubes with Signal Corps type numbers and commercial numbers follows:

Quantity	Signal Corps Type No.	Commercial No.
1	VT-94	6J5
2	VT-116	6SJ7
1	VT-197-A	5Y3G
1	VT-202	9002
1	VT-( )	9006

7. CONSTRUCTION. Signal Generator I-222-A is of a single unit construction (with four subassemblies) housed in an olive drab finish, cold rolled steel cabinet. Handles mounted on each end permit easy handling and moving of the apparatus. All controls on the front panel are clearly labeled (fig. 2). Provision is made through a phone jack for plugging in a set of headphones. Input and output receptacles, protected by screw caps, are used for close coupling. Power is supplied through a detachable line cord which plugs into a male receptacle mounted on the rear of the chassis. Access is also given through the rear of the chassis to a screw control of the trimming capacitor of the crystal oscillator tank.

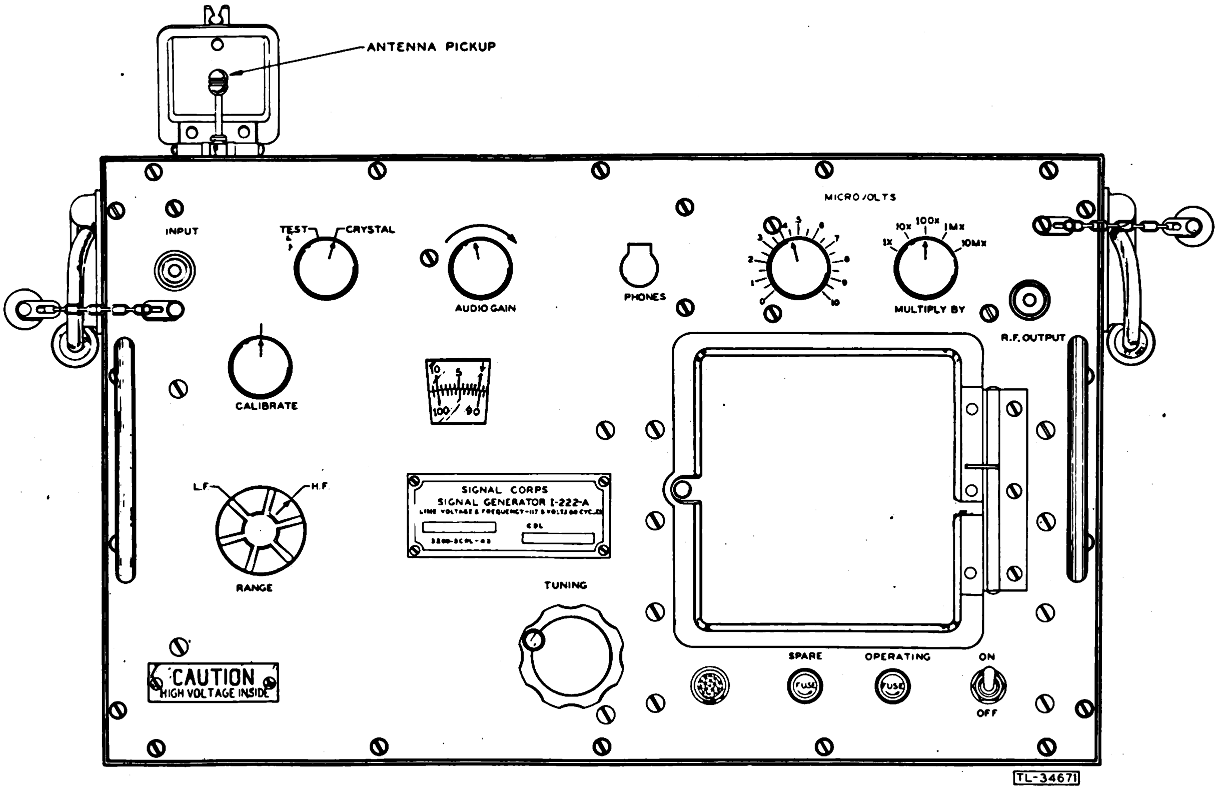


Figure 2. Signal Generator I-222-A, front panel.

SECTION II
OPERATION

8. PROCEDURE FOR OPERATION.

a. Plug in the power cord to a source of 60-cycle, 117.5 voltage.

b. Plug in the headphones to the jack marked PHONES in the top center of the operating panel (fig. 2).

c. Snap the ON-OFF toggle switch, located in the lower right hand corner, to ON position. The indicator bulb should show red.

d. Turn the operating switch, marked TEST-CRYSTAL, to the CRYSTAL position.

NOTE: The Signal Generator should not be used for at least the 15 minutes necessary for warm-up.

e. The equipment whose frequency is to be checked by Signal Generator I-222-A is to be tuned by its use to a chosen frequency or its frequency is to be determined by matching the frequency of the Signal Generator. This requires exact calibration of the test oscillator, which is accomplished as follows:

(1) A chart, giving calibration points for both high- and low-frequency bands, will be found underneath the hinged cover on the right side of the panel. This cover may be opened by turning the captive locking screw in a counterclockwise direction. Figures in red on the chart indicate crystal reference points for restoring the calibration of the unit to the value indicated. Since the test oscillator output frequencies must be accurate, the crystal-controlled oscillator, whose output is stable, is used to determine accurate dial readings for the test oscillator. Set the dial readings by turning the knob marked TUNING to the red reference points on the chart and then listen carefully in headphones for the *zero beat* as the control marked CALIBRATE is rotated in a clockwise or counterclockwise direction.

(2) Select the crystal point (given in red on the chart, as stated above) that is closest to the frequency to be monitored. If this frequency is unknown, restore the calibration at the center of the band or at 180 megacycles.

(3) Care must be exercised in determining the zero beat. The absence of sound in the headphones does not of itself indicate zero beat since, if the known crystal frequency and the test oscillator frequency are farther apart than the limit of the audio-frequency range (16kc), then the difference frequency generated will be supersonic, that is, it will be too high to be heard. As the frequencies approach each other more closely however until the difference between them becomes less than 16kc, an audible so-called *beat frequency* will become noticeable in the phones. As the two signals approach still more closely and the beat frequency decreases, the note in the phones becomes lower in pitch. Finally, when the signals are equal and there is accordingly no difference or beat frequency, a null point will be reached where no sound will be heard: the so-called zero beat. But if the test oscillator frequency be still further varied, then a gradually increasing difference or beat frequency will be developed and an audible note will be heard, low at first but rising in pitch until the limit of the audio range is reached, when it will disap-

pear. The null point sought, therefore, will be narrow and will be marked on one side by a falling, on the other by a rising, note. This procedure covers the self-calibration of the Signal Generator itself, a procedure which must always be gone through before checking any other equipment.

f. Snap open the antenna door and pull the antenna rod up from the case.

NOTE 1: Before the Signal Generator can be used to monitor an unknown frequency, the output from the source of the unknown frequency must be adjusted to the correct level. This is accomplished by listening to the signal with the headphones and adjusting its level by sliding the antenna rod up and down until a very weak signal results. MAKE THIS ADJUSTMENT WITH THE AUDIO GAIN CONTROL ROTATED TO ITS EXTREME CLOCKWISE POSITION.

NOTE 2: The detector used in Signal Generator I-222-A is of the untuned type; therefore, if a pulse-modulated signal be monitored, the repetition rate (pulse recurrence frequency) of the pulse will be heard throughout the range of the monitoring oscillator: and due to frequency drift there will be no absolute null. It usually sounds like a buzz. If a sine-wave modulated signal be monitored, a continuous audio note will be heard.

g. Set the dial to the desired frequency by turning the TUNING knob.

h. Rotate the TEST-CRYSTAL switch to the TEST position. This has the effect of removing the crystal oscillator from the circuit. The calibration of the equipment having been restored, the crystal oscillator is switched off and only the test oscillator is used.

i. In the case of very low impedance sources with negligible radiation, the antenna pick-up will be insufficient and will not be used. Return the antenna to its case, unscrew the cap from the r-f input socket and connect the r-f cable. Loop the free end of the cable around the source of signal to be monitored.

j. The i-f cable provided is intended for the alignment of certain radar receivers, providing that they have an i-f in the range of 8-15 megacycles.

SECTION III
THEORY OF OPERATION

9. SIGNAL GENERATORS AND WAVEMETERS. A signal generator is a device for the accurate production of radio-frequency voltages with provision for a continuous adjustment of the output amplitude. It consists essentially of a well shielded oscillator together with an attenuator and metered output. If the known frequency output of a signal generator be mixed with an unknown frequency (heterodyning), a difference or beat frequency will be developed. If provision is made by the inclusion of a detector circuit and one or more stages of audio amplification to listen to this beat frequency in a set of headphones, the device becomes useful for determining the unknown frequency. For when the oscillator (known as the *test oscillator*) of the signal generator is adjusted to the same frequency as the signal under test, the difference or beat frequency becomes zero and the audible note in the headphones disappears sharply. Such a device is called a frequency meter or wavemeter. It can readily be seen that a device of this sort, supplying an accurate, readily controlled radio-frequency voltage, can be put to two main uses:

a. It provides a means of measuring the frequency output of equipment such as a transmitter (monitoring).

b. By application of a proper r-f signal it provides a means of aligning the r-f and i-f circuits of a receiver. Also, the r-f attenuator will serve as a means of approximately measuring the i-f gain of a receiver.

10. FUNCTION OF SIGNAL GENERATOR I-222-A.

a. General. Inasmuch as the test oscillator of Signal Generator I-222-A has a low-frequency range of 8-15 megacycles and a high-frequency range from 135-230 megacycles, it cannot be used to monitor trans-

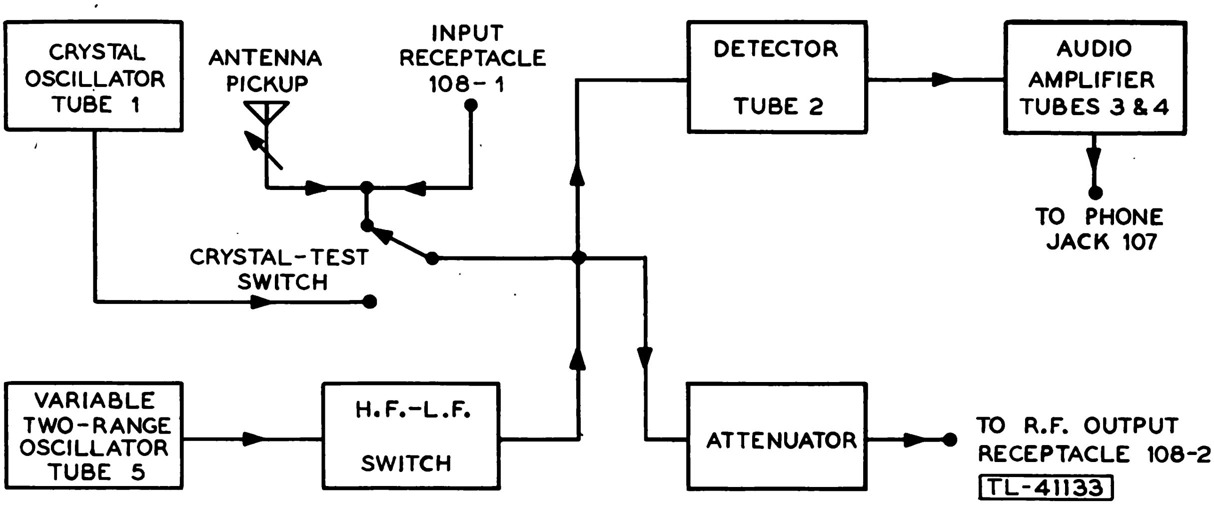


Figure 3. Signal Generator I-222-A, block diagram.

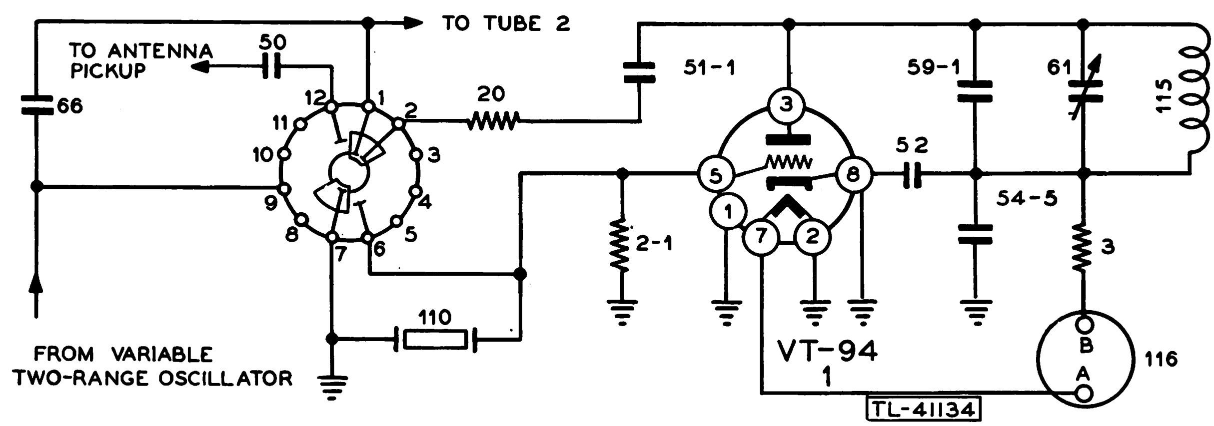


Figure 4. Crystal oscillator.

mitters operating outside of these ranges nor to align broadcast receivers using the conventional low intermediate frequencies prevalent in commercial use. It is, however, used as a rapid method of accurately checking frequencies of many radio recognition transmitters and receivers.

(1) Figure 3 is a block diagram of Signal Generator I-222-A. Six tubes are utilized: one Tube VT-94 (1) as a crystal-controlled oscillator to calibrate the frequency of the test oscillator; one 9006 tube (2) as a detector; two Tubes VT-116 (3 and 4) as a two-stage audio amplifier; one Tube VT-202 (5) as a variable two-range test oscillator; and one Tube VT-197-A (6) as a full-wave rectifier for the power supply.

(2) The circuit also comprises an r-f input receptacle, an -r-f output receptacle, antenna pick-up, switches, jacks, an attenuator, and headphones.

b. Crystal Oscillator Circuit (fig. 4). Tube VT-94 (1) is used as a conventional, crystal-controlled, self-excited oscillator. The crystal is of the AT-cut type, ground to 5 megacycles, and housed in bakelite.

(1) The plate tank circuit, consisting of coil 115, capacitor 59-1, and variable capacitor 61, is tuned a little below the resonant frequency of the crystal so that tube VT-94 draws slightly more than minimum plate current. This insures greater frequency stability and an output of high harmonic content, which is important, since the second and third harmonics of the crystal oscillator are used in calibrating the low-frequency range of the test oscillator and the ninth and fifteenth harmonics in calibrating the high-frequency range.

