

CALIBRATION

Before starting the Generator calibration, carefully study the operation of each control and switch as described in Figure 2 on Page 23.

An AM radio is needed to calibrate bands A, B, C, D, and E. The tuned circuit and component parts for band F have been preadjusted at the factory. If additional accuracy is desired, an FM radio must be used to calibrate band F.

BANDS A THROUGH E

- () Turn the BAND switch to band B.
- () Turn the Modulation switch to EXT MOD.
- () Turn the FINE ATTEN control fully clockwise.
- () Set the COARSE ATTEN switch at HI.
- () Connect the shielded output cable to the Generator RF OUT connector. Place the free end of this cable near the loop or antenna lead of the AM radio, but do not connect it directly to the radio.
- () Turn the Generator and AM radio on. Allow the Generator and radio to warm up for 15 minutes so all components will reach normal operating temperature.

The following procedure will be used to calibrate the Generator.

First, a signal of known frequency is tuned in on the AM radio. Then the dial pointer of the Generator is set to the exact frequency of the station the radio is tuned to. The RF oscillator is then tuned to the same frequency as the radio station by adjusting it until a zero beat is heard in the radio.

This zero beat is the signal that is created by the beating together of the oscillator signal and the station signal in the radio. When the beat is heard, it starts out as a high pitched tone, which gradually changes as the beat frequency becomes lower until the tone becomes very low pitched. Once the zero beat point is passed, the tone gradually increases in pitch until it can no longer be heard.

At these frequencies it is often hard to get a complete zero beat (no sound at all) between the signals. Often, a low pitched tone or a slow popping sound will be as close as you will be able to come to a complete zero beat. The output level of the Generator should be just high enough to give a clear beat sound; do not set the Generator output level higher than necessary.

- () Locate the alignment tool blade supplied with this kit. Refer to Figure 1 and use a pair of long-nose pliers. Insert the blade into the smaller hole of the nut starter until the blade end is flush with the end of the nut starter. This now can be used as a trimmer alignment tool.

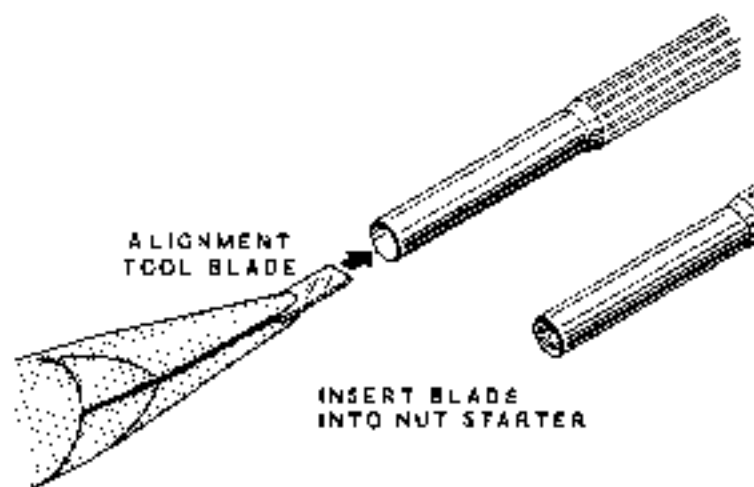


Figure 1



- () Referring to Pictorial 7 (Page 18) and using the trimmer alignment tool, preset trimmer capacitor C6 until the top of the adjustment screw is 1/2" above the chassis.
- () Tune the AM radio to a station of known frequency between 800 and 1000 kc. The frequency of this station should preferably be one whose frequency falls directly on one of the calibration points on the dial, such as 800 kc, 850 kc, 900 kc, or 1000 kc.
- () Turn the dial pointer on the Generator to the place on the dial that indicates the exact frequency of the station the radio is tuned to.
- () Adjust trimmer capacitor C6 for a zero beat in the radio. Use the FINE ATTEN and COARSE ATTEN controls to set the output level of the Generator just high enough to give a clear zero beat in the radio.

This completes the calibration of bands A through E. Turn off the AM radio.

