

COLLINS TYPE 20K

AM TRANSMITTER

INSTRUCTION BOOK



Charlie
Gitman
50-14950
By 3-4200
Empire 3-0281
Weston Electrical Instrument Co
Newark NJ
425
8 Amp seal
W/External
Thermostat
3/4"



COLLINS RADIO COMPANY

SERVICE BULLETIN

EQUIPMENT TYPE 20K 100W B/W Transmitter BULLETIN NO. L-1 DATE 3-17-54
 SUBJECT: Repair Kit for 230-7000-00 Tuning Motor used in all tuning motor assemblies on above equipment.

Collins Radio Company has found it increasingly difficult to fill service replacement orders for 230-7000-00 motors because it has been impossible to procure this motor for several years. The original manufacturer has definitely discontinued this motor and extensive efforts to locate another motor to replace it in the various assemblies has met with continued failure. Analysis of field troubles in the mechanism have revealed that practically 100% of the trouble can be corrected by cleaning and lubrication of the gears in the assembly, and, by replacing the small pinion gear and clutch on the motor drive shaft, and the fiber idler gear which is engaged by the drive shaft pinion gear.

Because of the tooling costs involved in our manufacture of these parts which were formerly supplied by the Alliance Company from old tooling, it is no longer possible to sell them at the very low price quoted for several years. A study of the problem by our Methods Department led to our decision to supply them as a repair kit for one motor rather than as individual items. The kit, Part Number 506-8962-002 is now available at \$7.35 and can be obtained through our Service Parts Department, with your order directed to the attention of Mr. Wayne Kischhaefer.

This kit consists of the following:

- | | | |
|----|----------------------------------|--------------|
| 1. | Item E. One Installation Drawing | 506-8962-002 |
| 2. | Item D. One Clutch | 506-8964-002 |
| 3. | Item C. One Fiber Gear Idler | 506-8968-002 |
| 4. | Item B; Two No. 4 Flat Washers | 310-0054-00 |
| 5. | Item A. One Bag Container | 024-2000-00 |

It is requested that users of the above type transmitter examine one of their 230-7000-00 tuning motors carefully so as to understand the operation of the parts covered in this bulletin and in order to more accurately diagnose cases of trouble caused by wear in the two gears. By doing so, it is felt that the customer can be saved delay and expense.

As information to users who have obtained these two gears previously under Part Numbers 097-0144-00 and 097-0622-00 we wish to point out that the fibre gear 097-0144-00 will now become known as Part Number 506-8968-002, and the clutch gear 097-0622-00 will become known as Part Number 506-8964-002.

Collins Radio Company

CML:LF

INSTRUCTION BOOK

for

TYPE 20K AM TRANSMITTER

MANUFACTURED BY

COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA, U. S. A.

520 9075 00

12105

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL SHOULD AT ALL TIMES OBSERVE ALL THE SAFETY RULES LISTED BELOW. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES FOR PROTECTION BUT ALWAYS SHUT DOWN POWER EQUIPMENT AND OPEN MAIN SWITCH IN POWER SUPPLY CIRCUIT. ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages which are dangerous to human life is necessary to the successful operation of the radio transmitting equipment covered by these instructions, certain precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within metal cabinet enclosures, provided with access doors which are generally fitted with safety interlock switches which remove dangerous voltages within the cabinets when access doors are open.

Interlocks are also provided on certain removable panels within the cabinets. Other panels, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

KEEP AWAY FROM LIVE CIRCUITS: Under no circumstances should any person reach within a cabinet with interlocked gates while power supply line switches to the equipment are closed; or handle any portion of exposed equipment which is supplied with power; or to connect any apparatus external to the cabinets to circuits within the cabinets; or to apply high voltages to the equipment even for testing purposes while any non-interlocked portion of the cabinet is removed. Whenever feasible in testing circuits, make continuity and resistance checks rather than directly checking voltage at various points when any high voltage is applied to the transmitter circuits.

DON'T SERVICE OR ADJUST ALONE: Under no circumstances should any person reach within a cabinet for the purpose of servicing or adjusting the equipment without the presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS: Door or safety interlock switches should not be removed or short circuited, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

GUARANTEE

This equipment is guaranteed against defects in material, workmanship or manufacture, for a period of one year from the date of delivery. Our obligation under this guarantee is limited to repairing or replacing any item which shall prove, by our examination, to be thus defective, provided the item is returned to the factory for inspection with all transportation charges paid. Before returning any item believed to be of defective material, workmanship or manufacture, a detailed report must be submitted to the company giving exact information as to the nature of the defect. The information shall include, in as much detail as possible, all subject material listed under instructions for replacement of parts. Upon receipt of the report by the company, detailed instructions as to how the equipment is to be returned will be issued. Do not return any material until instructed to do so by the company.