(2) The output of the oscillator is coupled from the plate through a blocking capacitor

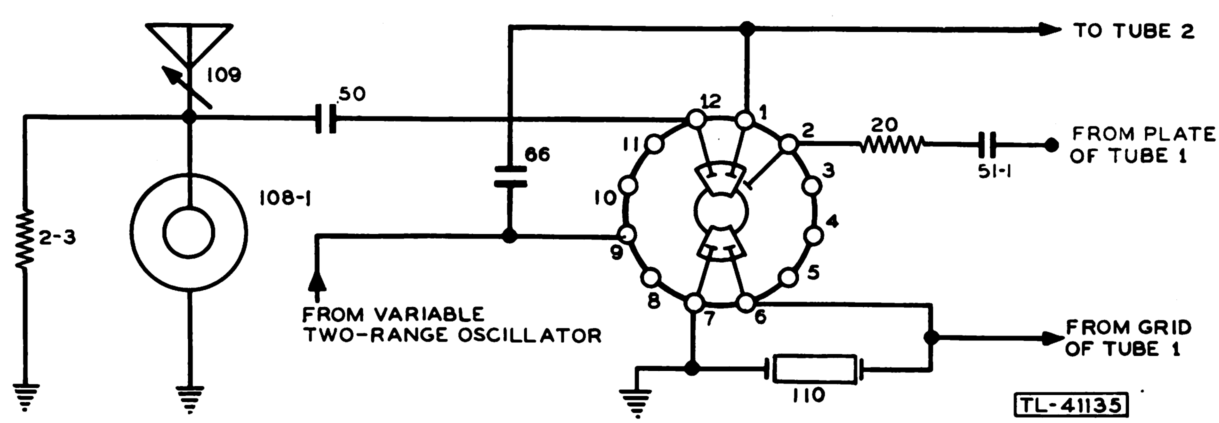


Figure 5. Switch 106 (TEST position).

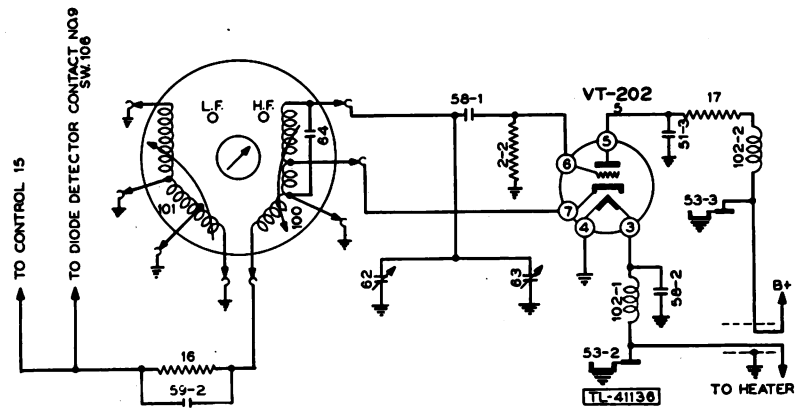


Figure 6. Variable two-range oscillator (switch in h-f position).

(51-1) and limiting resistor (20) to the plate of tube 2, the diode detector.

(3) When switch 106, marked TEST CRYSTAL, is in the CRYSTAL position, points 1 and 2 are connected, coupling the oscillator output to the detector. When the switch is turned to the TEST position, this circuit is open and points 6 and 7 are connected, shorting out CRYSTAL 110. In the CRYSTAL position, the short circuit is broken and the crystal is in the grid circuit (fig. 5). A 0.005mf capacitor (52) and 0.1mf capacitor (54-5) serve as an r-f filter together with resistor 3. Resistor 2-1 is the grid leak.

(4) The use of two parallel capacitors, 52 and 54-5, instead of a single capacitor, was occasioned by the fact that, due to the inductance present in 54-5, a paper capacitor, loading of the tank circuit developed a quasi-resonance in the middle of the h-f band. Accordingly, mica capacitor 52 was added in shunt across capacitor 54-5 to shift the resonance point.

c. Variable Two-range Oscillator (fig. 6). This is the test oscillator. It uses a midget triode Tube VT-202 u-h-f (5) in a modified Hartley circuit. A turret, having both a high-frequency coil (100) and a low-frequency coil (101), rotates as the switch marked RANGE is turned to either the h-f or l-f position. This places the desired coil in the circuit, removing the other coil (fig. 7). The cathode is connected to a tap on the coil and feedback between the grid and plate circuits secured by mutual inductance between the two sections of the coil. Resistor 2-2 is the grid leak, capacitor 58-1 the grid capacitor. Variable capacitor 63 is the main tuning capacitor and is controlled from the panel by the knob marked TUNING. A small variable air capacitor 62 in parallel with capacitor 63 is used as a vernier control for restoring the calibration of the main tuning capacitor by adding or subtracting as much capacity as is required; it is controlled from the panel by the knob marked CALIBRATE.

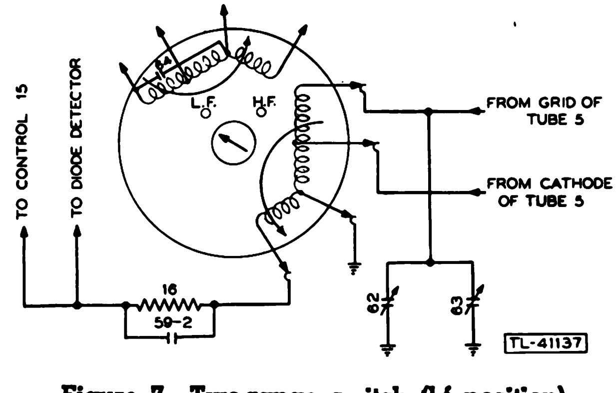


Figure 7. Two-range switch (l-f position).

(1) Resistor 17 is a B+ dropping resistor, capacitor 51-3 is an r-f bypass. Chokes 102-1 and 102-2 together with spark-plates 53-2 and 53-3 and capacitor 58-2 are r-f filters.

(2) The output is developed across a low impedance coil, mutually coupled to the oscillator tank inductance. It is coupled through a shunt impedance to the diode detector and also to the attenuator system and r-f output.

(3) Resistor 16 and capacitor 59-2 in parallel act as a network that discriminates against low frequencies. The impedance of the network is the parallel combination of the capacitive reactance of 59-2 and the constant resistance of 16. In the l-f band, the reactance of capacitor is very high and the impedance of the network is 900 ohms, or the resistance of resistor 16. In the h-f band, the reactance of the capacitor is much lower and the parallel impedance of the network is lowered to 1/10 of the value of resistor 16 to approximately 90 ohms. Accordingly, there is a lower voltage drop across the network on the h-f band and more voltage is applied to the diode detector. This is necessary to bring up the voltage level of the harmonic content since for the h-f range the third harmonic of the oscillator is used.

d. Detector (fig. 8).

(1) The output of the two-range oscillator is coupled through capacitor 66 to the plate of diode tube 9006, which is used as a detector. If the TEST-CRYSTAL knob is in the CRYSTAL position, the output from the crystal oscillator is applied to the detector at the same time; otherwise, if the knob is in the TEST position, there is a simultaneous application of an r-f signal either from the antenna pick-up 109 or from the input jack 108-1, depending upon whether the antenna is being used to receive the signal to be monitored or whether it is being coupled to the signal generator through the r-f cable.

NOTE: If the signal is of sufficiently high level, the antenna pick-up will be utilized; when, however, a signal is being monitored from a lower impedance source, as in the case, for example, of monitoring the output from some other signal generator, whose shielding prevents much radiation, it will be necessary to couple the source voltage to Signal Generator I-222-A through the r-f input cable which is connected to the input jack 108-1. Inductive coupling should then be used, the cable being looped around or near the source of signal output.

(2) The output of tube 2, which is a rectified mixture of the two r-f signals, and also of their sum and difference, is applied across load resistors 1 and 4 in series. Since capacitors 51-2 and 53-1 appear as virtual short-circuits to high frequencies, they will act as a return path for the r-f, but inasmuch as they present a high impedance to audio, the audio beat frequency voltages will be developed across resistor 4, the audio load. A potentiometer control, resistor 4, makes it possible to apply any portion desired of the audio voltages across the input load resistor 5-1. This is the control knob marked AUDIO GAIN.

e. Audio Amplifier. Whatever level of voltage is selected from resistor 4 by the gain control is applied to resistor 5-1 onto the grid of tube 3. Tubes 3 and 4 constitute

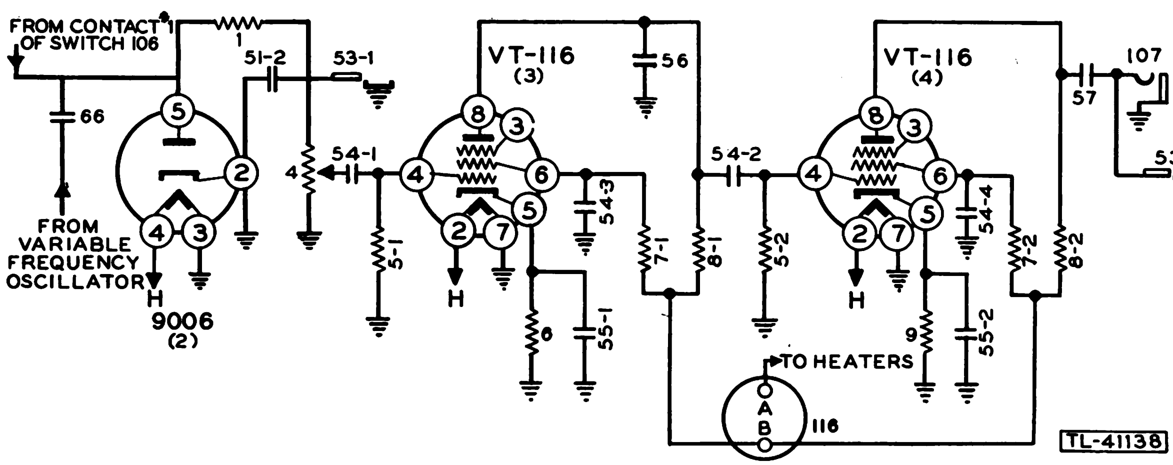


Figure 8. Detector and amplifier.

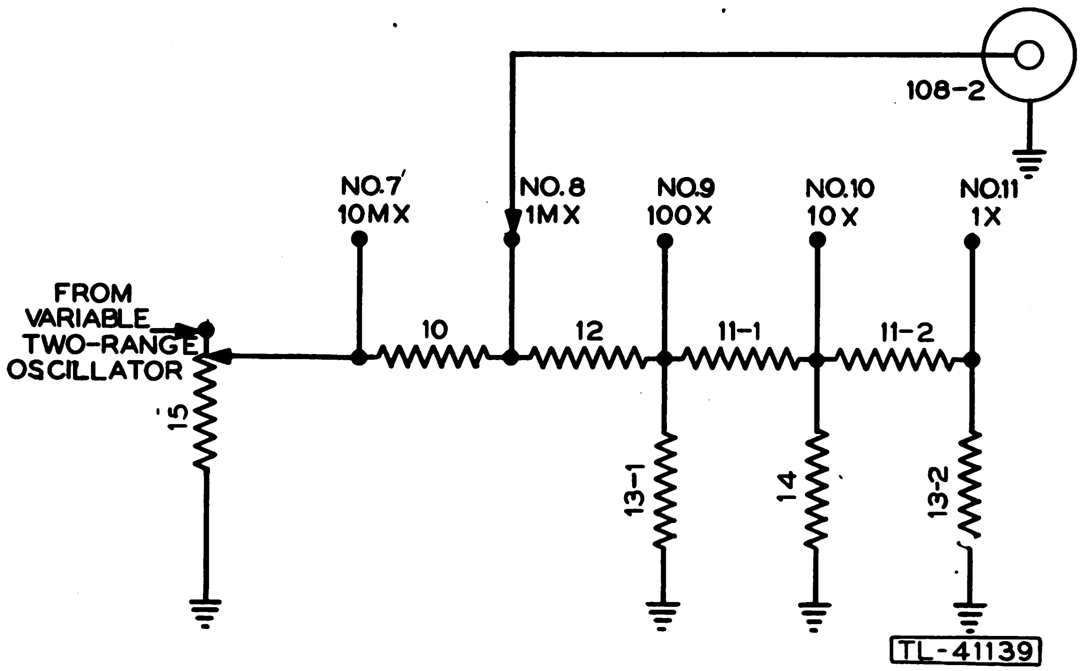


Figure 9. R-f attenuator.

a two-stage resistance-coupled audio amplifier of conventional design, using two pentode Tubes VT-116 in cascade. The amplifiers are operated class A and use cathode bias. Tube 4 uses a somewhat higher bias to prevent linear distortion since the input is higher than that of tube 3 inasmuch as it has already been amplified by tube 3. The final output of the amplifier is applied through coupling capacitor 57 to phone jack 107, which is an open circuit jack.

f. R-f Attenuator (fig. 9).

(1) This is a calibrated attenuator of the constant impedance, pi-structure type which is reasonably accurate. The input impedance is 100 ohms for all positions of the multiplier switch; the impedance when measured from the output side (receptacle 108-2 to ground) is 100 ohms with the multiplier switch 105 A-B in position No. 7 (fig. 30); with the switch in postion No. 8, the output impedance is 50 ohms; with the switch in position 9, 10, or 11, the impedance is 5 ohms.

(2) The total attenuation is 100,000 to 1. There is a coarse control of five positions (the switch on the dial marked MULTIPLY BY) providing attenuation in steps of ten to one. The fine control operated by the knob to the left of the multiplier switch is calibrated from 0 to 10 and provides vernier attenuation between the coarse steps. Accordingly, a continuously variably output is obtainable over the entire range of 100,000 to 1.

(3) The approximate output in microvolts of the signal generator is obtained by multiplying the setting of the coarse control by that of the fine control. For example, if the coarse control is set at 10Mx (M standing for 1000 and x meaning *Multiply*) and the fine control is set at 6, then the output is 10Mx6 or 60,000 microvolts.

(4) The voltage output from the test oscillator, as explained previously, is applied through a frequency divider discriminating network consisting of resistor 16 and capacitor 59-2 to resistor 15, which is a potentiometer. This constitutes a voltage divider which has a 10 to 1 division ratio on the l-f band and a 2 to 1 division ratio on the h-f band. Any portion of the input voltage which appears across resistor 15 may be fed by the potentiometer control to the fixed-step pi-network. The potentiometer control is operated by the knob calibrated from 0-10, with 0.5 division marks between numbers; the calibration of this control is approximate.

(5) The MULTIPLY BY control knob operates two-deck switch 105A-B and connects the r-f output socket to various positions along the fixed divider network. When this switch is in position 7 and the arm of the potentiometer control in the maximum position, maximum voltage is available. The following positions, 8, 9, 10 and 11, respectively, give an attenuation of 10 to 1 from the next preceding position.

g. Power Supply.