The frequencies, for bands A through E, were adjusted with trimmer capacitor C6. This was possible because the adjustment slug, for each coil on these bands, was accurately adjusted at the factory. A slight improvement in accuracy could be obtained if the slug in each coil was adjusted by zero beating the Generator signal with an accurate frequency standard. An accurate frequency standard could be obtained by tuning a communications receiver to a WWV frequency such as 2.5 mc, 5 mc, 10 mc, etc., (National Bureau of Standards). Standard frequencies can also be obtained from a precision laboratory generator (with an accuracy of at least 1%), in conjunction with an oscilloscope to indicate the zero beat. If the coil slugs are adjusted, each band should be adjusted near the low end of the dial. A coil alignment tool, for adjusting the coil slugs, is supplied with the kit.

BAND F

To calibrate band F to obtain additional accuracy, you must use an FM radio.

- () Turn on the FM radio and tune it to a station between 88 mc and 100 mc.
- () Set the BAND switch to band F, and turn the dial pointer to the frequency of the FM station.
- () Turn the Modulation switch to INT MOD/AF OUT.
- () Connect the output cable of the Generator to the antenna terminals of the FM radio.
- () Turn the Generator dial pointer back and forth and listen for the 400 cps tone modulation in the FM radio. This 400 cps tone will be weakest at the correct frequency, and it will be louder on both sides of this frequency.
- () Turn the Generator dial pointer to the place where the 400 cps tone is weakest. If the dial indicator points to a frequency lower than the station frequency, gently squeeze together the turns of coil F. Then retune the dial pointer to the weakest 400 cps tone. Repeat this procedure until the correct frequency is indicated on the Generator dial. See Pictorial 5 to identify coil F. If the dial pointer indicates a higher frequency than the station frequency, the turns of coil F should be spread apart slightly.

This completes the calibration of band F.