THE COLLINS RADIO COMPANY

REPLACEMENT OF PARTS

In case a replacement under the guarantee is desired, a full report must be submitted to the company. This report shall cover all details of the failure and must include the following information:

- (A) Date of delivery of equipment.
- (B) Date placed in service.
- (C) Number of hours in service.
- (D) Part number of item.
- (E) Item number (obtain from Parts List or Schematic Diagram).
- (F) Type number of unit from which part is removed.
- (G) Serial number of unit.
- (H) Serial number of the complete equipment.
- (I) Nature of failure.
- (J) Cause of failure.
- (K) Remarks.

When requisitioning replacement parts, the following information must be furnished:

- (A) Quantity required.
- (B) Part number of item.
- (C) Item number (obtain from Parts List or Schematic Diagram).
- (D) Type number of unit.
- (E) Serial number of unit.
- (F) Serial number of equipment.

NOTE: Blank Service Report forms will be found in the appendix of this instruction book.

TABLE OF CONTENTS

<u>Paragraph</u>	<u>Page</u>
<u>SECTION I - GENERAL DESCRIPTION</u>	
1. General	1-1
a. General Description	1-1
2. Reference Data	1-2
a. List of Major Units	1-2
b. Accessories	1-2
c. Frequency Range	1-3
d. Frequency Control	1-3
e. Character of Emission	1-3
f. Carrier Output	1-3
g. Power Source	1-3
h. Output Impedance	1-4
i. Input Impedance	1-4
j. Audio Input Requirements	1-4
3. Vacuum Tube Complement	1-4

SECTION II - THEORY OF OPERATION

1. Electrical	2-1
a. General	2-1
b. Control and Primary Power Circuits	2-1
c. Rectifier Systems	2-2
d. Audio System	2-2
e. Radio Frequency System	2-2

SECTION III - INSTALLATION AND INITIAL ADJUSTMENTS

1. Installation	3-1
a. Preliminary	3-1
b. Installation Procedure	3-1
c. External Connections	3-4
d. Assembly of Transmitter Trim	3-5
2. Initial Adjustments	3-5
a. Controls	3-5
b. Energizing the Equipment	3-7

SECTION IV - OPERATION

1. General	4-1
2. Starting the Equipment	4-1
3. Reducing Power	4-2

TABLE OF CONTENTS

Paragraph Page

SECTION V - OPERATORS MAINTENANCE

1. Routine Checks	5-1
2. Fuse Replacement	5-2
a. Locating Blown Fuse	5-2
3. Tube Replacement	5-3
a. General	5-3

SECTION VI - PREVENTATIVE MAINTENANCE

1. General	6-1
2. Cleaning	6-1
a. General	6-1
b. Air Filter	6-1
3. Relays	6-1
4. Lubrication	6-1
a. Blower Motor	6-1
b. Tuning Motors	6-1
5. Crystal Oven Thermostats	6-1

SECTION VII - CORRECTIVE MAINTENANCE

1. General	7-1
2. Typical Voltage Measurements	7-1
3. Typical Audio Frequency Data	7-2
4. Tube Filament Voltages	7-3
5. Tube Failure	7-3
6. Trouble Shooting	7-3
a. Isolating the Trouble	7-3
7. Trouble Shooting Chart	7-4
8. Servicing the Equipment	7-5

SECTION VIII - PARTS LIST

Parts List	8-1
List of Manufacturers	8-31

LIST OF ILLUSTRATIONS

<u>Figure</u>	<u>Title</u>
1	20K Transmitter
2	20K Transmitter, Front View Open
3	20K Transmitter, Rear View
4	20K Transmitter, Rear View Open
5	11K Output Circuit
6	33J R-F Unit, Top View
7	33J R-F Unit, Bottom View
8	102K Relay Unit, Top View
9	102K Relay Unit, Bottom View
10	101K Control Panel, Rear View
11	403K Power Supply, Top View
12	403K Power Supply, Bottom View
13	417K Mod. Units and 418K Power Supply
14	40E Frequency Control Unit, Front View
15	40E Frequency Control Unit, Rear View, Dust Cover Removed
16	40E Frequency Control Unit, Inside View
17	Crystal Oven and Adjusting Tool
18	Power Control Circuits
19	Meter Circuits
20	Floor Plan
21	40E Frequency Control Unit Schematic
22	20K Transmitter Simplified Schematic
23	20K Transmitter Cabling Schematic
24	20K Transmitter Complete Schematic

SECTION I

GENERAL DESCRIPTION

1. GENERAL.

This Instruction Book has been compiled as an aid to the installation, adjustment, operation and maintenance of the Collins Type 20K-4 Radio Broadcasting equipment.

The Collins Type 20K-4 Radio Broadcasting Equipment is designed for the broadcast frequencies with a carrier output of 1000 watts amplitude modulated. Provision is made for reducing the power output to 500 watts without a break in transmission.

a. GENERAL DESCRIPTION.

(1) MECHANICAL DESCRIPTION. - The equipment covered by these instructions is a complete 20K radio broadcast transmitting installation designed particularly for high fidelity service. This transmitter is high level amplitude modulated with a Class "B" modulator system. The audio frequency system, employing a feedback circuit, is designed for exceptionally high fidelity.

