CO-AN 08-30APT1-2

HANDBOOK OF MAINTENANCE INSTRUCTIONS

for

TRANSMITTING EQUIPMENT AN/APT-1

CONFIDENTIAL

Approved 30 MARCH 1944

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LIST OF REVISED PAGES ISSUED

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LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

Destruction of Abandoned Materiel in the Combat Zone

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:—

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever heavy object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.
5. Burying all debris or disposing of it in streams or other bodies of water, where possible and when time permits.

Procedure:—

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch- and instrument-boards.
3. Destroy all controls, switches, relays, connections, and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water-cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving, or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING!

★

Unsatisfactory Report

For U. S. Army Air Force Personnel:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, AAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of Army Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Airplane model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

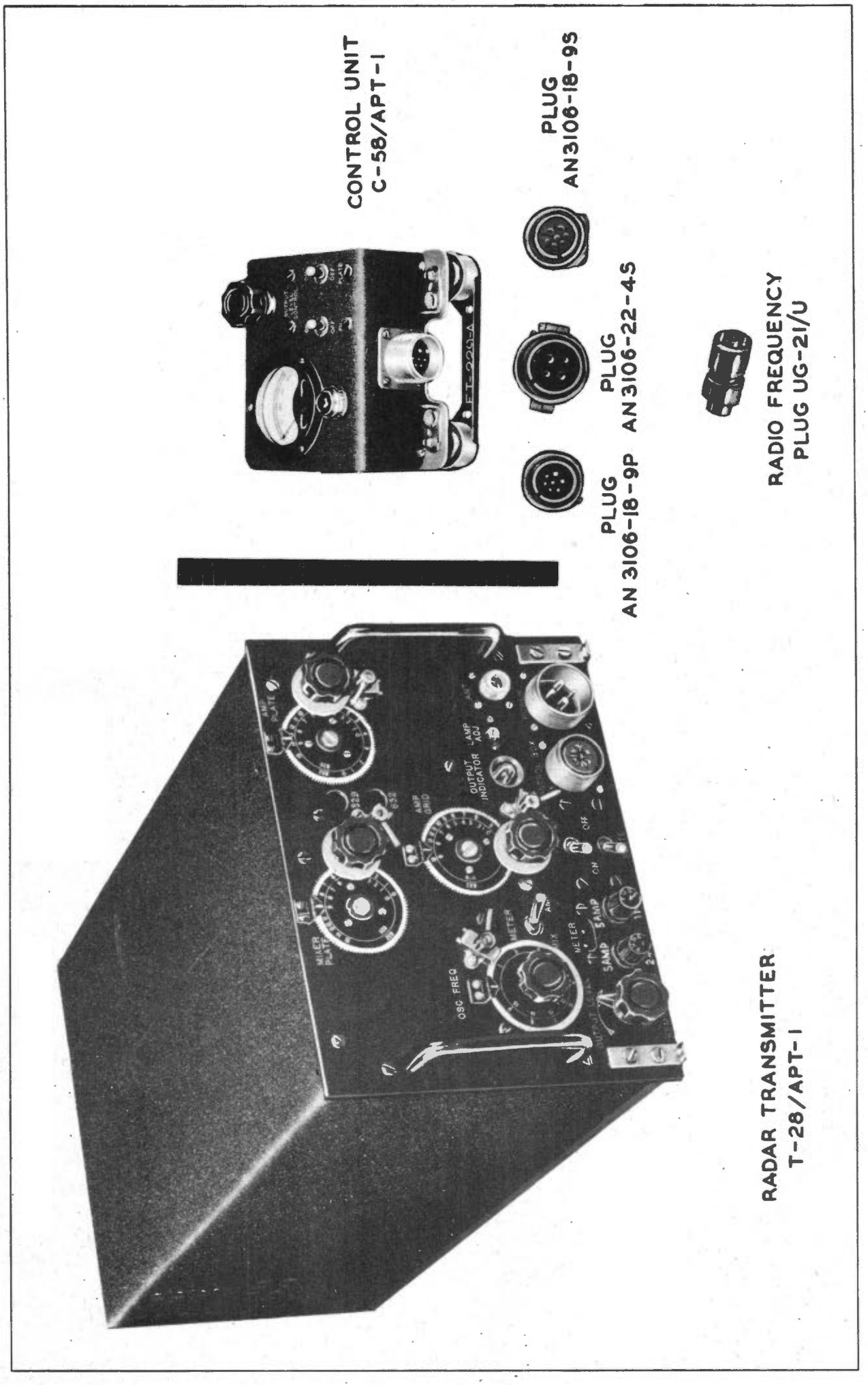
For U. S. Navy Personnel:

Report of failure of any part of this equipment during its guaranteed life shall be made on Form N. Aer. 4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. In addition to other distribution required, one copy shall be furnished to the inspector of Naval Materiel (location to be specified) and the Bureau of Ships. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Replacement needed (yes—no).
7. Remedy used or proposed to prevent recurrence.

For British Personnel:

Form 1022 procedure shall be used when reporting failure of radio equipment.



Frontispiece. Transmitting Equipment AN/APT-1—Components

SAFETY NOTICE

This equipment employs high voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

SECTION I
GENERAL DESCRIPTION

1. GENERAL.

(See frontispiece.)

a. Transmitting Equipment AN/APT-1 is an airborne jamming transmitter intended to confuse or obliterate the information which is normally given by enemy radar systems operating in the frequency range from 93 to 210 megacycles.

b. The equipment produces an ultra-high frequency jamming signal of approximately 5 megacycles width which can be set to any desired frequency in the 93 to 210 megacycles band.

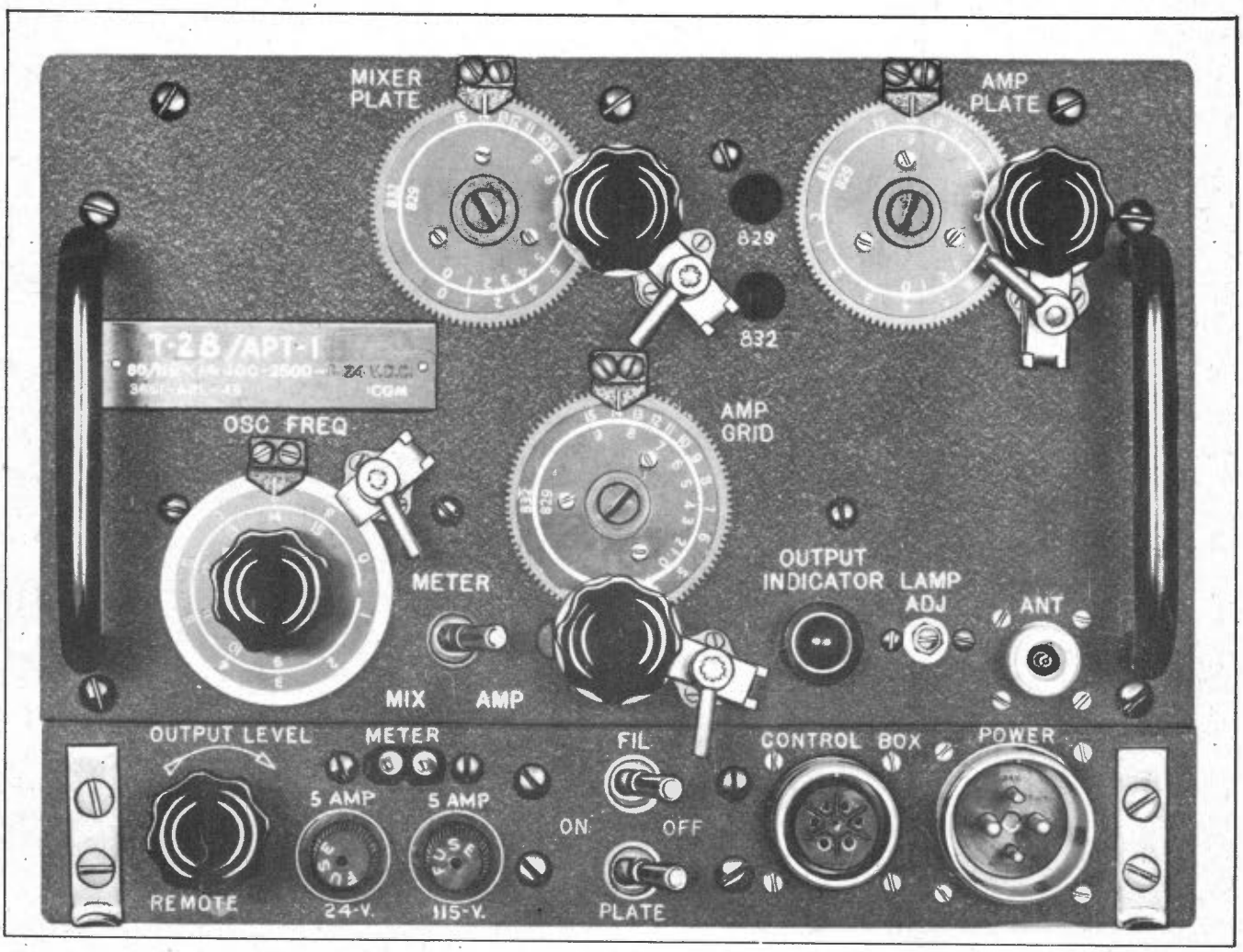


Figure 1-1. Radar Transmitter T-28/APT-1—Panel View

c. The equipment consists of the following units:

(1) Radar Transmitter T-28/APT-1 which produces the disturbance to jam enemy radar reception.

(2) Control Unit C-58/APT-1 which allows remote control operation.

(3) Three quarter-wave stub antennas of different lengths, only one of which is installed and used at one time.

2. COMPONENT PARTS.

a. EQUIPMENT SUPPLIED.—The following table lists components supplied with dimensions and weights. Total weight is 49.4 pounds.

Quan.	*Name of Unit*	*Dimensions (inches)*	*Weight (lbs.)*
1	Radar Transmitter T-28/APT-1	21 x 10½ x 7⅝	35
1	Mounting MT-23/A or Mounting Base MT-171/U	Size #1 ATR	2
1	Control Unit C-58/APT-1	5 x 3⅞ x 2	1.2
1	Mounting Base MT-114/APT-1	5⅝ x 1⅛	0.3
1	Antenna Stub AT-36/APT	Length 16½	10
1	Antenna Stub AT-37/APT	Length 22½	10
1	Antenna Stub AT-38/APT	Length 29	10
1*	Plug AN-3106-22-4S (PL-P230) or AN3108-22-4S (PL-Q230)	2⅛ x 1 19/32 diameter	0.5
1*	Plug AN3106-18-9P or AN3108-18-9P	2 x 1 5/16 diameter	0.5
1*	Plug AN3106-18-9S or AN3108-18-9S	2 x 1 5/16 diameter	0.5
2**	Radio Frequency Plug UG-21/U	1⅝ x ⅝ diameter	0.2
1	Tube JAN-829B (for optional use in power amplifier stage)		
2	Radio Frequency Adapter UG-27/U		0.2
2	Cable Adapter AN3057-10		
1	Cable Adapter AN3057-12		

* Plug AN3106-22-4S is a straight connector and plug AN3108-22-4S is a right-angle connector. Only the right-angle connector is referred to throughout the text, but either type may be used.

** These plugs have formerly been referred to as Navy Type C-49268 or simply Type N plugs.

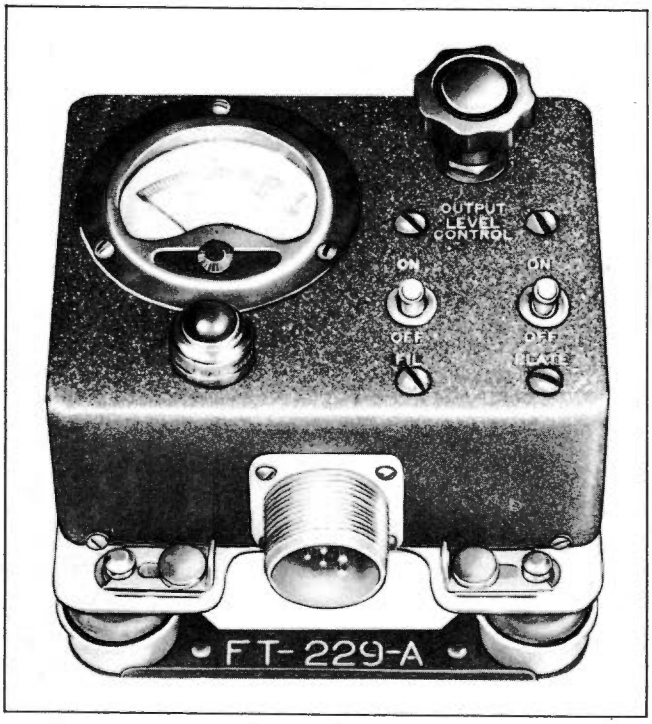


Figure 1-2. Control Unit C-58/APT-1—Exterior View

b. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

(1) The equipment required as part of the installation, but not supplied, includes power wiring, remote control unit wiring, and Radio Frequency Cable RG-8/U or RG-31/U [Cable WC-549-( )]. Most issues of Cable WC-549-( ) may be used. Desired lengths of this equipment will be determined at the time of installation.

(2) The special equipment required for tuning and for pre-flight tests is as follows:

Monitor BC-1255-A, Frequency Meter TS-174( )/U, or TS-175( )/U, General Radio 720A Frequency Meter, or equivalent.
Test Set I-139-A (Test Meter TS-60/U).
Headset HS-23.
Cord CD-307 or CD-307-A.
Amplifier Alignment Unit TS-92/AP.

3. DESCRIPTION OF COMPONENTS.

a. RADAR TRANSMITTER T-28/APT-1.—This is an unconventional transmitter with a special kind of hash modulation. It is housed in a size B1-D standard aircraft radio case as shown in frontispiece. All controls and receptacles are located on the front panel. Mounting MT-23/A or Mounting Base MT-171/U is provided for its installation.

b. CONTROL UNIT C-58/APT-1.—This unit is a remote control device designed to enable the transmitter to be turned on and off and controlled from a remote point. Mounting MT-114/APT-1 is provided for its installation. (See fig. 1-2.)

c. ANTENNAS.—Three antenna stubs are supplied which are similar to each other but of different lengths. Antenna Stub AT-36/APT, length 16½ inches, is for the 150- to 210-megacycle band. Antenna Stub AT-37/APT, length 22½ inches, is for the 115- to 150-megacycle band. Antenna Stub AT-38/APT, length 29 inches, is for the 93- to 115-megacycle band. Only one antenna is installed, depending upon the frequency to be jammed. Each antenna stub is a quarter-wave antenna, copper-plated on an impregnated maple base. It is fed through a 50-ohm coaxial cable from the transmitter.

4. TUBE COMPLEMENT.

(See fig. 1-3.)

Quantity	*Type Designation*	*Function*
1	JAN-931A	Hash generator
3	JAN-6AC7 (VT-112)	Hash amplifier
1	JAN-6V6GT/G (VT-107A)	Hash amplifier
2	JAN-6C4	Oscillator
1	JAN-832 (VT-118) or JAN-832A (VT-286)	Mixer
1	JAN-832 (VT-118) or JAN-832A (VT-286) or JAN-829B or JAN-829 (VT-259)	Power amplifier
2	JAN-5R4GY	Rectifier
1	JAN-6X5GT/G (VT-126B)	Rectifier

5. POWER REQUIREMENTS.

Transmitting Equipment AN/APT-1 requires two power sources as follows:

a. Alternating current requires 80 or 115 volts, 400 to 2600 cycles per second.

b. Direct current requires 24 volts.

NOTE

The a-c power required at 115 volts and 400 to 2600 cycles per second is 300 watts at 0.80 power factor. One ampere is required from the d-c source.

6. POWER OUTPUT.

a. When tube JAN-832 is installed in the power amplifier stage, the r-f power output varies with frequency from 13 watts at 93 megacycles to 6 watts at 210 megacycles.

b. When the optional tube JAN-829B is installed in the power amplifier stage, the r-f power output varies with frequency from 28 watts at 93 megacycles to 16 watts at 162 megacycles. The maximum frequency at which this tube should be used is 162 megacycles. The a-c input will be increased to about 310 watts.

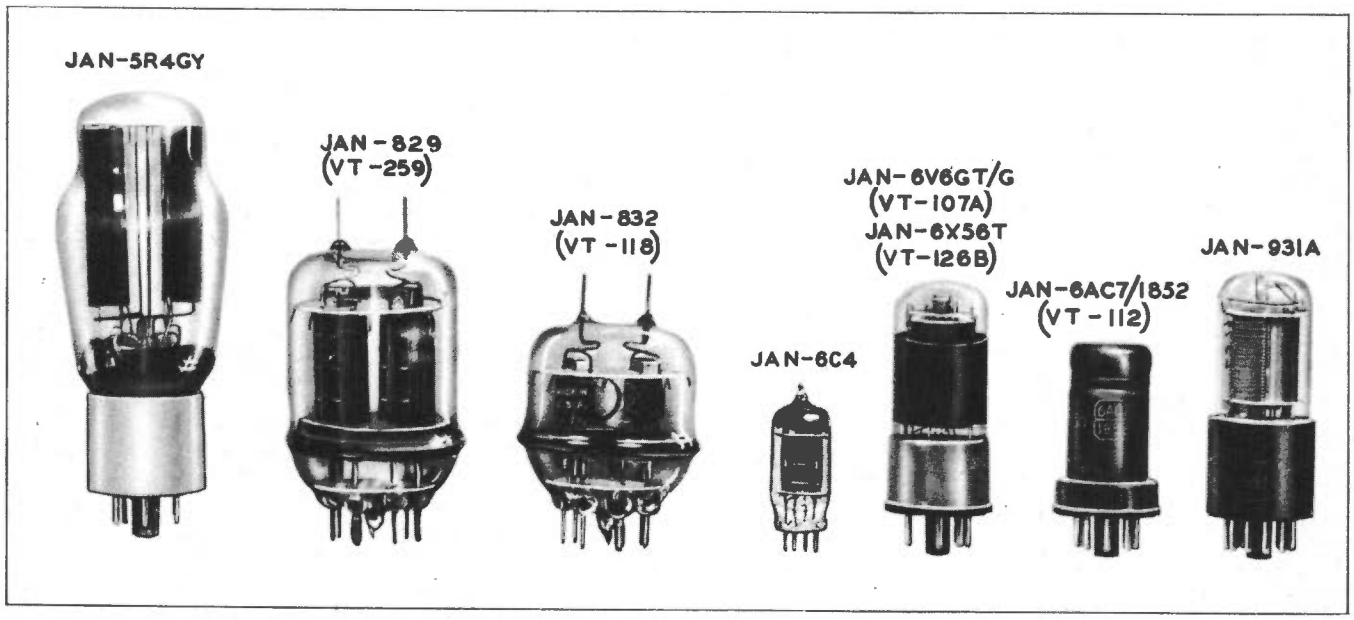


Figure 1-3. Radar Transmitter T-28/APT-1—Tube Complement

SECTION II
INSTALLATION AND ADJUSTMENT

1. INSTALLATION.

a. ANTENNAS.

(1) Choose the antenna stub according to the radar frequency to be jammed as follows:

(a) 93 to 115 megacycles, use Antenna Stub AT-38/APT.

(b) 115 to 150 megacycles, use Antenna Stub AT-37/APT.

(c) 150 to 210 megacycles, use Antenna Stub AT-36/APT.

(2) Consider the following factors when choosing a location for the antenna:

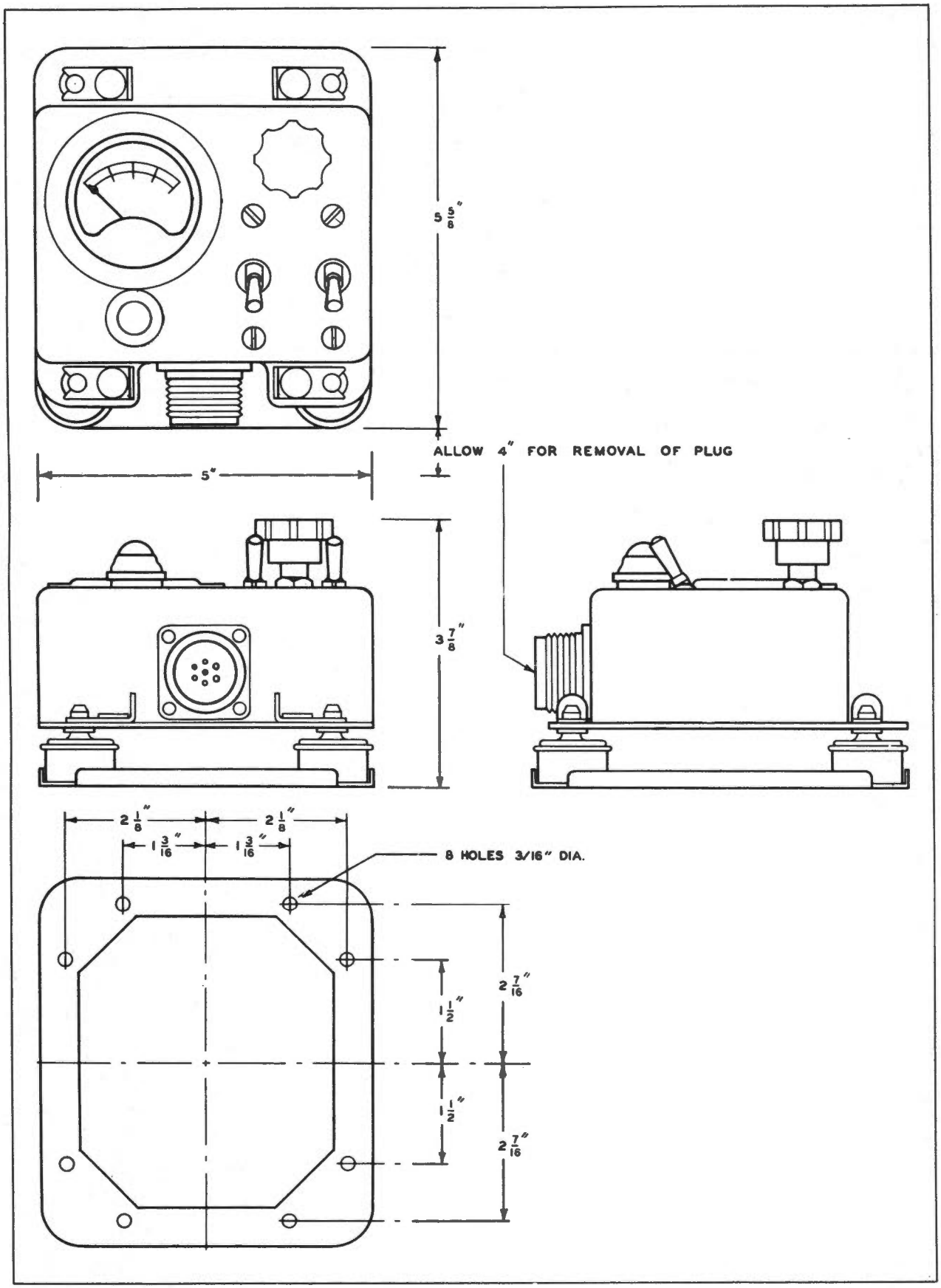


Figure 2-2. Control Unit C-58/APT-1—Outline Dimensions

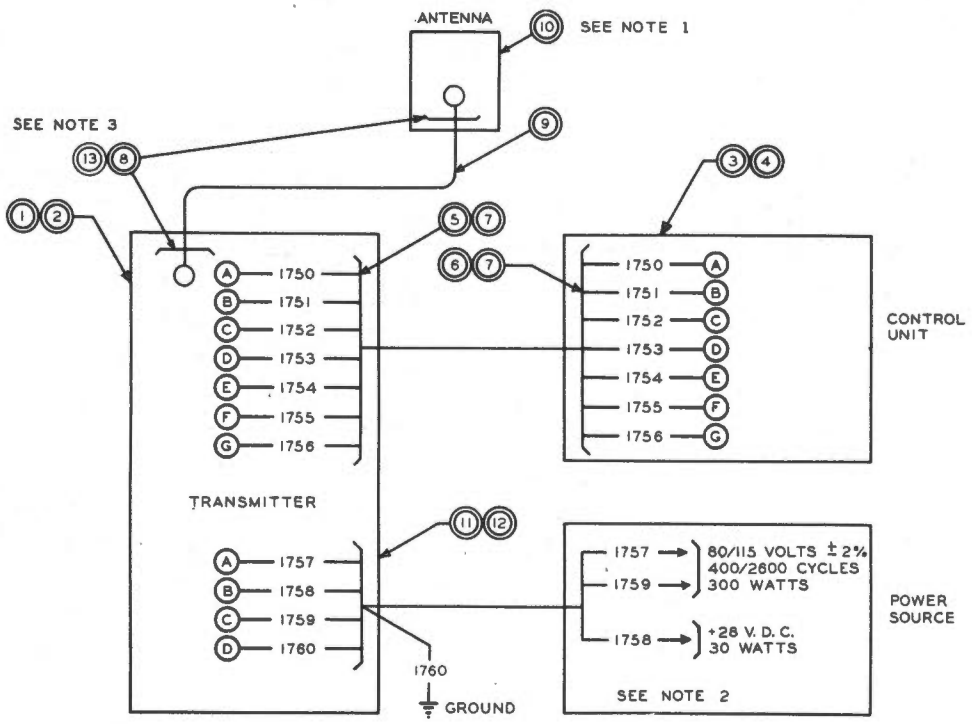
WIRE TABLE

WIRE	SIZE	REMARKS
1750	AN-22	
1751	AN-18	
1752	AN-22	
1753	AN-22	
1754	AN-18	
1755	AN-22	
1756	AN-18	
1757	AN-18	
1758	AN-18	
1759	AN-18	
1760	AN-18	

WIRE IS AIRCRAFT CABLE PER SPEC. AN-J-C-48 UNLESS OTHERWISE SPECIFIED.

	ITEM	EQUIPMENT	NO. REQ'D	NOMENCLATURE
*	1	RADAR TRANSMITTER	1	T-28/APT-1
*	2	MOUNTING BASE	1	MT-23/A OR MT-171/U
*	3	CONTROL UNIT	1	C-58/APT-1
*	4	MOUNTING BASE	1	MT-114/APT-1
*	5	PLUG	1	AN 3108-18-9P
*	6	PLUG	1	AN 3108-18-9S
*	7	ADAPTER (CABLE CLAMP)	2	AN 3057-10
*	8	RADIO FREQUENCY PLUG	2	UG-21/U
*	9	RADIO FREQUENCY CABLE	AS REQ'D	RG-8/U (OR) RG-31/U
*	10	ANTENNA	3	SEE NOTE 1
*	11	PLUG	1	AN 3108-22-4S
*	12	ADAPTER (CABLE CLAMP)	1	AN 3057-12
*	13	RADIO FREQUENCY ADAPTER	2	UG-27/U

* INDICATES GOVERNMENT FURNISHED EQUIPMENT



WT. OF TRANSMITTER & SHOCK MTG. 45 POUNDS
WT. OF CONTROL UNIT & MTG. BASE 1.75 POUNDS
DIMENSIONS: (HEIGHT INCLUDES SHOCK MOUNTS.)

ITEM (1) 1 ATR. $10\frac{1}{4}$ W X 9.25 H X $19\frac{1}{2}$ D

ITEM (3) 4 W X 6 L X 3D

NOTES-1:
ANTENNA STUB AT-36/APT, AT-37/APT, OR AT-38/APT

2:
ONE (1) VOLT DROP IS ALLOWED BETWEEN POWER SOURCE AND EQUIPMENT PER SPEC. 32310-B. OHMS PER FOOT FOR SIZE AN-18 WIRE IS .008

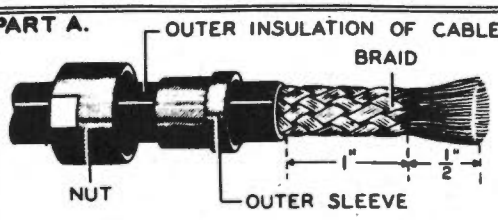
3:
USE RADIO FREQUENCY ADAPTER UG-27/U ONLY WHEN NECESSARY

Figure 2-3. Cabling Diagram

INSTALLATION INSTRUCTIONS
RADIO FREQUENCY PLUG UG-21/U *

NOTE:- THESE PLUGS WILL CAUSE A MIS-MATCH OF IMPEDANCE IN THE CIRCUIT UNLESS THE INSTRUCTIONS GIVEN BELOW ARE FOLLOWED EXACTLY. EXTREME CARE MUST BE TAKEN IN CUTTING THE CABLE INSULATION SO THAT NO AIR GAPS EXIST BETWEEN THE INSULATION OF THE CABLE AND THE PLUG.