(1) The power supply utilizes a high-vacuum, full-wave rectifier, Tube VT-197-A (6) (fig. 30). The 117.5 voltage source is applied at receptacle 111. Single-pole, single-throw switch 112, and safety fuse 113 are in series with the primary winding of power transformer 104. R-f chokes 102-3 and -4, together with spark-plates 53-4, 53-5, 53-6, and 53-7, provide r-f filtering.

(2) Power transformer 104 has four secondary windings: three separate sources of filament voltage and one high-voltage winding to the plates of the rectifier. Across the filament winding supplying tubes 1, 2, 3, and 4 are two pilot lights, 114-1 and 114-2; one lights up the red jewel on the dial, which indicates that the power is turned on, the other illuminates the tuning dial.

(3) The rectifier circuit utilizes a double capacitor-input filter, consisting of a dual choke, 103A and 103B, and capacitors 60-A, 60-B, and 60-C. The bleeder is a voltage divider consisting of parallel resistors 18-1 and 18-2 in series with resistor 19. The B+ voltage is applied to terminal B of the plug and the filament voltage is applied to terminal A of that plug for tubes 1, 2, 3, and 4.

SECTION IV
MAINTENANCE

11. MAINTENANCE OF SIGNAL GENERATOR I-222-A.

a. Removal of Unit and Subassemblies. The unit consists of four subassemblies, namely power supply, attenuator, detector-amplifier, and high-low frequency oscillator assemblies (fig. 11).

(1) To remove the unit from the case, pull the plug, attached to the a-c line cord, from the receptacle at the rear of the signal generator. Close and latch the receptacle cover. Open the antenna rod cover and push the antenna rod down as far as it will go. Tip the signal generator over on its back. Place two strips of wood under the Signal Generator so that it will not rest on the receptacle cover. Remove the 18 screws around the border of the panel. Take the unit from the case (fig. 10).

(2) To remove the attenuator assembly, remove the two screws from the attenuator assembly cover. Remove the cover from the case. Unsolder the green tracer wire coming from the metal tubing at the terminal in control 15 (fig. 29). Unscrew the hex nut at the end of the metal tubing. Remove the nut and washer from the wire. Remove the protective cap on the receptacle marked R-F OUTPUT. With a No. 8 Allenhead wrench, loosen the setscrew on each of the two knobs just below MICROVOLTS on the front panel (fig. 10). Remove the four mounting screws and remove the assembly from the panel.

(3) To remove the detector-amplifier assembly, remove the eight detector-amplifier cover mounting screws and remove the cover (fig. 12). Disconnect the rubber covered cable, provided with an Amphenol fitting, from the detector-amplifier case. Remove the four knurled thumbnuts from the high-low frequency oscillator assembly. Remove the cover from the case (fig. 11). Unsolder from one of the terminals of capacitor 59-2, the white wire with green tracer (fig. 28). Unsolder the wire between jack 107 and sparkplate 53-8 (fig. 27). Remove the screw which fastens the braided ground strap to the detector-amplifier case. Remove the protective cap from the receptacle marked INPUT (fig. 10). With a No. 8 Allenhead wrench, loosen the setscrew on the TEST-CRYSTAL and AUDIO GAIN control knobs. Remove the knobs from the shafts. Remove the five mounting screws and remove the case from the panel (fig. 10).

CAUTION: Make sure that the white wire with green tracer slips through the hole in the high-low frequency oscillator case as the detector-amplifier is removed from the panel.

(4) Remove the high-low frequency oscillator assembly and turn the unit over so that it rests on the handles. Remove the four knurled thumbnuts from the cover of the high-low frequency oscillator assembly. Unsolder the white wire with green tracer at the terminal of resistor 16 (fig. 28). Unsolder the white and black rubber covered conductors and the shielded braid of the rubber covered cable coming from the high-low frequency oscillator. Unsolder the white wire with black tracer from terminal 7 of transformer 104. Remove the clamp holding the black rubber covered cable to the power supply chassis (fig. 13). Turn the unit up

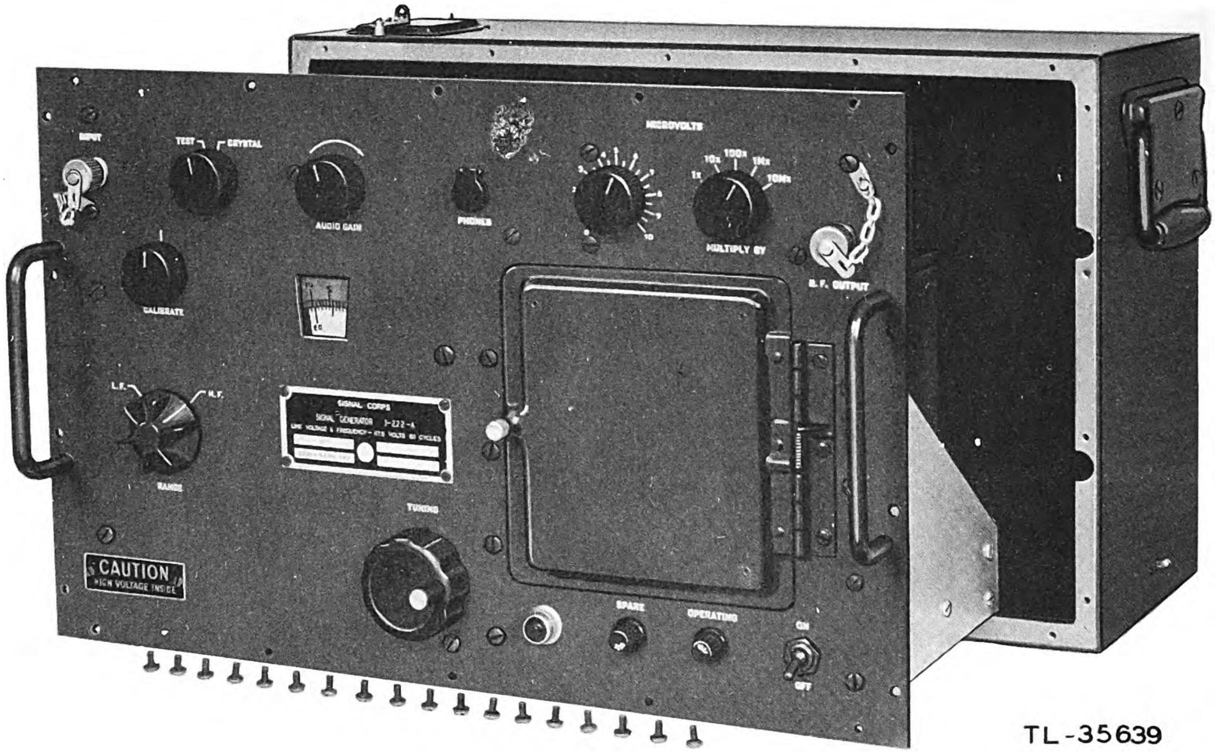


Figure 10. Signal Generator I-222-A, removal from chassis.

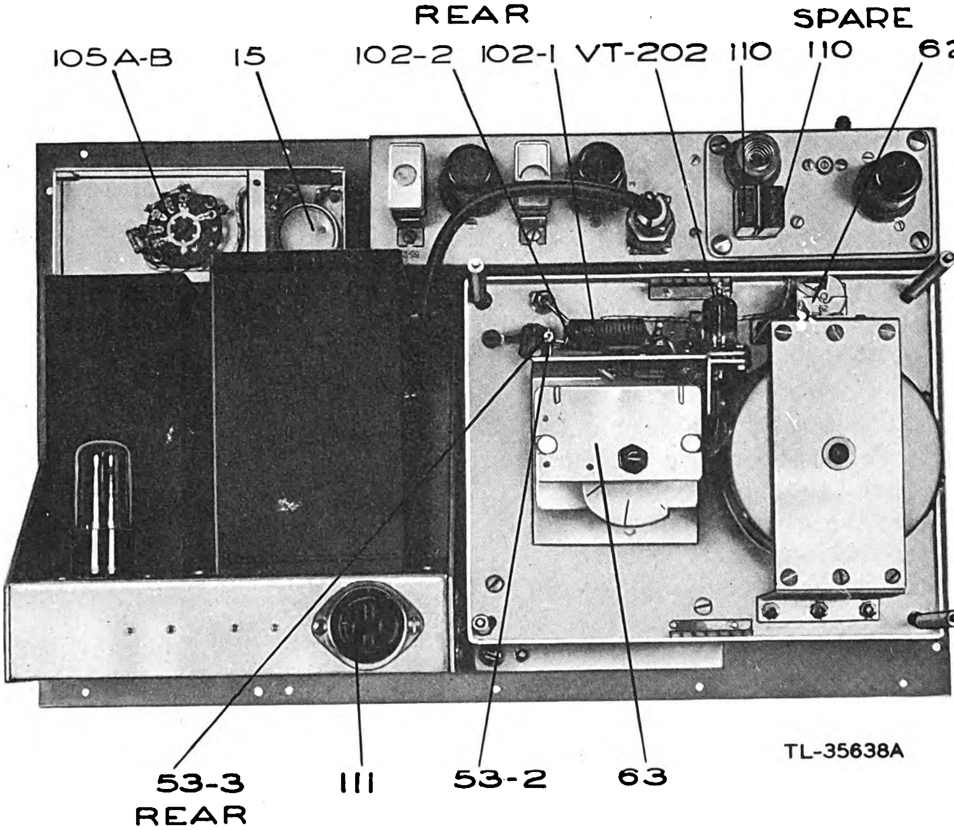


Figure 11. Signal Generator I-222-A, rear view.

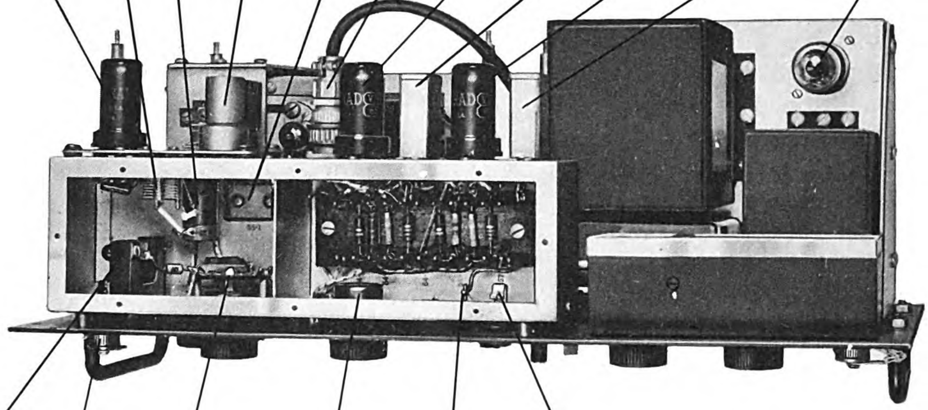


Figure 12. Signal Generator I-222-A, detector-amplifier assembly cover removed.

so that it is resting on the power supply chassis. Remove the cover from the attenuator assembly case. Unsolder the wire, encased in the metal tube, at the terminal on control 15 (fig. 29). Remove the nut and washer from the tubing. With No. 8 Allen-head wrench, loosen the setscrew on the CALIBRATE, TUNING and H-F-L-F BAND control knobs. Remove the knobs from the shafts (fig. 10).

CAUTION: The TUNING knob is provided with two setscrews. Make sure that both setscrews are loosened before removing this knob from the shaft.

(5) Remove the high-low frequency oscillator assembly from the panel. Make sure that the rubber covered cable and the white wire with black tracer follows through the hole in the side of the power supply chassis as the assembly is removed.

b. Replacement of Circuit Elements. The fuse and pilot lamp may be replaced without removing the unit from the case. In order to replace the other elements, it is necessary to remove the unit from the case.

(1) To remove Tubes VT-94 (1), VT-116 (3), VT-116 (4), and VT-197-A (6), grasp

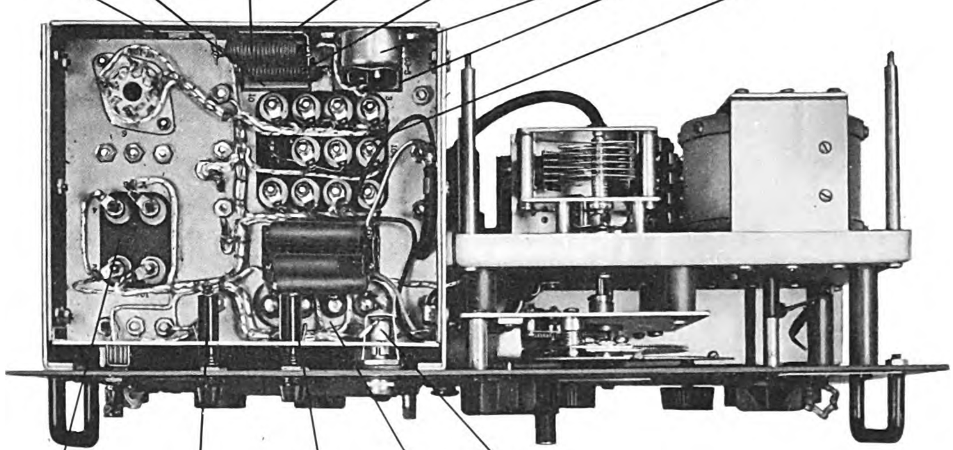


Figure 13. Signal Generator I-222-A, bottom view.

the tube firmly and rock gently from side to side while pulling upward.

(2) To remove No. 2 tube (9006), remove the metal shield and the spring shield (fig. 12). Grasp the tube near the base and pull gently upward.

CAUTION: This tube is very fragile. Care must be exercised in removing and replacing this tube as the seal, where the pins leave the glass envelope, is easily broken.

(3) To remove Tube VT-292 (5), it is necessary to remove the high-low frequency oscillator assembly cover. Remove the four knurled thumbnuts (fig. 11). Grasp the cover by the handles and with a rocking motion pull the cover from the assembly. Remove the tube by gently pulling upward.

(4) To replace fuse 113, turn the bakelite button marked OPERATING counterclockwise (fig. 10). Remove the fuse holder and fuse. Replace the fuse. Assemble in reverse order.

(5) To replace the pilot lamp, unscrew the metal collar. Remove the collar and glass jewel. Remove the lamp by pressing in and turning counterclockwise, simultaneously, until the lamp is released from the socket (fig. 10). Assemble in reverse order.

(6) To replace the dial lamp, it is necessary to remove the detector-amplifier assembly. Remove the detector-amplifier assembly as described in paragraph 11*a*, (3). Press in on the lamp while turning counterclockwise until the lamp is released from the socket (fig. 14).