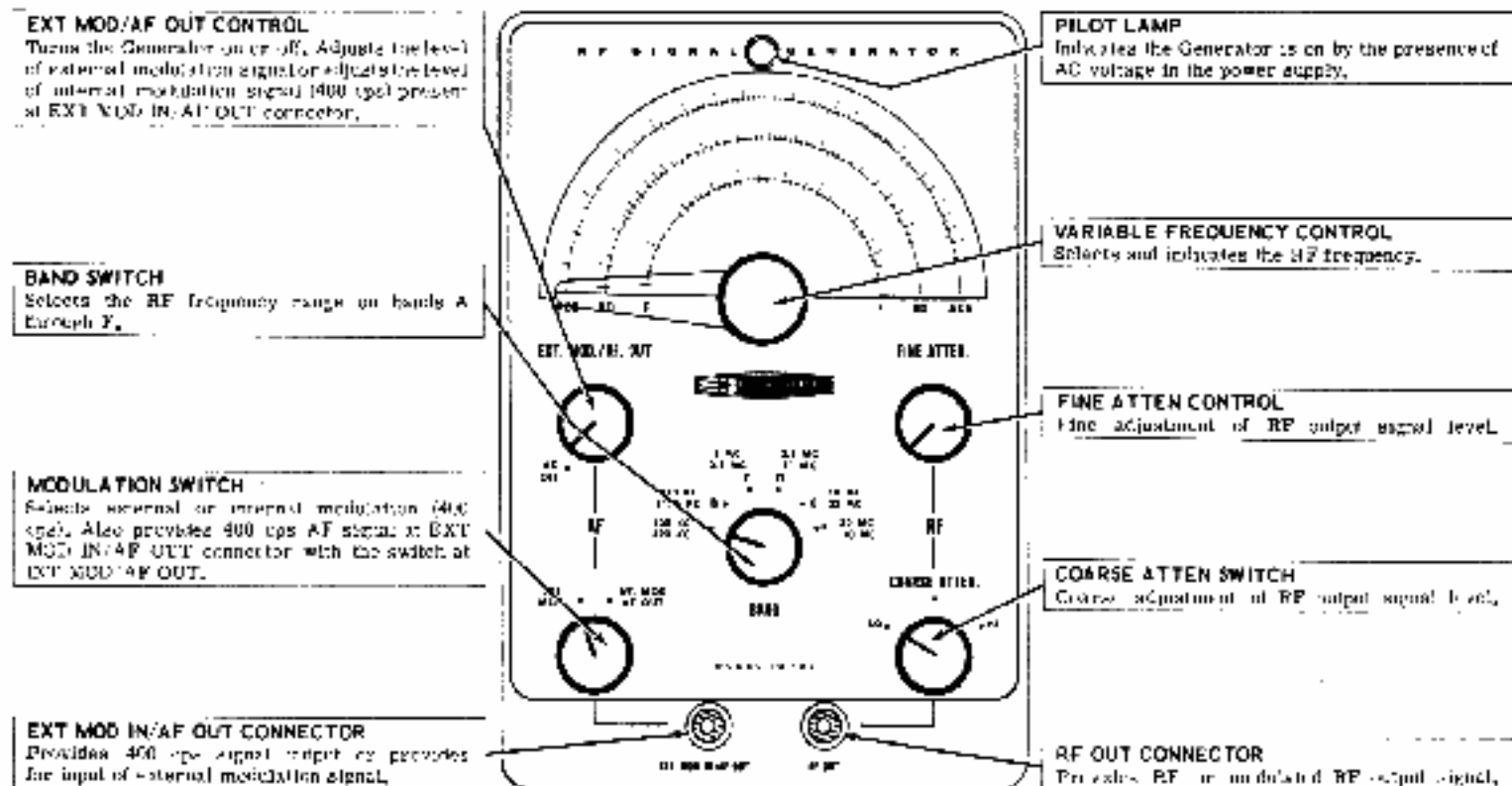


Figure 2

OPERATION

Figure 2 explains the basic functions of the front panel controls. A detailed explanation of how to read the dial scale, and the use of some front panel controls, is given in the following paragraphs.

DIAL SCALE

The RF output frequency of the Generator depends on the number the dial pointer is set to, and the position of the BAND switch. Bands A, C, and E are read on the outside dial scale, bands B and D are read on the center dial scale, and band F is read on the inside dial scale. See Figure 3.

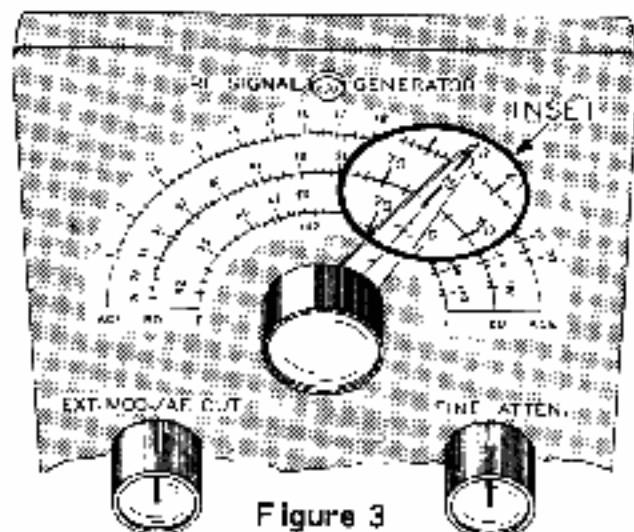


Figure 3

Proceed as follows to read the dial scales. On bands A and B, multiply the number indicated on the dial by 10 to obtain the frequency in kc. On bands C and D, divide the number indicated on the dial by 10 to obtain the frequency in mc. On bands E and F, the dial is read directly in mc. Refer to the inset drawing on Figure 3 and the following table for examples of how to read the dial scale.

| BAND | DIAL READING | FREQUENCY |
|------|---------------------|-----------|
| A | 23 (multiply by 10) | 230 kc |
| B | 75 (multiply by 10) | 750 kc |
| C | 23 (divide by 10) | 2.3 mc |
| D | 75 (divide by 10) | 7.5 mc |
| E | 23 (read direct) | 23 mc |
| F | 77 (read direct) | 77 mc |

The numbers from 100 to 220 on the inside of scale F are calibrated harmonic frequencies of band F. This dial scale, which should be read directly, adds another range of frequencies from 100 mc to 220 mc. The most commonly used IF frequencies for AM and FM radio receivers are indicated with a special mark on the dial; 455 kc (AM) is marked on band B and 10.7 mc (FM) is marked on band E.