PART A.

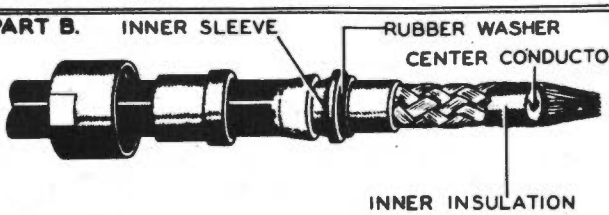


STEP 1. SLIDE NUT AND OUTER SLEEVE OVER CABLE.

STEP 2. CUT OFF OUTER INSULATION 1½ INCHES FROM END OF CABLE.

STEP 3. FAN SHIELD BRAID ½ INCH IN FROM THE END.

PART B.



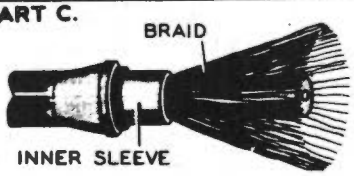
STEP 4. CUT INNER INSULATION AND CENTER CONDUCTOR 1/2 INCH IN FROM END OF BRAID.

STEP 5. TWIST FANNED END OF BRAID.

STEP 6. SLIDE INNER SLEEVE OVER BRAID AND UNDER OUTER INSULATION.

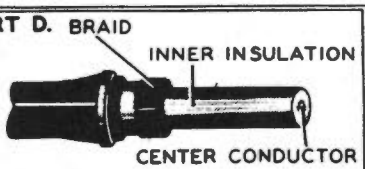
STEP 7. CHECK TO BE SURE RUBBER WASHER IS ON INNER SLEEVE.

PART C.



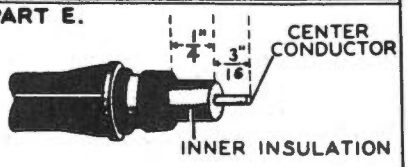
STEP 8. SEPARATE AND FAN THE BRAID BACK TO END OF INNER SLEEVE.

PART D.



STEP 9. FOLD BRAID BACK OVER SLEEVE AND TRIM AS SHOWN.

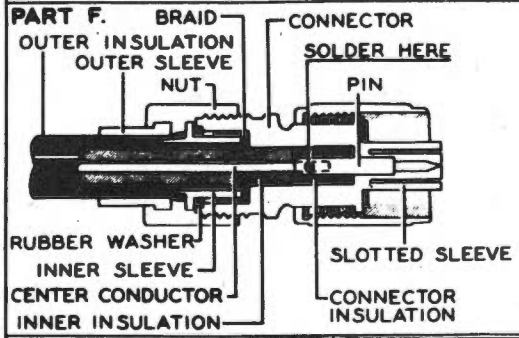
PART E.



STEP 10. CUT INNER INSULATION AND CENTER CONDUCTOR EXACTLY TO DIMENSIONS SHOWN. BE SURE INSULATION IS CUT EVENLY AND AT A 90° ANGLE TO CENTER CONDUCTOR.

STEP 11. TIN CENTER CONDUCTOR

PART F.

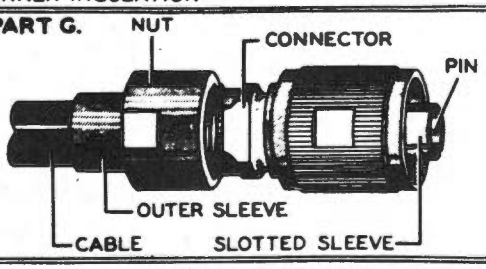


STEP 12. REMOVE PIN FROM CONNECTOR AND FIT OVER CENTER CONDUCTOR. SOLDER THROUGH HOLES IN THE SIDE. REMOVE ALL SOLDER FROM EXTERIOR OF PIN.

STEP 13. FORM BRAID BY FORCING INTO CONNECTOR.

STEP 14. ASSEMBLE PIN IN PLUG TO CHECK POSITION. THE TIP OF THE PIN SHOULD BE FLUSH WITH SLOTTED SLEEVE. OF CONNECTOR. SEE PART G.

PART G.



STEP 15. SLIDE CABLE INTO CONNECTOR AND TIGHTEN NUT WITH A WRENCH.

NOTE:- CONNECTOR MUST NOT BE ALLOWED TO TURN WHEN NUT IS TIGHTENED.

NOTE:- PLUG AND JACK ARE PUT ON CABLE IN THE SAME MANNER.

* FORMERLY REFERRED TO AS NAVY TYPE C-49268 OR SIMPLY TYPE N PLUG.

Figure 2-4. Radio Frequency Plug UG-21/U—Installation Instructions

obstructed. It should not be closer than two inches to the fuselage.

(e) The front panel of the transmitter, when mounted, must be accessible.

(f) If possible it should be within sight of the control unit.

(g) The transmitter may be quickly removed from the mounting.

(2) Secure the transmitter to its mounting.

(a) Make sure the two pins at the rear of the mounting enter the chassis through holes in the transmitter housing.

(b) Tighten the two knurled thumb nuts at each side of the mounting over the lugs mounted on the front panel.

c. CONTROL UNIT C-58/APT-1.

(1) Fasten Mounting MT-114/APT-1 within the plane so that:

(a) The front panel of the control box, when mounted, will be readily accessible and in a convenient position.

(b) The controls will be within reach of the pilot or radio operator.

(c) There is sufficient light to read the meter.

(2) Secure the control unit to Mounting MT-114/APT-1 by means of the snapslides provided.

d. CABLES AND WIRING.

(1) ANTENNA CABLE.

(a) Cut Radio Frequency Cable RG-8/U to a length (not greater than 30 feet) which will reach from the antenna to the transmitter and attach Radio Frequency Plug UG-21/U to each end of the cable. (See figs. 2-3 and 2-4.)

(b) Connect one end of the cable to the "ANT" socket on the transmitter and the other end to the antenna as shown in figure 2-5.

(2) POWER WIRES.

CAUTION

Be sure that the "FIL" and "PLATE" switches on both transmitter and remote control unit are in the "OFF" positions.

(a) Cut wires to the proper lengths to reach from the source of power to the transmitter and attach plug AN3108-22-4S to one end of the wire. (See fig. 2-3.)

(b) Connect plug AN3108-22-4S to the "POWER" socket on the transmitter and the other end of the wires to the source of power as shown in figure 2-5.

(3) CONTROL BOX WIRES.

(a) Cut wires to the proper lengths to reach from the transmitter to the control unit and attach plug AN3108-18-9P to one end and plug AN3108-18-9S to the other end. (See fig. 2-3.)

(b) Connect plug AN3108-18-9P to the "CONTROL BOX" socket on the transmitter and plug AN3108-18-9S to the socket on the control unit. (See fig. 2-5.)

2. GENERAL PRECAUTIONS.

a. Do not operate the equipment longer than necessary to accomplish a specific purpose. This precaution is necessary to keep the enemy from locating the equipment and to avoid jamming friendly radar systems.

b. Careless tuning procedures may cause burn-out of the "OUTPUT INDICATOR" pilot lamp.

c. Manipulation of the tuning dials with no regard to the tuning procedure may cause serious damage to the

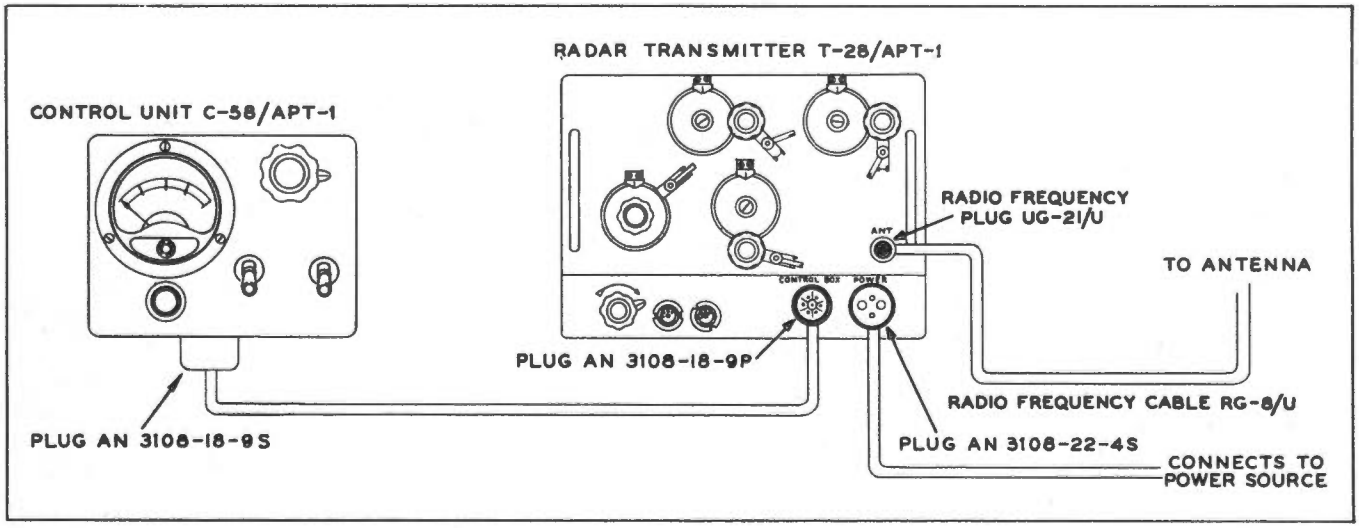


Figure 2-5. Cording Diagram

Figure 2-6. Test Set I-139-A—External View

power amplifier tube. Do not turn on the transmitter unless all dials are set to same number.

d. Do not operate the transmitter with the dust cover removed. Stray light striking the JAN-931A phototube will cause the "OUTPUT LEVEL" control to be ineffectual.

e. To stop the operation of the equipment, it is necessary that the power switches on both the transmitter and the control unit be turned to the "OFF" position.

f. Do not alter the setting of any of the controls except as specifically directed in this handbook. The hash amplifier is correctly aligned by the manufacturer and should require no further adjustment. Necessary adjustments to any components of the transmitter are to be made specifically according to instructions given in this handbook.

g. Do not operate the transmitter unless all tubes are in place and securely held.

3. PREPARATION FOR USE.

a. EQUIPMENT REQUIRED.

(1) Test Set I-139-A (Test Meter TS-60/U) (See fig. 2-6).

(2) Monitor BC-1255-A (See fig. 2-8), Frequency Meter TS-174( )/U or TS-175( )/U, or equivalent.

(3) Headset HS-23.

(4) Cord CD-307 or CD-307-A.

(5) 18-inch length of flexible wire about size No. 18, bare or insulated.

(6) 24-inch length of stiff wire.

b. PRELIMINARY INSPECTION.

(1) Withdraw the transmitter from its dust cover according to the following instructions:

(a) Loosen the two hold-down thumb screws at each side of the front which hold the transmitter to the mounting.

(b) Remove the two screws in the top just behind the panel.

(c) Loosen the two screws at the rear.

(d) Withdraw the transmitter from the dust cover using the handles on the front panel.

(2) Check that the transformer taps correspond

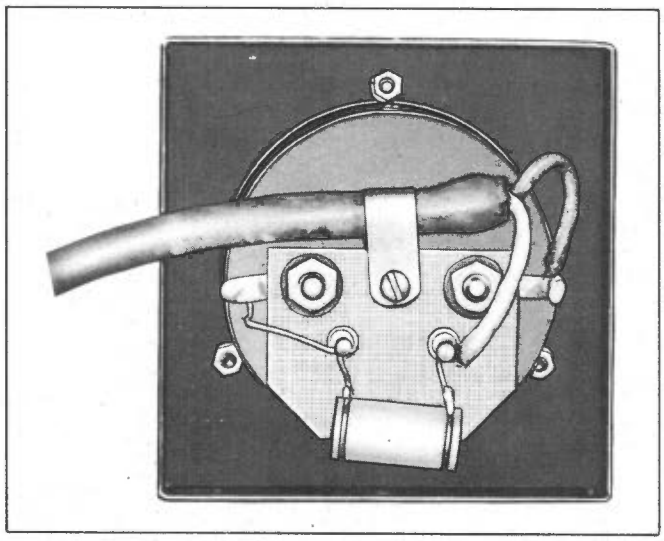


Figure 2-7. Test Set I-139-A—Rear View

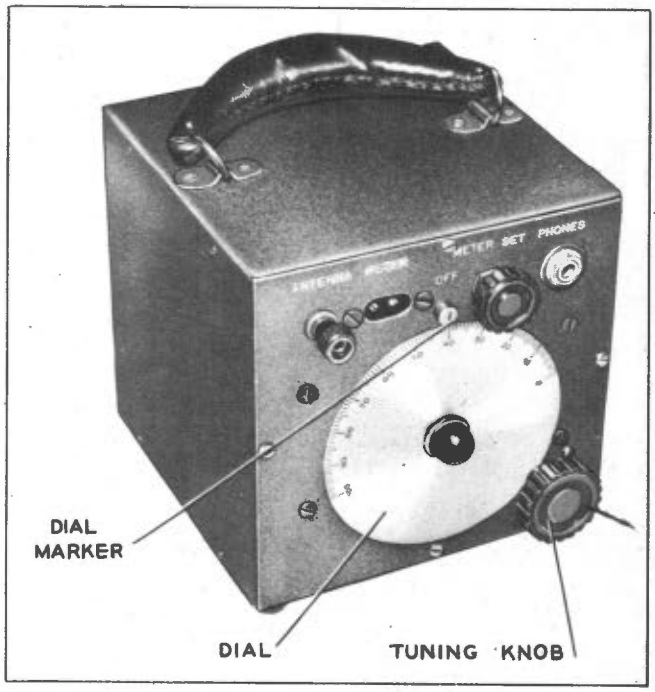


Figure 2-8. Monitor BC-1255-A—External View

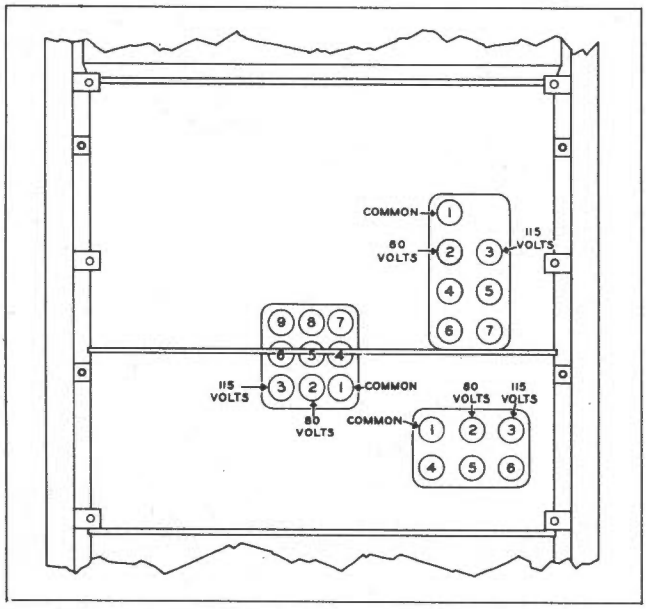


Figure 2-9. Radar Transmitter T-28/APT-1, 80- and 115-Volt Primary Taps on Power Transformers

to the applied voltage from the a-c power source. (See fig. 2-9.)

(3) See that all vacuum tubes and pilot lamps are in place.

(4) Note what tube is in the final amplifier position (JAN-832 or JAN-829B) and see that the 832-829 switch is in the corresponding position. (See fig. 2-10.)

(5) Make sure that two Buss type 4AB5, 5-ampere spare fuses are mounted on the back of the front panel.

(6) Replace the transmitter in its dust cover and make secure to the mounting.

(7) Make certain that the following components on the front panel of the transmitter are in place and securely held:

(a) Power plug AN3106-22-4S.

(b) Control Unit plug AN3106-18-9P.

(c) Antenna Radio Frequency Plug UG-21/U.

(d) "5 AMP, 115 V." fuse and "5 AMP, 24 V." fuse.

(e) "OUTPUT INDICATOR" pilot light.

(8) See that the antenna, its wiring, and plugs are in place and securely held.

(9) See that the control unit is secure in its mounting and that plug AN3106-18-9S is tight.

(10) See that there are no objects near the transmitter case which might obstruct the air flowing through the ventilating louvers.

(11) Check that the a-c and d-c power sources are operative.

NOTE

This equipment is fairly sensitive to changes in its supply voltage. When tuning adjustments are made on the ground before flight, the input voltage conditions should be about the same as those encountered in flight. Failure to take this precaution may result in decreased power output and change in frequency. In making the tuning adjustments on the ground, the gas-engine driven generator should be adjusted to give the same voltage as the normal airplane bus voltage in flight. It may be necessary to set the voltage selector switch of the inverter in the "HIGH" position to obtain the desired inverter output voltage. These voltage measurements should be made under the same load that will be connected while in flight. voltmeters of 2 percent accuracy or better should be used when measuring this voltage.

(12) Prepare Monitor BC-1255-A as follows:

(a) Check the condition of the batteries, in Monitor BC-1255-A by plugging Test Set I-139-A into the "METER" jack and turning the "METER SET" knob fully clockwise. The meter should indicate at least half-scale. If it is not possible to obtain this indication, replace the batteries. (Refer to sec. V, par. 9*b*.)

NOTE

Do not use any signal input for this check.

(b) Plug Headset HS-23 into the "PHONES" jack.

(c) Connect a 12-inch piece of flexible wire to the "ANTENNA" post.

CAUTION

Do not turn the monitor on except when checking or testing.

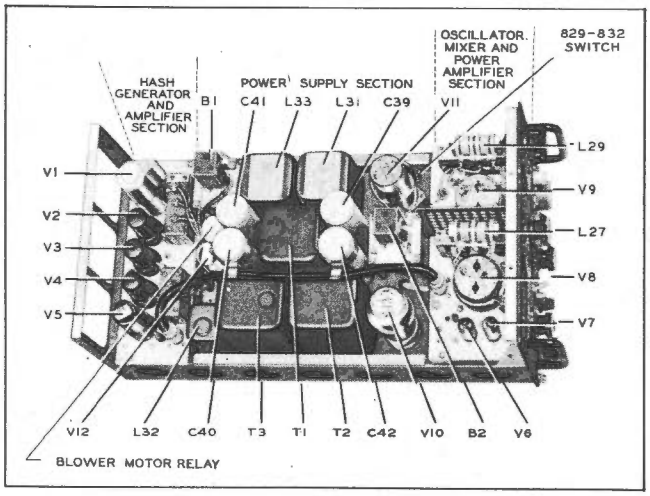


Figure 2-10. Radar Transmitter T-28/APT-1 —Top View with Dust Cover Removed

c. TUNING PROCEDURE.—Follow the procedure below whenever the transmitter is to be tuned to a desired frequency.

(1) If a remote control unit is installed, make sure that the "FIL" and "PLATE" switches on that unit are turned to the "OFF" positions.

(2) Plug Test Set I-139-A into the "METER" jack on the transmitter panel.

(3) Turn on the "FIL" switch on the transmitter panel and allow the set to operate for a warm-up period of at least two minutes.

(4) Set the "METER" switch to the "MIX" position.

(5) Determine from responsible authority the radar frequency which is to be jammed.

(6) Set the "OSC FREQ" dial, the "MIXER PLATE" dial, the "AMP GRID" dial, and the "AMP PLATE" dial at the numbers indicated in the frequency calibration table for the selected frequency to be jammed. (See table below in *(c)* of this paragraph.)

(a) The "OSC FREQ" dial has two scales. If the number to which the dial is to be set occurs on both scales, it is immaterial which scale is used.

(b) The "MIXER PLATE", the "AMP GRID", and the "AMP PLATE" dials each have two calibration scales. The correct scale to use depends upon what type of tube has been installed in the power amplifier stage. Use the inner scale (829) when a JAN-829B tube is installed, and the outer scale (832) when a JAN-832 tube is installed.

(c) To determine which tube has been installed, look through the holes (labelled 829 and 832) provided in the front panel. If the top of a tube can be seen at eye level through the 829 hole, a JAN-829B tube has been installed. If a tube cannot be seen through the 829 hole and the top of a tube is visible at eye level through the 832 hole, a JAN-832 tube has been installed. JAN-832 tube is shorter than the JAN-829B tube and can be seen only through the lower hole.

FREQUENCY CALIBRATION TABLE FOR RADAR TRANSMITTER T-28/APT-1

Approximate Output Frequency Desired *Megacycles*	"OSC FREQ," "MIXER PLATE," "AMP GRID," "AMP PLATE" *Dial Settings*
93	0
98	1
102	2
106	3
110	4
118	5
126	6
140	7
150	8
166	9
170	10
178	11
186	12
200	13
210	14

NOTE

Setting of the dials to the numbers given in the preceding table is only approximate but is a step preliminary to the accurate tuning procedures. This is necessary in order to avoid any possibility of tuning the power amplifier to the oscillator frequency. The signal at the oscillator frequency is very much stronger than the sideband signals and if the power amplifier is left tuned to this signal for longer than three minutes the power amplifier tube will require replacement.

(7) Unlock the "OUTPUT LEVEL" control knob and turn in the counterclockwise direction until a slight opposition is felt as the knob starts to operate an incorporated switch. Make sure the switch is not operated.

(8) Turn the "PLATE" switch located on the transmitter panel to the "ON" position. Listen for operation of the fan motors.

(9) The meter on Test Set I-139-A should now read between 0.40 and 0.70 milliamperes. If it does not the set is defective and should be repaired.

(10) Throw the "METER" switch to the "AMP" position.

(11) Turn the "OUTPUT LEVEL" knob clockwise until an indication is obtained on the test meter. The actual indication obtained is not important except that it should not exceed 0.40 ma on the test set at this point in the procedure. If it is not possible to obtain any reading, set the "OUTPUT LEVEL" knob at about half setting and proceed anyway with the following adjustments in an attempt to obtain a reading.

(12) Simultaneously adjust the "MIXER PLATE" and the "AMP GRID" dials, rocking them back and forth slightly (not more than three divisions in either direction) until the test set meter shows maximum indication. Do not exceed 0.5 ma for JAN-832 (1.0 ma for JAN-829B). If necessary reduce the setting of the "OUTPUT LEVEL" knob (counterclockwise) to cause the maximum indication to occur below these limits.

(13) Readjust the "AMP PLATE" dial to the center of the band of frequencies present in the output circuit. It is recommended that this be done by observing the range of tuning of this control over which the "OUTPUT INDICATOR" gives indication of output and setting the control at the center of this range. From 93 to about 150 megacycles, two peaks may be observed in the brightness of the lamp as the "AMP PLATE" control is tuned back and forth. In this case, tune to a point half-way between the two peaks. If only one peak is observed, tune for maximum brilliance of the "OUTPUT INDICATOR." From about 150 to 210 megacycles, only one peak will be observed in most cases. In these cases, tune for maximum brilliance of the "OUTPUT INDICATOR."

NOTE

The brightness of the "OUTPUT INDICATOR" lamp depends on the output of the transmitter to the antenna. For any given output, its brightness may be adjusted by the "LAMP ADJ." screw. Normally the lamp should be adjusted to a low brilliancy; however, if the brilliancy is very low, it may be necessary to remove the lamp assembly cover to see if the lamp is lighted. The lamp may be easily burned out by large output unless the brilliancy is kept low.

(14) Readjust the "OUTPUT LEVEL" knob to obtain either a maximum brilliance on the "OUTPUT INDICATOR" or a reading of 0.5 ma for JAN-832 tube (1.0 ma for JAN-829B tube) on the test set meter whichever occurs first. If a reading above 0.30 ma cannot be obtained for JAN-832 tube (0.50 for JAN-829B tube), remove the unit for repair.

NOTE

The transmitter is now set only to the approximate frequency of the radar signal to be jammed. This is because the initial "OSC FREQ" dial setting was only approximate. The following instructions are for setting the jammer accurately to the radar frequency.

(15) Place Monitor BC-1255-A, or equivalent, inside the plane near the radar transmitter to be tuned.

(16) Turn on the monitor by rotating the "METER SET" control fully in clockwise direction and allow the equipment to warm up.

(17) Plug in Headset HS-23 into the "PHONES" jack on the monitor panel.

(18) Connect about 1½ feet of flexible wire to the "ANTENNA" post of the monitor. Wind three or four turns of this wire around the antenna cable of the transmitter (not more than 5 feet away from the "ANT" socket on the transmitter).

(19) Refer to the calibration chart supplied with the monitor and set the monitor dial to the desired frequency to be jammed. If the frequency to be jammed is above the range of the monitor calibration, set the monitor dial at one-half the frequency and increase the number of turns about the transmitter cable to about eight or ten.

NOTE

The frequency range of Monitor BC-1255-A does not cover the band between 146 and 150 megacycles. Consequently, if the frequency to which the transmitter is to be tuned lies between these limits, it will be necessary either to make an approximate setting, or to obtain Frequency Meter TS-174( )/U or TS-175( )/U if it is available, (or equivalent). This frequency meter covers the entire frequency range of Transmitting Equipment AN/APT-1.

(20) The following instructions explain how to tune the transmitter so that the center of the jamming signal will correspond with the monitor setting.

(21) Listen in the monitor headset. If a low rough hiss can be heard, it indicates that the signal is very nearly tuned to the desired frequency and only slight readjustments may be needed. Tune the monitor dial above and below the setting to see if the signal is equally distributed about the frequency to be jammed. The signal should be heard over a range of about 3 to 6 megacycles. If the signal is not equally distributed, note in what direction it must be shifted to bring about the desired condition and retune the transmitter according to the instructions given in (23) below so that the signal is shifted in the desired direction.

(22) If a low rough hiss cannot be heard at the monitor setting, tune the monitor dial until the signal is heard. Then by reference to the monitor calibration chart, determine the approximate frequency of the transmitter signal and retune the transmitter as instructed in paragraph (23) so that the signal is shifted toward the desired value.

(23) Turn the transmitter "OSC FREQ" dial to shift the signal frequency in the desired direction. Make this change slowly and carefully and in only a small amount (generally much less than one division). Readjust the transmitter "MIXER PLATE" and "AMP GRID" dials for maximum indication on the test set meter. Then readjust the transmitter "AMP PLATE" dial for maximum brilliance of the "OUTPUT INDICATOR". Recheck by listening to the monitor as in sub-paragraph (21) or (22) above. Repeat this process until the center of the signal coincides with the desired monitor dial setting.

CAUTION

Be very careful not to tune the mixer or power amplifier to the oscillator frequency, which is always about 30 megacycles away from the jamming signal frequency (above or below depending upon the signal frequency). This may be avoided by turning the dials only a small amount at a time and by keeping within the limits stated throughout the procedure.

(24) Readjust the "OUTPUT LEVEL" knob to obtain a maximum indication on the test set meter. This should fall within the limits of 0.30 ma to 0.50 ma for JAN-832 power amplifier tube (0.50 to 1.00 ma for JAN-829B Tube).

(25) Adjust for correct bandwidth using the monitor as follows:

(a) Detune the monitor 2 megacycles below the desired setting and check for sound of the low rough hiss. If the monitor has been set directly on the frequency to be jammed, 2 megacycles is represented by two divisions on the dial of Monitor BC-1255-A. If the monitor has been set to one-half the frequency of the

jamming signal, 2 megacycles are represented by one division on the dial.

(b) Detune the monitor to 2 megacycles above the desired setting and again check for low rough hiss. If the signal is not heard at either of these two points, readjust the "AMP PLATE" dial on the transmitter while repeating the detuning checks until the desired bandwidth is obtained.

(26) If Amplifier Alignment Unit TS-92/AP is available, it may be used instead of Monitor BC-1255-A in adjusting the bandwidth. (For more complete information on this unit, see section VI, this handbook, or the Handbook of Maintenance Instructions for the alignment unit.)