The main transmitter circuit is installed in a single cabinet of neatly styled appearance. The front panel arrangement of the transmitter is such that all power tubes are accessible through two access doors mounted near the top of the cabinet. Full vision of the power amplifier and modulator tubes is provided by means of glass windows in the access doors. For service and maintenance purposes, removable panels are provided on the front of the cabinet and hinged doors on the rear. This feature provides quick and convenient access to the working parts of the transmitter. Removable panels and doors are provided with high voltage interlocking switches for the protection of maintenance personnel.

The 40E Frequency Control Unit is mounted in a separate cabinet. There is ample space in this cabinet to mount frequency monitoring and audio monitoring equipment. The 40E unit is coupled to the transmitter by means of a small concentric line, hence the cabinet may be mounted adjacent to or at some distance from the 20K transmitter assembly as desired. Refer to figure 20 for floor plan and cable ducts.

(2) ELECTRICAL DESCRIPTION.

(a) TYPE 20K TRANSMITTING UNIT. - Radio frequency power from the Type 40E Frequency Control Unit is applied to the grid of a Type 813 high gain beam power tube. The power output of this tube is more than ample to excite the grids of the parallel connected Type 833A power amplifier tubes operating in Class "C" service. The Type 833A power amplifier tubes are tuned to resonance

GENERAL DESCRIPTION

and coupled to the antenna feed line by a pi section network in series with an L section network. The L section makes it possible to operate the transmitter into low impedance transmission lines.

The audio frequency input to the 20K transmitter is made to a 500 ohm impedance input transformer. The audio is amplified by a pair of Type 6J5G tubes operating in push-pull. These are resistance coupled to a pair of Type 845 driver tubes also operating in push-pull Class "A" service. The driver tubes are transformer coupled to a pair of Type 833A triode tubes operating in Class "B" service as modulators.

Two mercury-vapor rectifier power supplies furnish the plate voltages necessary for operation of the 20K unit while a high-vacuum rectifier power supply furnishes the required amount of fixed bias for the modulator tubes.

(b) TYPE 4OE FREQUENCY CONTROL UNIT. - Two temperature controlled quartz plates are available for frequency control of the 4OE unit. Either may be selected by operating a tap switch. The crystals control the frequency of an extremely stable oscillator employing a Type 6SK7 tube in a transitron circuit. Energy from the oscillator is coupled to the Type 807 output tube through a Type 6V6G beam power tube which is untuned and operates as a decoupling device so the tuning of the Type 807 output tube will have no reaction on the oscillator circuit. The 4OE Frequency Control Unit is coupled to the 20K transmitter by a concentric line.

2. REFERENCE DATA.

a. LIST OF MAJOR UNITS. - The following table lists the major units used in the 20K installation along with the overall dimensions and weights:

<u>Collins Type No.</u>	<u>Description</u>	<u>Overall Dimensions</u>	<u>Uncrated Weight</u>
20K-4	Transmitter	41-1/2" x 30" x 78"	1364 lbs.
19G	Frequency Control Cabinet	20-3/8" x 14" x 78"	136 lbs.
4OE	Frequency Control Unit		45 lbs.

b. ACCESSORIES. - A suggested list of accessories appears below:

GENERAL DESCRIPTION

<u>Manufacturer</u>	<u>Description</u>	<u>Type No.</u>
Collins	Antenna Tuning Unit	42E
General Radio Company	Frequency Deviation Monitor	1181-A
General Radio Company	Modulation Monitor	1931-A
Collins	Speech Console	212A or 212B
Collins	Limiting Amplifier	26W

c. FREQUENCY RANGE. - This equipment may be obtained for operation on any frequency from 540 to 1600 kc. After the frequency of operation has once been set, any substantial change in frequency may require modification of the output tank circuit capacities as well as changes in the neutralization system.

d. FREQUENCY CONTROL. - Two quartz crystals are supplied in individually temperature controlled units. Either crystal may be selected by operating a tap switch. The carrier frequency deviation is held within 10 cps of the assigned value.

e. CHARACTER OF EMISSION. - The modulation system of the 20K transmitter is designed to provide full 100% modulation of the carrier at modulating frequencies between 30 and 10,000 cps. The audio frequency response is constant within plus or minus 1-1/2 db of the mean value from 30 to 10,000 cps. The audio frequency distortion is less than 2% rms at any single frequency between 50 and 7500 cps at 100% modulation. The residual noise level is more than 60 db below the 100% modulated level. The radio frequency harmonic output is approximately 70 db below the fundamental output when used with a Type "T" section antenna coupling unit.

f. CARRIER OUTPUT. - The transmitter will deliver 1 kw of radio frequency power, on any frequency within the range of 540 to 1600 kc, into a substantially resistive transmission line load having an impedance value of about 70 ohms. Provision is made for instantaneous reduction of power to 500 watts by means of auxiliary loading capacitors in the output circuit. The values are chosen so that power reduction is accomplished without requiring an appreciable change in tuning of the output circuit.

g. POWER SOURCE. - The 20K transmitter is arranged for operation from a 220 volt, 3 phase, 60 cps power system. The maximum power demand at 100% modulation with a modulating frequency of 400 cps is approximately 4.7 kw. When the transmitter is modulated at average program level, the power required is approximately 4 kw at a power factor of 85%.