(7) To replace air trimmer capacitor 61, remove the detector-amplifier cover. Unsolder the connections to the capacitor. Remove the two small screws located between tubes No. 1 and No. 2 and remove the capacitor (fig. 11). Assemble in reverse order.

(8) To replace variable capacitor 63, remove the high-low frequency oscillator assembly from the panel as described in paragraph 11*a* (4). Remove the four dial mechanism mounting screws. With a No. 8 Allenhead wrench, remove the two setscrews, which connect the dial shaft with the capacitor rotor shaft, at the dial shaft universal joint. Remove the dial mechanism from the high-low frequency oscillator assembly mounting plate. Remove tube No. 5. Unsolder the green tracer wire, encased the metal tubing, at the terminal of resistor 16 (fig. 28).

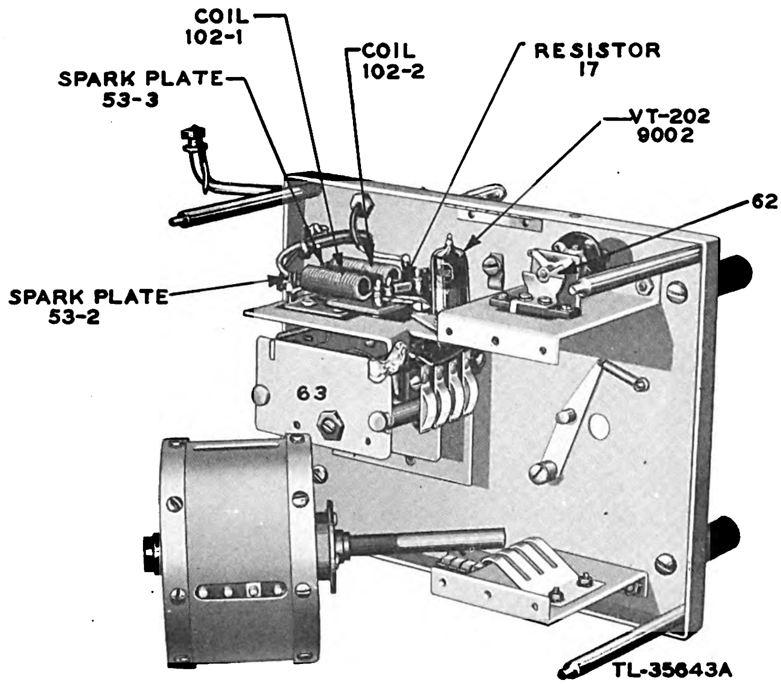


Figure 14. Signal Generator I-222-A, rear view of dial panel.

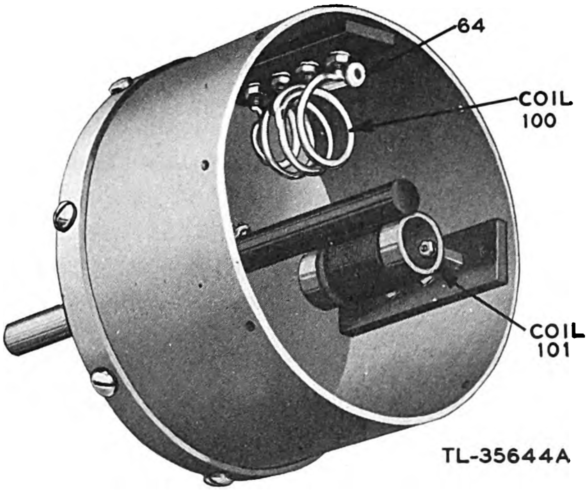


Figure 15. Signal Generator I-222-A, coil turret assembly.

Unsolder the wire connected to the terminal of capacitor 62 (fig. 14). Remove the three capacitor support mounting screws. Remove the clamp which holds the rubber covered cable in place. Remove the capacitor support assembly mounting plate. Unsolder the connections to the stator of capacitor 63. Remove the three capacitor mounting screws which fastens the capacitor to the capacitor-supporting mounting plate. Remove the capacitor. Assembly in reverse order.

(9) To replace l-f band coil 101 or h-f band coil 100, remove the high-low frequency oscillator assembly as described in paragraph 11*a* (4). Remove the six bearing plate mounting screws. Remove the bearing plate and the coil turret (fig. 14). Remove the eight screws that mount the end of the coil turret to the turret housing (fig. 15). Remove the screw which holds the other end of the bakelite strip, on which the coil is mounted, to the turret housing. Remove the coil assembly. Assemble in reverse order.

(10) To remove tank coil 115, remove the cover of the detector-amplifier assembly. Remove the screw which fastens the coil to the case. Unsolder the wire at the coil terminal. Remove the coil. Assemble in reverse order.

(11) To replace switch 106, remove the detector-amplifier assembly as described in paragraph 11*a* (3). Remove the nut and washer which fasten the switch to the case. Unsolder the wires connected to the switch terminals and remove the switch. Assemble in reverse order.

(12) To remove the antenna support assembly, remove the detector-amplifier assembly from the panel as described in paragraph 11*a* (3). Remove the three antenna support mounting screws. Unsolder the wires at the terminals. Remove the support from the case. Assemble in reverse order.

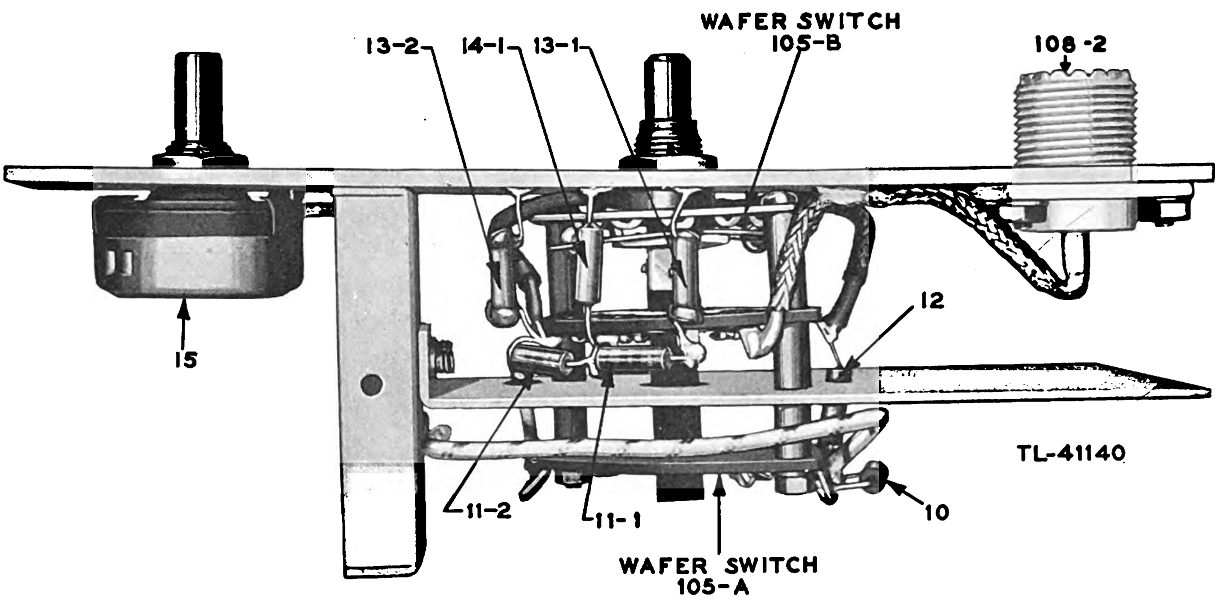


Figure 16. Signal Generator I-222-A, attenuator assembly removed from housing.

(13) To replace switch 105A — B, remove the attenuator assembly case from the front panel as described in paragraph 11*a* (2). Remove the two screws on the side of the case. Lift the attenuator assembly from the case (fig. 16). Remove the nut and washer from the switch shaft. Unsolder the wires and remove the switch. Assemble in reverse order.

12. GENERAL TROUBLE SHOOTING. It is impossible to anticipate all types and combinations of circumstances which will cause faulty operation of the Signal Generator. However, some tests may help to isolate the circuit that is causing the trouble.

a. Causes of Trouble Shooting.

(1) The absence of a tone in the headset, with the switch in the TEST position, is probably due to one of three conditions: the variable high-low frequency oscillator circuit is defective, the signal tested is too weak, or the frequency being tested lies out of the range of the signal generator.

(2) The absence of a tone in the headset, when the frequency is being calibrated, is an indication of a defective crystal oscillator circuit.

(3) If no tone is heard in either case, the trouble may be in the detector stage, the two audio-amplifier stages, or the power supply.

(4) After the case has been removed, a visual inspection will often determine the cause of the trouble. Inspect the wiring and apparatus. Look for burned parts, visible shorts, wax melted from capacitors or coils, foreign material such as pieces of loose wire scraps or solder chips, and physical damage to parts. Check for smooth mechanical operation of all controls.

(5) If a defective power supply is suspected, make a test of the resistances and voltages to ground at the rectifier tube socket terminals and at the filament leads before making any other tests (figs. 20 and 21).

(6) If noises are heard in the head set when the TUNING knob is rotated, the trouble is due to corroded or dirty bearing surfaces of the rear bearing screw (capacitor 63).

b. Trouble-shooting Data. The following data is provided as an aid in locating trouble.

(1) The table of tube socket voltages lists typical d-c voltages from vacuum tube terminals to ground and a-c voltages across socket terminals connected to the transformer. These measurements are made with the power on. The type of meter used is indicated on the chart. The voltage values will vary slightly and therefore the readings are approximate (fig. 21).

(2) The table of tube socket resistances lists approximate resistance values from tube terminals to ground with no power applied to the signal generator (fig. 20).

(3) The terminal boards make it possible to check voltage and resistance of circuit elements (figs. 22 to 25).

c. Trouble-shooting Chart.

Indication of faulty operation	Probable causes
1. Low tube terminal voltage.	1. Low a-c power supply. Incorrect value of bleeder or load resistor. Faulty filter system.
2. High tube terminal voltage.	2. High a-c power supply. Incorrect value of bleeder or load resistor. Faulty filter system. Open bleeders or load resistors of other stages.
3. No tube terminal voltage.	3. No a-c power supply. Burned-out fuse 113. Burned-out power transformer 104. Shorted filter capacitor. Open resistor or circuit. Damaged rectifier Tube VT-197-A.

4. No pilot or dial light.

4. No a-c power.
Open power switch 112.
Burned-out fuse 113.
Lamps loose in sockets, burned-out or open circuits.

5. No tone heard when making calibration check (CRYSTAL position), but tone is heard when checking an unknown frequency.

5. Trouble in crystal oscillator stage.
Crystal damaged or dirty, or contacts corroded.
Crystal switch open.
Crystal oscillator tube defective.
Capacitors 51-1, 59-1, 52, and 54-5 open or shorted.
Resistors 20, 3, and 2-1 open or shorted.

6. No tone heard in checking unknown frequency (TEST position) but tone heard in calibration test.

6. Antenna not extended far enough.
Mounted out of range.
Unknown frequency lies outside of the frequency range.

7. No tone on either external frequency or calibration checks.

7. No power.
Trouble in variable oscillator stage.
Trouble in detector stage.
Trouble in amplifier stages.
Filter, bias, grid leak, or bypass resistances and capacitors open or shorted.
Defective tubes.
Coupling capacitor 54-2, 57 open or shorted.
Coil 115.
Coil 100 or 101 open or shorted.
Transformer 104 defective.
Variable capacitors 62 or 63 defective.

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13. MOISTUREPROOFING AND FUNGIPROOFING.

a. General. Communication failures commonly occur when Signal Corps equipment is operated in a tropical area where temperature and relative humidity are extremely high. The following problems are typical:

(1) Resistors and capacitors fail.

(2) Electrolytic action takes place in coils, chokes, transformer windings, etc., causing eventual break-down.

(3) Hook-up wire and cable insulation break-down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical leakage paths on terminal boards and insulating strips causing flash-over.

(5) Moisture provides leakage paths betweeen battery terminals.

b. Treatment. A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture-resistant and fungi-resistant varnish applied by means of a spray gun and/or brush.

c. Step-by-step Instructions.

(1) PREPARATION.

(a) All repairs and adjustments necessary for the proper operation of the equipment are made.

(b) Equipment to be processed is thoroughly cleaned of all dirt, dust, rust, fungus, oil, grease, etc.

(2) DISASSEMBLY.

(a) Remove the phone plug, disconnect the r-f output cable, and take out the power receptacle from the rear of the unit.

(b) Remove the 18 screws from the front panel and pull the chassis out of the case (fig. 10).

(c) Take out the two screws and remove the cover from the shielded section housing switch 105A-B, etc. (fig. 18).

(d) Remove the eight screws and the shield cover of the sub-chassis on the top left of the unit (fig.17).

(e) Remove the four thumbnuts from the corners of the large shield covering the tuning section and remove this shield (fig. 18).

(f) Remove the crystal holders and replace them after the drying operation (fig. 11).

(g) Disassemble the turret containing ccils 100 and 101 and remove one end cap (fig. 18).

(3) MASKING.

(a) On the sub-chassis on the top left of the unit, mask the variable air capacitor 61 and switch 106 with paper and masking tape; then mask the contacts on part 109, switch 105-A-B, the hole in the case of potentiometer 4, and jack 107 with masking tape (figs. 17 and 18).

(b) With masking tape, mask any portions of the antenna pick-up rod likely to be coated by spraying or brushing as described below.

(4) DRYING.

(a) Dry the unit at 160°F for 2 to 3 hours.

(b) Do not heat the crystals.

(5) VARNISHING.

(a) Apply three coats of moistureproofing and fungiproofing varnish.