NOTE

The tests described in the two preceding sub-paragraphs check the bandwidth of the jamming signal. The bandwidth should be at least 4 megacycles or 2 megacycles each side of the center frequency. If this width cannot be obtained even after readjustment of the "AMP PLATE" dial, the transmitter may still be used for certain jamming operations such as spot jamming. This of course, depends upon tactical requirements and should be properly authorized. If the set is to be used for barrage jamming and the stated bandwidth cannot be obtained, the transmitter requires retuning or repairing.

(27) Lock securely the four transmitter tuning dials and the "OUTPUT LEVEL" knob.

(28) As a final overall check of the radiated signal, check the bandwidth according to the instructions given in section II, par. 4*d*.

4. PRE-FLIGHT TESTS.

NOTE

If the steps outlined in the preceding paragraph have just been completed satisfactorily, it will not be necessary to make the tests outlined in sub-paragraphs *a, b,* and *c* which follow. It is important, however, to check the bandwidth of the radiated signal from the antenna as described in sub-paragraph *d* below.

a. PLUG CHECK.—See that all connecting plugs are completely seated and that all locking rings are tightly screwed down.

b. CURRENT CHECK.—Check the mixer and amplifier plate currents on the remote control unit meter or on Test Set I-139-A.

(1) If it is desired to check the currents with the remote control unit meter, proceed as follows: (This is the recommended method since it checks the operation of the control unit as well as the transmitter.)

(a) See that "PLATE" and "FIL" switches on the transmitter panel are in the "OFF" position.

(b) Unlock the "OUTPUT LEVEL" knob located on the transmitter panel and turn fully counterclockwise until a click is heard as the incorporated switch is operated. This makes operation possible from the remote control unit.

(c) Turn the "FIL" switch located on the remote control unit to the "ON" position and allow about two minutes before proceeding.

(d) Throw the "PLATE" switch located on the remote control unit to the "ON" position.

(e) Throw the "METER" switch located on the transmitter panel to the "MIX" position. The meter on the remote control unit should read between 80 and 140 ma.

(f) Throw the "METER" switch located on the transmitter panel to the "AMP" position.

(g) If a JAN-832 power amplifier tube has been installed in the transmitter, the meter on the remote control unit should now read between 60 and 100 ma. If it does not, unlock the "OUTPUT LEVEL CONTROL" on the remote control unit and adjust until maximum indication is obtained, or until the meter reads 100 ma, whichever occurs first. Do not exceed 100 ma. If it is not possible to obtain an indication within the above limits, the equipment requires retuning or repairing.

NOTE

If it is not known whether a JAN-832 tube or a JAN-829B tube has been installed in the power amplifier stage, refer to directions in paragraph 3*c*(6)*(c)*, this section.

(h) If a JAN-829B power amplifier tube has been installed in the transmitter, the meter on the remote control unit should now read between 100 and 200 ma. If it does not, unlock the "OUTPUT LEVEL CONTROL" on the remote control unit and adjust until maximum indication is obtained or until the meter reads 200 ma, whichever occurs first. *Do not exceed 200 ma.* If it is not possible to obtain an indication within the above limits, the equipment requires retuning or repairing.

(2) If it is desired to check the currents with Test Set I-139-A proceed as follows: (This method is recommended only when Control Unit C-58/APT-1 is *not* used.)

(a) See that the "PLATE" and the "FIL" switches on the remote control unit are in the "OFF" position.

(b) Plug Test Set I-139-A into the "METER" jack on the transmitter panel.

(c) Turn the "FIL" switch located on the transmitter panel to the "ON" position and allow about two minutes before proceeding.

(d) Throw the "PLATE" switch located on the transmitter panel to the "ON" position.

(e) Throw the "METER" switch located on the transmitter panel to the "MIX" position. The test set meter should read between 0.40 and 0.70 ma.

(f) Throw the "METER" switch to the "AMP" position.

(g) If a JAN-832 power amplifier tube has been installed in the transmitter, the test set meter should read between 0.30 and 0.50 ma. If it does not, unlock the "OUTPUT LEVEL" knob located on the transmitter panel and adjust until maximum indication is obtained or until the meter reads 0.50 ma. whichever occurs first. *Do not exceed 0.50 ma.* If it is not possible to obtain an indication within the above limits, the equipment requires retuning or repairing.

(h) If a JAN-829B power amplifier tube has been installed in the transmitter, the test set meter should now read between 0.50 and 1.00 ma. If it does not, unlock the "OUTPUT LEVEL" knob located on the transmitter panel and adjust until maximum indication is obtained or until the meter reads 1.00 ma, whichever occurs first. *Do not exceed 1.00 ma.* If it is not possible to obtain an indication within the above limits, the equipment requires retuning or repairing.

(3) Securely lock all dials and knobs.

c. OUTPUT INDICATOR LAMP CHECK.

(1) With the equipment operating, see if the "OUTPUT INDICATOR" lamp is lighted. The lamp should be at low brilliancy. It may be necessary to remove the lamp assembly cover to see if the lamp is lighted.

(2) If the lamp is not lighted, turn the "LAMP ADJ" screw through its range to see if this is attenuating the brilliancy.

(3) If the lamp is still not lighted, it is burned out or the transmitter requires retuning or repairing.

d. BANDWIDTH CHECK.

(1) Obtain Monitor BC-1255-A and prepare it according to directions given in paragraph 3*b*(12) this section, or obtain Frequency Meter TS-174( )/U or TS-175( )/U, if available. (See sec. VI, this handbook.) General Radio 720A frequency meter may also be used.

NOTE

The following instructions apply specifically to the use of Monitor BC-1255-A*. If an equivalent monitor or frequency meter is used, the instructions will also apply if interpreted in a general manner, keeping in mind that panel markings, etc., will differ.

* Amplifier Alignment Unit TS-92/AP may also be used to check the bandwidth, if it is available. In this case, the following instructions do not apply and reference must be made to the handbook of maintenance instructions for the amplifier alignment unit, for information on the procedure to be followed.

(2) Place the monitor on the ground outside of the plane at a point about 15 feet from the antenna.

(3) Fasten a 2-foot length of stiff wire to the "ANTENNA" terminal of the monitor and arrange the wire so it is parallel to the transmitter antenna. Be sure there are no obstructions in the line of sight between the monitor antenna and transmitter antenna.

(4) Turn on the monitor by turning the "METER SET" knob in the clockwise direction and plug Headset HS-23 into the "PHONES" jack.

(5) Referring to the calibration table in paragraph 3*c*(6)*(c)*, this section, supplied with the monitor, set the monitor dial to the desired frequency to be jammed. If the frequency to be jammed is above the range of the monitor calibration, set the monitor dial at one-half the frequency. Listen for the sound of a low rough hiss.

NOTE

The frequency range of Monitor BC-1255-A does not cover the band between 146 and 150 megacycles. Consequently, if the bandwidth to be checked is in this range, only an approximate check can be made. Frequency Meter TS-174( )/U or TS-175( )/U covers the entire frequency range of Transmitting Equipment AN/APT-1 and should be used if available. Tune the monitor dial two megacycles below and then two megacycles above the frequency of the radar system to be jammed. Listen for the sound of a low rough hiss in each case. If the monitor has been set directly on the frequency to be jammed, two megacycles is represented by two divisions on the dial of Monitor BC-1255-A. If the monitor has been set on one-half the frequency, two megacycles are represented by one division on the dial.

(6) If the low rough hiss is heard in each of the two proceeding tests the transmitter has sufficient coverage for suitable jamming of the radar signal. If it is not heard, touch the monitor antenna with the bare hand to increase the pick-up and repeat the tests. If it still cannot be heard, then repairs or retuning of the transmitter are necessary.

NOTE

If the monitor can pick up any signal at 30 feet from the transmitter antenna, regardless of bandwidth, the equipment is operating in a fair manner and may be partially effective for emergency jamming.

(7) When the preceding tests are completed, see that the "FIL" and the "PLATE" switches on both the transmitter and the remote control unit are in the "OFF" position.

SPECIAL NOTICE

Operation from both remote and local positions is discussed in this section. Operation from the remote control unit is recommended whenever possible because the remote control unit meter can be used for making quick checks of the transmitter operation.

SECTION III
OPERATION

1. OPERATION FROM CONTROL UNIT C-58/APT-1

a. STARTING THE EQUIPMENT.

(1) Unlock the "OUTPUT LEVEL" control located on the transmitter panel and turn in a counterclockwise direction until a click is heard as the incorporated switch is operated. This puts the remote control unit into operation. Lock the control after this click is heard.

(2) Check that the "FIL" and "PLATE" switches located on the transmitter panel are in the "OFF" position and that the "METER" switch is in the "AMP" position.

(3) Throw the "FIL" switch on the control unit to the "ON" position. Allow about two minutes before proceeding.

(4) Throw the "PLATE" switch on the control unit to the "ON" position.

CAUTION

Do not throw the "PLATE" switch before the "FIL" switch has been thrown for two minutes.

b. OPERATION.

IMPORTANT

Do not alter the setting of any of the controls except as specifically directed in this handbook.

(1) The pilot lamp on the control unit is lighted whenever either "FIL" switch is in the "ON" position.

(2) If a tube can be seen at eye level through the 829B hole on the transmitter panel, unlock the "OUTPUT LEVEL CONTROL" on the control unit and turn until the control unit meter reads 200 ma or until a maximum indication is obtained, whichever occurs first. *Do not exceed 200 ma.* Lock the control when either reading is obtained. If a tube can be seen at eye level through the 832 hole and not the 829B hole, unlock the "OUTPUT LEVEL CONTROL" and turn until the meter reads 100 ma or until a maximum indication is obtained, whichever occurs first. *Do not exceed 100 ma.* Lock the control when either reading is obtained.

(3) Check the operation of the equipment by seeing if the "OUTPUT INDICATOR" lamp on the transmitter panel is lighted. The brilliancy of this lamp may be adjusted by the "LAMP ADJ" screw. It should be pre-adjusted to a low brilliancy. If the lamp brilliancy is turned very low or the exterior illumination is high, it may be necessary to remove the lamp assembly cover.

(4) Readjust the "OUTPUT LEVEL CONTROL" after 15 minutes of operation as in sub-paragraph (2) above.

(5) No other adjustments need be made during flight except in case emergency repairs are necessary.

c. STOPPING THE EQUIPMENT.

(1) REMOVAL OF SIGNAL DURING TACTICAL USE.—To remove the signal without shutting down the equipment, throw the "PLATE" switch on the control unit to the "OFF" position. Use this procedure only during the time the equipment is actually being used for tactical purposes. In restoring operation of the equipment by throwing "PLATE" switch to the "ON" position, proceed as follows:

(a) If a tube can be seen at eye level through the 829B hole in the transmitter panel, unlock the "OUTPUT LEVEL CONTROL" on the control unit and adjust for maximum indication on the control unit meter or until the meter reads 200 ma whichever occurs first. *Do not exceed 200 ma.* Lock the control when this reading has been obtained.

(b) If a tube can be seen at eye level through the 832 hole and not the 829B hole, unlock the "OUTPUT LEVEL CONTROL" and adjust for maximum indication on the meter or until the meter reads 100 ma. whichever occurs first. *Do not exceed 100 ma.* Lock the control when this reading has been obtained.

(c) Readjust after 15 minutes of operation.

(2) SHUTTING DOWN THE EQUIPMENT COMPLETELY.

(a) Throw the "PLATE" switch to the "OFF" position.

(b) Throw the "FIL" switch to the "OFF" position.

2. OPERATION FROM THE TRANSMITTER PANEL.

a. STARTING THE EQUIPMENT.

(1) Check that the "FIL" and the "PLATE" switches on the control unit are in the "OFF" position.

(2) Throw the "FIL" switch on the transmitter panel to the "ON" position. Allow two minutes before proceeding.

(3) Throw the "PLATE" switch on the transmitter panel to the "ON" position.

CAUTION

Do not throw the "PLATE" switch before the "FIL" switch has been thrown for two minutes.

b. OPERATION.

IMPORTANT

Do not alter the setting of any of the controls, except as specifically directed in this handbook.

(1) The "OUTPUT INDICATOR" lamp indicates by its brilliancy that the transmitter has output. Adjust the brilliancy of the lamp by the "LAMP ADJ" screw. It should be preadjusted to a low brilliancy. If the lamp brilliancy is turned very low or the exterior illumination is high, it may be necessary to remove the lamp assembly cover.

(2) No other adjustments need be made during flight except in case emergency repairs are necessary.

c. STOPPING THE EQUIPMENT.

(1) REMOVAL OF SIGNAL DURING TACTICAL USE. — To remove the signal without shutting down the equipment, throw the "PLATE" switch to the "OFF" position. Use this procedure only during the time the equipment is actually being used for tactical purposes.

(2) SHUTTING DOWN THE EQUIPMENT COMPLETELY.

(a) Throw the "PLATE" switch to the "OFF" position.

(b) Throw the "FIL" switch to the "OFF" position.

SECTION IV
MECHANICAL AND ELECTRICAL CHARACTERISTICS

1. GENERAL.

a. Transmitting Equipment AN/APT-1 is designed to produce interference to jam enemy radar operation. The equipment differs from the more conventional types of jamming transmitters in that, instead of radiating an interference-modulated carrier, the carrier frequency is effectively suppressed and the radiation consists entirely of interference-modulated side bands.

b. Interference or "hash" is generated by an electron-multiplier-type photo electric cell. This hash is amplified and then mixed with the output of an oscillator to pro-

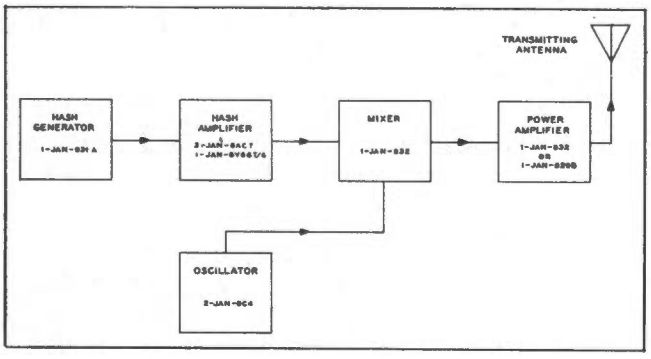


Figure 4-1. Radar Transmitter T-28/APT-1 —Block Diagram

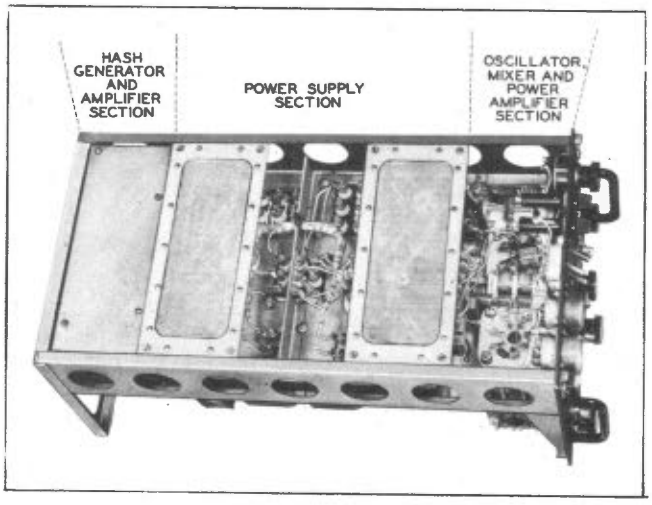


Figure 4-2. Radar Transmitter T-28/APT-1 —Bottom View

duce the desired type of signal which is subsequently amplified and fed to the antenna.

c. The block diagram in figure 4-1 shows the component parts of the transmitter. The location of these parts is shown in figure 2-10 and 4-2.

(1) Hash is generated by the type JAN-931-A nultiplier phototube V1 in the hash generator circuit.

(2) The hash is amplified by a four stage wide band amplifier consisting of three JAN-6AC7 (V2, V3, V4) tubes and one JAN-6V6GT/G (V5) tube.

(3) A high frequency signal is generated in the oscillator circuit which consists of two JAN-6C4 tubes (V6, V7).

(4) The hash is mixed with the oscillator signal in the JAN-832 (V8) mixer circuit. The output circuit of the mixer is tuned to one of the side bands and not to the carrier frequency.

(5) The output of the mixer circuit is amplified by a JAN-832 (V9) tube and then fed to the antenna to be radiated.

NOTE

A JAN-829B tube may be substituted for the JAN-832 in the power amplifier stage if more power output is required. This change is recommended only for the 93- to 162-megacycle band.

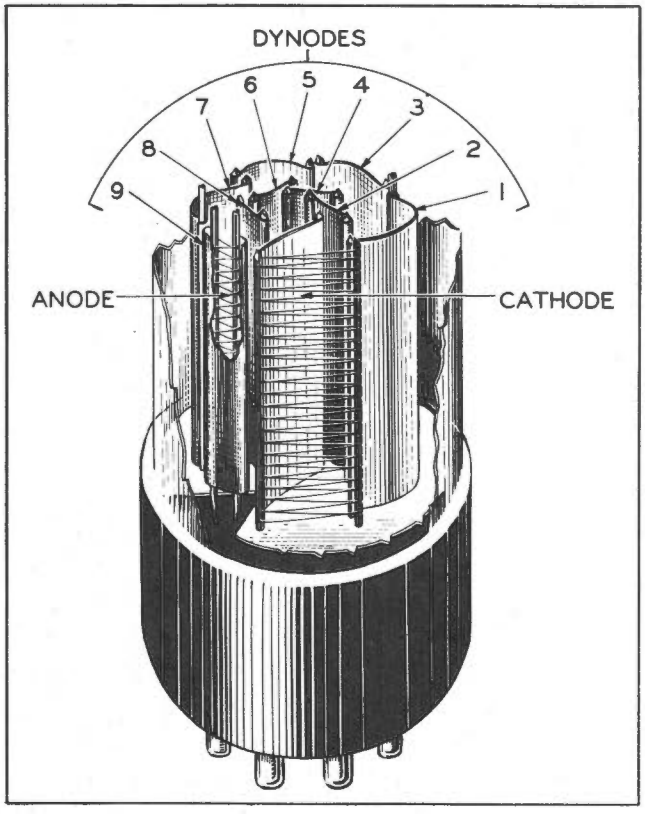


Figure 4-3. Type JAN-931-A Multiplier Photo Tube—Cut-away View

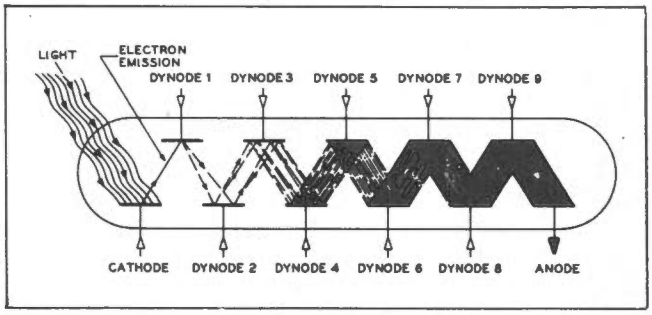


Figure 4-4. Electron Multiplication —Functional Drawing

(6) The power supply consists of two JAN-5R4GY tubes (V10 and V11) and one JAN-6X5GT/G (V12) tube.

2. HASH GENERATOR.

a. Hash frequencies are generated in the multiplier phototube V1. (See fig. 4-3.)

(1) Electrons are emitted from the light sensitive cathode when it is acted upon by light from the exciter lamp 11. (See fig. 4-4.)

(2) The electrons emitted by the cathode are attracted to dynode 1 by the positive voltage impressed on it.

(3) The electrons hit the first dynode with sufficient energy to knock other electrons off the surface. This is known as secondary emission.

(4) Each primary electron causes the emission of more than one secondary electron.

(5) These secondary electrons are attracted to dynode 2, and the process repeats to the dynode 9.

(6) The electrons leaving dynode 9 are attracted by the still higher positive voltage on the anode. The total electron current received by the anode will be much larger than that emitted by the cathode, the additional electrons entering the tube at the dynodes.

(7) The emission of an electron represents a pulse of current, and since the electrons are emitted at random, the output of the multiplier phototube contains many small random voltages which can collectively be called interference or hash. These are very small and ordinarily would not be noticed but can be amplified to any level.

(8) The hash output is adjustable by control of the brilliancy of the exciter lamp I1. This adjustment is made with the "OUTPUT LEVEL" control R34 on the panel of the transmitter, or with the "OUTPUT LEVEL CONTROL" R36 on the control unit.

(9) The circuits for control of the exciter lamp I1 are shown in figure 4-5.

(a) The exciter lamp I1 is energized from a 6.3 volt winding on filament transformer T1. (See figs. 2-10 and 4-6.)

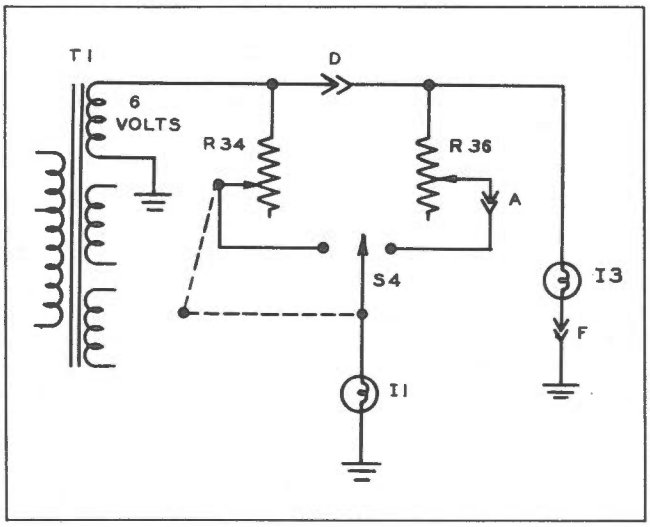


Figure 4-5. Radar Transmitter T-28/APT-1 —Hash Generator Exciter-Lamp Circuit

(b) The brilliancy of the exciter lamp may be controlled by either rheostat R34 or R36.

(c) Rheostat R34 and switch S4 are assembled together and controlled by the "OUTPUT LEVEL" knob on the transmitter panel.

(d) When the "OUTPUT LEVEL" knob is turned to the extreme counterclockwise position, the circuit to the exciter lamp is completed through rheostat R36 on the control box.

(e) When the "OUTPUT LEVEL" knob is turned in a clockwise direction, switch S4 is thrown to the opposite side and the exciter lamp circuit is completed through rheostat R34.

(f) In figure 4-5, the connectors A, D, and F are on plugs AN3102-18-9S and 9P, which are part of the cable connecting the control unit to the transmitter.

b. The circuit of the hash generator is shown in figure 4-7. The circuit obtains a d-c voltage supply of 750 volts from the power source. Because of the nature of the power supply circuits, ground potential is at an

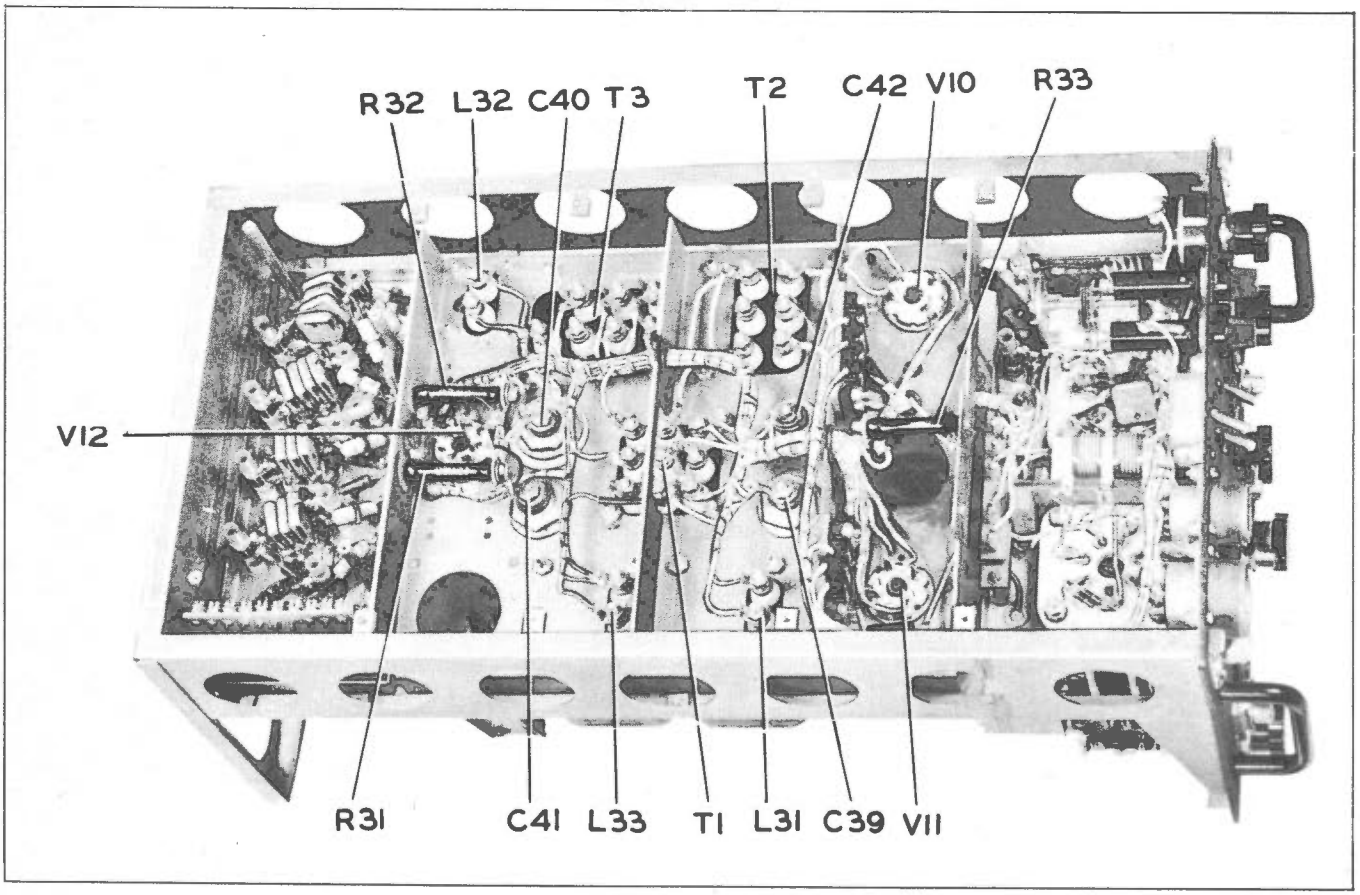


Figure 4-6. Radar Transmitter T-28/APT-1—Bottom View with Shields Removed

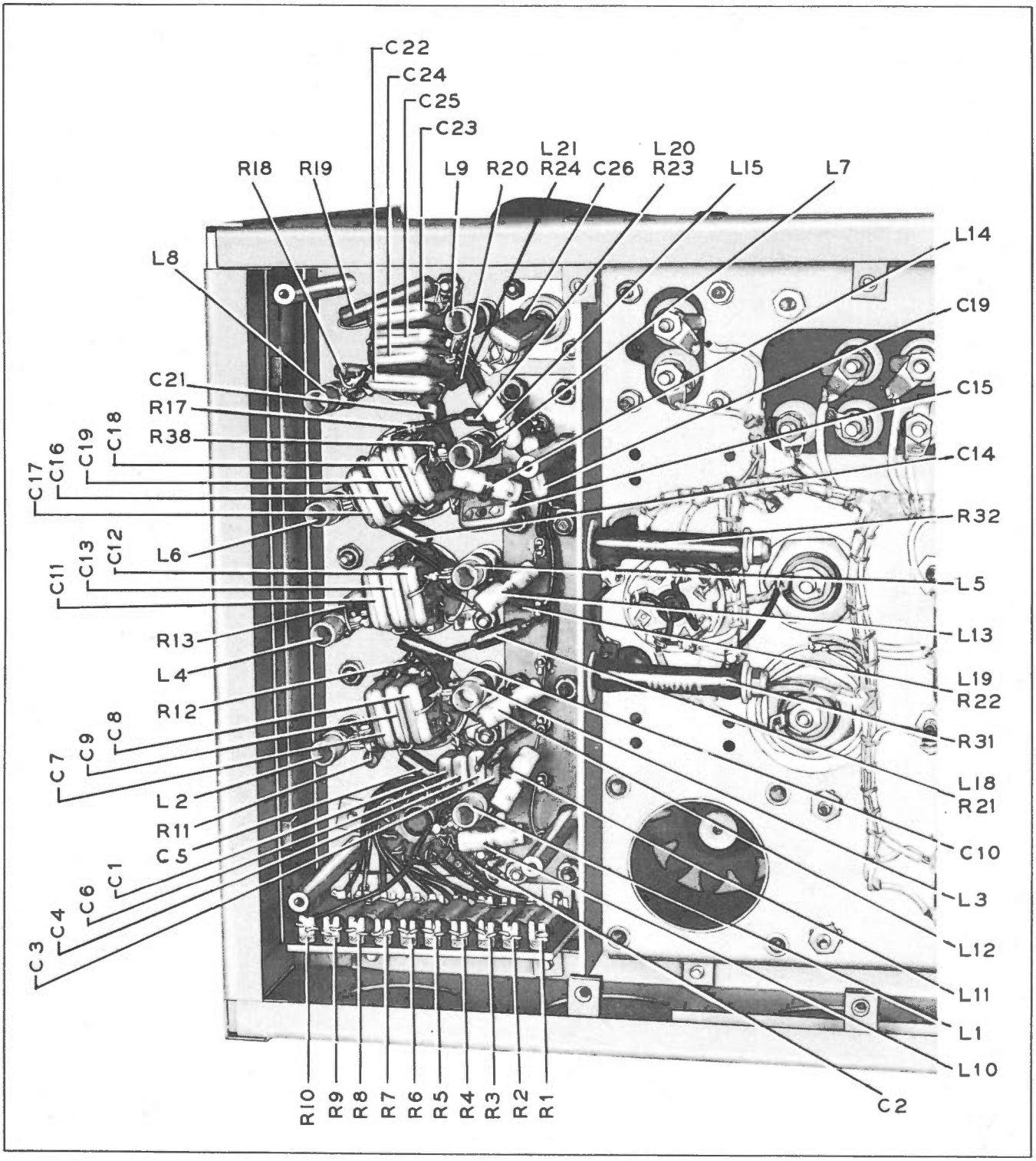


Figure 4-7. Radar Transmitter T-28/APT-1—Bottom View of Hash Generator and Amplifier Section

intermediate point between the positive and the negative voltage points.

c. A voltage divider circuit consisting of resistors R1 to R10 inclusive (see fig. 4-8) divides the 750-volt supply and applies the correct voltage to each dynode.

d. The d-c voltage is obtained through a filter network consisting of coils L10, L11, L16, L17, and capacitors C1, C2, C3, C4, and C6. (See fig. 4-8.) This network blocks any feedback from higher power circuits which might cause unwanted oscillations.

e. The output is developed across a slug-tuned coil L1 (see fig. 4-8) and is coupled to the grid of the first amplifier through capacitor C5. Coil L1 constitutes a tuned circuit because of distributed capacitance.