GENERAL

When the Modulation switch is turned to INT MOD/AF OUT, a 400 cps audio signal is available at the connector marked EXT·MOD IN/AF OUT. With this switch turned to EXT MOD, the

internal 400 cps oscillator is turned off, and the RF signal may be modulated by connecting an external audio signal to the EXT MOD IN/AF OUT connector. An audio signal with a level of about 3 volts is needed for 30% modulation of the RF frequency.

SPECIFICATIONS

RF OUTPUT SIGNAL

| | |
|------------------------------|---|
| Frequency Range. | 100 kc to 110 mc in six bands (bands A through F). 100 mc to 220 mc (additional band of calibrated harmonics). |
| Frequency Accuracy. | ±2%. |
| Output Impedance. | 50 ohms. |
| Internal Modulation. | 400 cps (30% modulation). |
| External Modulation. | 3 volt signal input for 30% modulation. |

AF OUTPUT SIGNAL

| | |
|-------------------------|--------------------------|
| Frequency. | 400 cps. |
| Output Voltage. | 10 volts (open circuit). |

GENERAL

| | |
|-------------------------------|---|
| Front Panel Controls. | Variable Frequency control. Band switch. Fine Attenuator control. Coarse Attenuator switch. External Modulation or AF Output control. Modulation switch. |
| Tube Complement. | 12AT7 RF oscillator. 6AN8 amplifier and modulator. |
| Power Requirements. | 105 to 125 volts AC, 50/60 cps, 15 watts. |
| Cabinet Dimensions. | 6-1/2" wide x 9-1/2" high x 5" deep. |
| Net Weight. | 4-1/2 lbs. |

CIRCUIT DESCRIPTION

Refer to the Block Diagram and Schematic (fold-out from Page 33) to follow the circuit and identify the circuit components while reading this description.

The Circuit Description of the RF Signal Generator is outlined in four sections: RF Oscillator, AF Oscillator, Amplifier And Modulator, and Power Supply.

RF OSCILLATOR

A Hartley oscillator, consisting of tube V1B and its associated circuitry, is used to generate the RF signal for bands A, B, C, D, and E. The correct coil for each band of frequencies is selected by Band switch S2.

Section BF of Band switch S2, supplies B+ voltage to the plate of tube V1B when the switch is in positions A through E. The desired oscillator coil is connected through capacitor C7 to the grid of tube V1B by section AF of Band switch S2. The tap of each coil is connected to the cathode of tube V1B by section BR of Band switch S2. Section AR of Band switch S2 shorts out all oscillator coils except the one being used.

Capacitor C9, which is one section of the tuning capacitor, is connected across the desired oscillator coil and completes the tuned circuit of the RF oscillator. Trimmer capacitor C6, which is connected to the grid of tube V1B, adjusts the oscillator frequency on bands A through E.

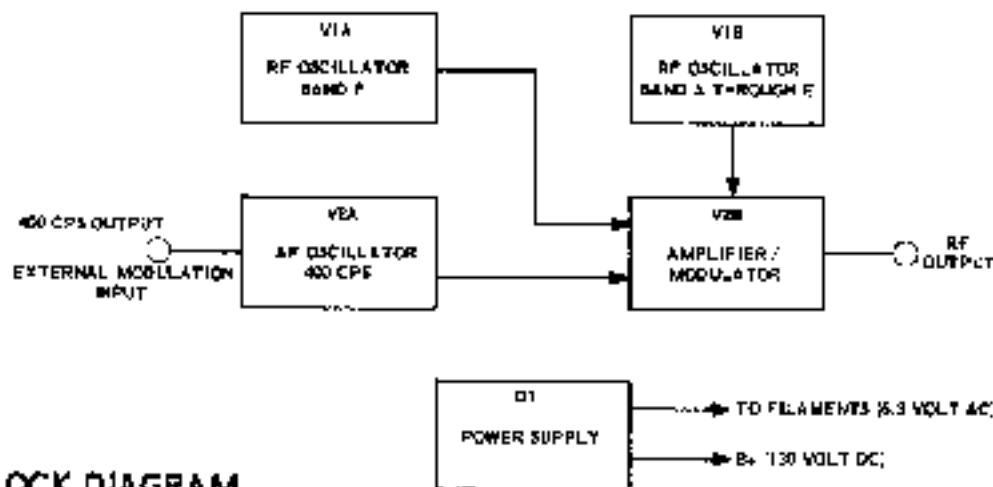
Resistor R3 and capacitor C7 supply bias voltage to the grid of tube V1B. The RF signal is coupled through capacitor C8 to the grid of tube V2B.