GENERAL DESCRIPTION

The power required for operation of the 40E Frequency Control Unit is approximately 100 watts at 110 volts 60 cps.

h. OUTPUT IMPEDANCE. - 70 ohms.

i. INPUT IMPEDANCE. - 500 ohms.

j. AUDIO INPUT REQUIREMENTS. +16 dbm* for 100% modulation.

3. VACUUM TUBE COMPLEMENT.

The vacuum tubes employed in the 20K Equipment are listed below:

<u>Quantity</u>	<u>Tube Type</u>	<u>Function</u>	<u>Unit</u>
1	6SK7	Crystal Oscillator	40E
1	6V6G	First Buffer Amplifier	40E
1	807	Second Buffer Amplifier	40E
1	5Z3	350 volt Rectifier	40E
1	813	Intermediate Amplifier	33J
2	833A	Power Amplifier	33J
2	6J5G	Speech Amplifier	33J
2	845	Audio Driver	33J
2	833A	Class "B" Modulator	33J
2	5Z3	Bias Rectifier	403K
2	866A/866	1000 Volt Rectifier	403K
3	872A/872	2500 Volt Rectifier	403K

* ZERO LEVEL - 1 milliwatt 600 ohm base

SECTION II

THEORY OF OPERATION

1. ELECTRICAL.

a. GENERAL. - The r-f electrical portion of the 20K Broadcast Transmitter is composed of a crystal controlled high stability oscillator, an isolation amplifier stage, a buffer stage, a driver amplifier and a power amplifier. The audio portion consists of an audio amplifier stage, a modulator driver stage and a modulator stage. Filament power to all tubes is supplied by step-down transformers. The high voltage for plate and bias supplies is furnished by step-up transformers and tube rectifiers.

b. CONTROL AND PRIMARY POWER CIRCUITS. - The tube filament transformers, the bias supply transformers, the tuning motor transformers and the time delay relay coil are energized when the FILAMENT POWER START button is depressed. The filament control relays D1 and D2 and the time delay relay D3 are energized by the circuit from terminal number 0 on unit D through the START contacts on E1, the STOP contacts on E1, the coils of relays D1, D2 and D3, to the center tap on the autotransformer. Contacts number 3 and 4 on relay D1 are in parallel with the START contacts on the FILAMENT POWER push button and form a hold-in circuit for relays D1, D2, and D3. When the STOP push button is depressed, the exciting current to the relays is broken and the hold-in circuit is opened, releasing relays D1, D2 and D3.

After the tube filaments are energized and the time delay relay D3 has operated, the energizing power for the plate transformers may be applied. The circuit for operating plate power contactor D4 is from terminal number C on unit D through the hold-in contacts on relay D1, the START contacts on PLATE POWER push button E2, the time delay relay contacts 1 and 2, the STOP contacts on E2, the door switches, the contacts on the overload relays D17 and D18, the contacts on the bias interlock relay D48, the coil of the plate power relay D4 to the center tap on the autotransformer. A pair of auxiliary contacts on plate power relay D4 is shunted across the START contacts on E2 to form a hold-in circuit. Depressing the STOP push button will break the energizing circuit to the coil on plate power relay D4 allowing the relay to open.

The control circuit sequence is as follows: Operation of the filament power start button energizes all filament circuits and the bias rectifier system through relays, Items 1 and 2. Simultaneously, voltage is applied to the time delay relay, Item 3, and after a suitable time delay, the contacts of relay 3 close. Upon establishment of bias voltage, the bias interlock relay, Item 48, closes. The time delay contacts and the bias interlock relay contacts are in series with the door switches and the plate start circuit so that if the door switches are closed, bias voltage exists, and the time delay relay has operated, the plate contactor, Item 4, may be energized by pressing the plate power start button. When the plate power stop button is depressed, the plate contactor drops out and removes voltage from the high voltage and low voltage

THEORY OF OPERATION

rectifiers. Overload relays are inserted in two of the three-phase power leads to the plate power transformer in order to prevent damage to the equipment in case of sudden overload. All other circuits in the transmitter are fused. All fuses are located in the 102K Relay Panel.

c. RECTIFIER SYSTEMS.

(1) THE 2500 VOLT SUPPLY. - This rectifier furnishes plate power to the 833A power amplifier tubes, the 833A modulator tubes, and the 813 intermediate amplifier tube. It is capable of delivering 1.2 amperes at 2500 volts. Three type 872A tubes are arranged in a three-phase, half-wave rectifier circuit and operate into a single-section choke input filter.