3. POWER SUPPLY CIRCUITS.

(See figures 2-10, 4-6, and 8-2.)

a. The circuits which supply plate and grid voltages consist of two full-wave and one half-wave rectifiers.

b. The plate voltage of the power amplifier tube V9 and the plate of the multiplier phototube V1 are supplied from a conventional rectifier circuit consisting of plate transformer T2, a type JAN-5R4GY full-wave rectifier tube V10, filter choke L31, and filter capacitor C39. This circuit furnishes 600 volts direct current to ground.

c. Another full-wave rectifier circuit supplies plate and screen grid voltages to the three type JAN-6AC7 tubes (V2, V3, V4) and the type JAN-6V6GT/G tube (V5) in the hash amplifier, plate voltage to the two type JAN-6C4 oscillator tubes (V6 and V7), plate and screen grid voltage to the type JAN-832 mixer tube (V8), and screen grid voltage to the type JAN-832 power amplifier tube (V9). The remainder of the circuit consists of plate transformer T3, a type JAN-5R4GY full-wave rectifier tube V11, filter choke L33, and filter capacitor C42. This circuit also furnishes 300 volts direct current to ground.

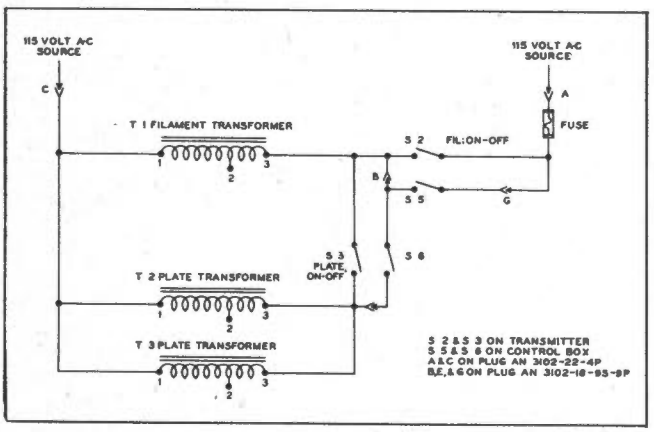


Figure 4-8. Power Switch Control

WARNING

There is no bleeder resistor in this circuit, therefore capacitor C42 will hold its charge after the power is disconnected. Remove this charge by short circuiting the capacitor whenever the bottom of the chassis is exposed.

d. A half-wave rectifier circuit is provided to supply the grid bias voltages for the mixer tube V8 and the power amplifier V9 and to put the potential of the cathode of the multiplier phototube V1 below ground.

(1) This circuit is a conventional half-wave circuit except for having a positive ground.

(2) It is energized from a portion of the high voltage secondary winding on plate transformer T3.

(3) It consists of a type JAN-6X5GT/G tube V12, filter choke L32, filter capacitor C40, and a voltage divider circuit R31, R32, and S7.

(4) This circuit furnishes 150 volts negative to ground.

(5) The purpose of switch S7 is to short circuit a part of resistor R32 when a type JAN-829 tube or JAN-829B is used as the output power amplifier in order to obtain the correct grid bias on the power amplifier and mixer tubes. A sliding top is provided on resistor R32 to allow the bias voltage to be adjusted.

(a) The Switch is open when type JAN-832 tube is used.

(b) The switch is closed when a type JAN-829 or JAN-829B tube is used.

(c) The switch is located on top of the chassis on the right side adjacent to a type JAN-54GY rectifier tube.

(6) Note that the operating voltage for the multiplier phototube V1 is derived partly from this circuit and partly from the circuit fed from transformer T2. The plate of the tube is 600 volts positive with respect to ground; the cathode is 150 volts negative with respect to ground; thus the plate is 750 volts positive with respect to the cathode of the tube.

e. A relay is connected between terminal 5 on transformer T3 and ground. When the transmitter tube warms up and the plate voltage is applied, the resulting plate current flows through this relay coil and energizes it. The relay contacts are in series with the 24-volt d-c power source and two blower motors. Therefore, the blower motors will not operate until the "PLATE" switch is on and unless the transmitter tubes are in their sockets. Resistor R39 is in series with the relay coil but has no function except to balance this circuit after a pre-production modification has been made.

f. The arrangement of power switches for controlling filament and plate transformers from both transmitter panel and remote control unit is illustrated in figure 4-8. This arrangement is used so that the plate transformer cannot be energized before the filament transformer.

The pilot lamp I3 on the remote control unit will be lighted whenever either filament switch is on, since it is connected to the 6-volt alternating current coinciding on T1 whenever the control unit is connected to the transmitter panel.

4. HASH AMPLIFIER.

(See figures 2-10 and 4-7.)

a. The hash amplifier, (see fig. 11) which amplifies the output of the multiplier phototube V1, is a four stage wide-band amplifier containing three JAN-6AC7 tubes (V2, V3, V4), and one type JAN-6VGT/G tube (V5).

b. The individual amplifier stages are each tuned to amplify a band of frequencies between 27.5 and 32.5 megacycles.

(1) Wide band amplification is accomplished partly by tuning the plate and grid circuits to different frequencies (27.5 and 32.5 mc. alternately) and partly by broadening the resonance curves with loading resistors.

(2) Tuning is accomplished by moving powdered-iron cores in or out of the tuning coils. These are preset at the factory and should not be touched unless it has been definitely proven that all other means do not correct the trouble.

c. The first amplifier stage consists of a type JAN-6AC7 tube V2 which receives a hash-signal from the multiplier phototube V1 through coupling capacitor C5.

(1) The tube is operated at zero grid bias.

(2) In the input circuit, resistor R11 is connected across the tuned circuit L2 to reduce the peak of the resonance curve and thus broaden it for wide-band amplification.

(3) Resistor R12 is the screen voltage dropping resistor.

(4) Capacitor C7 is the screen by-pass.

(5) Capacitor C8 in conjunction with choke L12 makes up the plate and screen voltage supply filter for this stage.

(6) The filament supply is filtered by capacitor C9 and inductance L18.

(7) Resistor R21 has no function except to furnish a convenient form upon which L18 is wound.

d. The second amplifier stage V3 is identical to the first.

e. The third amplifier stage V4 is similar to the first and second but has certain modifications, which are as follows:

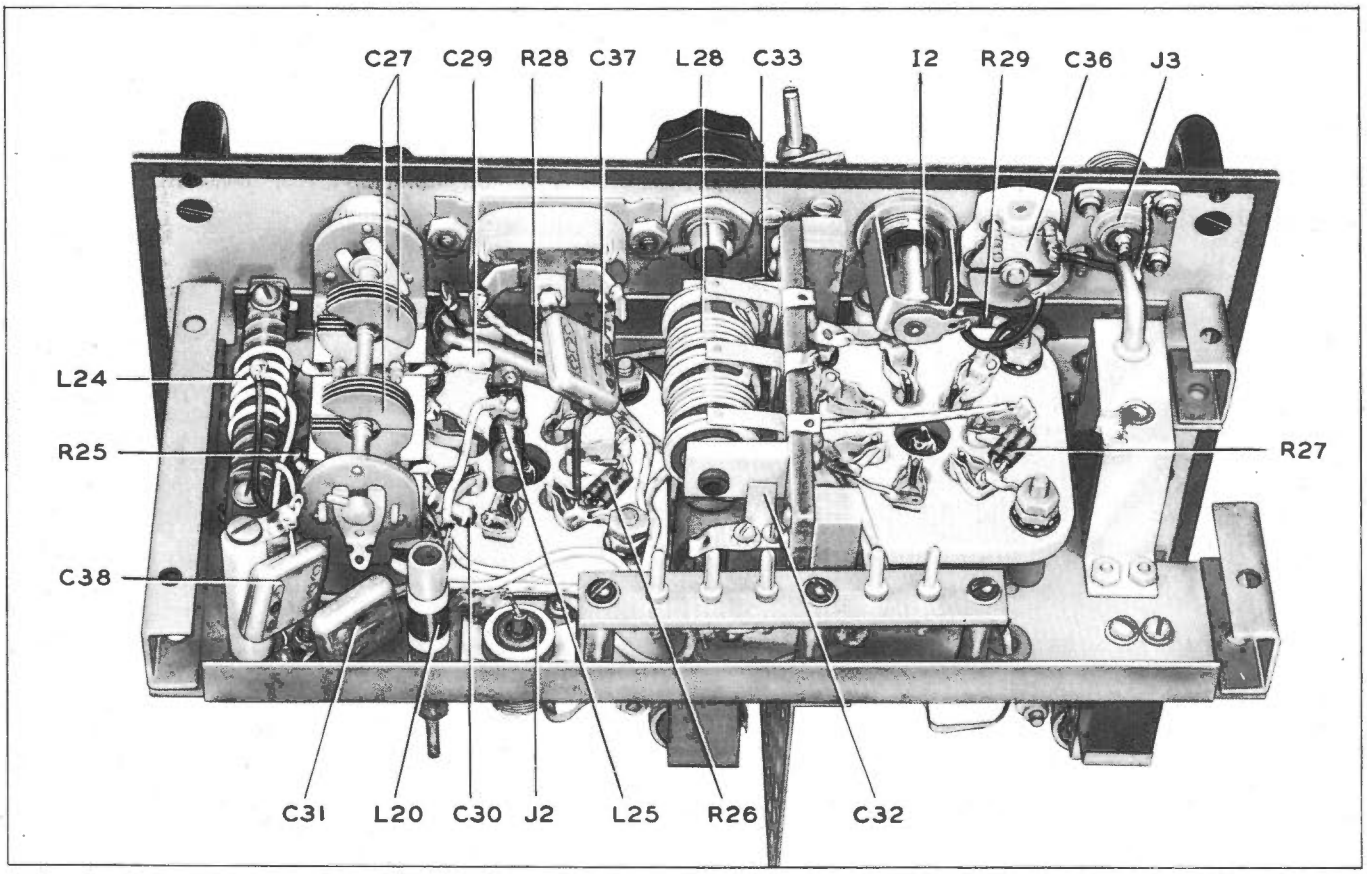


Figure 4-9. Radar Transmitter T-28/APT-1—Bottom View of Oscillator, Mixer, and Power Amplifier Section

(1) The tube is self-biased by resistor R16 bypassed by capacitor C17.

(2) A load resistor R38 is connected across the plate tuned circuit L7 for wide-band amplification.

f. The fourth amplifier stage contains a type JAN-6V6GT/G tube V5 connected similarly to the third amplifier stage.

g. Additional filtering of the filament supply to all stages is accomplished by capacitor C20 and inductance L23.

h. Additional filtering of the plate supply is accomplished by capacitor C15 and inductance L22.

i. The final output of the hash amplifier is coupled to a transmission line by capacitor C26. This transmission line leads to the mixer stage grid circuit.

The output coil L9 is provided with a tap from which the output is obtained. Band pass characteristics are obtained through the position of this tap, with the final result that approximately 5 watts are furnished to the mixer.

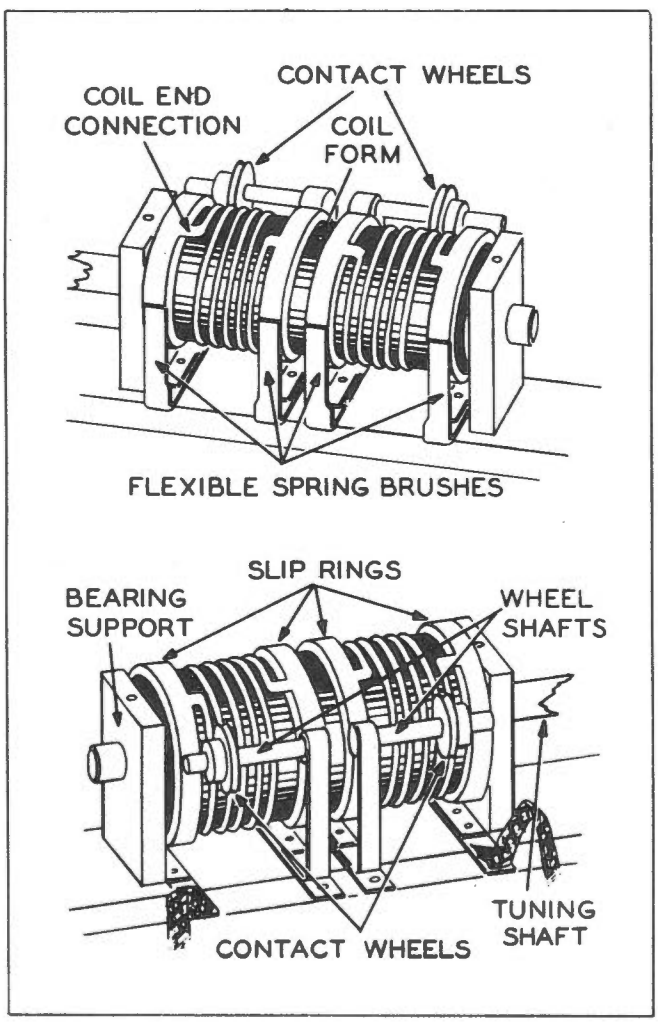


Figure 4-10. Radar Transmitter T-28/APT-1 —Oscillator Plate Tuning Coil (Rolo Coil L25)

5. OSCILLATOR.

(See figure 4-9.)

a. The oscillator is designed to generate a frequency which is adjustable from approximately 123 to 180 megacycles.

b. The oscillator consists of two JAN-6C4 high-frequency power triodes V6 and V7 (fig. 2-10) operating in a push-pull tuned-plate circuit.

c. The oscillator tubes are located in the left front of the chassis (top view) with the oscillator coil L24 directly beneath the tube sockets.

d. The oscillator tuning coil consists of a few turns of bare wire for the plate coil interwound with a few turns for the grid coil.

e. Resistor R25 provides self-grid bias for the oscillator. No bias capacitor is necessary because of the push-pull circuit.

f. The oscillator is tuned by the split-rotor tuning capacitor C27 which is controlled by the "OSC FREQ" dial on the front panel.

g. The plate supply for this circuit is about 300 volts. Filter capacitor C38 (.001 mfd) prevents high frequency currents from feeding back into the power supply.

6. MIXER.

(See figure 4-9.)

a. The mixer stage uses a JAN-832 push-pull r-f beam power amplifier tube V8 operated as a grid-modulated amplifier.

b. The input consists of the oscillator signal in the 123 to 180 megacycle range and the hash signal containing a band of frequencies of about 27 to 33 megacycles.

c. The signal from the oscillator is coupled to the mixer grid coil L25 through capacitors C29 and C30. Coil L25 is located beneath the mixer tube socket with leads soldered directly to the grid terminals of the socket.

d. The hash signal is introduced into the grid circuit through a tap on inductance L26. Inductance L26 is a small coil located beneath the chassis just behind the mixer tube socket and adjacent to the plug where the transmission wire from the noise amplifier terminates.

e. The grid of the mixer is operated with fixed bias. Capacitor C31 prevents any high frequency voltages from feeding back into the grid-bias supply circuit.

f. The two input signals heterodyne together to produce two distinct bands of frequencies and a carrier.

(1) The upper side band is derived from the sum of the oscillator frequency and the hash band frequencies. (For example: an oscillator frequency of 180 megacycles added to the hash band of 27-33 megacycles produces an upper side of 207 to 213 megacycles.)

(2) The lower side band is derived from the difference between the oscillator frequency and the hash band frequencies. (For example: the difference between an oscillator frequency of 180 megacycles and the noise band of 27-33 megacycles produces a lower side band of 147-153 megacycles.)

g. If the plate circuit L27 (see fig. 2-10) is tuned to one side band, the output will not contain the carrier (oscillator frequency) nor the other side band in any appreciable amount. The selectivity of the modulator plate circuit and the wide spacing between the carrier and the side bands make this possible.

h. A jamming signal is thus produced which is about 6 megacycles wide and which may be tuned (accomplished by adjusting the oscillator frequency) to cover any 6-megacycle frequency band between the limits of approximately 93 and 210 megacycles. The age and condition of the JAN-931-A tube will affect these limits somewhat.

i. The output circuit of the mixer contains a tuned circuit in which the inductance rolo coil L27 (see pars. 8 and 9 this section) is adjustable. Distributed capacitance of the coil and circuit forms the capacitive portion of the tuned circuit.

(1) Coil L27 is located on top of the chassis near the front center and is connected directly to the top plate terminal on top of the mixer tube.

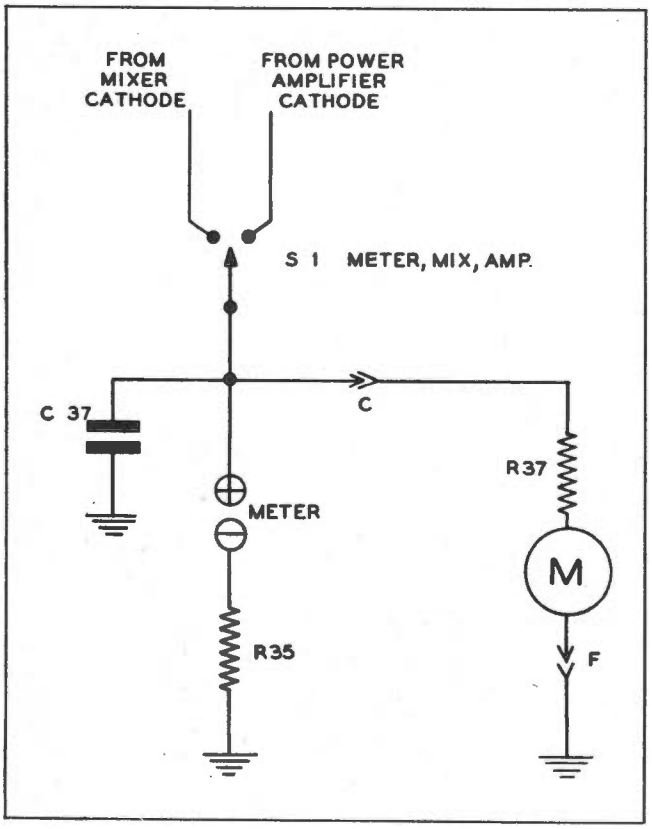


Figure 4-11. Schematic Diagram of Plate Current Meter Circuit

(2) Adjustment of the inductance of Coil L27 (and distributed capacitance to a certain extent) is accomplished by turning the entire coil form with the "MIXER PLATE" control. As the coil turns, two wheel-like contacts are moved along the coil parallel to its axis. Since the contacts are electrically connected to the center of the coil, various turns are short circuited by this action. (See fig. 4-10.)

j. Resistor R26 (5 ohms) functions only as an aid to measuring the plate current as explained in the following paragraph.

7. PLATE CURRENT METER CIRCUIT.

a. When "METER" switch S1 is thrown to the "MIX" position, a milliameter is connected in parallel with resistor R26 and will give an indication which is proportional to the mixer cathode current. (See fig. 4-11.)

b. When a remote control unit is used, the included meter can be used.

c. When a remote control unit is not used, Test Set I-139-A, which includes the meter, must be plugged into the "METER" jack on the transmitter panel.

d. When the control unit is used, it is possible to use a meter plugged into the transmitter panel if desired. The two meters will then indicate correctly at the same time.

e. When "METER" switch S1 is thrown to the "AMP" position, the meter will indicate the cathode current of the power amplifier tube.

f. Capacitor C37 (see fig. 4-9) is used to by-pass r-f currents around the meter circuit to prevent possible burn-out of the meter.

8. POWER AMPLIFIER PLATE TUNING COIL L29 (ROLO COIL).

(See figs. 2-10 and 4-10.)

a. The power amplifier plate tuning coil is a rolo coil wound in two sections on insulated forms which are securely mounted on a common tuning shaft. The tuning shaft turns in bearings mounted at the ends of the coil.

b. The coil ends are connected to slip rings which are securely mounted on the coil forms.

c. Electrical contact to the coils is made through metallic brushes which are held against the slip rings by spring tension.

d. To make the coil inductance adjustable, two metallic contact wheels are held against the coil turns by spring tension. These wheels are free to rotate and to move back and forth on their respective shafts. The springs which support the contact wheels and shafts are connected to the brushes on the center slip rings through the mounting beneath the coils.

e. As the coils are rotated by the knob on the tuning shaft, the contact wheels follow the coil wires as a nut follows the threads on a screw. Thus the contact wheels

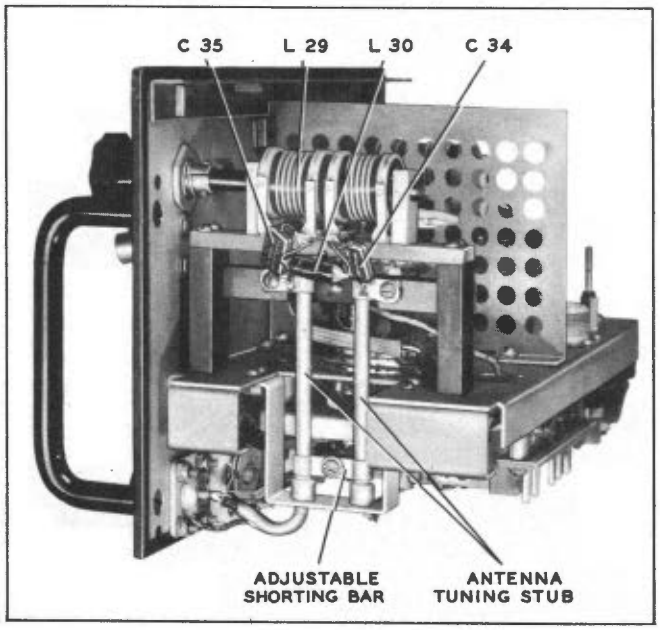


Figure 4-12. Radar Transmitter T-28/APT-1 —Side View of Antenna Coupling Circuit of Oscillator, Mixer, and Power Amplifier Section

act as movable taps and the inductance of the coils is adjustable over the entire range.

f. It is important that the contact wheels always be an equal number of turns from the center of the coil, and that the contact wheels reach either end of the coil at the same time that the stop on the dial is reached. With a one-turn difference between the ends and the center of either of the power amplifier plate coil L29 or the mixer coil L27, the transmitter output dropped at least 50 percent on early equipments. With a one-turn difference on the power amplifier grid coil L28, no noticeable change in output was observed but the dial calibration was off. No other abnormal indications such as high plate current or broad tuning were observed under these conditions. Visual inspection is recommended if trouble is suspected.

9. MIXER PLATE COIL L27 AND POWER AMPLIFIER GRID COIL L28 (ROLO COILS).

(See fig. 4-9.)

These coils are identical with Coil L29 except that they have only three slip rings, one at each end and one in the center, thus providing each coil with a tap in the center.

10. POWER AMPLIFIER.

a. The final amplifier uses either a JAN-829B tube or a push-pull r-f beam power amplifier tube V9 operated as a push-pull tuned amplifier.

b. The input is the band of frequencies obtained from the mixer stage and coupled to the grid circuit by capacitors C32 and C33. (See fig. 4-9.)

c. The grid circuit contains the tuned circuit L28 which is a coil similar in construction to coil L27.

(1) A grid bias of 75 volts is applied when Tube JAN-832 is used and —45 volts when JAN 829B tube is used. The change in voltage is accomplished by changing the position of switch S7. In either case, the bias voltage is also determined by the position of the sliding tap of resistor R32. In case oscillations at undesirable frequencies occur in the power amplifier stage, a slight readjustment in the bias voltage may be required.

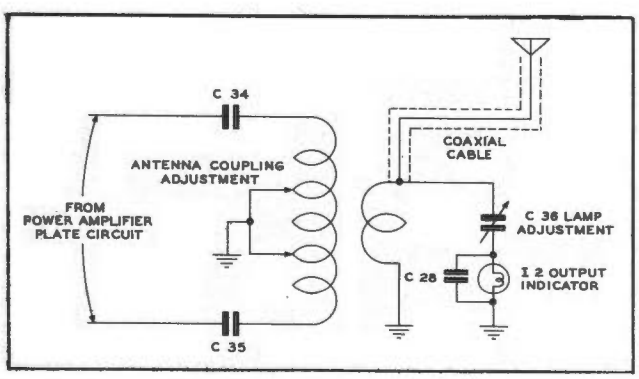
(2) Coil L28 is located beneath the chassis in front center between the mixer tube socket and the power amplifier tube socket.

(3) Coil L28 is tuned by the "AMP GRID" control.

(4) Resistor R30 is connected across coil L28 as a damping resistor to prevent undesirable oscillations which occur in the 70 to 90 megacycle band.

e. Inductance L29 and the distributed capacitance constitute the tuned plate load.

(1) Coil L29 is constructed similarly to coils L27 and L28, except for changes necessary to split it into two sections.