(b) Spray all unmasked visible objects and surfaces inside the case of the sub-chassis on the top left of the unit. After re-

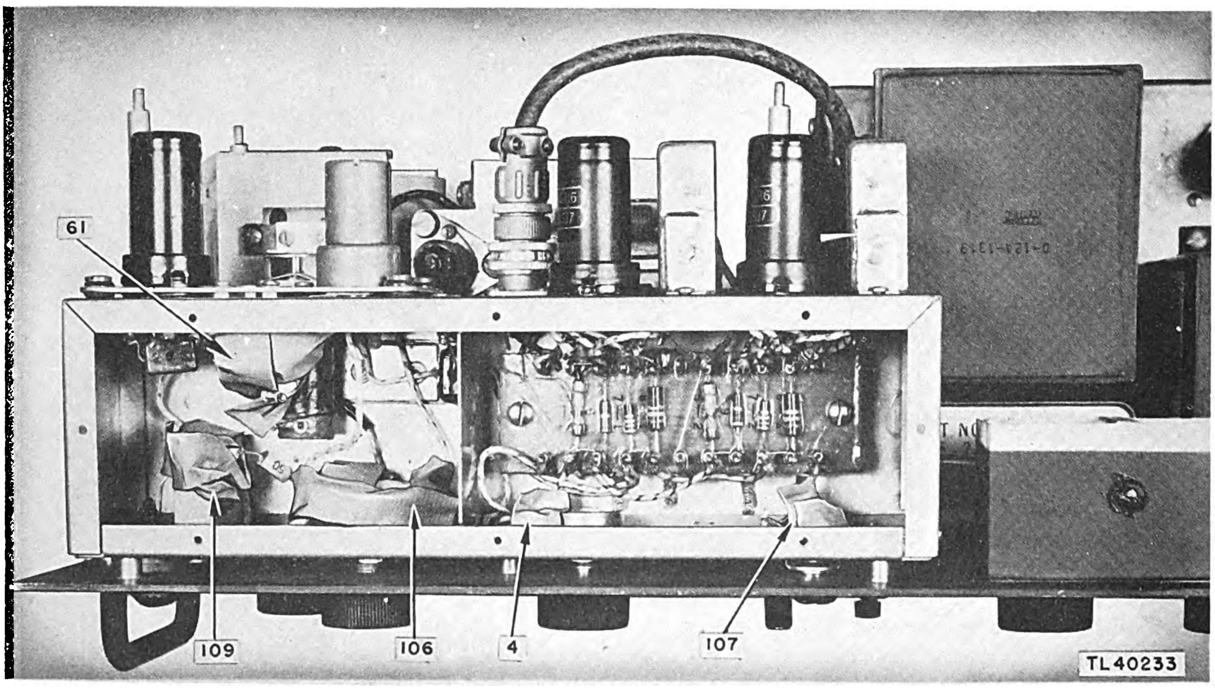

Figure 17. Signal Generator I-222-A, top view showing masking tape.

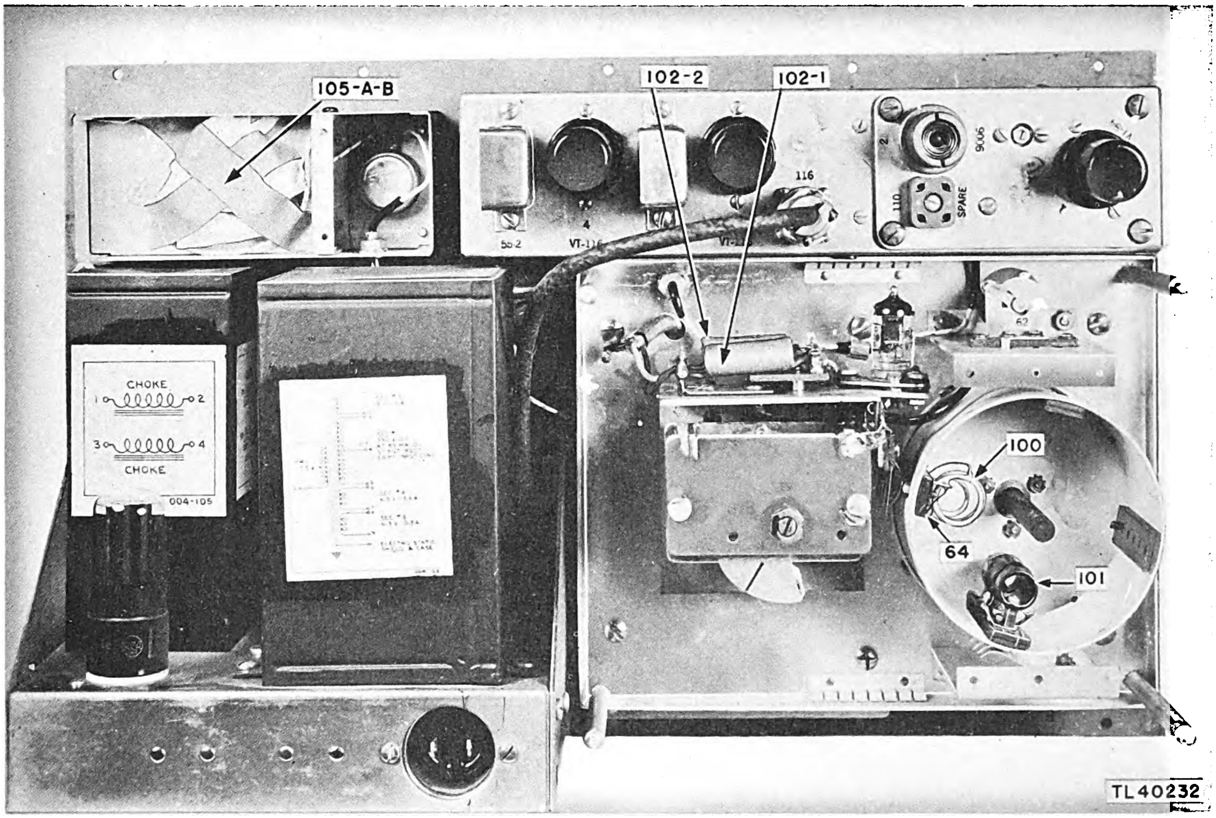

Figure 18. Signal Generator I-222-A, bottom view showing masking tape.

moving masking, touch up with a brush capacitor 66, the insulation of switch 106, and the uncoated wiring.

(c) Brush-coat wiring, resistors, and switch insulation in the section where switch 105-A-B is located (fig. 18).

(d) Spray all visible surfaces and objects on the under side of the power subchassis.

(e) In the tuning section, spray coils 102-1, 102-2, and the wiring, circuit elements, and phenolic materials in the immediate vicinity of these coils (fig. 18). Brush-coat all other phenolic materials, wiring (except rubber-covered), small circuit elements under the socket of the RC-9002 Tube VT-202, and the phenolic stand-off insulators.

(f) Spray coils 100 and 101, capacitor 64, and the insulating material inside the turret which houses these articles (fig. 18). Brush-coat the insulation visible from the exterior of the turret, keeping the coating material off the contacts.

(6) ASSEMBLE. Reasonable and test operation.

(7) MARKING. Mark MFP and date of treatment.

d. Reference. For a full description of the varnish-spray method of moistureproofing and fungiproofing refer to TB SIG. 13.

SECTION V

SUPPLEMENTARY DATA

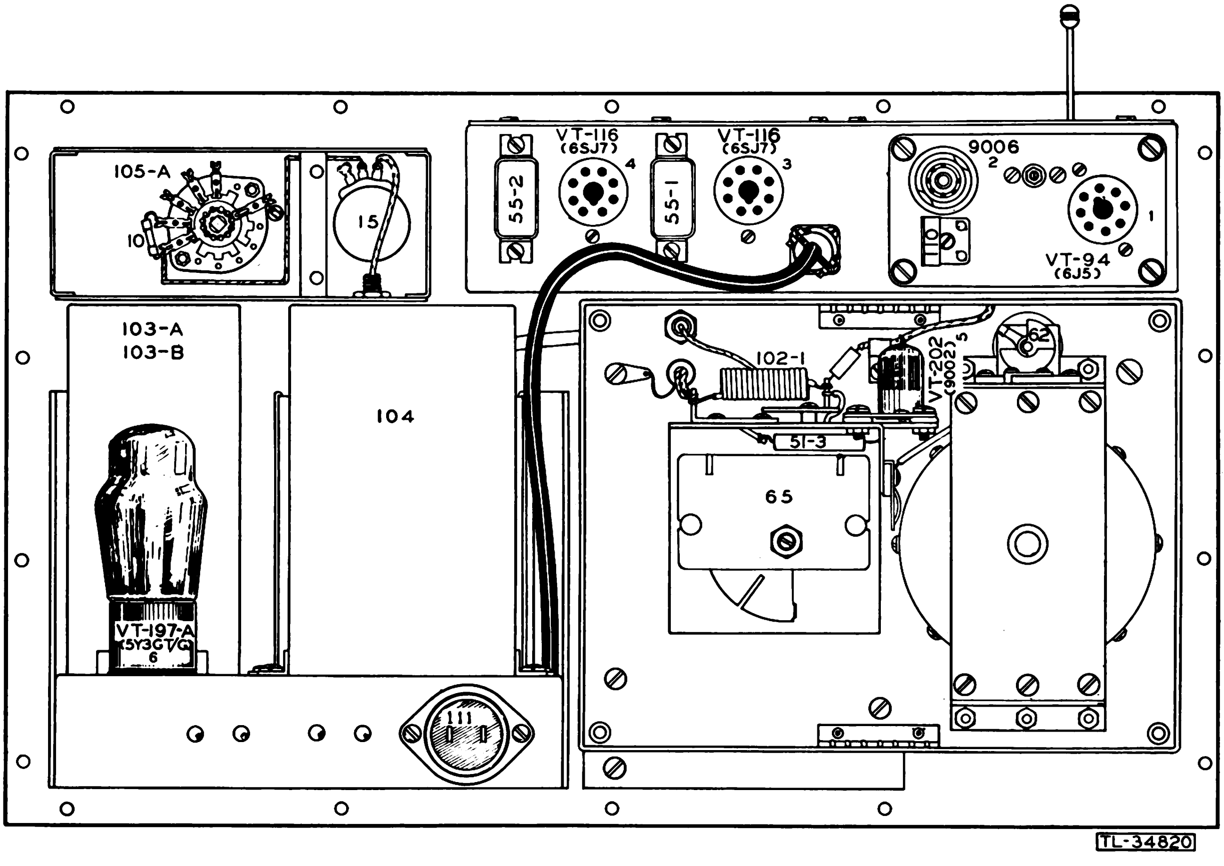

Figure 19. Signal Generator I-222-A, rear view, showing tube arrangement.

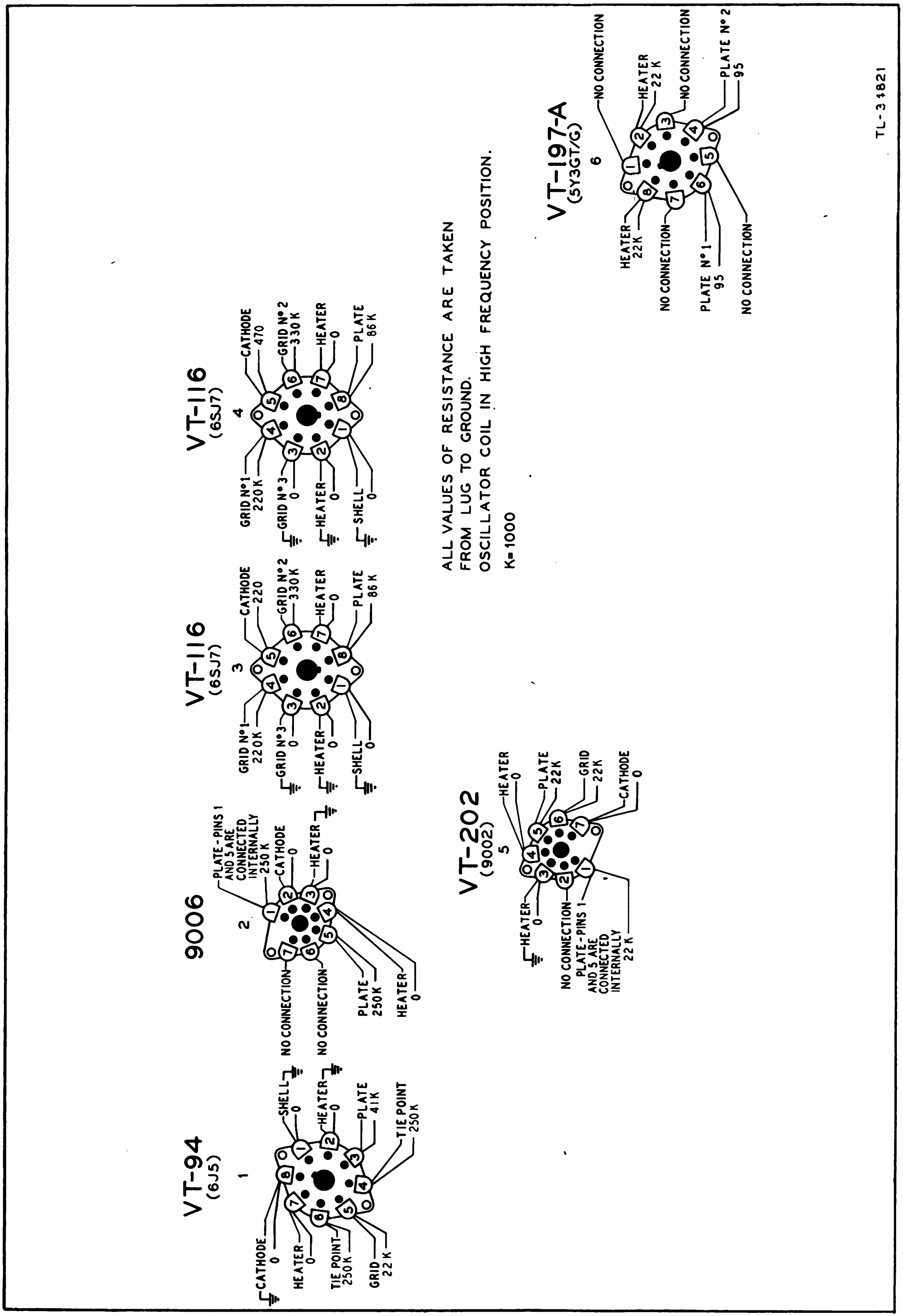

Figure 20. Signal Generator I-222-A: Tube socket resistance chart.