(2) THE 1100 VOLT SUPPLY. - This rectifier furnishes plate power to the type 845 and 6J5G speech amplifier stages and screen voltage to the 813 intermediate amplifier. It is capable of delivering 250 milliamperes at 1100 volts. Two type 866A rectifier tubes are employed in a single-phase, full-wave circuit and operate into a two-section choke input filter which reduces the hum level to a very low value.

(3) THE BIAS SUPPLY. - The bias rectifier employs two type 5Z3 rectifier tubes in a single-phase, full-wave circuit operating into a two-section choke input filter. Bias voltage adjustment is obtained by means of a tap bleeder resistor. A maximum of 200 volts bias is obtainable.

d. AUDIO SYSTEM. - The audio amplifier in this transmitter consists of a pair of 6J5G tubes resistance coupled to the grid circuit of a pair of 845 tubes which serve as audio drivers. An audio input level of plus 16dbm at 500 ohms is sufficient for 100% modulation. Both stages are powered from the 1100 volt supply. Proper plate voltage for the 6J5G stage is obtained by the use of dropping resistors in series with the high voltage. Grid bias is obtained in both stages by the use of cathode resistors.

The modulator stage, consisting of two type 833A tubes, is transformer coupled to the driver stage. The negative audio feedback is from the 833A modulator plates to the secondary of the input transformer of the speech amplifier. The feedback is fixed at 24 db at the factory. This considerable amount of feedback serves to render the audio amplifier and modulator insensitive to changes in bias voltages, tubes, etc. Plate power for the modulator stage is obtained from the main 2500 volt rectifier system. Grid bias is obtained from a tap on the bleeder across the bias supply.

e. RADIO FREQUENCY SYSTEM.

THEORY OF OPERATION

(1) FREQUENCY CONTROL UNIT. - The 40E Frequency Control Unit is a standard 19" relay rack mounting unit requiring 10-1/2" panel space. This unit contains the crystal oscillator circuit and the first and second buffer amplifier stages.

A type 6SK7 or 6SK7GT tube is employed in the oscillator circuit. The oscillator circuit is an adaptation of the transitron oscillator for crystal control. This is essentially a two terminal oscillator having high inherent frequency stability against variation of d-c supply voltages or variation in tube characteristics. The inherent stability of this type of oscillator in conjunction with a low temperature coefficient quartz crystal provides an oscillator whose frequency is capable of being maintained within one or two parts in a million per degree centigrade over long periods of time. Especially selected low temperature coefficient "AT" cut quartz plate crystals, with less than three parts in a million per degree centigrade frequency drift, are supplied.

Space for two crystals mounted in type 297 crystal ovens are provided. The crystals are maintained at a temperature of 50° centigrade by means of a mercury thermostat having a sensitivity of 0.2°. A panel reading thermometer is provided for each crystal oven. Due to the construction of the 297 oven, operating temperature is reached within thirty minutes after application of power, so that power failure during the night does not mean operating with a cold crystal as the crystals will reach operating temperature during the warm up period of the transmitter. Two crystal ovens are provided with complete separate heat control circuits. A switch for instantaneously changing from one crystal to the other is provided. In this way removal of one oven, for replacement of crystal or thermostat, or the failure of heat control relay or rectifier, does not interrupt the use of the other crystal oven and proper operation of the equipment.

Following the oscillator, a type 6V6G tube is used as an untuned "Class A" buffer amplifier stage loosely coupled to the oscillator. This tube provides no power gain but isolates the oscillator from reaction to changes in circuit tuning or operating conditions of the following stages.

Following the "Class A" buffer stage, a single 807 beam power tube is employed as the second buffer amplifier which is capable of delivering from 10 to 15 watts of radio frequency power. The output of this stage is arranged to be link coupled to the grid circuit of the intermediate amplifier stage in the transmitter. In addition, an adjustable voltage source is available from the 807 stage suitable for the operation of a frequency monitor.

Power for the operation of the oscillator and buffer stages in the 40E Frequency Control Unit is obtained from a self-contained high voltage rectifier employing a single 5Z3 rectifier tube. The maximum plate voltage available to the 807 stage is 440 volts.

THEORY OF OPERATION

(2) INTERMEDIATE AMPLIFIER. - The intermediate amplifier employs one type 813 beam power tube. A low impedance concentric transmission line is used to couple the grid tank circuit of this stage to the output of the 807 buffer amplifier stage in the 40E Frequency Control Unit. A movable tap on the plate tank coil provides a means of adjusting the excitation to the power amplifier stage which follows. A portion of the plate tank circuit is coupled to the power amplifier stage for inductive neutralization. The grid and plate circuits are tuned from the front panel of the transmitter by means of tuning motors which are operated by means of the tuning selector and tuning control switches.

(3) POWER AMPLIFIER. - The power amplifier stage consists of two type 833A tubes in a parallel connected "Class C" amplifier circuit. Inductive neutralization is employed in this stage. A plate potential of approximately 2500 volts is employed. The plate circuit is tuned by means of a variable inductance coil operated by a tuning motor controlled from the front panel of the transmitter.