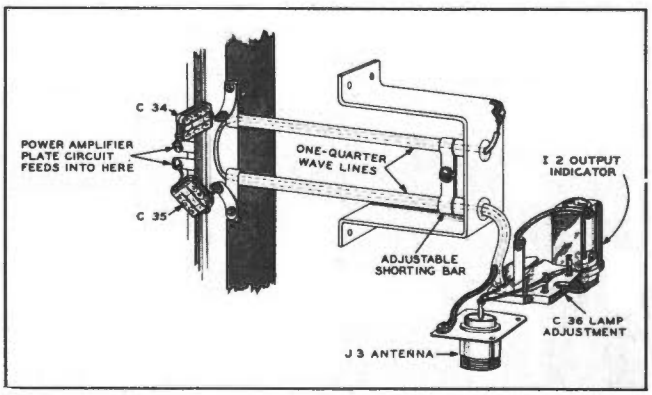


Figure 4-13. Coupling Circuit from Amplifier Output Circuit to Antenna

(2) Coil L29 is adjustable by "AMP PLATE" control on the transmitter panel.

f. Plate voltage is fed to the two halves of the tube through the center tapped r-f choke coil L30. (See fig. 4-12.)

g. The output of the amplifier is fed to the antenna through blocking capacitors C34 and C35 and a coupling circuit as shown in figures 4-12 and 4-13.

(1) This coupling circuit functions as represented schematically in figure 4-13. The lines shown are one-quarter wave length electrically and not physically. Capacitive loading decreases the physical length to a large degree.

(2) The coupling circuit matches the impedance of the balanced amplifier tube output circuit to the 50-ohm unbalanced antenna transmission line.

(3) The shorting bar enables maximum output to be obtained for any frequency setting. Its adjustment is not critical and will not affect the output more than about 5 percent (about one watt). It is best to leave this bar down all the way all the time with the screw in the center tight.

SECTION V
MAINTENANCE

WARNING

Filter capacitor C42 holds an electrical charge of 300 volts after the transmitter has been turned off. Remove this charge by short circuiting the capacitor with a short piece of insulated wire whenever the bottom of the chassis is exposed. See figure 4-6 for location of this capacitor.

1. INSPECTION.

Inspect the following items at least every 30 days regardless of the actual time which the equipment is operated.

a. ANTENNA.

(1) Check that the antenna mast is securely held by its mounting clamps.

(2) Check that the mounting clamps are securely held to the structural members of the aircraft.

(3) Check that ground connections are good and are clean and that antenna cable connections for the antenna are securely held in place.

(4) See that no moisture, dust, or corrosion is present in the antenna connectors.

(5) See that the antenna cabling is continuous and securely held.

b. TRANSMITTER.

(1) See that all tubes are securely held in their sockets.

(2) See that there are 5-amp fuses in the fuse holders on the front panel and that adequate spares are available inside the chassis on back of front panel.

(3) Check that all indicator and exciter lights are in place and operative.

(4) See that the blower motors are free to operate and are not affected by dust or moisture. It will probably be unnecessary to change brushes in these motors during the life of the transmitter.

Clean the brushes by lifting the small springs on the side of the bearing shaft housing, carefully pulling out the brushes and smoothing the inner ends with sandpaper.

(5) See that the cable connectors on the front panel of the transmitter are free from dust, moisture, or corrosion.

(6) See that all control knobs and shaft couplers are in place and properly secured to their respective shafts.

(7) Remove excessive dust, moisture, or corrosion from any part of the equipment. This is particularly important for variable condensers, cable connectors, coils, tube sockets, switch contacts, and ground connections.

(8) See that mountings are in place and securely held. Shock mounts should be free from obstructions.

(9) Remove any nearby obstructions which would prevent the adequate flow of air through the ventilation holes.

c. REMOTE CONTROL UNIT.

(1) See that the "OUTPUT INDICATOR" pilot lamp is in place and operative.

(2) Clean dust, moisture, or corrosion from all the cable connectors. This is very important.

(3) See that the mounting for the control unit is securely held to the airplane.

NOTE

All tubes of a given type supplied with the equipment shall be consumed prior to employment of tubes from general stock.

2. TROUBLE LOCATION AND REMEDY.

a. GENERAL. — The "OUTPUT INDICATOR" lamp serves as a good indicator of the operation of the transmitter. If this lamp does not light, check the following before going into any detailed search for trouble within the transmitter. If these checks do not locate the source of the trouble, make a more detailed search according to instructions in paragraphs *b*, *c*, and *d* following.

(1) "LAMP ADJ" screw out of adjustment. Refer to section III, paragraph 1*b*(3).

(2) Fuse F1 blown (this is the "115 V. 5 AMP" fuse on the front panel).

(3) Power source not operating.

(4) Burned out indicator lamp I2.

(5) "OUTPUT LEVEL CONTROL" out of adjustment. Refer to section III, paragraph 1*b*(2).

(6) Shorted antenna cable or antenna.

(7) Burned out exciter lamp I1.

(8) Equipment out of tune. (Refer to section II, paragraph 3*c*.)

(9) Defective control unit or cable. This can be determined by disconnecting the remote control unit cable at the transmitter panel and noting whether trouble ceases.

b. ANTENNA.

(1) Touch a small ¼-watt neon bulb or flashlight bulb (0.10 amp, 6- to 8-volt Mazda), to the antenna mast tip. If it glows brightly the antenna is radiating power. If there is no r-f voltage present in the antenna, while at the same time the "OUTPUT INDICATOR" lamp shows the transmitter to be delivering power, the trouble lies in the antenna or transmission line. In this case, check these thoroughly for electrical continuity and short circuits and especially the "ANT" connector in which the female contact pin may be damaged or misplaced.

c. TRANSMITTER.

(1) POWER SUPPLY. — Serious trouble in the power supply unit will usually make itself known either by blown fuses, excessive mixer plate or amplifier plate currents, or no indication of current.

(a) If the 5-amp, 115-volt a-c fuse is blown, look for short circuits in the 600-volt supply, the 350-volt supply, or the negative 150-volt supply. The following are possible causes:

1. Shorted rectifier tubes.
2. Defective filter condensers.
3. Shorted bypass condensers in the pre-amplifier or the oscillator-mixer-amplifier section of the transmitter.
4. Damaged wiring or mechanical dislocations.
5. Shorted blocking condensers C34 and C35.

(b) In case of failure of the output voltage from either of the three power supplies, check for open circuits.

NOTE

The voltages referred to in the succeeding four paragraphs are measured at the two pre-amplifier terminals strips located on the forward edge of the pre-amplifier unit. These terminals left to right are: 6 volts a-c, 300 volts, d-c (on the two terminal strip), 600 volts d-c, minus 150 volts d-c, and 0-6 volts a-c (on the three-terminal strip).

(c) In case of no voltage at the 6-volt a-c terminal, inspect primary power source of filament transformer T1; there should be 115-volt a-c voltage across terminals 1 and 3 and 6-volt a-c voltage across terminals 4 and 5.

(d) In case of no voltage at the 300-volt d-c terminal, check capacitor C42, coil L33, transformer T3 and the JAN-5R4GY rectifier tube associated with the 300-volt power supply circuit. Also check for shorted bypass condenser in the pre-amplifier unit.

(e) In case of no voltage at the 600-volt d-c terminal, check capacitor C39, coil L31, transformer T2, and the JAN-5R4GY tube associated with this circuit. Also check for shorted bypass condenser in the pre-amplifier unit, or oscillator-mixer-amplifier unit. Another possible cause may be a shorted or gassy tube in these units in which case new tubes should be substituted.

(f) In case of no voltage at the negative 150-volt terminal, first check the JAN-6X5GT bias rectifier. Check capacitors C41 and C40 for shorts and coil L32 for continuity. Low voltage at this terminal is sometimes an indication of a defective JAN-832 tube (mixer) or a defective bypass capacitor C31 in the oscillator-mixer-amplifier unit. In the event this voltage reads positive instead of negative, first check capacitor C26 in the pre-amplifier unit for a short circuit.

(g) If the blower motors fail to operate, look for blown "24 V-DC" fuse, dirty relay contacts, open coil or open resistor R39.

(2) NOISE PRE-AMPLIFIER UNIT. — If, when tuning the equipment, the "OUTPUT LEVEL" control is turned in the clockwise direction and no change is observed in the "AMP" plate current, or if the current is not between the following limits as listed in the table below, the trouble may be a burned out exciter lamp V1 in the oscillator-mixer-amplifier unit or in the pre-amplifier unit.

Tube Limit	*Control Unit Meter*	*Test Set I-139-A*
Upper Limit for JAN-829	200 ma	1.0 ma
Lower Limit for JAN-829	100 ma	0.5 ma
Upper Limit for JAN-832	100 ma	0.5 ma
Lower Limit for JAN-832	60 ma	0.3 ma

If the pre-amplifier unit is suspected, proceed as follows.

(a) Make certain that all tubes (both in the pre-amplifier and the other transmitter sections) are good, either by testing on a tube tester or by replacing them with tubes known to be good. Be sure to check exciter lamp.

(b) Make point-to-point resistance measurements of all circuits.

(c) Inspect for loose components, bad tube socket contacts, defective solder joints, and mechanical failure.

(d) Disconnect the r-f cable plug P2 (this cable connects the pre-amplifier with the oscillator-mixer-amplifier section). Remove the JAN-6C4 oscillator tubes V6 and V7. Turn on the equipment with the remaining tubes all in place. Couple the antenna of a radio receiver to the disconnected cable and tune the receiver through the range of 20 to 40 megacycles, with the "OUTPUT LEVEL" control turned clockwise as far as possible. It should be possible to hear the low rough hiss signal in the receiver headphones when the receiver is tuned from about 24 to 35 megacycles. If this signal cannot be heard yet all other parts are found to be good, refer to paragraph 3 of this section.

(3) OSCILLATOR-MIXER-AMPLIFIER UNIT.

(a) The most common causes of failure in this unit are:

1. Defective tubes which may become gassy after prolonged operation. This will probably be indicated by a blue color in the tubes causing a gradual decline in power output.
2. Loose or dirty contacts on rolo coils.
3. Failure of the bias and plate supply.
4. Defective wiring or mechanical failures.

(b) With the "OUTPUT LEVEL" control in the counter-clockwise position for minimum output of the pre-amplifier unit, and the "METER" switch in the "MIX" position a current of 80 to 140 milliamperes on the control unit meter or 0.4 to 0.7 on Test Set I-139-A should be observed. The test set should be plugged into the "METER" jack on the transmitter. If the mixer current is low, check power supply voltages at the terminal strip located on bottom side of deck plate.

(c) If the voltages as measured in the preceding paragraph are normal, failures in the oscillator circuit may be caused by:

1. Defective oscillator tubes.
2. Faulty wiring.
3. Broken leads on the oscillator coil assembly or tube sockets.
4. Open coupling condenser C29 or C30.
5. Improper operating voltages.
6. Shorted or dirty rotor plates on capacitor C37.

(d) If the mixer plate current is normal, place the "METER" switch in the "AMP" position with the "OUTPUT LEVEL" control remaining in the counter-clockwise position for minimum output from the pre-amplifier. The plate current should read not more than 1/4 scale depending on the amount of light getting to tube V1. Cover this tube with a box or rag to shield it from external light.

(e) Advance the "OUTPUT LEVEL" control in a clockwise direction; the power amplifier plate current should rise to a value of about 1/2 scale on the meter. If insufficient plate current is obtained by these adjustments, proceed as follows:

1. Check Terminal voltages on the mixer and power amplifier tubes.
2. Make certain that rolo coil contacts on coils L27, L28 and L29 are secure, clean and in correct positions.
3. Replace the mixer and power amplifier tubes.
4. Examine coupling capacitors C32 and C33 for mechanical dislocation, adjusting the spacing between the coil L28 end bearings and the capacity plates to about 1/8 inch.
5. Inspect thoroughly for wiring faults or mechanical failure.
6. Check continuity of external metering circuit.

(f) If it has been determined that the oscillator, mixer, and power amplifier sections of this unit are operative and the "OUTPUT INDICATOR" lamp still does not indicate r-f output power, proceed as follows:

1 Make sure that all controls associated with rolo coil L29 are clean, secure and in correct positions corresponding to dial readings and dial stops.
2. Check coupling capacitors C34 and C35 for open circuit.
3. Inspect the mechanical assembly of transmission line transformer.
4. Check for wiring faults associated with coils L29 and L30; capacitors C34, C35 and C36; and lamp I2.

d. UNUSUAL TROUBLES.

(1) In some cases oscillation may occur in one or more of the pre-amplifier stages. The most common source of this trouble is the V5 output stage. It may be necessary to replace this tube even though the old tube may check good. Low frequency parasitic oscillations, poor power supply filtering, and other troubles which in some way distort the output spectrum of the transmitter are not generally detrimental. If they do not cause abnormal operation, they only aid in jamming.

(2) In case of insufficient output in the pre-amplifier unit, when all voltage and resistor measurements are normal, the trouble may be traced to open

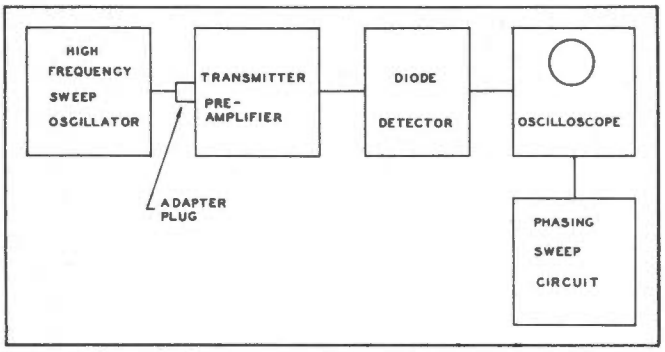


Figure 5-1. Block Diagram of Test Equipment Set-up Used When Tuning Pre-Amplifier Coils

or disconnected coupling condensers C5, C10, C14, C21, or C26. Open circuited bypass condensers C7, C11, C8, or C12 may also cause trouble which can be located by paralleling these condensers with condensers known to be good.

(3) After prolonged operation of the transmitter, the oscillator, mixer, or power amplifier tubes may become gassy; this is sometimes indicated by a blue glow. This will probably be evidenced by a gradual decline of output during operation of the transmitter; that is, the transmitter may appear to have normal output when it is first turned on, and then decrease considerably in power after use for an hour or two. This trouble can be located only by substituting new tubes and testing the transmitter after each substitution.

(4) Undesirable oscillations occurring or originating in the power amplifier stage can be detected generally by the fact that the "OUTPUT INDICATOR" lamp I2 will continue to light even after the "OUTPUT LEVEL" control has been turned to the extreme counterclockwise position. Readjustment of the power amplifier grid bias by moving the sliding tap on resistor R32 will generally stop these oscillations. The bias voltage on the power amplifier tube should be about —75 volts for the JAN-832 tube and about —45 volts for the JAN-829B tube. An open circuit in resistor R30 may also allow these oscillations to occur.

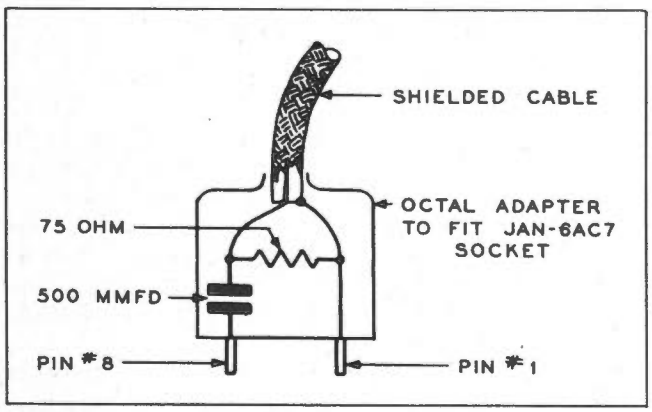


Figure 5-2. Adapter Used with Sweep Generator when Tuning Pre-amplifier Coils

3. TUNING NOISE PRE-AMPLIFIER COILS.

a. GENERAL. — When trouble is noticed in the equipment, either in the form of weak jamming signal or insufficient bandwidth, and all other possible causes have just been investigated, then tuning of the pre-amplifier coils is generally indicated. This tuning should not be necessary unless the coils have been tampered with or damaged. However, tuning may be necessary as described below.

b. EQUIPMENT REQUIRED FOR TUNING.

(See fig. 5-1.)

(1) High frequency sweep oscillator with a range covering 20 to 35 megacycles (an RCA MI-18709C high frequency sweep generator is suitable).

(2) Oscilloscope.

(3) Diode-Detector unit constructed and connected according to instructions in the following paragraphs.

(4) Phasing sweep circuit connected according to following instructions.

(5) Adapter plug wired according to following instructions.

(6) Wavemeter with a range covering 20 to 35 megacycles (absorption type).

NOTE

Amplifier Alignment Unit TS-92( )/AP may also be used in this tuning procedure. For further instructions on this equipment refer to section VI of this handbook or the handbook of maintenance instructions for this equipment.

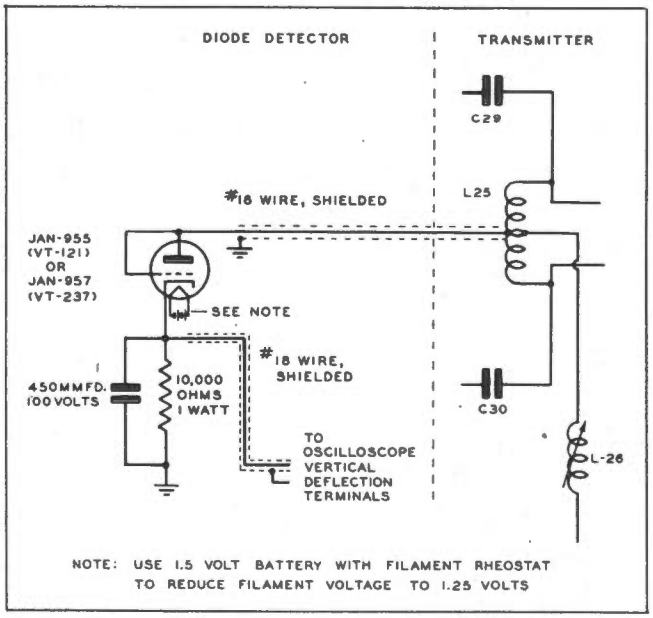


Figure 5-3. Schematic Diagram of Diode-Detector Unit Used when Tuning Pre-amplifier Coils

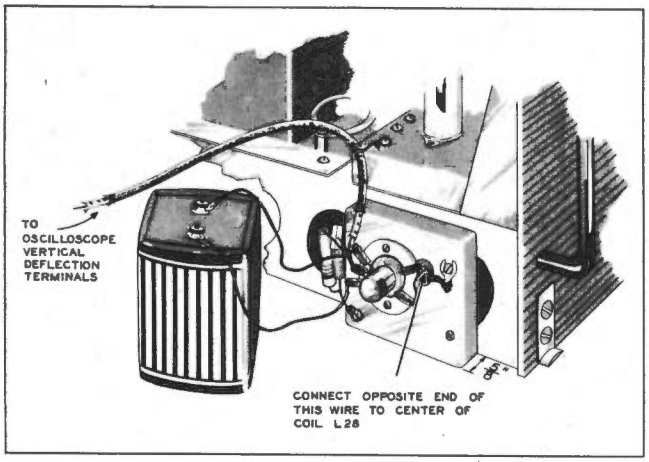


Figure 5-4. Construction and Placement of Diode-Detector Unit Used when Tuning Pre-amplifier Coils

c. PREPARATION FOR TUNING.

(1) Remove the tubes V10, V12, V1, V2, V3, V4, and lamp I1 from their sockets on the transmitter. Unsolder the lead from terminal No. 1 (300-volt terminal) on the female part of the five-terminal connector on the oscillator-mixer-power amplifier unit.

(2) Connect the sweep oscillator to the socket of tube V4 on the pre-amplifier chassis, using the adapter illustrated in figure 5-2. This introduces the signal between the plate of this tube (terminal No. 8) and ground (terminal No. 1).

(3) Construct a diode-detector unit according to the schematic diagram in figure 5-3 and the sketch in figure 5-4. Mount the unit temporarily on the side of the transmitter chassis as shown in figure 5-4. Be sure to make good electrical contact between the detector base and the transmitter chassis. Connect the plate of the detector tube to the center tap of the transmitter oscillator plate coil L25 using the center conductor of the shielded lead. Connect the cathode of the detector tube to the oscilloscope vertical deflection terminal with the shield cable.

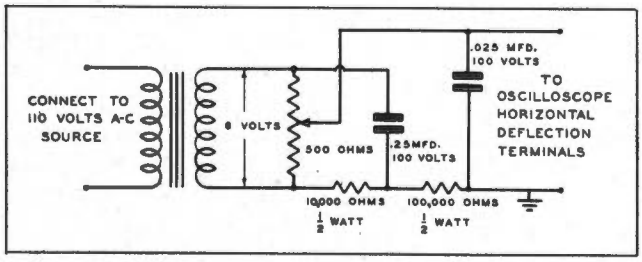


Figure 5-5. Schematic Diagram of Phasing Circuit Used with Oscilloscope when Tuning Pre-amplifier Coils

(4) Provide an external sweep circuit for the oscilloscope (horizontal) according to the circuit illustrated in figure 5-5. The frequency of the voltage from this circuit must be the same as that driving the modulating capacitor of the sweep oscillator. The response curve on the oscilloscope screen will have linear frequency distribution. Adjust the phasing potentiometer of this circuit until the voltages are correctly phased. This can be determined when the image appears as shown in figure 5-6. Use the horizontal amplifiers of the oscilloscope.

(5) Obtain an absorption-type wavemeter whose range includes 25 to 35 megacycles and couple closely to the plate terminal on the diode-detector. This will cause a calibration mark to be superimposed on the oscilloscope trace in the form of a pip. The pip will occur at the frequency for which the wavemeter is set.

d. PROCEDURE FOR TUNING.

(1) Connect the transmitter to its power sources and turn on the "FIL" switch. Allow the tubes to heat. Turn on the oscilloscope, the sweep oscillator, the phasing sweep circuit, and the diode detector. Turn on the transmitter "PLATE" switch.

(2) Tune coil L26 in the mixer grid circuit for maximum response at either 27.5 or 32.5 mc, whichever can be done.

NOTE

In the initial production models of this equipment the range of tuning of this coil allows it to be peaked only at 27.5 mc. If this is changed in later equipments, it can easily be detected during this alignment procedure.

Tune coil L9 for maximum response at 32.5 megacycles. (The peak on the opposite side of the center frequency from that obtained by tuning L26.) Tune coil L8 for maximum response at 27.5 megacycles (the opposite peak from that obtained by tuning coil L9). Tune coil L7 for maximum response at 32.5 megacycles.

(3) Turn off the "PLATE" switch. Move the sweep

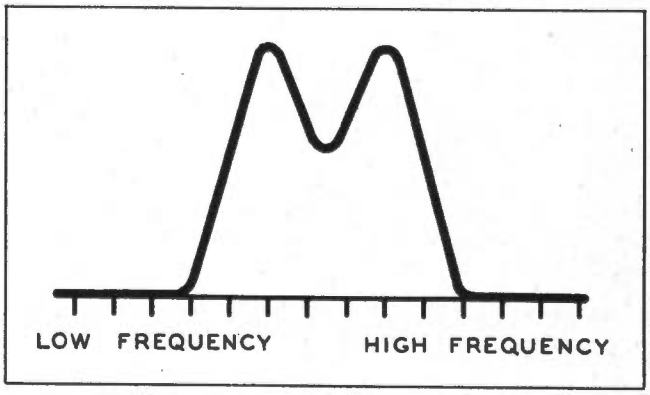


Figure 5-6. Sample Image to be Obtained when Tuning Pre-amplifier Coils

generator adapter plug to V3 socket. Insert tube V4 in its socket. Turn on the "PLATE" switch.

(4) Tune coil L7 for maximum response at 32.5 mc (the opposite peak from that obtained by tuning L8). Then tune coil L6 for maximum response at 27.5 mc. and coil L5 for maximum response at 32.5 mc. Sufficient gain should be realized to allow reduction of the input signal voltage to about one-fifth to one-tenth the previous setting for the same height on the oscilloscope screen.

(5) Turn off the "PLATE" switch. Move the sweep generator adapter plug to V2 socket. Insert tube V3 in its socket. Turn on the "PLATE" switch.

(6) Tune coil L5 for maximum response at 32.5 megacycles (the opposite peak from that obtained by tuning L6). Tune coil L4 for maximum response at 27.5 megacycles and coil L3 for maximum response at 32.5 megacycles. Reduce the signal input voltage to about one-fifth to one-tenth as required.

(7) Turn off the "PLATE" switch. Plug in tube V1 and feed in the full voltage of the sweep oscillator signal by coupling capacitively through the glass envelope. This may be accomplished by using two or three turns of wire or a small ungrounded metal can around the tube envelope. Then place a cloth or box over the tube to cut off all external light.

(8) Tune coil L2 for maximum response at 27.5 megacycles. Tune coil L1 for maximum response at 30.0 megacycles in order to bring up the dip in the image midway between 27.5 and 32.5 megacycles.

(9) Turn off the "PLATE" switch. Disconnect the test equipment and replace all tubes. Resolder the 300-volt lead to terminal No. 1 on the oscillator-mixer-power amplifier chassis terminal strip.

e. OPTIONAL TUNING PROCEDURE. — If the equipment used for the procedure above is not available, obtain a signal generator which will cover the range of about 20 to 40 megacycles, and a vacuum-tube voltmeter which will work satisfactorily over this frequency range. Follow the general instructions given below, keeping in mind that this is a substitute method and is not entirely satisfactory.

(1) Connect the signal generator successively at the same points as described for the sweep oscillator above. Connect the vacuum tube voltmeter at the same point as the diode detector.

(2) Vary the frequency of the signal between 24 and 35 megacycles and adjust the coupling coils (where necessary only) for proper peaking at 27.5 and 32.5 megacycles as shown by the vacuum-tube voltmeter.

4. REMOVAL OF OSCILLATOR-MIXER-POWER AMPLIFIER SECTION FROM THE CHASSIS.

a. Remove the dust cover.

b. Disconnect the coaxial cable just behind the mixer tube.

c. Disconnect the terminal strip connector underneath the chassis.

d. Remove the front panel screws.

e. Lift out the oscillator-mixer-power amplifier section.

5. ADJUSTMENT OF ROLO COILS.

Adjust rolo coils L27, L28, and L29 according to the following procedure:

a. Remove the transmitting equipment from the dust cover.

b. Release the locking nut on the dial which turns the coil to be adjusted. Loosen the knob set screw and remove the knob. Loosen the large screw in the center of the calibrated dial and pull the dial out just enough to disengage the gears.

c. Turn the dial toward the high frequency end until it reaches the stop. (At this point the contact wheels should be at the outer ends of the coil.)

CAUTION

Do not use excessive pressure when turning the dial or the stops might be sheared off.

The contact wheels should always be an equal number of turns from the center of the coil and should reach either end of the coil at the same time the stop on the tuning dial is reached. A difference of even one turn between the positions of the rollers on the coils may cause a decrease in output or an error in dial calibration. If the contact wheels are not in the proper position on the coils, make sure that the dial rests against the stop and loosen the coupling screw. Adjust the contact wheels by carefully turning by hand the shaft on which the coil is mounted until the contact wheels reach the outer ends of the coil.

IMPORTANT

Watch the contact wheels while turning the dial to be sure the contact wheels do not reach the ends of the coils and drop off the coil winding before the dial reaches the stop.

d. Tighten the coupling screw.

6. REPLACEMENT OF FUSES.

a. GENERAL. — The equipment contains one 5-ampere type 4AB5 115-volt fuse and one 5-ampere type 4AB5 24-volt fuse both marked "5 AMP" on the front panel. Two spare 5-ampere fuses are mounted inside the transmitter on the back of the front panel. The spare fuses are only made accessible by sliding the transmitter chassis out of the dust cover. To do this, it may be necessary to disconnect the three cable plugs from the front panel and remove the transmitter from its mounting in order to gain access to the screws in the rear which secure the dust cover.