Tube V1A is the RF oscillator stage for band F only. Coil F is permanently connected to the grid of tube V1A through resistor R1 and capacitor C3. This helps reduce variations in wiring capacitance that would occur if this coil were switched like the other coils. These variations would cause the dial calibration to be inaccurate on band F.

Capacitor C1, which is one section of the tuning capacitor, is connected across coil F to complete the tuned circuit for band F. Section BF of Band switch S2 supplies B+ voltage to the plate of tube V1A when the switch is in position F. Capacitor C3 and resistor R1 supply bias voltage to the grid of tube V1A. The RF signal is coupled from the cathode of tube V1A through capacitor C4 to the grid of tube V2B.

AF OSCILLATOR

Tube V2A, which is connected as an AF oscillator, is tuned by transformer T2 and capacitor C15 to oscillate at a frequency of about 400 cps. The 400 cps audio signal is coupled from the plate of tube V2A through capacitor C17 and resistors R7 and R8 to the grid of tube V2B. This audio signal is also applied across control R4 and through capacitor C11 to the AF Output Connector.



BLOCK DIAGRAM

When switch S3 is in the External Modulation position, tube V2A is used to amplify the external modulation signal that is connected to the External Modulation In connector. This signal is coupled through capacitor C11 to control R4, and then to the grid of tube V2A. The signal is then amplified by tube V2A and coupled through capacitor C17 and resistors R7 and R8 to the grid of tube V2B.