(4) OUTPUT CIRCUIT. - The output circuit of the transmitter is essentially a low pass filter and provides maximum attenuation of harmonic frequencies. Adjustment of power amplifier loading is obtained by means of variable tuning condensers on the output of the circuit. One of these condensers, which are mounted in the roof of the transmitter, is adjusted by means of a tuning motor controlled from the front panel of the transmitter. The output is arranged for operation into a load of 60 to 80 ohms, substantially resistive.

(5) POWER REDUCTION. - A rotary switch on the control panel of the transmitter provides for power change without interruption of the carrier. The 20K Transmitter may be operated at 1000 watts or 500 watts r-f power output depending upon the position of this switch. Power shift is accomplished by means of a relay which reduces the load on the final amplifier by means of a padding condenser in parallel with the capacity normally used for 1000 watt operation. The audio input level for 100% modulation remains unchanged for both power levels due to the fact that the large amount of feedback practically eliminates regulation in the modulators.

(6) MONITORING CIRCUIT. - Terminals are provided at the rear of the 40E Exciter Unit for the connection of a radio frequency monitor. The radio frequency voltage supplied to the monitor may be varied by means of an adjustable potentiometer connected across the radio frequency output terminals of the 807 buffer amplifier stage.

Radio frequency voltage from the modulated amplifier is available for the operation of a modulation indicator or distortion meter. This voltage can be varied from zero to a maximum value by means of a slider on a small coil, Item 10, connected across the transmission line terminals.

SECTION III

INSTALLATION AND INITIAL ADJUSTMENTS

1. INSTALLATION.

a. PRELIMINARY.

(1) UNPACKING. - Check the equipment received against the packing list and "Table of Equipment Supplied" in Section I of this instruction book. If the crate is marked with arrows to indicate the upright position, remove the crate cover only. Use a nail puller to remove nails, a bar or a hammer may damage the equipment within. Remove all of the packing material and lift the units out carefully. Search all of the packing material for small packages. Inspect each unit for loose screws and bolts. Be certain all controls such as switches, dials, etc., work properly. All claims for damage should be filed promptly with the transportation company. If a claim for damage is to be filed, the original packing case and material must be preserved.

b. INSTALLATION PROCEDURE.

(1) 20K TRANSMITTER. - The transmitter is shipped with the heavier iron core units as well as some of the more fragile parts removed from the cabinets. It is recommended that no attempt be made to place these components in position until the cabinets have been permanently placed on the transmitting room floor. The comparatively simple arrangement to accommodate the wiring at the base of the transmitter is outlined in Figure 20. The requirements of the illustration may be met by suitably installing the necessary conduit in a concrete floor or by the installation of a conduit trench of sufficient depth and width. Another alternative is the installation of a false floor under which the necessary wiring may be placed. There will be no need to fasten the 20K transmitter unit to the floor, however, holes are provided in the base of the 19G cabinet which may be used in event it is desirable to bolt this unit to the floor. Refer to Figure 20 for mounting dimensions.

Adequate clearance should be allowed in front of the units for the operator to adjust the controls. There should be approximately 48" clearance at the rear of the unit for installing and removing the units in the 20K transmitter. This clearance will be adequate for ventilation purposes. Enough clearance at the sides of the 20K unit should be allowed to remove the dust covers and make the external connections. This should be remembered when choosing a position for the 19G cabinet.

The following tabulation lists the type numbers of the various units in the transmitter. For the purpose of identification on the cabling diagram, each unit has been assigned an arbitrary letter designation. These unit letters are used as a prefix when referring to terminals on any unit. Inter-unit

INSTALLATION AND INITIAL ADJUSTMENTS

wiring on the cabling schematic drawing is indicated by showing at any terminal the type of wire and the terminal and unit to which each wire routes.

<u>Unit Letter Designation</u>	<u>Unit Type Number</u>	<u>Unit Description</u>
A	82H-4	Meter Panel
B	11K-4	Output Circuit
C	33J-1	R-F and Modulator
D	102K-1	Relay Panel
E	101K-2	Control Panel
F	403K-1	Rectifier Unit
G	418K-1	HV Power Supply
H	417K-1	Modulator Unit
I		Transmitter Terminal Strip

The order of designation of inter-unit cabling is as follows: When a wire terminates on a single numbered terminal on a unit, the wire route is from the source of the terminal on the specified unit and is indicated by the unit letter designation followed by the terminal number. Thus, referring to the schematic diagram of the 20K transmitter, Figure 23, note that there is a wire starting from terminal number 1 on Unit C which terminates on terminal number 1 of Unit E. Therefore, an arrow at terminal number 1 on Unit C indicates that the wire routes to terminal E1, and the arrow is designated E1. An arrow from terminal number 1 on Unit E indicates that the particular wire in question is terminated on terminal number 1, Unit C. The designation at the end of the arrow is 1C.