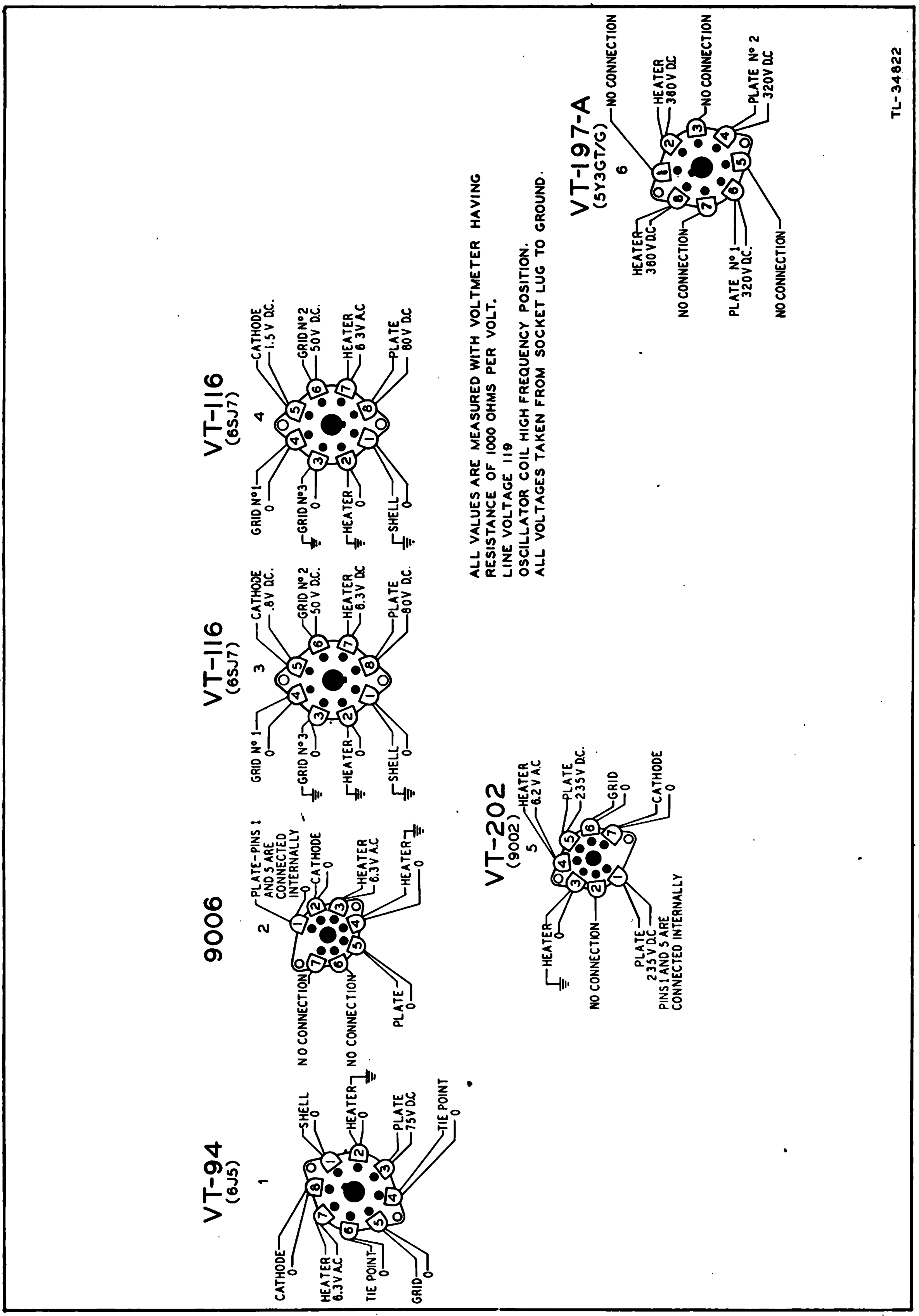

Figure 21. Signal Generator I-222-A: Tube socket voltage chart.

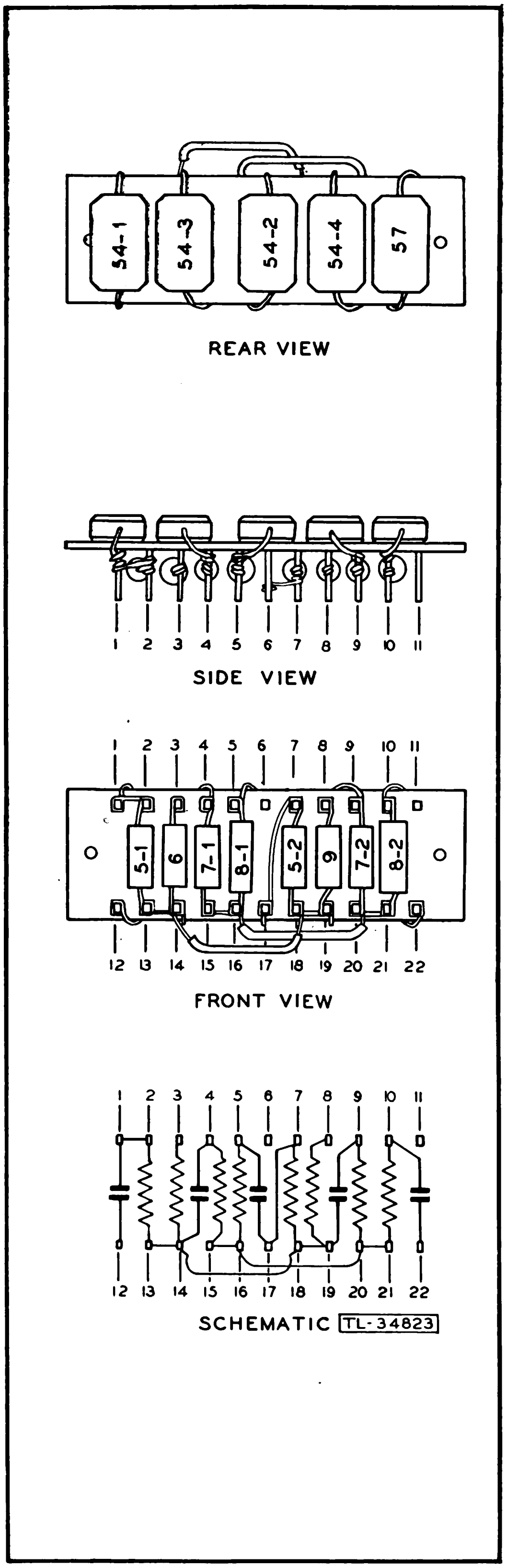

Figure 22. (Dwg. 60C-4261). Signal Generator I-222-A, detector and audio-amplifier terminal board.

Voltage and Resistance Chart of Detector and Audio-amplifier Terminal Board (fig. 22)

Terminal	*Volts*	*Ohms*
1	0	220K
2	0	220K
3	0.6	220
4	55	350K
5	100	88K
6	0	Infinite
7	0	220K
8	1.2	470
9	50	350K
10	100	88K
11	0	Infinite
12	0	250K
13	0	0
14	0	0
15	250	20K
16	250	20K
17	0	220K
18	0	0
19	0	0
20	250	20K
21	250	20K
22	0	Infinite

K=1000

Test Conditions

1. All measurements made between points indicated and ground.
2. Voltage measurements made with voltmeter having resistance of 500 ohms per volt.
3. RANGE switch in either L-F or H-F position.
4. TEST-CRYSTAL switch in TEST position.
5. R-f attenuator controls in extreme counterclockwise position.
6. Headphones not plugged in.
7. AUDIO GAIN control in extreme clockwise position.

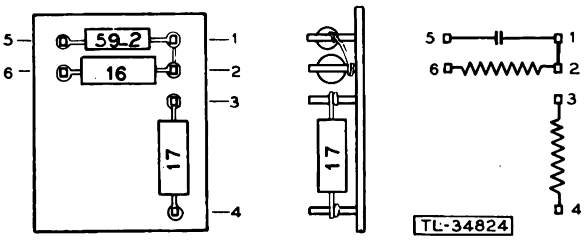

Figure 23. (Dwg. 60C-4262). Signal Generator I-222-A, variable-frequency oscillator terminal board.

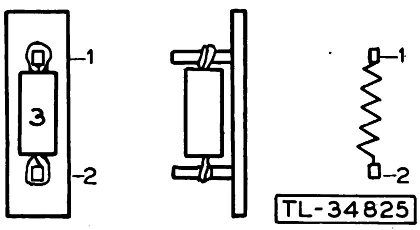

Figure 24. (Dwg. 60C-4263). Signal Generator I-222-A, detector and audio-amplifier terminal board.

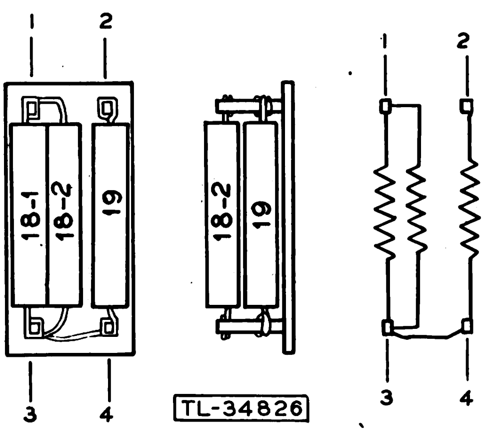

Figure 25. (Dwg. 60-C-4264). Signal Generator I-222-A, power supply terminal board.

Voltage and Resistance Chart of Variable-frequency Oscillator Terminal Board (fig. 23).

Terminal	*Volts*	*Ohms*
1	0	0
2	0	0
3	220	22.2K
4	250	20 K
5	0	0
6	0	110

K = 1000

Test Conditions

1. All measurements made between points indicated and ground.
2. Voltage measurements made with voltmeter having resistance of 500 ohms per volt.
3. RANGE switch in either L-F or H-F position.
4. TEST-CRYSTAL switch in TEST position.
5. R-f attenuator controls in extreme counterclockwise position.
6. Headphones not plugged in.
7. AUDIO GAIN control in extreme clockwise position.

Voltage and Resistance Chart of Detector and Audio-amplifier Terminal Board (fig. 24).

Terminal	*Volts*	*Ohms*
1	75	42K
2	250	20K

K = 1000

Voltage and Resistance Chart of Power Supply Terminal Board (fig. 25).

Terminal	*Volts*	*Ohms*
1	320	22K
2	0	0
3	250	20K
4	250	20K

K = 1000

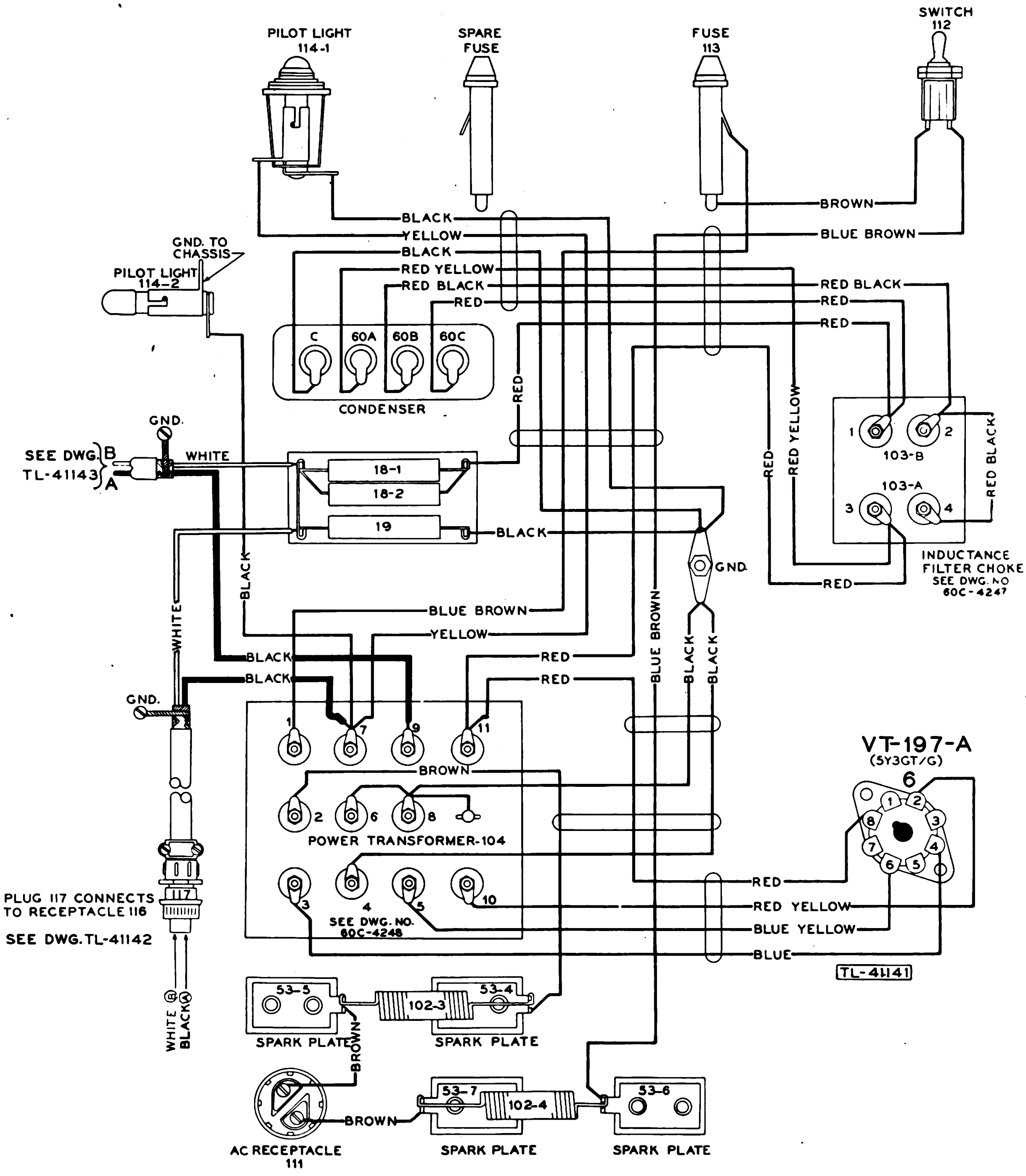

Figure 26. (Dwg. 60C-4249). Signal Generator I-222-A: wiring diagram of power supply.

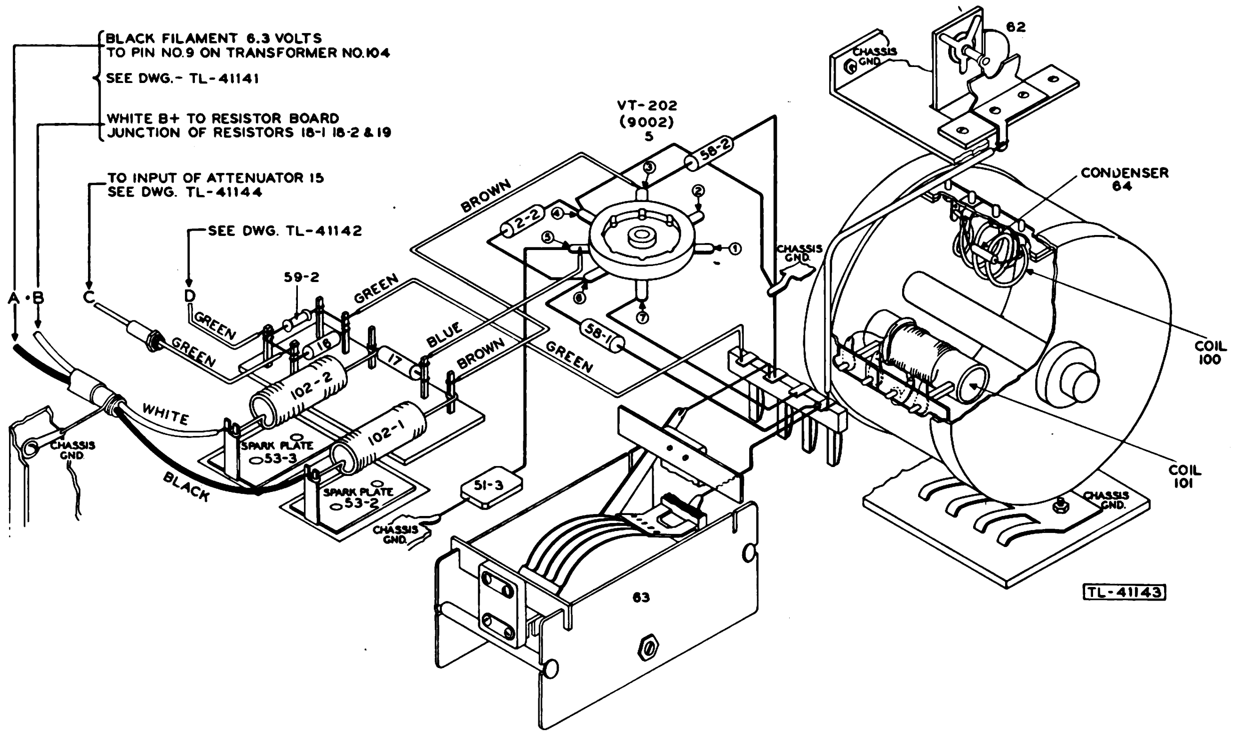

Figure 28. (Dwg. 60C-4251). Signal Generator I-222-A, wiring diagram of variable-frequency oscillator assembly.