AMPLIFIER AND MODULATOR

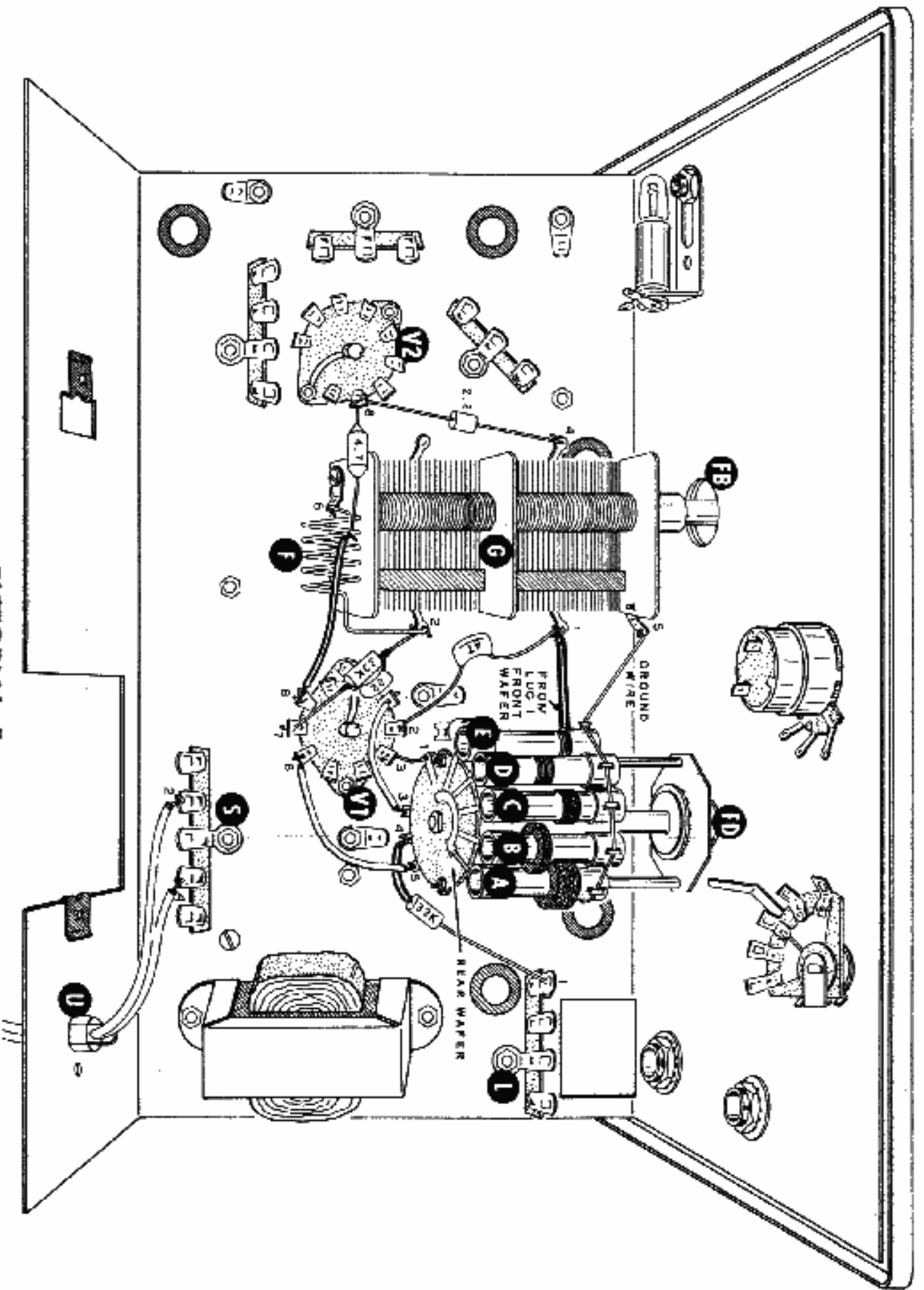
The RF and AF signals are coupled to the grid of tube V2B. Resistors R7 and R9 keep the AF signal from overdriving the grid of tube V2B and also determine the modulation level. From the plate of tube V2B, the modulated

RF signal is coupled through capacitor C20, Fine Attenuator control R12, Coarse Attenuator switch S4, and capacitor C22 to the RF Output connector.