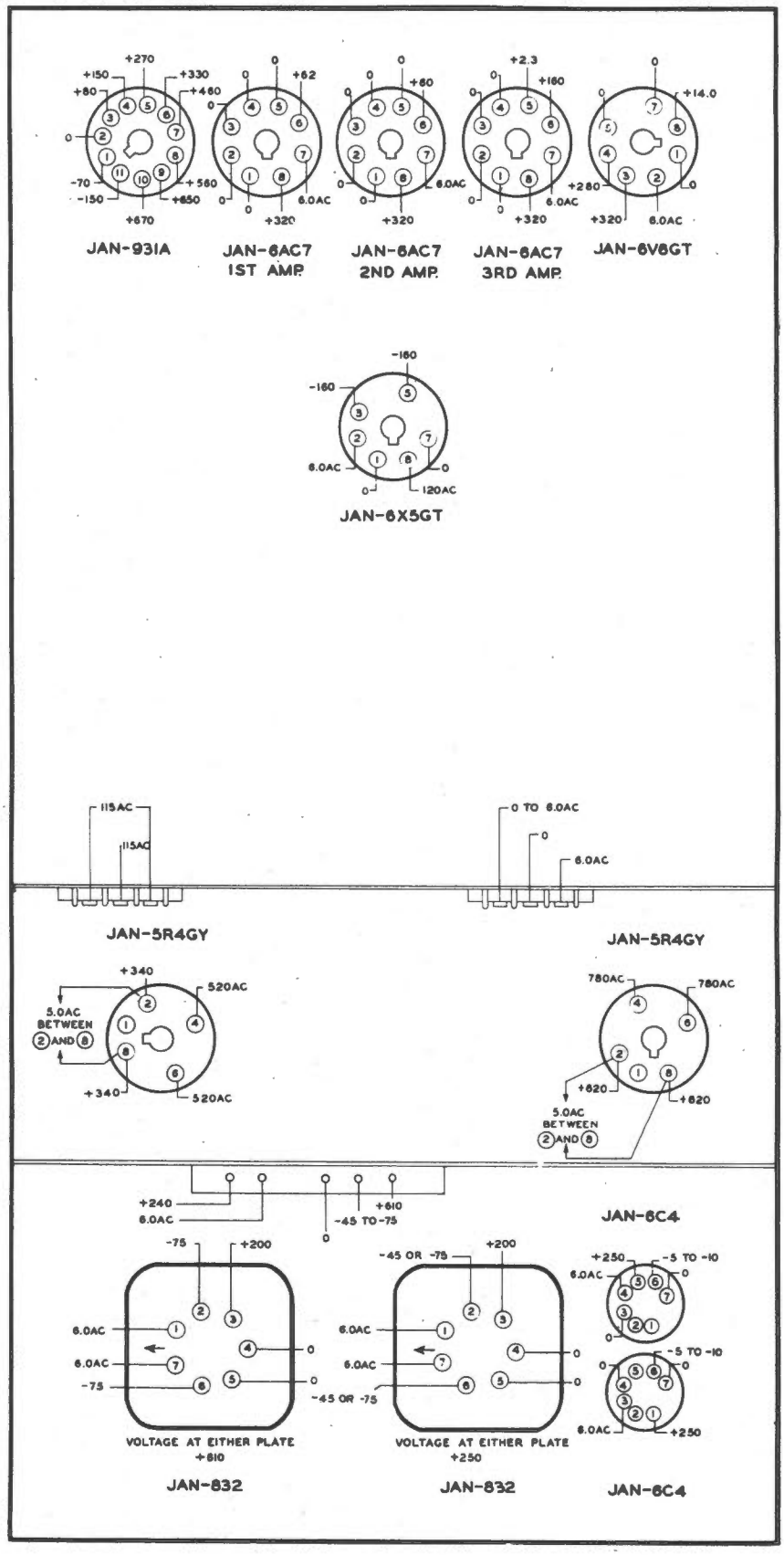


Figure 5-7. Radar Transmitter T-28/APT-1—Voltage Check Points (1000 Ohm-per-Volt Meter)

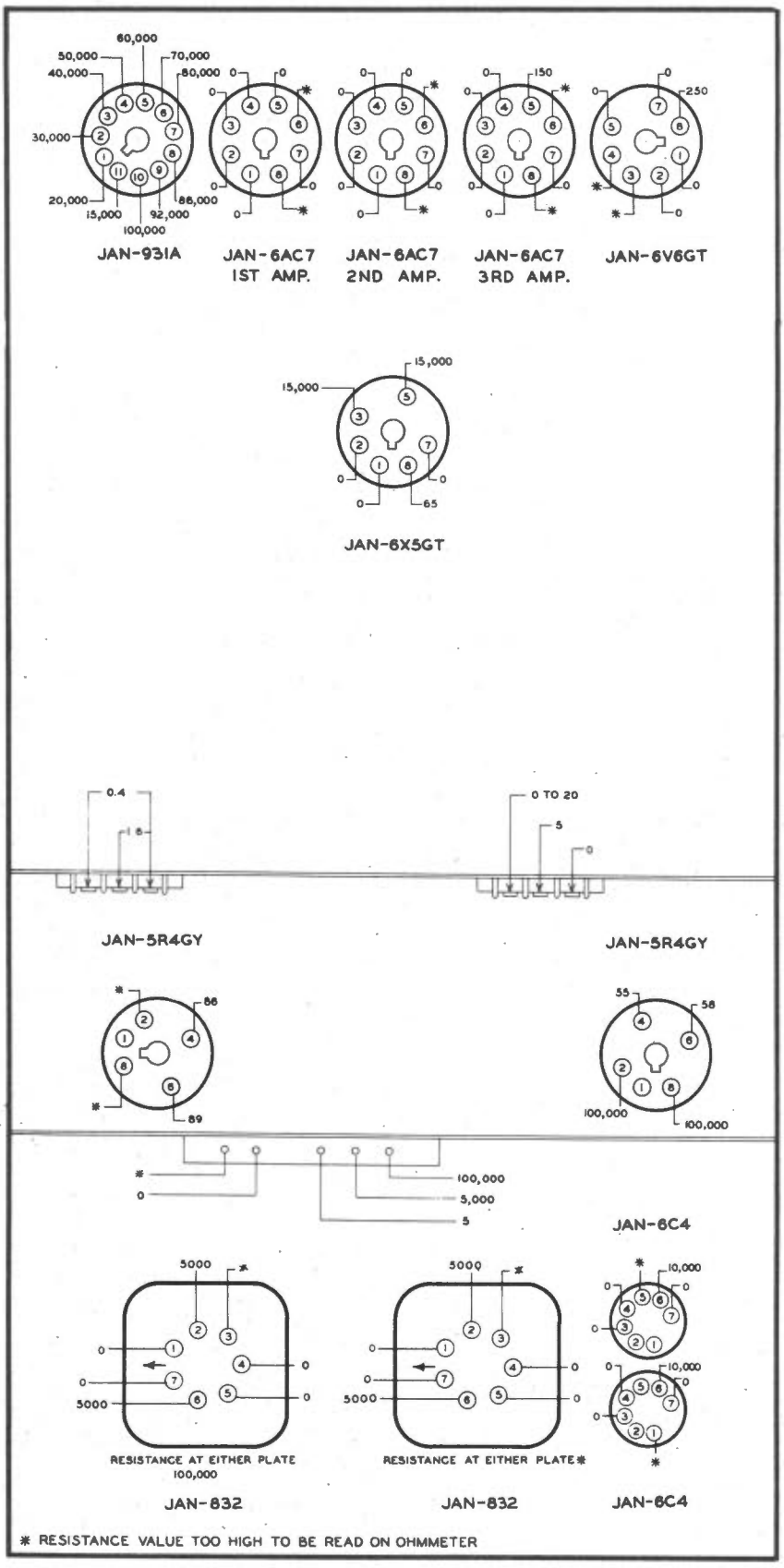


Figure 5-8. Radar Transmitter T-28/APT-1—Resistance Check Points

b. PROCEDURE.—Replace the 24-volt fuse if the fan motors cannot be heard after putting the equipment into operation. Replace the 115-volt fuse whenever:

(1) The "OUTPUT INDICATOR" lamp or the pilot lamp does not light.

(2) No indication can be had on the control box meter.

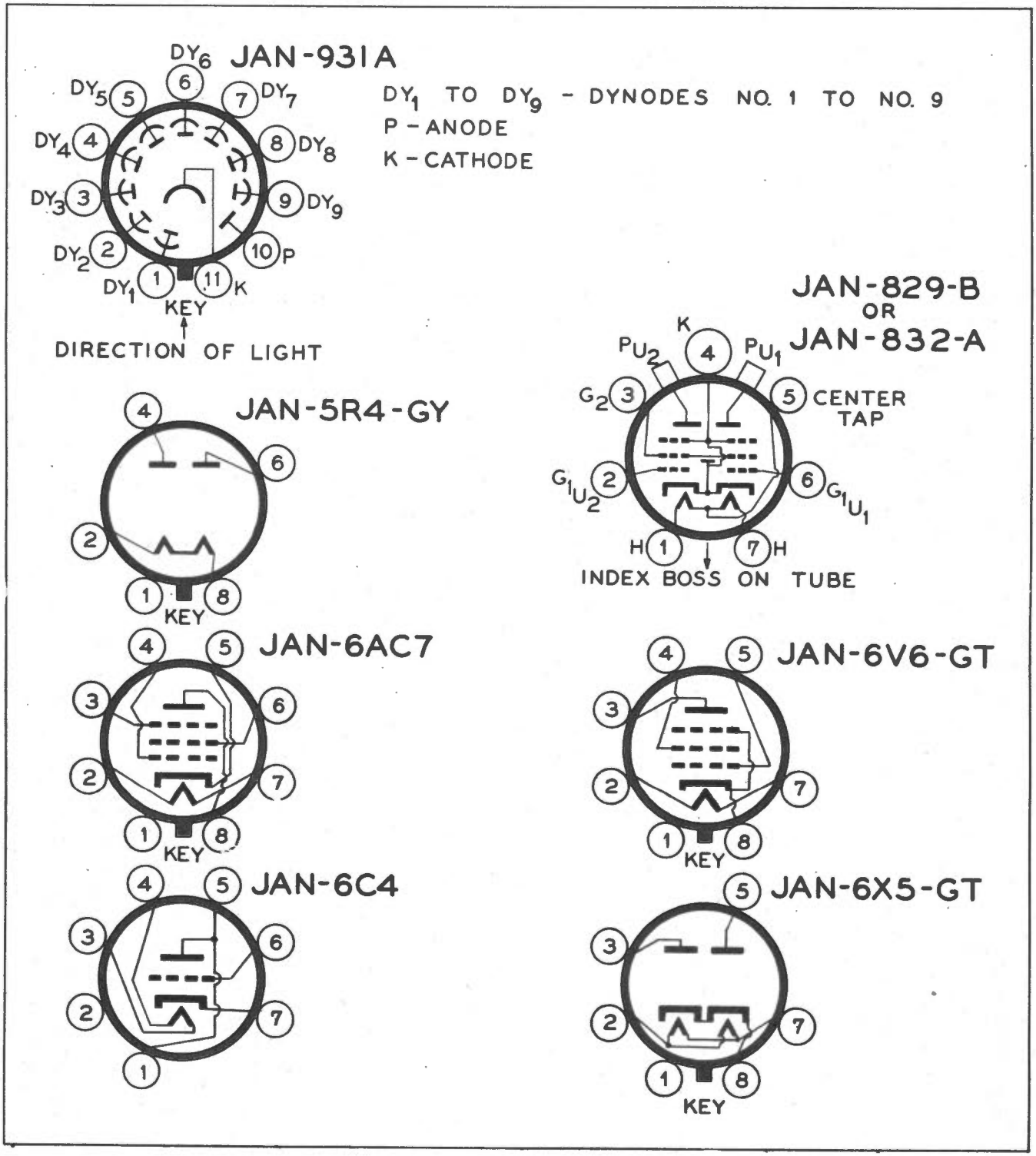


Figure 5-9. Tube Base Diagrams

(3) It is questionable that the equipment is operating.

7. POWER OUTPUT MEASUREMENT.

If available, Radio Frequency Wattmeter TS-118/AP may be used to measure the r-f power output of the transmitter. Refer to section VI of this handbook for a general description of the instrument and for instructions as to its use; see the handbook of maintenance instructions for the wattmeter.

8. VOLTAGES AND RESISTANCES AT TUBE SOCKETS AND TERMINAL STRIPS.

(See figs. 5-7, 5-8, and 5-9.)

NOTE

The voltage and resistance values given in the following tables were taken with all tubes in their sockets, and with the "OUTPUT LEVEL" control set in the counterclockwise direction until it just started to engage the switch. Two sets of voltages are given, made with 1000 ohm-per-volt and 20,000 ohm-per-volt, meters. All voltages and resistances were measured to ground. Directions for right and left were taken from the front of the transmitter setting right side up.

a. HASH AMPLIFIER SECTION.

(1) JAN-931-A HASH GENERATOR TUBE SOCKET (V1).

Socket Terminal	*1,000 Ohm/Volt (Volts)*	*20,000 Ohm/Volt (Volts)*	*Ohms to Ground*
#1 Dynode #1	− 70	− 70	20,000
2 Dynode 2	0	+ 20	30,000
3 Dynode 3	+ 80	+120	40,000
4 Dynode 4	+150	200	50,000
5 Dynode 5	+270	320	60,000
6 Dynode 6	+330	400	70,000
7 Dynode 7	+460	480	80,000
8 Dynode 8	+560	560	86,000
9 Dynode 9	+650	640	92,000
10 Anode	+670	750	100,000
11 Cathode	−150	−150	15,000

(2) JAN-6AC7 FIRST HASH AMPLIFIER TUBE SOCKET (V2).

Socket Terminal	*1,000 Ohm/Volt (Volts)*	*20,000 Ohm/Volt (Volts)*	*Ohms to Ground*
1 Shell	0	0	0
2 Heater	0	0	0
3 Suppressor	0	0	0
4 Control Grid	0	0	0
5 Cathode	0	0	0
6 Screen	+62	+70	Infinite
7 Heater	6.0 a.c.	6.0 a.c.	0
8 Plate	+320	+320	Infinite

(3) JAN-6AC7 SECOND HASH AMPLIFIER TUBE SOCKET (V3).

Socket Terminal	*1,000 Ohm/Volt (Volts)*	*20,000 Ohm/Volt (Volts)*	*Ohms to Ground*
1 Shell	0	0	0
2 Heater	0	0	0
3 Suppressor	0	0	0
4 Control Grid	0	0	0
5 Cathode	0	0	0
6 Screen	+60	+70	Infinite
7 Heater	6.0 a.c.	6.0 a.c.	0
8 Plate	+320	+320	Infinite

(4) JAN-6AC7 THIRD HASH AMPLIFIER TUBE SOCKET (V4).

Socket Terminal	*1,000 Ohm/Volt (Volts)*	*20,000 Ohm/Volt (Volts)*	*Ohms to Ground*
1 Shell	0	0	0
2 Heater	0	0	0
3 Suppressor	0	0	0
4 Control Grid	0	0	0
5 Cathode	+2.3	2.3	150
6 Screen	+160	+160	Infinite
7 Heater	6.0 a.c.	6.0 a.c.	0
8 Plate	320	320	Infinite

(5) JAN-6V6GT/G FOURTH HASH AMPLIFIER TUBE SOCKET (V5).

Socket Terminal	*1,000 Ohm/Volt (Volts)*	*20,000 Ohm/Volt (Volts)*	*Ohms to Ground*
1 Shield	0	0	0
2 Heater	6.0 a.c.	6.0 a.c.	0
3 Plate	+320	320	Infinite
4 Screen	+280	290	Infinite
5 Control Grid	0	0	0
6 N. C.			0
7 Heater	0	0	0
8 Cathode	+14.0	+15	250

(6) LEFT SIDE TERMINAL STRIP (TOP OF CHASSIS NEAR THE REAR).

Terminal	*1,000 Ohm/Volt (Volts)*	*20,000 Ohm/Volt (Volts)*	*Ohms to Ground*
1 Filament Supply (left)	6.0 a.c.	6.0 a.c.	0
2 Plate Supply (right)	320	320	Infinite

(7) RIGHT SIDE TERMINAL STRIP (TOP OF CHASSIS NEAR THE REAR).

Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
(left to right)			
1 High Voltage Supply	+610	+610	100,000
2 Negative Supply	−150	−150	15,000
3 Exciter Light	0 to 6 a.c.	0 to 6 a.c.	0 to 300

b. POWER SUPPLY SECTION.

(1) JAN-6X5GT BIAS RECTIFIER TUBE SOCKET (V12).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
1 Shield	0	0	0
2 Heater	6.0 a.c.	6.0 a.c.	0
3 Plate	−160	−160	15,000
4 N. C.	——	——	——
5 Plate	−160	−160	15,000
6 N. C.	——	——	——
7 Heater	0	0	0
8 Cathode	120 a.c.	120 a.c.	65

(2) JAN-5R4GY 600-VOLT RECTIFIER TUBE SOCKET (LEFT SIDE) (V10).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
2 Heater	+620	+610	100,000
4 Plate	780 a.c.	780 a.c.	55
6 Plate	780 a.c.	780 a.c.	58
8 Heater	+620	+620	100,000
Heater Volts	5.0 a.c.	5.0 a.c.	

(3) JAN-5R4GY 300-VOLT RECTIFIER TUBE SOCKET (RIGHT SIDE) (V11).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
2 Heater	+340	+340	Infinite
4 Plate	520 a.c.	520 a.c.	86
6 Plate	520 a.c.	520 a.c.	89
8 Heater	+340	+340	Infinite
Heater Volts	5.0 a.c.	5.0 a.c.	

(4) LEFT SIDE TERMINAL STRIP (LOCATED BENEATH CHASSIS UNDER FRONT SHIELD SCREEN).

Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
(left to right)			
1 Heater Voltage	6.0 a.c.	6.0 a.c.	0
2 Meter	0	0	5
3 Exciter Light	0 to 6 a.c.	0 to 6 a.c.	0 to 20

(5) RIGHT SIDE TERMINAL STRIP (LOCATED BENEATH CHASSIS UNDER FRONT SHIELD SCREEN).

Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
(left to right)			
1 AC line common	No ground in set	No ground in set	
2 AC line Fil.	115 a.c. to 1	115 a.c. to 1	1.6 to #1
3 AC line Plate	115 a.c. to 1	115 a.c. to 1	0.4 to #1

c. OSCILLATOR-MIXER-POWER AMPLIFIER SECTION.

(1) JAN-6C4 OSCILLATOR TUBE SOCKET (FRONT) (V6).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
1 Plate	+250	+250	Infinite
2 N. C.	——	——	——
3 Heater	6.0 a.c.	6.0 a.c.	0
4 Heater	0	0	0
5 N. C.	——	——	——
6 Grid	−5 to −10	−6 to −15	10,000
7 Cathode	0	0	0

(2) JAN-6C4 OSCILLATOR TUBE SOCKET (REAR) (V7).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
1 N. C.	——	——	——
2 N. C.	——	——	——
3 Heater	0	0	0
4 Heater	6.0 a.c.	6.0 a.c.	0
5 Plate	+250	+250	Infinite
6 Grid	−5 to −10	−6 to −15	10,000
7 Cathode	0	0	0

(3) JAN-832 MIXER TUBE SOCKET (V8).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
1 Heater	6.0 a.c.	6.0 a.c.	0
2 Grid	−45 or −75	−45 or −75	5,000
3 Screen	200	200	Infinite
4 Cathode	0	0	0
5 Heater C. T.	0	0	0
6 Grid	−45 or −75	−45 or −75	5,000
7 Heater	6.0 a.c.	6.0 a.c.	0
Top Plates	+250	+250	Infinite

(4) JAN-832 POWER AMPLIFIER TUBE SOCKET (V9).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
1 Heater	6.0 a.c.	6.0 a.c.	0
2 Grid	−75	−75	5,000
3 Screen	200	200	Infinite
4 Cathode	0	0	0
5 Heater C. T.	0	0	0
6 Grid	−75	−75	5,000
7 Heater	6.0 a.c.	6.0 a.c.	0
Top Plates	+610	+610	100,000

(5) JAN-829 ALTERNATE POWER AMPLIFIER TUBE SOCKET (V9).

Socket Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
1 Heater	6.0 a.c.	6.0 a.c.	0
2 Grid	−45	−45	5,000
3 Screen	+200	+200	Infinite
4 Cathode	0	0	0
5 Heater C. T.	0	0	0
6 Grid	−45	−45	5,000
7 Heater	6.0 a.c.	6.0 a.c.	0
Top Plates	+610	+610	100,000

(6) PLUG-IN TERMINAL STRIP.

Terminal	1,000 Ohm/Volt (Volts)	20,000 Ohm/Volt (Volts)	Ohms to Ground
(left to right)			
1 "B" Supply	+240	+240	Infinite
2 Heater Supply	6.0 a.c.	6.0 a.c.	0
3 Meter	0	0	5
4 Bias Supply	−45 or −75	−45 or −75	5,000
5 "B" Supply	+610	+610	100,000

9. COMPLETE OVERALL ALIGNMENT PROCEDURE.

The following procedure is suggested when it is desired to make a complete overall check of all circuits and adjustments.

a. Measure resistance values at tube sockets and compare with the values given in paragraph 8 above.

b. Test all tubes on a tube tester or in another equipment known to be good.

c. Check all fuses and pilot lamps.

d. Measure voltage values at tube sockets and compare with the values given in paragraph 8 above.

e. Check the rolo coils according to the instructions in paragraph 5, this section.

f. Tune the pre-amplifier coils according to instructions in paragraph 3 this section.

g. Tune the oscillator-mixer-power amplifier circuits according to instructions in section II, paragraph 3*c*.

h. Check the bandwidth according to instructions in section II, paragraph 3*c*.

i. Check the power output with Radio Frequency Wattmeter TS-118/AP if available.

10. MAINTENANCE OF MONITOR BC-1255-A.

a. GENERAL.

(1) Change batteries if Test Set I-139-A plugged into the meter jack cannot be adjusted by the "METER SET" knob to at least half-scale with no signal input to the monitor.

(2) If the monitor fails to operate after a good set of new batteries has been installed, check the tubes by replacing them with tubes known to be good.

(3) Make only minor maintenance repairs in the field, such as battery or tube replacements, or reconnection of any broken battery leads at monitor or battery end of battery cable. Replacement or adjustment of any other components may change calibration of the monitor.

(4) In case of major failure, secure a new monitor and return the defective one to the proper depot for repairs and re-calibration.

(5) Never disturb any dial or internal coupling set-screws, or internal adjustment controls. Failure to observe this rule will result in loss of calibration accuracy and render the monitor useless as a frequency standard.

b. BATTERY INSTALLATION OR REPLACEMENT.

(1) Remove the back cover of the monitor (held by four screws).

(2) Remove the batteries before disconnecting the leads.

(3) Connect the batteries as shown on the chart attached to the back cover of the monitor. (See fig. 5-10.)

(4) Follow the chart or diagram carefully. Incorrect battery connections will burn out all tubes.

(5) Carefully replace batteries and surplus cable in the battery compartment and fasten the cover in

place making certain that the chart side of the cover faces the inside of the case.

c. TUBE REPLACEMENT.

(1) Remove four screws from the front panel.

(2) Use extreme caution in removing the monitor from the case.

(3) See figure 5-11 for location and types of tubes used.

(4) Replace defective tubes and carefully put the monitor and surplus cable back into case.

(5) Replace the four panel screws.

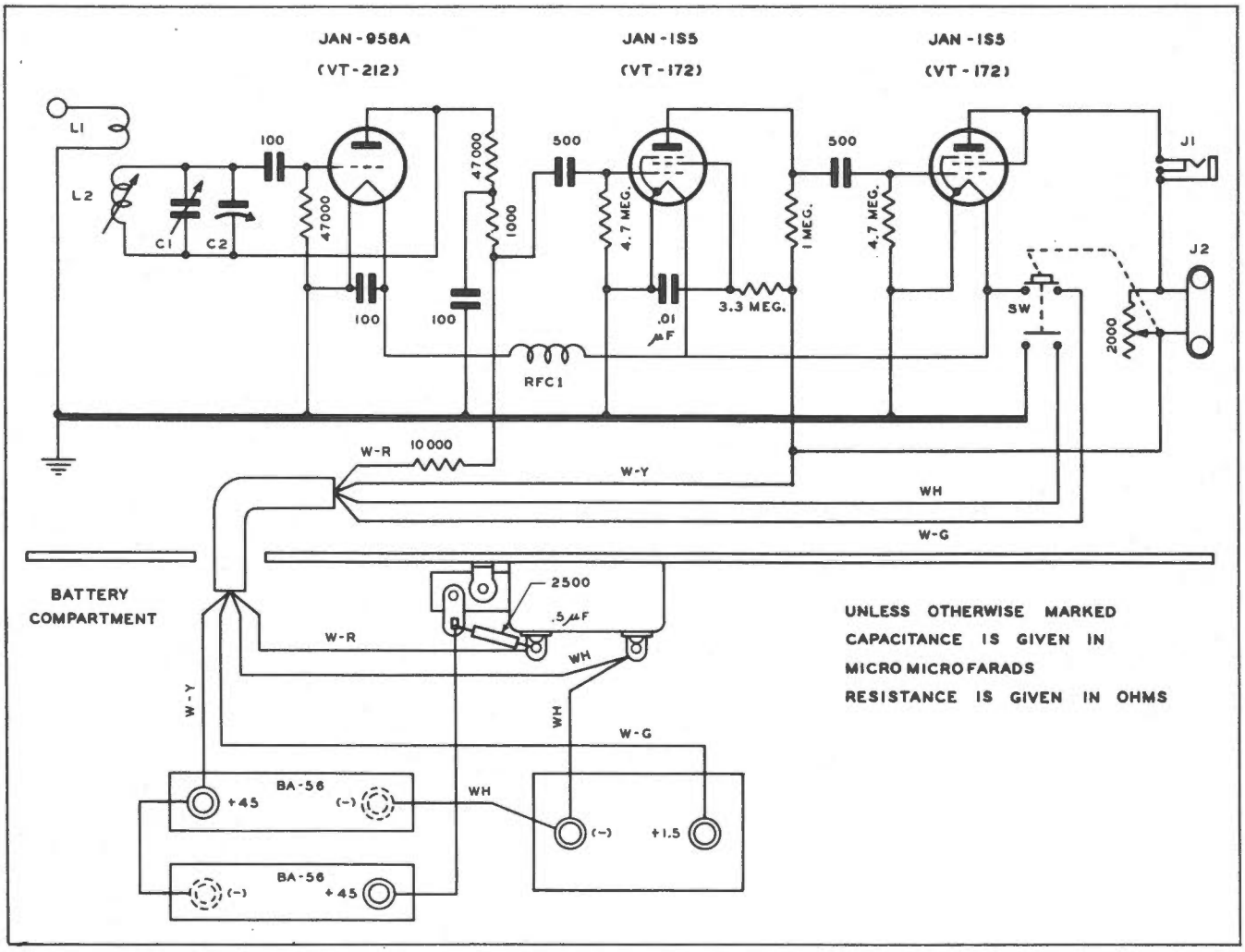


Figure 5-10. Monitor BC-1255-A—Schematic Diagram

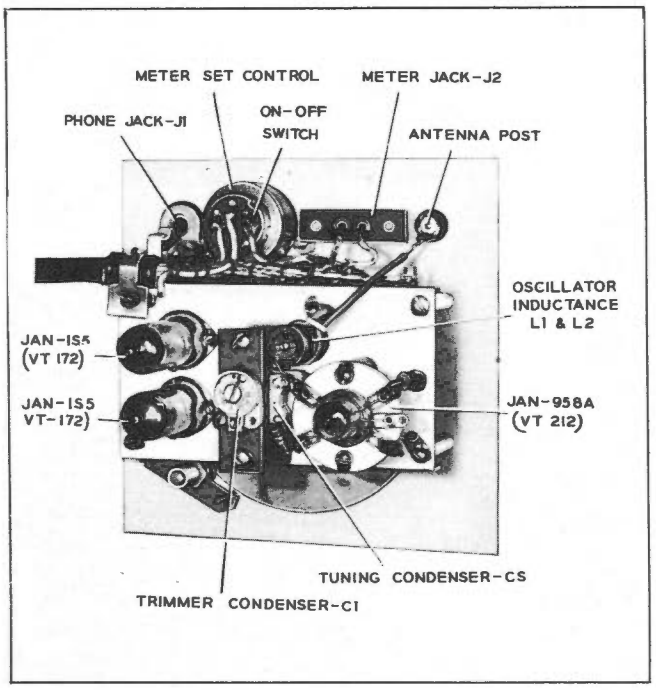


Figure 5-11. Monitor BC-1255-A—Interior View

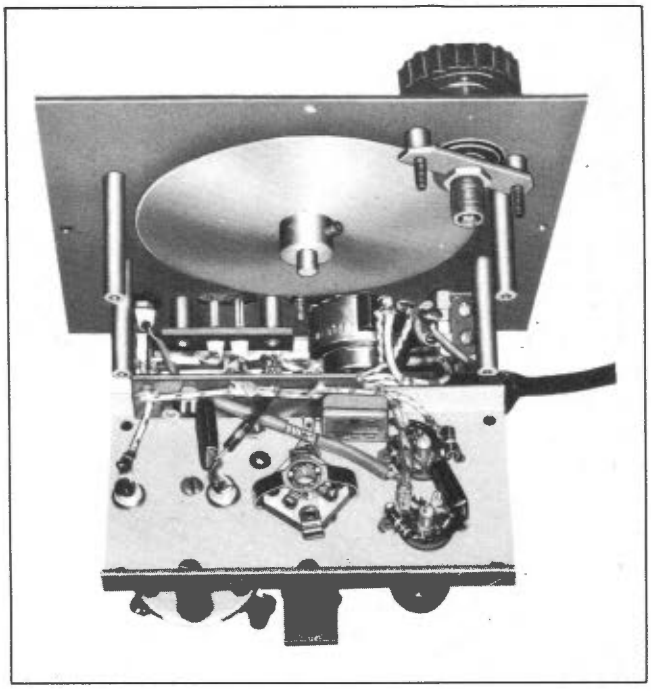


Figure 5-12. Monitor BC-1255-A—Interior View with Deck Dismounted

SECTION VI

SUPPLEMENTARY DATA

1. TECHNICAL DATA SUMMARY FOR TRANSMITTING EQUIPMENT AN/APT-1.

a. FREQUENCY RANGE. — The frequency range is from 93 to 210 megacycles.

b. BANDWIDTH.—The bandwidth is approximately 5 megacycles.

c. ANTENNAS.—The frequency range of the three quarter-wave-length stub antennas is as follows:

Antenna Stub AT-36/APT.....150 to 210 megacycles

Antenna Stub AT-37/APT.....115 to 150 megacycles

Antenna Stub AT-38/APT..... 93 to 115 megacycles

d. POWER OUTPUT.—With a JAN-832 tube as power amplifier, the power output is 13 watts at 93 megacycles and 6 watts at 210 megacycles. With a JAN-829B tube, the power output is 28 watts at 93 megacycles and 16 watts at 162 megacycles.

e. POWER INPUT.—300 watts is required from a 115-volt a-c supply, 400-2600 cps. One ampere is required from a 24-volt d-c supply.

f. POWER SUPPLY.—The d-c supply voltage is 24 volts and the a-c supply voltage is 80 or 115 volts. The a-c supply frequency may be between 400 and 2600 cycles per second. The a-c power factor is 0.80.

g. TYPE OF MODULATION. — The equipment uses amplitude modulation in which only one side band is used with the carrier suppressed.

h. CENTER FREQUENCY OF HASH AMPLIFIER. The center frequency of the hash amplifier is 30 megacycles.

i. HASH AMPLIFIER FREQUENCY RANGE. — The range of frequencies passed by the hash amplifier is approximately 27.5 to 32.5 megacycles.