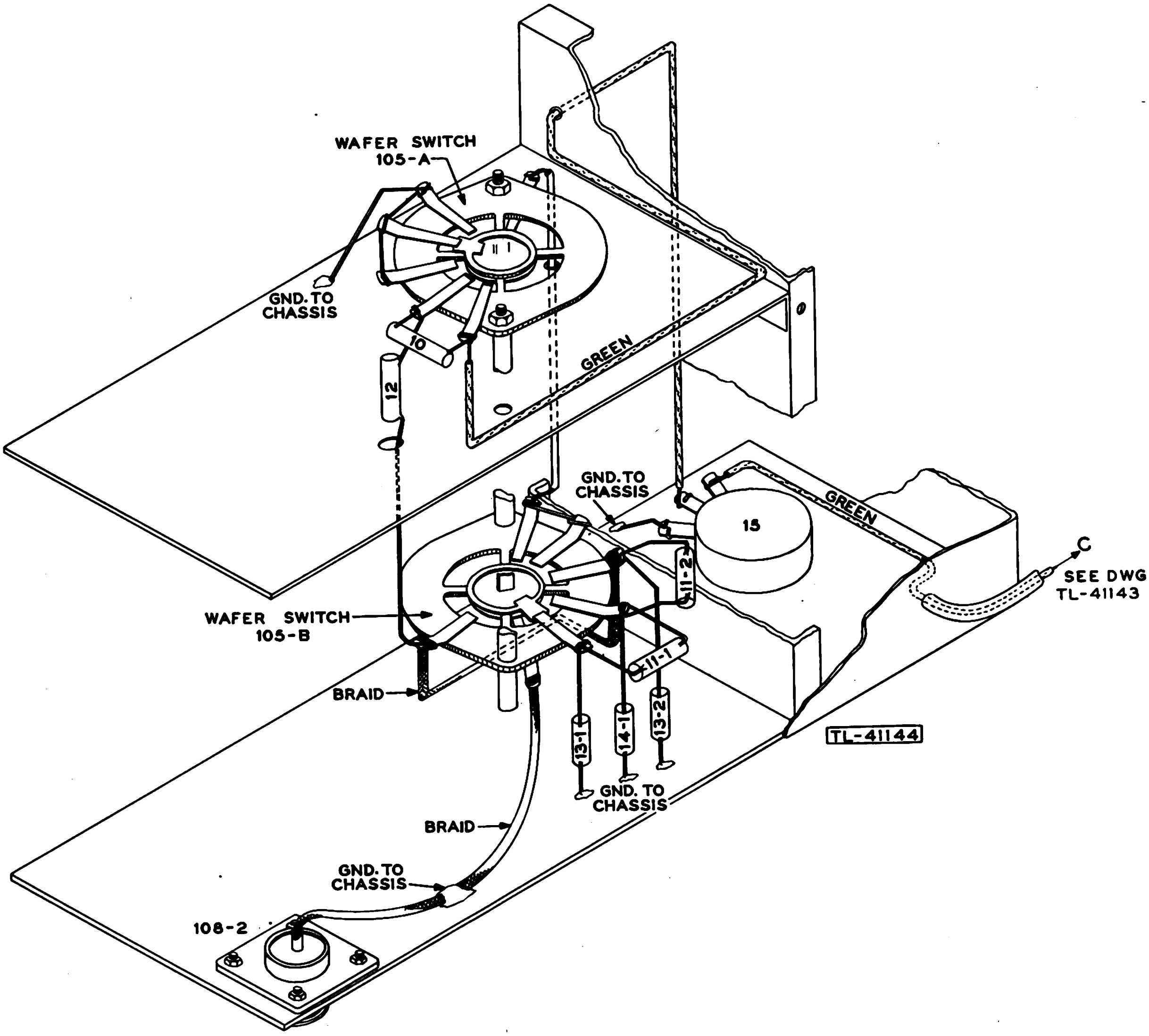

Figure 29. (Dwg. 60C-4253). Signal Generator I-222-A, wiring diagram of attenuator assembly.

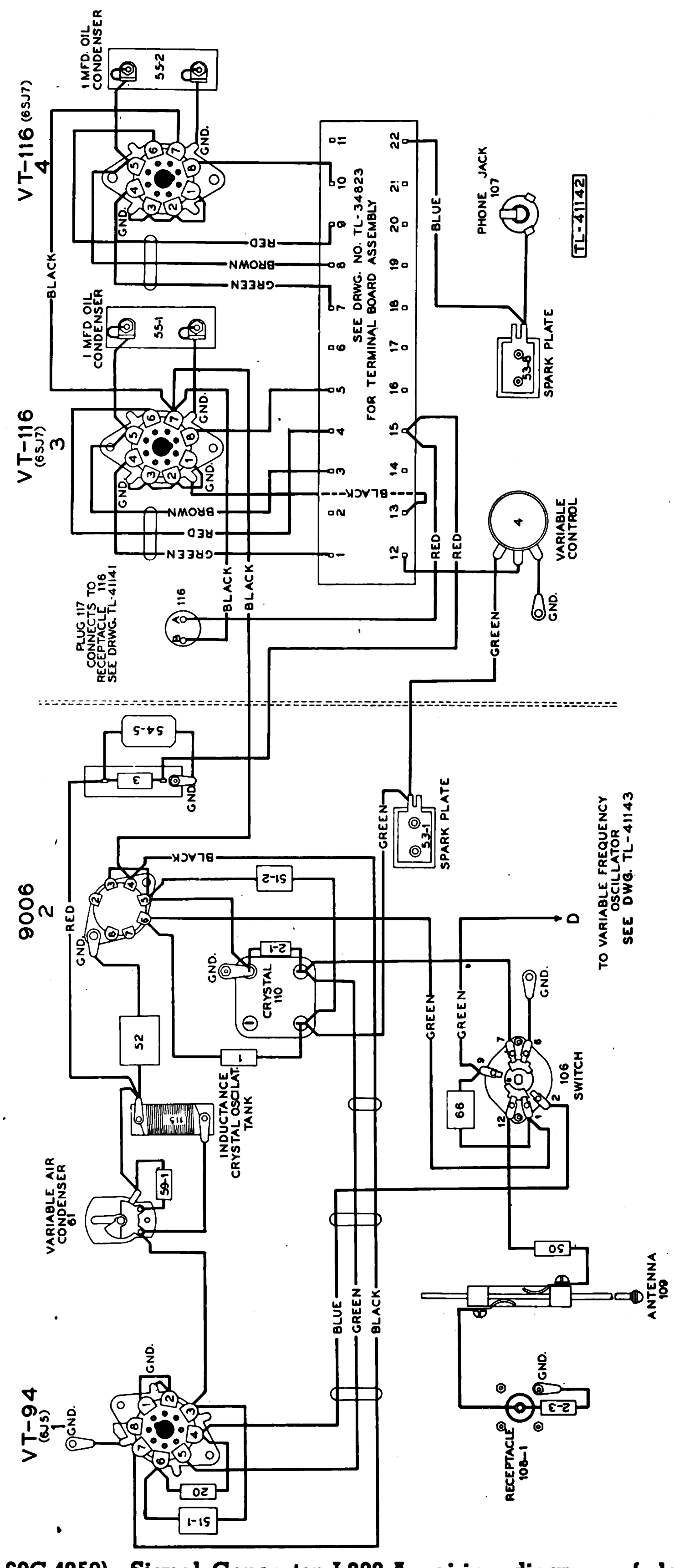

Figure 27. (Dwg. 60C-4250). Signal Generator I-222-A, wiring diagram of detector and amplifier assembly.

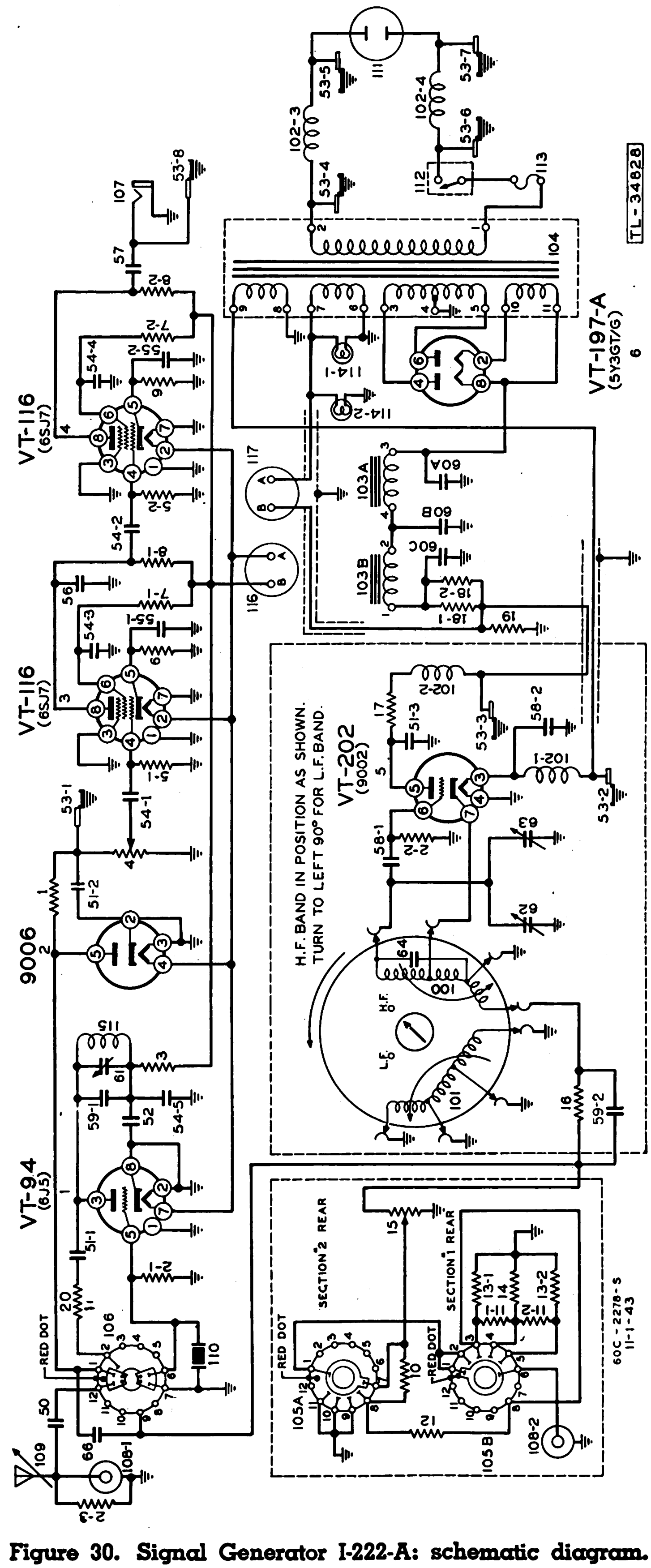

Figure 30. Signal Generator I-222-A: schematic diagram.

MAINTENANCE PARTS LIST FOR SIGNAL GENERATOR I-222-A

NOTE: Order maintenance parts by stock number, name, and description.
Only maintenance parts can be requisitioned.

Reference symbol	Signal Corps stock No.	Name of part and description	Running spares	Quan per unit	Orgn stock	3d ech	4th ech	Depot stock
	3E7144-3	CABLE: osc., 2 conductors, No. 20 gauge conductor made up of 26 strands of No. 34 tin copper wire, 0.036" thick, 30% rubber jacket, 16 7/8" long, 500 volts; Belmont Radio Corp., Chicago, Ill.		1	*			*
103-A to 103-B	3C323-4K	CHOKE: dual, No. 34 enamel covered, 0.006304", 119 turns per layer, 36 layers, 1 3/32" long, No. 466-001-095; Jefferson Electric Co., Bellwood, Ill.		1	*			*
101	3C1081-12D	COIL: osc., l-f, with mtg. strip, 55" of No. 23 enameled copper wire, 0.0225" diam., and 9" of No. 30 enameled copper wire 0.010025" diam. Diam. of coil 0.655" x 1 5/8" long; Belmont Radio Corp., Chicago, Ill.		1	*		*	*
100	3C4081	COIL: h-f, osc., No. 12 copper wire, bare, 0.080808" diam., 3 turns on h-f grid coil and 1 turn on the pick-up loop, outside diam. 0.878" h-f grid coil and 0.660" diam. on the pick-up loop, 1 5/16" mtg. centers; Belmont Radio Corp., Chicago, Ill.		1	*		*	*
115	3C1081-12C	COIL: osc., tank, No. 24 enameled copper 0.0201" diam., 44 turns, 0.770" diam., OD x 1 15/16"; Belmont Radio Corp., Chicago, Ill.		1	*		*	*
102-1 to 102-4	3C323-4L	COIL: r-f, choke; No. 16 copper, double cotton covered; 0.05082" diam., 22 turns, 11/32" ID, coil approx. 1.333" long; Belmont Radio Corp., Chicago, Ill.		4	*			*
63	3D9067VE8	CAPACITOR: variable; max. 67.8 ±1%, min. less than 10.3 mmf, 500 volts; 3 3/16" x 2 5/8" x 1 7/8" approx; S-3090; Oak Mfg. Co., Chicago, Ill., or equal.		1	*	*	*	*
60A to 60C	3DB5-26	CAPACITOR: oil-filled, 2.5 mf-2.5 mf-5.0 mf −10% +20%, 600 volts dc; 5" long x 3 13/16" wide x 1 9/16" thick, mtg. centers 4 1/2"; type BMM 324-46; Micamold Radio Corp., Brooklyn, N. Y., or equal.		1	*	*	*	*
55-1 to 55-2	3DB1-2946	CAPACITOR: oil-filled, 1.0 mf ±20%, 400 volts dc; 2 3/8" high x 1 9/32" wide x 3/4" thick, mtg. centers 1 3/4", type DM 4-1; Solar Mfg. Co., New York, N. Y., or equal.		2	*	*	*	*
56	3DK9500-99	CAPACITOR: mica; 0.0005 mf x 500 volts dc ±10%; 11/16" x 7/16" x 3/16", type O; Micamold Radio Corp., Brooklyn, N. Y., or equal.		1	*	*	*	*
51-1 to 51-3	3D9100-95.1	CAPACITOR: mica; 0.0001 mf x 500 volts ±10%, 11/16" x 7/16" x 3/16", type O; Micamold Radio Corp., Brooklyn, N. Y., or equal.		3	*	*	*	*
52	3DA5-32	CAPACITOR: mica; 0.005 mf x 500 volts ±10%, 3/4" sq. x 1/4" thick, type W; Micamold Radio Corp., Brooklyn, N. Y., or equal.		1	*	*	*	*
66	3DK9150-22	CAPACITOR: mica; 0.00015 mf x 500 volts dc ±10%: 11/16" x 7/16" x 3/16", type O; Micamold Radio Corp., Brooklyn, N. Y., or equal.		1	*	*	*	*
50	3D9030-15	CAPACITOR: ceramic; 30 mmf ±10%, 500 volts dc; 7/16" long x 7/32" diam., type N 750 K-30; Erie Resistor Corp., Erie, Pa., or equal.		1	*	*	*	*
58-1 to 58-2	3D9040-21	CAPACITOR: ceramic; 40 mmf ±10%, 500 volts dc; type NPOC-40; Erie Resistor Corp., Erie, Pa., or equal.		2	*	*	*	*