Color coding of wires follows the Standard Cable Wire Code designations, a copy of which will be found in Section 8 of this book. The code is indicated by a letter such as A, B, etc., followed by a figure such as 1, 3, 5, etc. The letter designates the wire structure, size, amount and kind of insulation and the current and voltage rating. The figures refer to the RMA color code for resistors, etc. The RMA color code is reproduced here for convenience:

<u>Identifying Number</u>	<u>Color</u>	<u>Identifying Number</u>	<u>Color</u>
0	Black	5	Green
1	Brown	6	Blue
2	Red	7	Violet
3	Orange	8	Gray
4	Yellow	9	White

INSTALLATION AND INITIAL ADJUSTMENTS

Tracer wires are designated by these figures as follows: A red (Number 2) wire with white (Number 9) tracer will carry the number 29. A Class "A" wire (See Standard Cable Wire Code) with a red body and white tracer would be designated A29.

The procedure for the installation of the various units is as follows: Remove the large panel at the bottom front of the transmitter; remove both top and bottom panels on the rear of the transmitter cabinet. (The front panel is removed by inserting the hooks provided into the small holes along the top edge of the panel and pulling outward.) The heavier power components located in the base of the cabinet may now be put in place. These consist of the high voltage power transformer, the intermediate voltage power transformer, the filter reactor, and the blower assembly. The transformers are set in place over locating pins in the base of the cabinet and need not be bolted in place. All leads are appropriately marked so that no difficulty should be encountered in making proper connections. The modulation transformer and modulation reactor are mounted on the heavy spars near the front of the transmitter cabinet immediately above the power transformer and the filter reactor.

Immediately in the rear of the modulator unit are chassis cleats for the installation of the 403K Rectifier Unit. This unit should be securely bolted to the chassis cleats and the formed cable attached to the terminals. The 102K Relay Unit is then placed in position immediately above the rectifier unit. This unit should also be securely bolted to the chassis cleats and the formed cable attached. It should be noted that terminals 23 and 25 of this unit, also terminals 28 and 29, are connected by a flat brass strip. The 33J Radio Frequency Unit may now be installed and bolted into place. Terminals 1, 2, 3 and 4 are unused as these are a part of the equipment placed in service when the 5 kw amplifier is added. The output inductance coil may now be installed. This coil, because of the fact that it is supported on rather fragile mycalex bars, should be handled with some care and should be installed as shown in the rear view photograph.

All cable connections to units were properly tagged when the transmitter was dismantled for shipment. For this reason, it is a simple matter to place the proper cable lead on the proper unit terminal when making the installation. All pieces of copper bus and other miscellaneous items disconnected when the output coil assembly was removed for packing are properly labeled both on the item itself and the terminal connection so that no difficulty should be encountered in placing these items properly.

For checking purposes, (refer to figure 5) the following connections are made to the output coil, Item 7

INSTALLATION AND INITIAL ADJUSTMENTS

(a) A clip is connected to the hot side of the output tuning capacitor, Item 4 and the plate blocking capacitor, Item 5.

(b) A connection is made to the lower end of inductor, Item 15B.

(c) A connection is made from the neutralizing coil to the low potential side of the intermediate amplifier capacitor, Item 31.

(d) A connection is made from the neutralizing coil to the excitation clip on the intermediate amplifier plate coil, Item 40.

(2) 40E FREQUENCY CONTROL UNIT. - The 40E Frequency Control Unit is mounted in the 19G Cabinet. This cabinet may also house the frequency monitor and deviation meter or any other essential monitoring equipment. The exact equipment layout is optional, although it is recommended that the frequency control unit be mounted near the top of the equipment assembly. Conduit, with several convenience outlets to serve various units which are to be installed in the cabinet, should terminate at the cabinet base. The ac power supply to the 40E Unit may be carried to the appropriate terminals using a rubber covered tube conductor cable with a plug attached to one end.

c. EXTERNAL CONNECTIONS.

(1) INTERCONNECTIONS BETWEEN THE 40E AND THE 20K. - A single concentric cable is recommended for connecting the output of the 40E Exciter terminals 2 and 3 to the terminals 9 and 10 on the 33J unit in the 20K cabinet. Terminal number 2 on the 40E and terminal number 9 on the 33J should be connected to the outer conductor. This cable may be brought down the side of the 19G cabinet into the floor pit or through suitable conduit to the 20K transmitter unit. No other connections are made between the 40E Frequency Control Unit and the 20K Transmitter.

(2) SPEECH INPUT CONNECTIONS. - The audio input to the transmitter is made to terminals 19 and 20 on the terminal strip at the bottom of the transmitter. These connections should be made by means of a twisted pair shielded cable. The shield should be connected to terminal number 13 on the transmitter terminal strip. To gain access to this terminal strip it will be necessary to remove the six bolts that fasten down the blower unit. The blower unit and air filter must then be lifted out. Remove the plate which is located in the cabinet floor. The terminal strip is then exposed. Refer to figure 13.