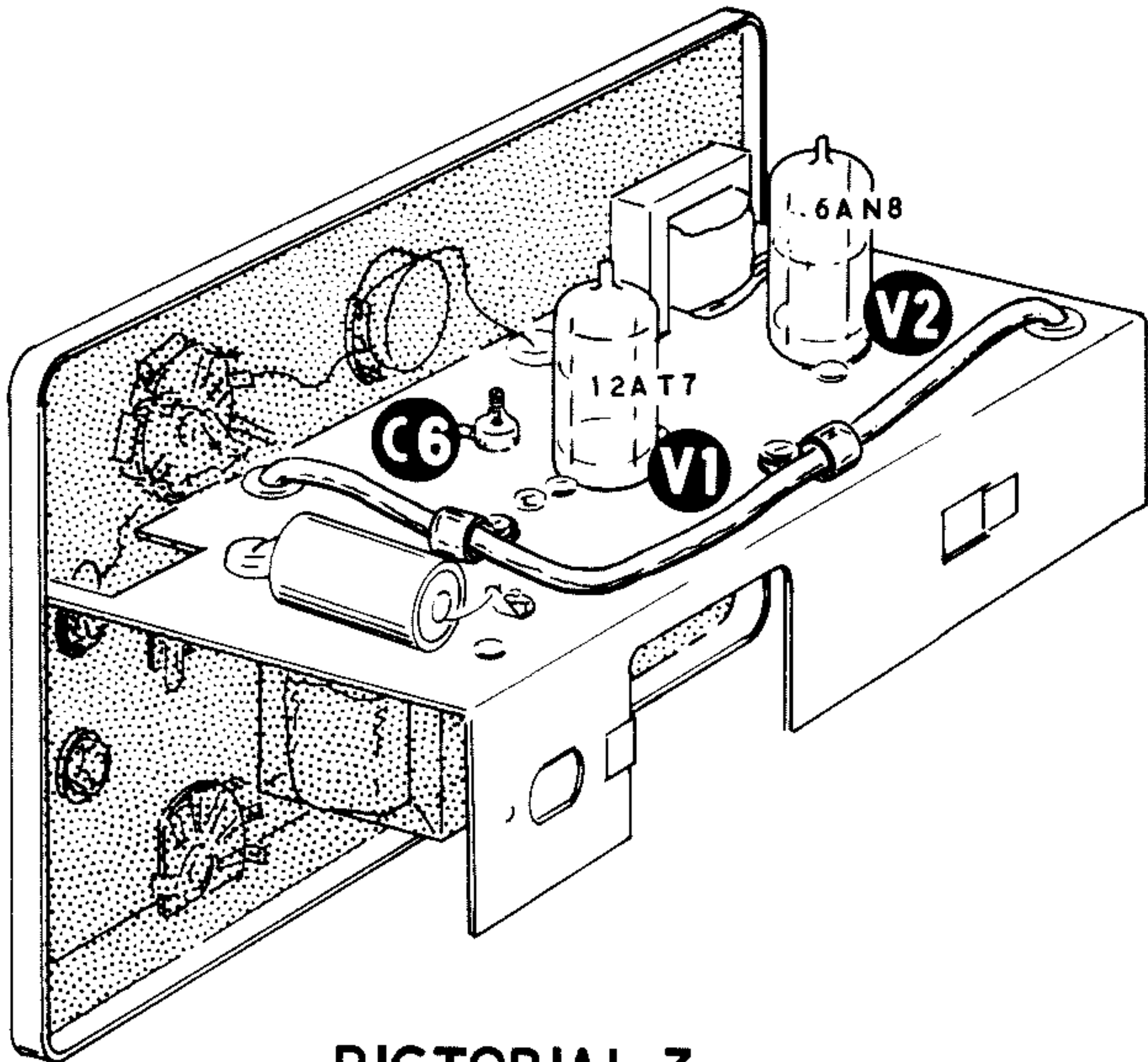
POWER SUPPLY

B+ voltage is supplied to all stages of the Generator by a half-wave rectifier circuit consisting of diode D1. Resistor R17 with capacitors C25A and C25B provide filtering of the B voltage.