2. METER SCALES.

a. The meter on the control unit, which reads directly with no multiplier, has a full scale deflection of 200 milliamperes.

b. The meter on Test Set I-139-A has a scale of 1 milliampere. The use of the shunt multiplier incorporated in the meter increases the range to 200 milliamperes full scale. Thus the reading of 1 milliampere on the test set is the same as 200 milliamperes on the control unit meter.

3. FREQUENCY CALIBRATION CHART.

Approximate Output Frequency Desired	*Oscillator Frequency*	*"OSC FREQ" "MIXER PLATE" "AMP GRID" "AMP PLATE"*
Megacycles	*Megacycles*	*Dial Settings*
93	123	0
98	128	1
102	132	2
106	136	3
110	140	4
118	148	5
126	156	6
140	170	7
150	180	8
166	136	9
170	140	10
178	148	11
186	156	12
200	170	13
210	180	14

4. TUBE COMPLEMENT.

The following list gives the quantity, type and function of all tubes required in Radar Transmitter T-28/-APT-1. (See fig. 1-3.)

Quantity	*Type*	*Function*
1	JAN-931A	Hash Generator
3	JAN-6AC7 (VT-112)	Hash Amplifiers
1	JAN-6VGT/G (VT-107A)	Hash Amplifier
2	JAN-6C4	Oscillator
1	JAN-832 (VT-118) or JAN-832A (VT-286)	Mixer
1	JAN-832 (VT-118) or JAN-832A (VT-236) or JAN-829B or JAN-829 (VT-259)	Power Amplifier
2	JAN-5R4GY	Rectifier
1	JAN-6X5GT/G (VT-126B)	Rectifier

5. MONITOR BC-1255-A.

Monitor BC-1255-A is a portable, heterodyne frequency meter which can be used in adjusting the radar transmitter to a desired frequency and in checking the bandwidth of the radiated signal. (See fig. 2-8.)

a. The monitor is complete with two Batteries BA-56, one Battery BA-54, two JAN-1S5 tubes, and one JAN-958A tube.

b. The following components are used with the monitor:

(1) Headset HS-23.

(2) Cord CD-307 or CD-307-A.

(3) Test Set I-139-A (Test Meter TS-60/U).

(4) Antenna wire (18 inch length).

6. FREQUENCY METERS TS-174( )/U AND TS-175( )/U.

a. Frequency Meter TS-174( )/U is suitable for general purpose squadron use in checking frequency in the range 20 to 250 megacycles. It is of the heterodyne type, operating on the fundamental frequency range of 20 to 50 megacycles and on the harmonics thereof in the range 50 to 250 megacycles. It has crystal check points. The equipment is battery operated, requiring four each Battery BA-23 and six each Battery BA-2. The case, chassis, dial mechanism, and battery complement are the same as those of Frequency Meter BC-221. It is 10 inches wide, 12½ inches high, and 9¼ inches deep. Its weight with batteries and spare tubes does not exceed 42 pounds.

b. Frequency Meter TS-175( )/U is suitable for general purpose squadron use in checking frequency in the range 85 to 1000 megacycles. It is of the heterodyne type, operating on the fundamental frequency range of 85 to 220 megacycles and on the harmonics thereof in the range 220 to 1000 megacycles. Crystal check points are provided. The equipment requires four each Battery BA-23 and six each Battery BA-2. The case, chassis, dial mechanism, and battery complement are the same as those of Frequency Meter BC-221. It is 10 inches wide, 12½ inches high, and 9¼ inches deep. Its weight with batteries does not exceed 42 pounds.

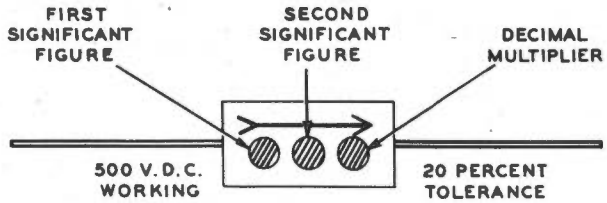
7. AMPLIFIER ALIGNMENT UNIT TS-92/AP.

The amplifier alignment unit consists of a receiver which can be used in aligning the amplifier stages of the special jamming transmitter for maximum gain as indicated on an output meter. The frequency range of the unit is 20 to 250 megacycles. Fifty watts of power is required from an a-c source of 110 volts, 60 to 2600 cps.

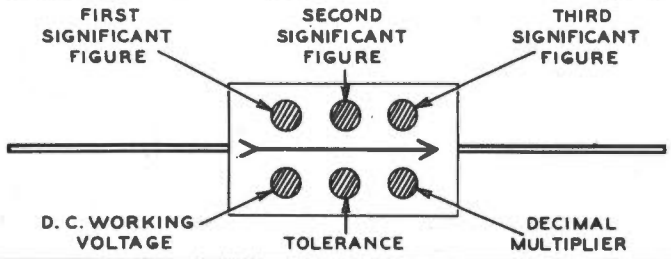
8. RADIO FREQUENCY WATTMETER TS-118/AP.

Radio Frequency Wattmeter TS-118/AP is an untuned wattmeter of the thermo-couple type, designed for checking the output of radio frequency amplifiers. The thermo-couples are replaceable to allow the instrument to cover the frequency band from 50 to 250 megacycles. The maximum range is 200 watts between 85 and 150 megacycles and 100 watts between 150 and 250 megacycles.

RMA COLOR CODES FOR CAPACITORS (MMFD)



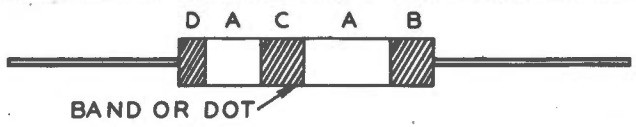
COLOR	NUMERAL	VOLTS	MULTIPLIER	TOLERANCE
BLACK	0		1	
BROWN	1	100	10	1%
RED	2	200	100	2%
ORANGE	3	300	1,000	3%
YELLOW	4	400	10,000	4%
GREEN	5	500	100,000	5%
BLUE	6	600	1,000,000	6%
VIOLET	7	700	10,000,000	7%
GRAY	8	800	100,000,000	8%
WHITE	9	900	1,000,000,000	9%
GOLD		1000	0.1	5%
SILVER		2000	0.01	10%
NO COLOR		500		20%



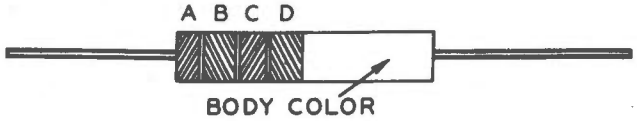
RMA COLOR CODE FOR RESISTORS (OHMS)

COLOR	A 1st DIGIT	B 2nd DIGIT	C MULTIPLIER
SILVER			0.01
GOLD			0.1
BLACK		0	1.0
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1,000
YELLOW	4	4	10,000
GREEN	5	5	100,000
BLUE	6	6	1,000,000
PURPLE	7	7	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	

D — TOLERANCE CODE:
GOLD = 5% SILVER = 10% NO COLOR = 20%



OLD COLOR ARRANGEMENT



NEW COLOR ARRANGEMENT

BODY COLOR (NEW COLOR ARRANGEMENT ONLY) INDICATES TYPE OF RESISTOR, AS FOLLOWS:—
BLACK — COMPOSITION, NON-INSULATED
TAN, OLIVE OR WHITE — COMPOSITION, INSULATED
DARK BROWN — WIRE-WOUND, INSULATED

SECTION VII

TABLE OF REPLACEABLE PARTS

SPECIAL NOTICE

Each Service using this list has established certain depots and service groups for the storage and issue of spare parts to its organizations requiring them. The regulations of each Service should be studied to determine the method and source for requisitioning spare parts. The information in this list, as to manufacturer's or contractor's name, type, model, or drawing number is not to be interpreted as authorization to field agencies to attempt to purchase identical or comparable spare parts direct from the manufacturer or a wholesale or retail store except under emergency conditions as covered by existing regulations of the Service concerned.

U. S. ARMY PERSONNEL: This table is for information ONLY and is not to be used as a basis for requisitioning parts. Authorities for obtaining maintenance items are as follows: for using organizations, applicable service publications of the 00-30 series of Army Air Forces Technical Orders; for higher maintenance and supply echelons, the applicable Standard Maintenance List.

MODEL: TRANSMITTING EQUIPMENT AN/APT-1 **MAJOR UNIT: RADAR TRANSMITTER T-28/APT-1**

Reference Symbol	Army Stock Number Navy Stock Number British Ref. Number	Name of Part and Description	Function	Mfr. and Desig. or AWS Type	Cont. or Govt. Dwg. or Spec. No.
C-1	3D9100-70.1	CONDENSER: mica, 100 mmf, ±10%; 800 volts d.c. working; 2000 volts d.c. test	V-1 dynode #9 bypass	Cornell-Dubilier 5WP	7250216
C-2	3D9100-70.1	CONDENSER: mica, 100 mmf, ±10%; 800 volts d.c. working; 2000 volts d.c. test	V-1 cathode bypass	Cornell-Dubilier 5WP	7250216
C-3	3D9500-101	CONDENSER: mica, 500 mmf, ±10%; 800 volts d.c. working; 2000 volts d.c. test	V-1 supply bypass	Cornell-Dubilier 5WP	7250215
C-4		CONDENSER: same as C-3			
C-5	3D9005-29	CONDENSER: mica; 5 mmf, ±20%; 800 volts d.c. rating; $1\frac{3}{32}$" long x $\frac{5}{32}$" O.D.; one black dot	V-1 to 1st amp. coupling	Cornell-Dubilier 5WP	7241837
C-6	3D9500-10.1	CONDENSER: mica; 500 mmf, ±10%; 800 volts d.c. working; 2000 volts d.c. test	V-1 supply bypass	Cornell-Dubilier 5WP	7250215
C-7	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%	V-2 screen bypass	Cornell-Dubilier Aerovox Solar	7248780
C-8	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%	V-2 plate supply bypass	Cornell-Dubilier Aerovox Solar	7248780
C-9	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-2 fil. bypass	Cornell-Dubilier Aerovox Solar	7248780
C-10	3D9005-20.1	CONDENSER: ceramic; 5 mmf, ±10%; 500 volts d.c.; rating $1\frac{3}{32}$" long x $\frac{5}{32}$" O.D.; one black dot	V-2 to V-3 coupling	Centralab	7247254
C-11	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-3 screen bypass	Cornell-Dubilier Aerovox Solar	7248780
C-12	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-3 plate supply bypass	Cornell-Dubilier Aerovox Solar	7248780

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: TRANSMITTING EQUIPMENT AN/APT-1 **MAJOR ASSEMBLY: RADAR TRANSMITTER T-28/APT-1**

Reference Symbol	Army Stock Number Navy Stock Number British Ref. Number	Name of Part and Description	Function	Mfr. and Desig. or AWS Type	Cont. or Govt. Dwg. or Spec. No.
C-13	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-3 fil. bypass	Cornell-Dubilier Aerovox Solar	7248780
C-14	3D9005-20.1	CONDENSER: ceramic; 5 mmf, ±10%; 500 volts d.c. rating; 13/32" long x 5/32" O.D.; one black dot	V-3 to V-4 coupling	Centralab	7247254
C-15	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	High voltage bypass	Cornell-Dubilier Aerovox Solar	7248780
C-16	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-4 screen bypass	Cornell-Dubilier Aerovox Solar	7248780
C-17	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-4 cathode bypass	Cornell-Dubilier Aerovox Solar	7248780
C-18	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-4 plate supply bypass	Cornell-Dubilier Aerovox Solar	7248780
C-19	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-4 fil. bypass	Cornell-Dubilier Aerovox Solar	7248780
C-20	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	Fil. supply bypass	Cornell-Dubilier Aerovox Solar	7248780
C-21	3D9005-20.1	CONDENSER: ceramic; 5 mmf, ±10%; 500 volts d.c. rating; 13/32" long x 5/32" O.D.; one black dot	V-4 to V-5 coupling	Centralab	7247254
C-22	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-5 screen bypass	Cornell-Dubilier Aerovox Solar	7248780
C-23	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-5 cathode bypass	Cornell-Dubilier Aerovox Solar	7248780
C-24	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-5 plate supply bypass	Cornell-Dubilier Aerovox Solar	7248780
C-25	3DKA3-61.1	CONDENSER: mica; 3000 mmf, ±10%; AWS #CM-30-B-302K	V-5 fil. bypass	Cornell-Dubilier Aerovox Solar	7248780
C-26	3D9500-101	CONDENSER: mica; 500 mmf, ±10%; 800 volts d.c. working; 1000 volts d.c. test	V-5 to line coupling	Cornell-Dubilier 5WP	7250215
C-27	3D9030V-9	CONDENSER: variable; 2.5 to 30 mmf, ±3%; 1" wide x 1½" high x 3" long; ¼" diam. shaft extending ½"; 2 - 8 plate condensers on common shaft	Osc. tuning	Teleradio AP-11	7249939
C-28	3D9010-47	CONDENSER: ceramic; 10 mmf, ±10%; 500 volts d.c. rating; 13/32" x 5/32" diam.; one blue dot	Output indicator shunt	Centralab	7247251
C-29	3D9010-47	CONDENSER: ceramic; 10 mmf, ±10%; 500 volts d.c. rating; 13/32" x 5/32" diam.; one blue dot	Coupling osc. to mixer	Centralab	7247251
C-30	3D9010-47	CONDENSER: same as C-29	Coupling osc. to mixer	Centralab	7247251

C-31	3K3010221	CONDENSER: mica; 1000 mmf, ±10%; AWS #CM-30B-102K	Bias supply bypass	Cornell-Dubilier Aerovox Solar	7248779
C-32 and 33	2C6900-48/P1	CAPACITY PLATE: sheet brass; silver plated; 5/8" high x 1/2" wide x 1/4"	Mixer to power amp. coupling		7248621
C-34 and 35	3D9025-49	CONDENSER: mica; 25 mmf, ±10%; 800 volts d.c. working; 2000 volts d.c. test	Power ampl. to ant. tuner coupling	Cornell-Dubilier 5WP	7250584
C-36	3D9005VE1	CONDENSER: trimmer; variable; 2.8 mmf to 5.1 mmf; 3 plates 17/36" dia.; 1" long; 1/4" hex adjusting nut and screwdriver slot	Ant. indicator adjustment	Amer. Steel Pkg. Co. 5-S	7247944
C-37	3K3010221	CONDENSER: mica; 1000 mmf, ±10%; AWS #CM-30B-102K	Meter switch bypass	Cornell-Dubilier Aerovox Solar	7248779
C-38	3K3010221	CONDENSER: mica; 1000 mmf, ±10%; AWS #CM-30B-302K	Plate supply bypass	Cornell-Dubilier Aerovox Solar	7248779
C-39	3DB2.21	CONDENSER: 2 mfd, ±10%; 1000 volts d.c.; tubular 5 1/2" long x 1 1/2" diam.; end mounting	600 volt filter	Cornell-Dubilier TLA-10020	7247703
C-40 and 41	3DB4-43	CONDENSER: 4 mfd; 600 volts d.c.; tubular 5 1/2" long x 1 1/2" diam.; end mounting	Negative supply filter	Cornell-Dubilier TLA-6040	7247702
C-42	3DB4-43	CONDENSER: 4 mfd; 600 volts d.c.; tubular 5 1/2" long x 1 1/2" diam.; end mounting	300 volt filter	Cornell-Dubilier TLA-6040	7247702
R-1 to 9	3Z6610-59 (A-B CB) 3Z6610-11 (Erie 518) 3Z6610-11 (IRC-BT 1)	RESISTOR: insulated carbon; 10,000 ohm, ±10%; 1 watt; 1 1/4" max. length; 1/4" max. diameter	V-1 dynode voltage dividers	IRC BT1 Erie 518 Allen-Bradley GB-103	7248785
R-10	3Z6615-4 (IRC-BT 1)	RESISTOR: insulated carbon; 15,000 ohm, ±10%; 1 watt; 1 1/4" max. length; 1/4" max. diameter	V-1 dynode voltage divider	IRC BT1 Erie 518 Allen-Bradley GB-1531	7248787
R-11	3Z6120-7 (A-B EB) 3Z6120-5 (IRC-BT 1/2)	RESISTOR: carbon; 1200 ohms, ±5%; 1/2 watt; 5/8" max. length; 3/16" max. diameter	V-2 grid loading	IRC BT1/2 Allen-Bradley Stackpole	7244974
R-12	3Z6700-81 3Z6700-100 3Z6700-95	RESISTOR: carbon; 100,000 ohms, ±10%; 1 watt; 5/8" max. length; 3/16" max. diameter	V-2 screen dropping	Erie 518 Allen-Bradley G-B Stackpole MB-1	7249798
R-13	3Z6120-7 (A-B EB) 3Z6120-5 (IRC-BT1/2)	RESISTOR: carbon; 1200 ohms, ±5%; 1/2 watt; 5/8" max. length; 3/16" max. diameter	V-3 grid loading	IRC BT1/2 Allen-Bradley Stackpole	7244974
R-14	3Z6700-81 3Z6700-100 3Z6700-95	RESISTOR: same as R-12	V-3 screen dropping		7249798
R-15	3Z6120-5 (IRC-BT 1/2) 3Z6120-7 (A-B EB)	RESISTOR: carbon; 1200 ohms, ±5%; 1/2 watt; 5/8" max. length; 3/16" max. diameter	V-4 grid loading	IRC BT1/2 Stackpole Allen-Bradley	7244974

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: TRANSMITTING EQUIPMENT AN/APT-1 **MAJOR ASSEMBLY: RADAR TRANSMITTER T-28/APT-1**

Reference Symbol	Army Stock Number Navy Stock Number British Ref. Number	Name of Part and Description	Function	Mfr. and Desig. or AWS Type	Cont. or Govt. Dwg. or Spec. No.
R-16	3Z6015-22 (Erie-504) 3Z6015-11 (A-B EB)	RESISTOR: insulated carbon; 150 ohms, ±10%; ½ watt	V-4 cathode bias	Erie 504 Allen-Bradley EB	7248701
R-17	3Z6647-19	RESISTOR: carbon; 47,000 ohms, ±10%; 1 watt; 5/8" max. length; 3/16" max. diameter	V-4 screen dropping	Allen-Bradley G-B	7247352
R-18	3Z6120-5 (IRC-BT ½) 3Z6120-7 (A-B EB)	RESISTOR: carbon; 1200 ohms, ±5%; ½ watt; 5/8" max. length; 3/16" max. diameter	V-5 grid loading	IRC BT½ Allen-Bradley Stackpole	7244974
R-19	3Z6025-8	RESISTOR: insulated carbon; 250 ohms, ±10%; 2 watt; 1¼" max. length x ¼" max. diameter	V-5 cathode bias	IRC BT2	7248712
R-20	3Z6610-38 (IRC-BT ½) 3Z6610-57 (A-B EB) 3Z6610-87 (Stackpole)	RESISTOR: carbon; 10,000 ohms, ±10%; ½ watt; 5/8" max. length; 3/16" max. diameter	V-5 screen dropping	IRC BT½ Allen-Bradley Stackpole	7244978
R-21, 22, 23 and 24		RESISTOR: This resistor is coil form only and is not supplied separately	Form for coils L-18, 19, 20, 21	IRC BT½	7251726
R-25	3Z6610-38 (IRC-BT ½) 3Z6610-57 (A-B EB) 3Z6610-87 (Stackpole)	RESISTOR: carbon; 10,000 ohms, ±10%; ½ watt; 5/8" max. length; 3/16" max. diameter	Osc. grid leak	IRC BT½ Allen-Bradley Stackpole	7244978
R-26 and 27	3Z6960-11	RESISTOR: matched paid of 210-ohm, ½ watt, ±5%; to give 5 ohms 1 watt total	Meter shunt	IRC BT½	7247852
R-28	3Z6500-8 3Z6500-113 3Z6500-146	RESISTOR: insulated carbon; 5000 ohms, ±10%; 1 watt; 1¼" max. length x ¼" max. diam.	V-8 mixer screen dropping	IRC BT1 Erie 518 Allen-Bradley GB5021	7248784
R-29	3Z6500-8 3Z6500-146 3Z6500-113	RESISTOR: insulated carbon; 5000 ohms, ±10%; 1 watt; 1¼" max. length x ¼" max. diam.	V-9 power amp. screen dropping	IRC BT1 Allen-Bradley Erie 518	7248784
R-30		RESISTOR: 100,000 ohms, ±10%; 1 watt	Power amplifier damping resistor	IRC or Speer	7244992
R-31	3Z6610-121	RESISTOR: vitreous enamel; 10,000 ohms, ±10%; 10 watts; 1¾" long x 3/16" I.D.	Bias voltage divider	Ohmite Brown Devil Lectrohm 1¾E	7248783

R-32		RESISTOR: vitreous enamel; 5000 ohms, ±10%; 25 watt	Bias voltage divider	Ohmite Type 0382	7247126
R-33	3Z6050-17	RESISTOR: vitreous enamel; 500 ohms, ±10%; 20 watts; 2" long x 5/16" I.D.	RF unit voltage dropping	Ohmite Brown Devil Lectrohm 1¾E	7250151
R-34	2Z72.78-28	POTENTIOMETER and SWITCH: 200 ohms; 3 watts; 1⅜" diam. x 1" thick; mounts on ⅜-32 thd.; 7/16" long; flatted ¼" diameter shaft extended ½"	Exciter light control	Centralab V-123 with K-11 switch	7248781
R-35	3Z6960-7.6	RESISTOR: insulated carbon; 920 ohms, ±2%; ½ watt; consists of two ½ watt resistors mounted in parallel to total 920 ohms	Meter series	IRC	7247887
R-36	2Z7278-27	POTENTIOMETER: 200 ohms; 3 watts; 1⅜" diameter x 9/16" thick; mounts on ⅜-32 thd.; 7/16" long flatted ¼" diameter shaft extends ½"	Exciter light control	Centralab V-123	7248799
R-37	3Z6960-11.1	RESISTOR: matched pair to give 950 ohms, ±2%; 1 watt total	Meter series control box	IRC	7251724
R-38	3ZK6330-18	RESISTOR: insulated carbon; 3300 ohms, ±10%; ½ watt; ⅝" max. length; 15/64" max. diameter	V-4 plate load	Allen-Bradley	7250073
R-39	3Z6020-80	RESISTOR: 200 ohms, ±10%; 20 watts, 2" x 5/16" diameter	Relay voltage dropping resistor	Electro-ohm Ohmite	7251854
L-1	3Z323-29H	INDUCTANCE COIL: 27 turns #28 wire; end mount; 2 lugs; 2-3 microhenries	V-1 plate coil		7248721
L-2	3Z323-29K	INDUCTANCE COIL: 21 turns #28 wire; end mount; 2 lugs 1.5—2.5 microhenries	V-2 grid coil		7248563
L-3	3Z323-29H	INDUCTANCE COIL: 27 turns #28 wire; end mount; 2 lugs; 2—3 microhenries	V-2 plate coil		7248721
L-4	3C323-29K	INDUCTANCE COIL: 21 turns #28 wire; end mount; 2 lugs; 1.5—2.5 microhenries	V-3 grid coil		7248563
L-5	3C323-29H	INDUCTANCE COIL: 27 turns #28 wire; end mount; 2 lugs; 2—3 microhenries	V-3 plate coil		7248721
L-6	3C323-29K	INDUCTANCE COIL: 21 turns #28 wire; end mount; 2 lugs; 1.5—2.5 microhenries	V-4 grid coil		7248563
L-7	3C323-29H	INDUCTANCE COIL: 27 turns #28 wire; end mount; 2 lugs; 2—3 microhenries	V-4 plate coil		7248721
L-8	3C323-29K	INDUCTANCE COIL: 21 turns #28 wire; end mount; 2 lugs; 1.5—2.5 microhenries	V-5 grid coil		7248563
L-9	3C323-29J	INDUCTANCE COIL: 31 turns #26 wire; end mount; tapped 9 turns from top; 1.5—2.5 microhenries	V-5 plate coil		7248722
L-10 and 11	3C323-29G	INDUCTANCE COIL: 200 microhenries	V-1 supply filters	Sickles #12695	7248746
L-12	3C323-29G	INDUCTANCE COIL: 200 microhenries	V-2 plate filter	Sickles #12695	7248746
L-13	3C323-29G	INDUCTANCE COIL: 200 microhenries	V-3 plate filter	Sickles #12695	7248746
L-14	3C323-29G	INDUCTANCE COIL: 200 microhenries	V-4 plate filter	Sickles #12695	7248746
L-15	3C323-29G	INDUCTANCE COIL: 200 microhenries	V-5 plate filter	Sickles #12695	7248746
L-16 and 17	3C323-29G	INDUCTANCE COIL: 200 microhenries	V-1 supply filters	Sickles #12695	7248746

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: TRANSMITTING EQUIPMENT AN/APT-1 **MAJOR ASSEMBLY: RADAR TRANSMITTER T-28/APT-1**