64	3D9005-24.1	CAPACITOR: ceramic; 5 mmf ±5%, 500 volts dc; 7/16" x 7/32" diam.; type N750 K-5; Erie Resistor Corp., Erie, Pa., or equal.		1	*	*	*	*
59-1 to 59-2	3D9010-15	CAPACITOR: ceramic; 10 mmf ±5%, 500 volts dc; type NPO K-10; Erie Resistor Corp., Erie, Pa., or equal.		2	*	*	*	*
57	3DA50-57	CAPACITOR: molded paper; 0.05 mf ±20%, 600 working volts; 1 7/16" x 3/4" x 3/8"; type 345-22; Micamold Radio Corp., Brooklyn, N. Y., or equal.		1	*	*	*	*
54-1 to 54-5	3DA100-112.1	CAPACITOR: molded, 0.1 mf ±20%, 400 working volts, 1 7/16" x 3/4" x 3/8", type 345-21; Micamold Radio Corp., Brooklyn, N. Y., or equal.		5	*	*	*	*
61	3D9003V-9	CAPACITOR: air, variable, 50 mmf max. 4.5 mmf min., 500 volts rms 60 cycles, 1 5/16" x 1 7/32" x 1 13/32", type APC; Hammarlund Mfg. Co., Chicago, Ill., or equal.		1	*	*	*	*
15	2Z7267.12	CONTROL: r-f attenuator, variable, 125-ohm ±20%, 1 watt, 15/32" shaft length, x 0.20" diam., 1/4" of shaft threaded 3/8"-32, 45° taper, type J; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
4	2Z7272-13	CONTROL: variable, audio, 250,000 ohms ±10%, 2 watts, 9/16" shaft length, x 0.25" diam., 1/4 of shaft threaded 3/8"-32, linear taper, type J; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
	3E7144-5	CORD: 8' with one 2-pole male plug, 110 volt GE No. 2721 (A-19-A-2.347.IRC) and one female 2-pole plug, 110 volts; Phenolic No. F11.		1	*			*
CD-1103	3E1999-103	CORD ASSEMBLY: single stranded conductor 33" long, plug PL-259 on one end, other end Plug PL-55.		1	*			*
CD-1104	3E1999-104	CORD ASSEMBLY: single conductor, Plug PL-259 on both ends.		1	*			*
CD-1141-2	3E1999-141	CORD ASSEMBLY: 2 conductors, 6 ft. long; one end male plug, other end special jack assembly.		1	*			*
CD-1106	3E1999-106	CORD ASSEMBLY: 21 conductors.		1	*			*
110	2X15-5000	CRYSTAL: 5 mc, 1 1/8" x 13/16" x 13/32", 0.484 plug in centers; type FT-243; Bliley Electric Co., Erie, Pa., or equal.		1	*	*	*	*
	3E7144-2	CABLE: det, 4-amp power, with connector at one end, 2 conductors, 20-gauge conductor made up of 26 strands of No. 34 tin copper wire, outside covering 0.036" thick, 38%-rubber jacket, 21" overall length, 500 volt; Belmont Radio Corp., Chicago, Ill.		1	*			*
113	3Z1950	FUSE: cartridge, 3 amps, cat. 3 Ag.; Littelfuse, Inc., Chicago, Ill., or equal.	*	2	*	*	*	*
	6Z4858-4	GROMMET: rubber, 7/16" OD x 3/16" ID x 7/32" thick; Lavelle Rubber Co., Chicago, Ill., or equal.		7	*			*
	3G1838-27-4	INSULATOR: bakelite, 0.015 XXXP, 7/8" x 1 11/16"; Lamicoid Fabricators, Inc., Chicago, Ill.		3	*			*
	3G1837-75	INSULATOR: stand-off, bakelite, 5/8" diam., 2 11/16" long, both ends tapped No. 10-24; Continental Diamond Fiber Co., Chicago, Ill.		2	*			*
	3G1837-32.10	INSULATOR: stand-off, bakelite, 5/8" diam., 1" long, with No. 10-24 tapped hole; Lamicoid Fabricators, Inc., Chicago, Ill.		4	*			*
107	2Z5534A	JACK: telephone, open circuit, bushing length 9/32", 3/8"-32 threads, overall length 1 7/32" x 3/4" diam., complete with hardware, type JK-34-A; P. R. Mallory & Co., Indianapolis, Ind., or equal.		1	*	*	*	*

*Indicates stock available.

MAINTENANCE PARTS LIST FOR SIGNAL GENERATOR I-222-A—(Cont.)

NOTE: Order maintenance parts by stock number, name, and description.
Only maintenance parts can be requisitioned.

Reference symbol	Signal Corps stock No.	Name of part and description	Running spares	Quan per unit	Orgn stock	3d ech	4th ech	Depot stock
	2Z5991	JEWEL: indicator and bracket, indicating unit operating, red, 15/16" diam. x 1 13/16" long, type No. 50; Drake Mfg. Co., Chicago, Ill., or equal.		1	*	*	*	*
114-1 to 114-2	2Z5927	LAMP PILOT LIGHT: bayonet base, 6.3-volt, 4-watt, type 44, Mazda or equal; General Electric Co., Chicago, Ill.	*	2	*	*	*	*
111	2Z7138.1	RECEPTACLE: male, 500 volts, cat. No. 61-M10; American Phenolic Corp., Chicago, Ill., or equal.		1	*	*	*	*
108-1 to 108-2	2Z711.61	RECEPTACLE: coaxial, flange type, 1 1/16" long, 1" square, type 83-IR; American Phenolic Corp., Chicago, Ill., or equal.		2	*	*	*	*
116	2Z7122.2	RECEPTACLE: flange type, male, 1 1/16" long, 7/8" square, type AN-3102G-12S-3P; American Phenolic Corp., Chicago, Ill., or equal.		1	*	*	*	*
5-1 to 5-2	3Z6722-5	RESISTOR: carbon, 220 K ohm, 1/2 watt, ±10%, 3/16" diam. x 5/8" long, type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		2	*	*	*	*
2-1 to 2-3	3Z6622-10	RESISTOR: carbon, 22 K ohm, 1/2 watt, ±10%, 3/16" diam. x 5/8" long, type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		3	*	*	*	*
9	3Z6047-5	RESISTOR: carbon, 470 ohms, 1/2 watt, ±10%, 3/16" diam. x 5/8", type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
71- to 7-2	3Z6733-2	RESISTOR: carbon, 330 K ohm, 1/2 watt, ±10%, 3/16" diam. x 5/8" type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		2	*	*	*	*
6	3Z6022-9	RESISTOR: carbon, 220 ohms, 1/2 watt, ±10%, 3/16" diam. x 5/8", type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
17	3Z6220-3	RESISTOR: carbon, 2200 ohms, 1/2 watt, ±10%, 3/16" diam. x 5/8", type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
20	3Z6470-27	RESISTOR: carbon, 4700 ohms, 1/2 watt, ±5%, 3/16" diam. x 5/8" long, type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
8-1 to 8-2	3ZK6668-14	RESISTOR: carbon, 68 K ohm, 1 watt ±10%, 3/16" diam. x 1 1/4" long, type GB; Allen Bradley Co., Milwaukee, Wis., or equal.		2	*	*	*	*
3	3Z6622-11	RESISTOR: carbon, 22 K ohm, 1 watt, ±10%, 3/16" diam. x 1 1/4" long, type GB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
19	3Z6620-106	RESISTOR: wire-wound, 20 K ohm, 10 watt, ±10%, 15/32" diam. x 1 27/32" long, type Koolohm 5K; Sprague Specialties Co., Chicago, Ill., or equal.		1	*	*	*	*
18-1 to 18-2	3Z6400-23	RESISTOR: wire-wound, 4 K ohm, 10 watt, ±10%, 15/32" diam. x 1 27/32" long, type Koolohm 10K; Sprague Specialties Co., Chicago, Ill., or equal.		2	*	*	*	*

10	3Z6045-15	RESISTOR: carbon, 450 ohms, 1-10 watt, ±5%, type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
12	3Z6004E5-5	RESISTOR: carbon, 45 ohms, 1-10 watt, ±5%, type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
13-1 to 13-2	3Z5995-20	RESISTOR: carbon, 5.5 ohms, 1-10 watt, ±5%, type MB-1/8; Stackpole Carbon Co., St. Marys, Pa., or equal.		2	*	*	*	*
11-1 to 11-2	3Z6005-53	RESISTOR: carbon, 49.5 ohms, 1-10 watt, ±5%, type MB-1/8; Stackpole Carbon Co., St. Marys, Pa., or equal.		2	*	*	*	*
14	3Z5996-12	RESISTOR: carbon, 6.11 ohms ,1-10 watt, ±5%, type MB-1/8; Stackpole Carbon Co., St. Marys, Pa., or equal.		1	*	*	*	*
16	3RC20BE911J	RESISTOR: carbon, 990 ohms, 1/8 watt, ±5%, 1/8" diam. x 3/8" long, type EB; Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
1	3Z6610-57	RESISTOR: carbon, 10 K ohm, 1/2 watt, ±10%, 3/16" diam. x 5/8", type EB, Allen Bradley Co., Milwaukee, Wis., or equal.		1	*	*	*	*
	2Z8795.1	SOCKET: steatite, 8, standard octal tubes, type No. RSS-8; American Phenolic Co., Chicago, Ill., or equal.		1	*			*
	2Z8761-14	SOCKET: mica-filled bakelite, 4-prong, type 98; Cinch Mfg. Co., Chicago, Ill., or equal.		1	*			*
	2Z8650.5	SOCKET: bakelite, for mounting standard octal tubes, type 9950; Cinch Mfg. Co., Chicago, Ill., or equal.		3	*			*
	2Z8677.5	SOCKET: mica-filled, bakelite, 7-prong midget type 78-7P; American Phenolic Corp., Chicago, Ill., or equal.		2	*			*
	2Z87777.11	SPRING: spiral, 0.035" steel spring wire, tube 3/4" diam. on one end, 5/16" diam. on other end x 5/8"; Cinch Mfg. Co., Chicago, Ill., or equal.		1	*			*
106	3Z9825-604	SWITCH: mixer, crystal to variable osc. for calibrating the dial, single decker, 5/8" shaft length 0.250" diam., 5/16" x 3/8"-32 threads, rotary 2 position, type H; Centralab Mfg. Co., Milwaukee, Wis., or equal.		1	*			*
105-A to 105-B	3Z9825-60.5	SWITCH: attenuator, rotary, 2-section, 5-position, 13/32" long x 0.250" diam. shaft with 5/16" x 3/8"-32 threaded bushing, type H, Centralab Mfg. Co., Milwaukee, Wis., or equal.		1	*	*		*
	3Z12059-7	TERMINAL: 45°-bend, hole for No. 6 screw, two 3/32" holes for wire, No. 2104-6; Shakeproof, Inc., Chicago, Ill., or equal.		4	*			*
	3Z12059-14	TERMINAL: 45° bend, hole for No. 4 screw, two 3/32" holes for wire, No. 2104-4; Shakeproof, Inc., Chicago, Ill., or equal.		1	*			*
	3Z12056-1	TERMINAL: straight, hole for No. 6 screw 0.812" long, 3/32" hole for wire, No. 2108-6; Shakeproof, Inc., Chicago, Ill., or equal.		1				*
	3Z12059-12	TERMINAL: 30° bend, hole for No. 10 screw, 3/32" hole for wire, No. 2103-10; Shakeproof, Inc., Chicago, Ill., or equal.		1				*

*Indicates stock available.

MAINTENANCE PARTS LIST FOR SIGNAL GENERATOR I-222-A—(Cont.)

NOTE: Order maintenance parts by stock number, name, and description.
Only maintenance parts can be requisitioned.

Reference symbol	Signal Corps stock No.	Name of part and description	Run-ning spares	Quan per unit	Orgn stock	3d ech	4th ech	Depot stock
	3Z12059.41.1	TERMINAL: two 30° bends, two 5/32" wire holes, 1 hole for No. 10 screw, No. 2116-10; Shakeproof, Inc., Chicago, Ill., or equal.						
	2Z9422.6	TERMINAL BOARD ASSEMBLY: wiring 22 terminals, base 5" long, 1⅝" wide, 0.093" thick, natural linen bakelite, two 0.173" diam. mounting holes, centers 4⅜" apart; B. R. C. Anchor Tool & Die Co., Chicago, Ill.		1				*
	2Z9404.47	TERMINAL BOARD ASSEMBLY: wiring 4 terminals, base 2½" long, 1⅛" wide, 0.093" thick, natural linen bakelite, two 0.177" diam. mounting holes, centers 1½" apart; B. R. C. Anchor Tool & Die Co., Chicago, Ill.		1				1
104	2Z9613.133	TRANSFORMER: power, fil. and high-voltage supply, overall dim. 6" x 4¼" x 3⅝", mtg. centers 4¼", type 463-001-126; Jefferson Electric Co., Bellwood, Ill., or equal.		1	*			*
VT-94	2J6J5	TUBE: detector amplifier triode.	*	1	*			*
VT-116	2J6SJ7	TUBE: triple-grid detector amplifier.		2	*			*
VT-197A	2V5Y3G	TUBE: full-wave high-vacuum rectifier.		1	*			*
VT-( )	2J9006	TUBE: high-frequency diode.	*	1	*			*
VT-202	2J9002	TUBE: detector amplifier oscillator.		1	*			*

*Indicates stock available.