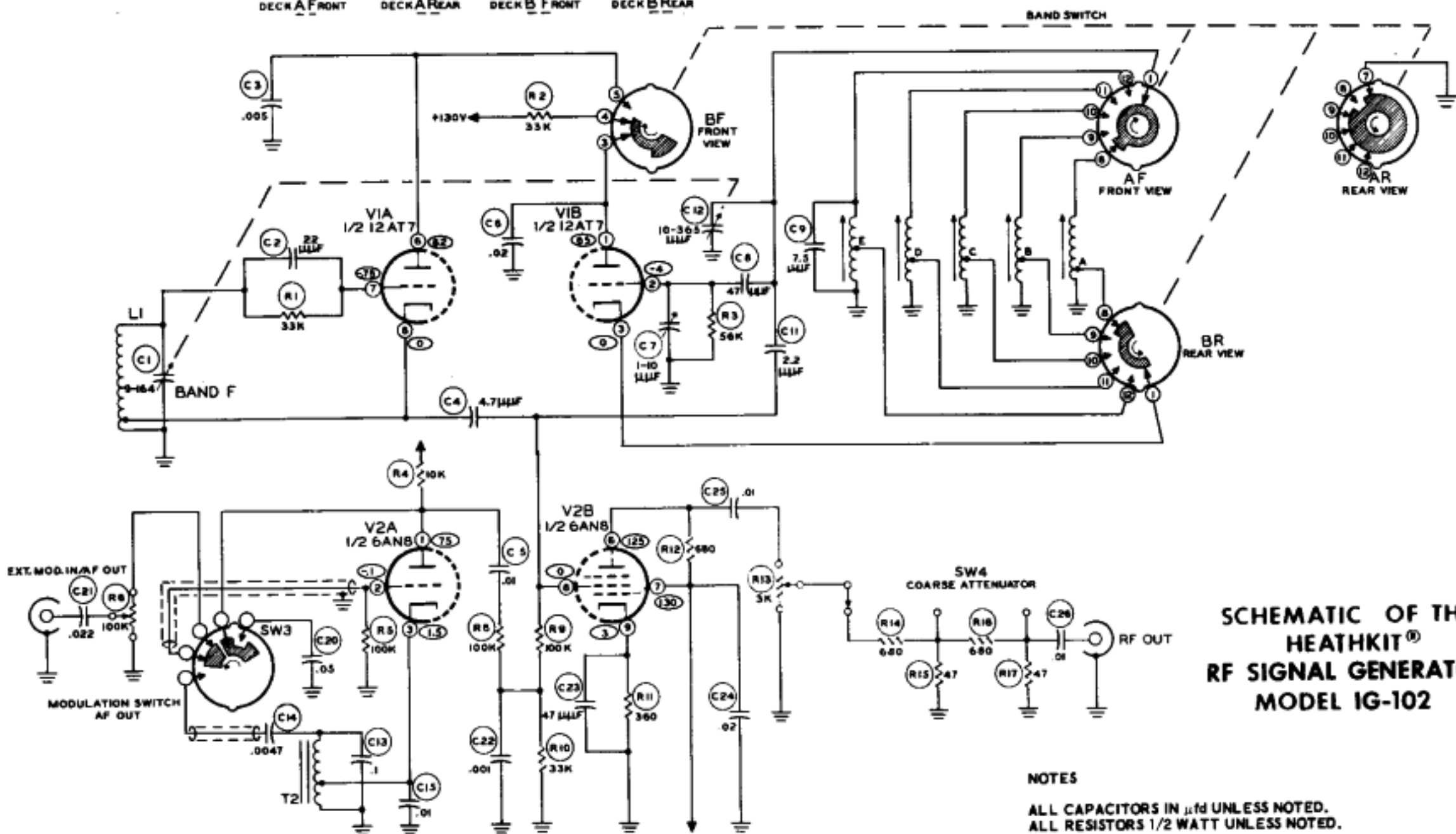
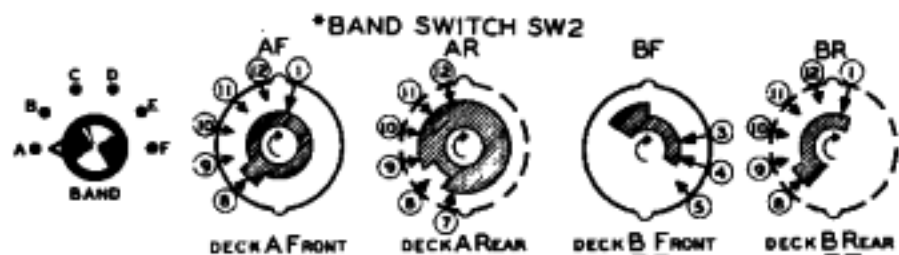
Filament voltage is supplied to the filaments of all tubes and the #47 lamp by a 6.3 volt AC winding on power transformer T1.



PICTORIAL 5



PICTORIAL 7



SCHEMATIC OF THE HEATHKIT[®] RF SIGNAL GENERATOR MODEL IG-102

NOTES

ALL CAPACITORS IN μfd UNLESS NOTED.
ALL RESISTORS 1/2 WATT UNLESS NOTED.

ALL SWITCHES SHOWN IN MAXIMUM COUNTERCLOCKWISE POSITION.
ALL VOLTAGES MEASURED FROM CHASSIS GROUND WITH HEATHKIT VTVM.
LINE VOLTAGE 117 V. VOLTAGES MAY VARY $\pm 10\%$.

TUNING CAPACITOR CLOSED.

* ALL SECTIONS SHOWN HERE (ONLY) AS VIEWED FROM THE FRONT PANEL; SWITCH SHOWN IN BAND A POSITION.

SWITCH LUGS WITH THE SAME NUMBERS ON DECKS AR AND AF ARE CONNECTED TOGETHER (12 TO 12, 11 TO 11, ETC.)