Reference Symbol	Army Stock Number Navy Stock Number British Ref. Number	Name of Part and Description	Function	Mfr. and Desig. or AWS Type	Cont. or Govt. Dwg. or Spec. No.
L-18, 19, 20 and 21		INDUCTANCE: #30 wire on a 1 meg, ½ watt resistor; 3 microhenries	Filament choke		7248774
L-22	3C323-29G	INDUCTANCE COIL: 200 microhenries	Hash amplifier high voltage filter	Sickles #12695	7248746
L-23		INDUCTANCE: Close wound #24 wire; no lugs; end leads; 10 microhenries; .1 ohm	Filament choke		7248775
L-24		INDUCTANCE: 2 windings on a threaded form; plate coil; 3 turns #14 wire; center tap; grid coil; 2 turns #14 wire; center tap	Oscillator coil		7248756
L-25	3C1084Z3-1	INDUCTANCE: 2 coils, 7 turns each; #20 wire; center tap	V-8 mixer grid coil		7248753
L-26	3C1084Z3	INDUCTANCE: 16 turns; #24 wire; tapped 5 turns from mounting end; end mount; two lugs	Mixer coil		7248720
L-27		INDUCTANCE: tuning coil assembly; two coils of 4 turns each; bottom mounting posts	V-8 mixer plate tuning coil		7250200
L-28		INDUCTANCE: tuning coil assembly; two coils of 4 turns each; side mounting posts	V-9 amp. grid tuning coil		7250572
L-29		INDUCTANCE: tuning coil assembly; two coils of 5 turns each; bottom mounting posts	V-9 amp. plate tuning coil		7250201
L-30		INDUCTANCE: close wound full length #30 wire; center tap; wound on 1 meg ½ watt resistor	V-9 amp. plate feed choke		7250202
L-31		CHOKE: can 2½" x 2⅜" x 3 1/16" high; mounts on four studs ½" long; 2 henries at 200 milliamperes d.c.; 100 ohms winding resistance	600 volt plate filter	Chicago Trans. #8335	7248691
L-32		INDUCTANCE: can 1¾" x 1⅞" x 2 3/16" high; mounts on four studs ½" long; 10 henries at 25 milliamperes d.c. winding resistance 500 ohms	Bias filter	Chicago Trans.	7248694
L-33		CHOKE: can 2⅜" x 2½" x 3 1/16" high; mounts on four studs ½" long; 1.5 henries at 250 milliamperes d.c.; 60 ohm winding resistance	300 volt plate filter	Chicago Trans. #8334A	7248692
T-1		TRANSFORMER: fil. primary: tap 1—0V, tap 2—80V, tap 3—115V; secondary; taps 4 and 5—6.5V, taps 6 and 7—5V, taps 8 and 9—5V; 2 11/16" x 2 13/16" x 3½" high	Filament transformer	Chicago Trans. #8355A	7248696
T-2	2Z9618-10	TRANSFORMER: plate-high voltage; primary: tap 1—0V, tap 2—80V, tap 3—115V; secondary: tap 4—0V, tap 5—750V, tap 6—750V; 2 15/16" x 3 3/16" x 3⅞" high	Plate transformer	Chicago Trans. #8357A	7248695
T-3	2Z9618-9	TRANSFORMER: plate—low voltage; primary: tap 1—0V, tap 2—80V, tap 3—115V; secondary: tap 4—100V, tap 5—common, tap 6 and 7—500V; 2 15/16" x 3 3/16" x 3⅞" high	Plate transformer	Chicago Trans. #8356A	7248693

J-1	2Z8799-239 Navy CPH-49194 Signal Corps 50-239	CONNECTOR: single pin-flanged	Connector for cable to pre-amplifier chassis	Amphenol 83-1R	7250554
J-2	49194	CONNECTOR: single contact, square flange	Cable to osc. mixer chassis		7249195
J-3		CONNECTOR: single contact, square flange, smooth edge	Ant. connector on panel	Mendohlson Speed Gun Astatic Selector	7250007
P-1 and 2	Navy CPH 49195 Signal Corps PL-259 2Z7226-259	CONNECTOR: single pin	Cable-osc. mixer to pre-amplifier chassis	Amphenol 83-15P	7246951
S-1	3ZK9849.50	SWITCH: SPDT; bat handle; plate top; 2 1/16" x 3/4" x 1"	Meter switch	Cutler-Hammer 8210B1B	7248726
S-2	3Z9848.8	SWITCH: SPST; bat handle; plate top; 2 1/16" x 3/4" x 1 1/8"	Panel fil. switch	Cutler-Hammer B-54	7247619
S-3	3Z9848.8	SWITCH: SPST; bat handle; plate top; 2 1/16" x 3/4" x 1 1/8"	Panel plate switch	Cutler-Hammer B-54	7247619
S-4		SWITCH: part of potentiometer R-34	Local-Remote control switch		
S-5	3Z9848.8	SWITCH: SPST; bat handle; plate top; 2 1/16" x 3/4" x 1 1/8"	Control box fil. switch	Cutler-Hammer B-54	7247619
S-6	3Z9848.8	SWITCH: SPST; bat handle; plate top; 2 1/16" x 3/4" x 1 1/8"	Control box plate switch	Cutler-Hammer B-54	7247619
S-7	3Z9849.19	SWITCH: DPDT; bat handle; stem mounting 1 5/32" x 1 1/16" x 1"; 3 amp 250 V or 6 amp 125 volt	Bias switch	Cutler-Hammer 8370	7246956
B-1 and 2	3H404-2	MOTOR: fan and mounting assembly	Cooling fans	Motor 5068571 Delco Appliance	7250199
	3H3100A01-3/B10	BRUSHES: motor (was Delco part No. 5066620)		Delco Appliance	5066741
I-1	2Z5952	LAMP: 6.3 volts; .15 amp	Photo tube exciter	G. E. Mazda #47	7246947
I-2	2Z5952	LAMP: 6.3 volts; .15 amp	Ant. output indicator	G. E. Mazda #47	7246947
I-3	2Z5952	LAMP: 6.3 volts; .15 amp	On-off indicator control box	G. E. Mazda #47	7246947
F-1	3Z1935	FUSE: 5 amp; 1 1/4" long x 9/32" diameter		Littelfuse 1094B Buss 4AB5	7247693
J-4	2ZK9402.33	JACK ASSEMBLY: meter; two pin	Test meter jack	Bendix A-102954	7246877
M	DBD2776	METER: calibrated 0—200 full scale; 1 milliampere resistance 50 ohms, ±20%; case: 2 1/16" diameter x 1 3/8" deep flange; 2 9/16" diameter	Plate current	Sun Mfg. 2V	7248514
	2Z5988-26	LAMP BRACKET ASSEMBLY: lamp sockets; bracket and lead	Exciter lamp		7248533
	DBD2453	ANT. LOOP AND BRACKET ASSEMBLY			7248933
	2Z1612.18	CAP: Receptacle		Amphenol 9760-18G	7250812
	2Z1384-8	BUSHING: .625" O.D.; .252" I.D.; .625" long; 3/32-32 thd.; 7/32" long	Osc. tuning shaft		7250136

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: TRANSMITTING EQUIPMENT AN/APT-1 **MAJOR ASSEMBLY: RADAR TRANSMITTER T-28/APT-1**

Reference Symbol	Army Stock Number Navy Stock Number British Ref. Number	Name of Part and Description	Function	Mfr. and Desig. or AWS Type	Cont. or Govt. Dwg. or Spec. No.
	2ZK2650-14	CLAMP ASSEMBLY: tube retainer			7247744
	2Z2650.3	CLAMP: 1/4" by 3/4"	Ant. loop slider		7248932
	2Z2650-4	CLAMP ASSEMBLY: clamp and nut	Ant. loop slider		7248931
	2Z8799-160 AN3102-22-4P	CONNECTOR	Power input		7247507
	AN3102-18-9P 2Z7117.18	CONNECTOR	Control box	Amphenol 3102-18-9P	7248727
	AN3102-18-9S 2ZK8677.17	CONNECTOR ASSEMBLY	Panel for control box lead	Amphenol 3102-18-9S	7248730
	2Z3708-11	DIAL: double calibration; 0 on inner scale; under 3 on outer scale	Amp. grid		7250204
	2Z3708-9	DIAL: double calibration; 0 on inner scale; under 0 on outer scale	Mixer plate		7250203
	2Z3708-10	DIAL: double calibration; inner scale has 0; under 2 on outer scale	Amp. plate		7248685
	2Z3708-7	KNOB AND DIAL ASSEMBLY	Osc. freq. control		7249969
	2Z3708-8	DIAL LOCK ASSEMBLY			7249975
	3ZK931	FUSE CAP FOR TYPE 4AG FUSES		Littelfuse 1212B	7248171
	3Z1939.1	FUSE HOLDER		Littelfuse Holder 1212-B	7246894
	2Z4871-37	GEAR AND HUB ASSEMBLY	Dial drive and stop		7248688
	2Z4871-38	GEAR AND BUSHING ASSEMBLY	Osc. tuner drive		7250451
	6Z4920-3	GROMMET: black rubber; 1/2" max. diameter; 1/4" I.D.; 3/16" thick; groove 3/8" diam. x 3/64" wide			1210716
	6Z4918-1	GROMMET: rubber; 5/8" max. diameter; 25/64" I.D.; groove 1/2" diameter x 1/16" wide			7232948
	2Z4928-9	HANDLE: 3.5 mounting centers; 8-32 thread; 1 1/8" high			7248643
	3G1837-15	INSULATOR: bakelite; 5/16" O.D. x .147" I.D. x 15/32" long	Osc. cond. mtg. screw		7249938
	2Z8807-58	SPACER: bakelite; 5/16" O.D. x .147" I.D. x .562" long	Osc. cond. mtg.		7248647
	3G1838-2.17	INSULATOR STRIP: bakelite; 2" x 7/8" x 1/8"	Under 3 section term. boards		7248559
	3G1250-12.5	INSULATOR: stand off; 3/8" O.D. x 3/4" long; tapped 6-32 both ends; glazed ceramic		Amer. Lava 1704	7248606

	3G1250-8.12	INSULATOR: stand off; glazed ceramic; 3/8" O.D. x 1/2" long; tapped 6-32 both ends		Amer. Lava 1700	7248644
	3GK1250-24.8	INSULATOR: stand off; glazed ceramic; 3/8" O.D. x 1 1/2" long; tapped 6-32 both ends		Amer. Lava 1209	7248645
	2Z5748.18	KNOB: 1 1/8" O.D., 1/4" I.D., 5/8" high; 6-32 set screw	Output level control		7251515
		KNOB AND CLAMP PLATE ASSEMBLY	Tuning coil		7249968
	2ZK5991-7	LAMP SOCKET ASSEMBLY: pilot light	Output indicator "ON-OFF" indicator	Drake #80	7246944
	DBD-2594	MARKER PLATE: dial 1/2" x 1/2" x .218" high			7248708
		NUT-COIL MOUNTING: special 4-40; 1/2" long; 5/16" hex	L-1 to 9 and L-26		7248567
		NUT: spacer 6-32 thd; 5/16" hex; 1/4" long	Term. board		7248573
	6LK3106-32B.1	NUT: 8-32 thd; 1/16" thick	Case, captive screw retainer		7248538
	2ZK2726.3	LEAD ASSEMBLY PLATE: clip terminal and 3 1/2" braid	Tube connection		7247882
	6LK4909-10	SCREW-CAPTIVE-SPECIAL: 8-32 x 1/2"	Case		7247881
	2Z8202.9	SHAFT AND PINION ASSEMBLY	Osc. freq. dial		7250137
	2Z8307-2	TUBE SHIELD ASSEMBLY: tubular; 3 1/4" long; 1 3/8" O.D. with two mounting feet	V-1 tube		7248800
	2Z8307-3	SHIELD ASSEMBLY: clips onto V-1 tube shield	Exciter light		7249994
	2Z8402-7	SHOCKMOUNT: cup and stud	Control box mounting		7244398
	3Z4801-5PH12	SHOCKMOUNT: 12 lb. rating	Transmitter mounting	Lord Mfg. 153PH12	7247501
	2Z9038-4	SLUG AND STUD ASSEMBLY: tuning; powdered iron slug on threaded stud	L-1 to 9 and L-26		7248560
	2Z8637	SOCKET-TUBE: low loss; mica filled phenolic; 8 contacts; 1 1/4" O.D. x 51/64" high; ring mounting octal	Tubes JAN-6AC7 and JAN-6V6GT	American Phenolic S-8TM	7251426
	2Z8681.5	SOCKET-TUBE: low loss; mica filled phenolic; 11 contacts; ring mounting 1 1/4" diam. x 4 3/64" high	Tube JAN-931A	American Phenolic S-11-T	7246930
	2Z8663-1	SOCKET-TUBE: square ceramic	Tubes JAN-829B and JAN-832	E. F. Johnson #247	7247689
	2Z8669-12	SOCKET-TUBE: miniature, 7 contact	Tube JAN-6C4	E. F. Johnson #267	7248733
	2ZK8674.17	SOCKET-TUBE: Octal	Tubes JAN-5R4GY and JAN-6X5GT		7247666
	2Z8877.31	SPRING: triangular; 9/32" x 1/4"; .032" diameter wire; core locking	Coils L-1 to 9 and L-26		7236240
	2Z9038-3	STUD: dial mounting; 10-32 x 5/8"	Tuner coil dials		7248686
	3G1838-56.8	ANTENNA LOOP SUPPORT: bakelite; 3 1/2" x 3/8" x 3/8"			7248976
	2Z8795.1	SOCKET-TUBE: Octal	Tube JAN-6X5GT		7248745
	3G1838-14.4	SUPPORT POST: cap plate; formica; 7/8" x 1/4" x 1/2" tapped; 4-40; two holes each end	C-32 and 33		7248617

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: TRANSMITTING EQUIPMENT AN/APT-1 **MAJOR ASSEMBLY: RADAR TRANSMITTER T-28/APT-1**

Reference Symbol	Army Stock Number Navy Stock Number British Ref. Number	Name of Part and Description	Function	Mfr. and Desig. or AWS Type	Cont. or Govt. Dwg. or Spec. No.
	2ZK9403.23	TERMINAL BLOCK ASSEMBLY: 3 section; 7/8" x 1 3/4" x 13/32"; bakelite	Power unit to lower panel	H. B. Jones #3-140	7246883
	2Z9405.35	TERMINAL STRIP ASSEMBLY: 5 plugs on bakelite strip	Power to R.F. unit		7248569
	2Z9405.33	TERMINAL STRIP ASSEMBLY: five sockets on bakelite strip	Power to R.F. unit		7248580
	2Z9408.32	TERMINAL BOARD ASSEMBLY: 8 terminals on bakelite strip	On modulator chassis		7248793
	2Z9420.9	TERMINAL BOARD ASSEMBLY: 20 terminal board with mounting bracket	Modulator resistor board		7248797
	2Z9403.47	TERMINAL BOARD ASSEMBLY: 3" x 1" bakelite	On modulator		7250597
	2Z9402.82	TERMINAL BOARD ASSEMBLY: two lugs on a bakelite strip; 2 3/16" x 1" x 1/8" thick	On modulator chassis		7250596
	6R57400-6	SPECIAL TOOLS: #6 Allen wrench			779428
	AT-36/APT 2A3391-36	ANTENNA STUB: 16 1/2" staff		Camfield	7251694
	AT-37/APT 2A3391-37	ANTENNA STUB: 22 1/2" staff		Camfield	7251695
	AT-38/APT 2A3391-38	ANTENNA STUB: 29" staff		Camfield	7251696
	2Z7585-40	RELAY: 1 1/4" x 1/2" x 1/2" with 22 1/2 ohm coil; 1/2" dia. x 1"; S.P.S.T.	Closes motor circuit	Delco Radio	7251852
	2Z8307-1	SHIELD: 1 3/8" dia. x 1 1/2"	Relay cover	Delco Radio	7251855
	3Z3285-8	FUSE PANEL	Holds spare fuses	Delco Radio	7247593
	2Z2650.5	CLAMP: loop; 1/4" x 5/8" x 3/16" I.D.	Ant. loop		7248938
	2Z2643.11	CLAMP ASSEMBLY: tube; 1 19/32" x 2 1/8" x 1 3/8" I.D.	Tube clamp		7248284
	3G1838-36.7	INSULATOR: 2 1/4" x 7/8" x 1/8" thick; bakelite	Terminal strip		7248558
	2ZK9404.26	TERMINAL STRIP: 4 station; 2 1/8" x 7/8"	Power unit to lower panel	H. B. Jones #4-140	7246882

SECTION VIII
DRAWINGS

CONFIDENTIAL
CO-AN 08-30APT1-2

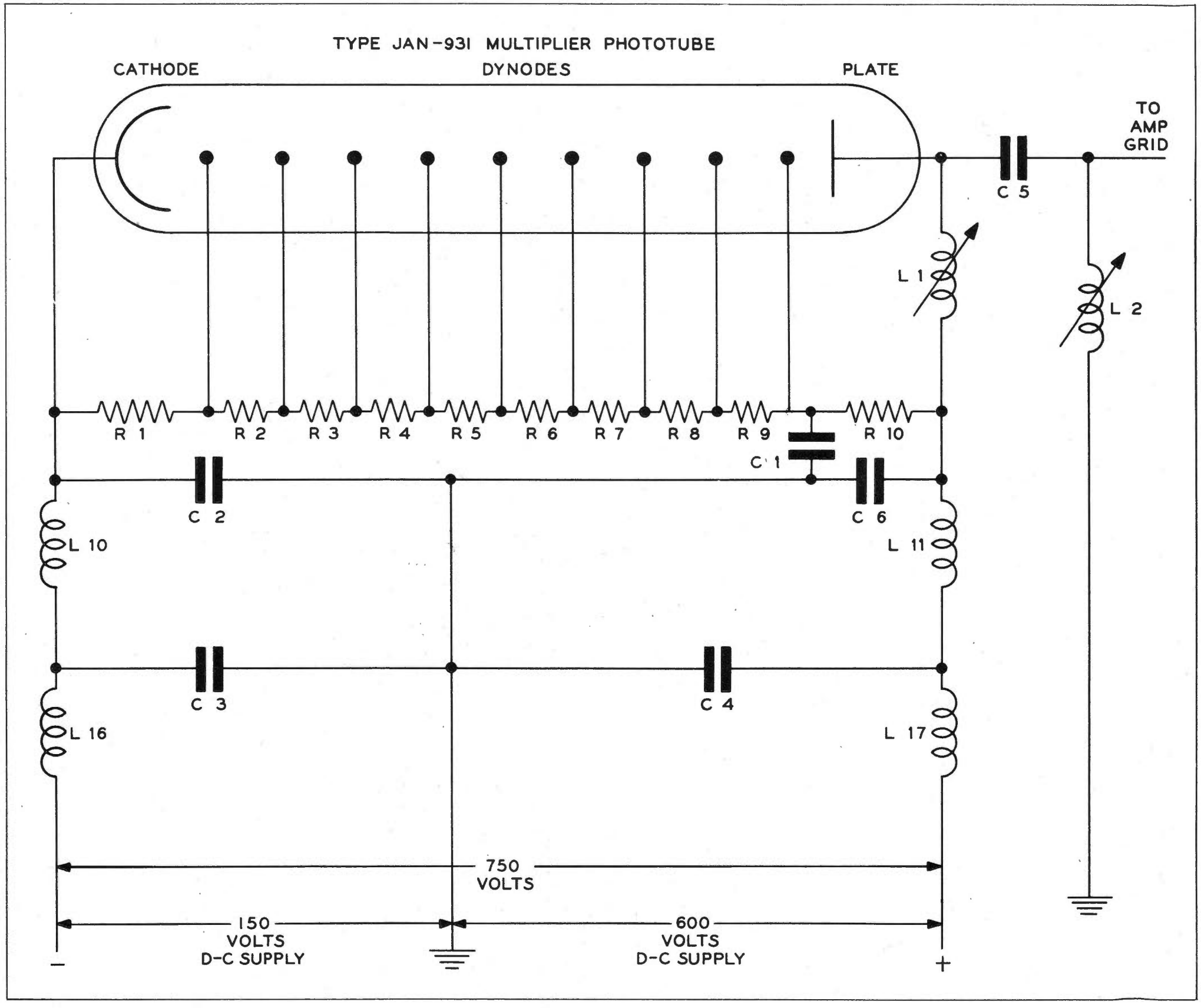


Figure 8-1. Radar Transmitter T-28/APT-1—Schematic Diagram of Hash Generator

CONFIDENTIAL

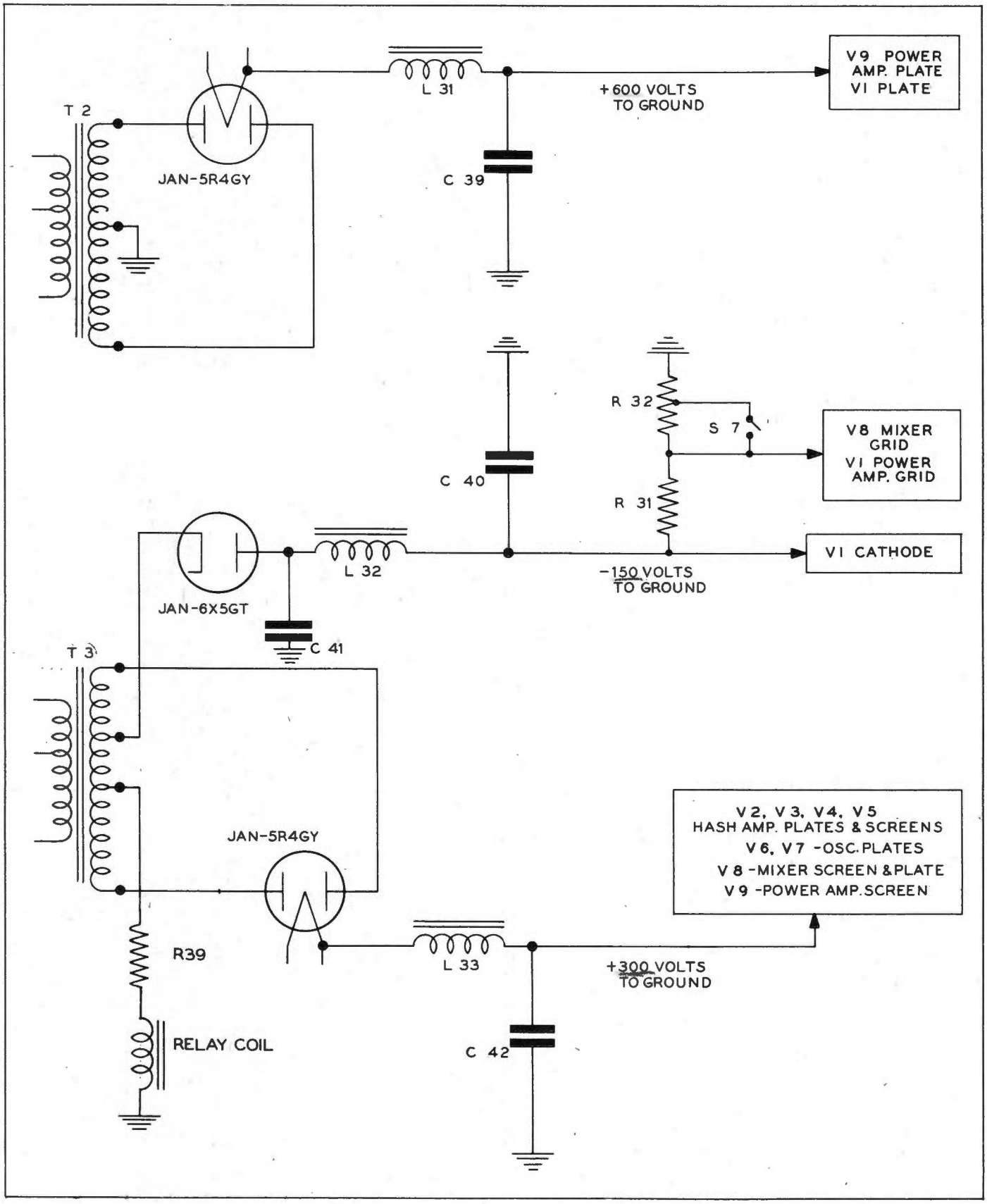


Figure 8-2. Radar Transmitter T-28/APT-1—Schematic Diagram of Power Supply

CONFIDENTIAL
CO-AN 08-30APT1-2

CONFIDENTIAL
CO-AN 08-30APT1-2

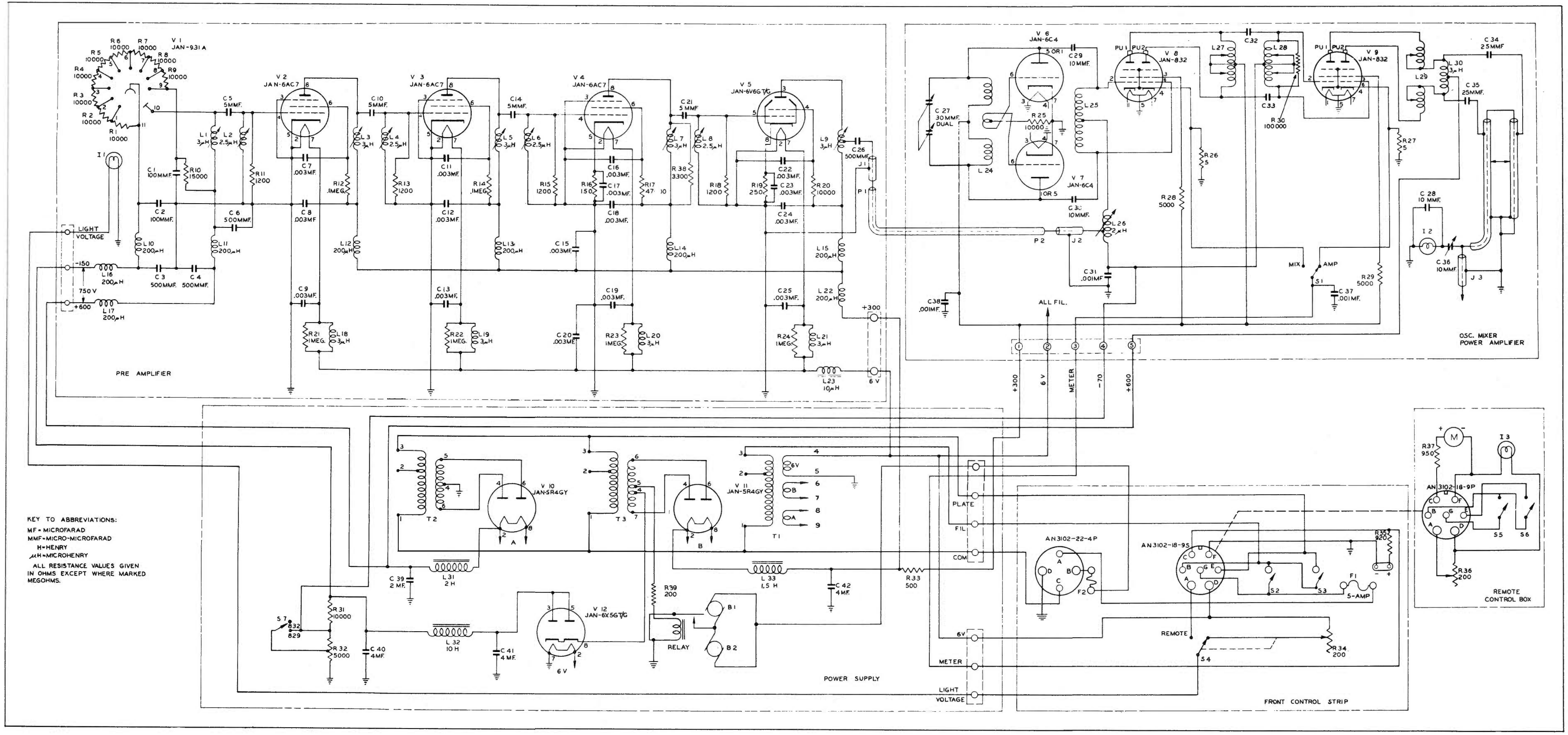


Figure 8-3. Transmitting Equipment AN/APT-1—Schematic Diagram

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