(3) POWER SOURCE CONNECTIONS. - The 220 volt, 3 phase input may be brought up the side of the cabinet channel through the grommet hole to terminals A, B, and C on the 102K Relay Unit. The power cable should have a rating of at least 30 amperes capacity. It is recommended that a main station switch be installed in the power line to the equipment at some location convenient to

INSTALLATION AND INITIAL ADJUSTMENTS

the transmitter, so that the power line may be completely disconnected from the equipment for servicing.

The 4OE Frequency Control Unit requires 115 volt, 60 cps single phase power source. This source of power should be separate from that of the transmitter proper in order that the transmitter may be completely isolated from the power lines for maintenance purposes without removing power from the crystal heating circuits.

(4) ANTENNA TERMINATION. - The 20K transmitter is intended for use with an external tuning unit to which it is connected by means of a concentric transmission line. The transmission line may be carried up the cabinet channel and the outer conductor or ground connection fastened securely to the transmitter ground terminal. The inner conductor of the line should be connected to the 1-1/4" ceramic bushing terminal located near the top of the transmitter. The 1/2" ceramic button terminal is provided for connection of the modulation monitor.

(5) CONNECTIONS FOR REMOTE LINES. - If remote control and metering of the transmitter is desired remove all jumpers from terminals in Unit I and make connections to terminals 1 through 12 and 14 and 15.

d. ASSEMBLY OF TRANSMITTER TRIM. - After all the necessary wiring has been installed, the dust covers may be put in place. These covers are built so that the front edge fits between the front panels and the transmitter frame, and the rear edge fits inside the cabinet channel angle. The top and bottom rear panels should also be attached at this time. Care should be taken to see that the convenience plug attached to the top rear panel is inserted in the receptacle provided on the right side of the cabinet. This connection is a part of the door switch interlocking circuit.

2. INITIAL ADJUSTMENTS.

a. CONTROLS.

(1) 4OE FREQUENCY CONTROL UNIT. Refer to figure 14.

(a) METER SWITCH. - The multi-scale meter, Item 55, is used to measure the plate current of the 6SK7 and 6V6G tubes, the grid current of the 807 tube and the plate voltage developed by the power supply. The METER SWITCH, Item 45, is used to connect the meter to the various circuits necessary to make the measurements mentioned.

(b) AMPLIFIER TUNING. - This Control operates Item 31, the plate tuning capacitor, for the 807 tube.

(c) The OSCILLATOR switch, Item 47, a toggle switch located under the multi-scale meter, is connected in the primary circuit of the power transformer.

INSTALLATION AND INITIAL ADJUSTMENTS

(d) The AMPLIFIER switch, Item 48, a toggle switch located under the Amplifier plate meter, is connected in the H. V. output lead of the power supply furnishing power to the 807 amplifier tube.

(e) The crystal heat control switch, Item 46, is operated from the rear of the main chassis. Located in the primary of the crystal heat power transformer, this switch makes it possible to remove the crystal heat power should it become necessary.

(f) The CRYSTAL selector switch control operates Item 44 to select either of the two quartz crystals.

(g) Item 24, a potentiometer accessible through the front door opening, is used to vary the bias on the oscillator tube suppressor grid.

(h) Item 64, a tap switch, accessible through the front door opening, is used to change the inductance value of the amplifier tank coil and is usually set at the factory for the operating frequency used.

(2) 20K TRANSMITTER UNIT.

(a) FILAMENT POWER START-STOP. - The filament power is turned on and off by a set of push buttons located at the extreme left hand edge of the 10LK control panel.

(b) The POWER LEVEL Control located on the 10LK Control Unit panel operates Item E3, a tap switch, to change the power output of the transmitter.

(c) The METER SELECTOR Control is connected to a tap switch which selects various circuits for metering. The GRID OR PLATE CURRENT meter is used for measurements.

(d) All major tuning adjustments are made with electric motor driven elements. The electric motors are selected by the TUNING SELECTOR Control which operates a tap switch.

(e) After the proper tuning motor has been selected by the TUNING SELECTOR Control, the motor is controlled by the operation of the TUNING CONTROL connected to a double throw switch with a normally open center position. This control is used to start, stop, and reverse the various tuning motors.

(f) PLATE POWER START-STOP. - The plate power is turned on and off by a set of push buttons located at the extreme right hand edge of the 10LK

INSTALLATION AND INITIAL ADJUSTMENTS

Control Panel.

(g) TUNE-OP. SWITCH. - Located on the rear edge of the Type 102K Relay Panel Unit is the TUNE-OP. Switch. This switch connects into or shorts out of the primary of the high voltage plate transformer a set of voltage dropping resistors used to drop the plate voltage while making initial tuning adjustments.

(h) ANTENNA LOADING 500 W. - This control operates a variable capacitor and is located at the top rear of the transmitter. Access to the control is had by releasing the two Dzus fasteners observed in the small plate just above the rear doors and removing the plate.

b ENERGIZING THE EQUIPMENT.

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL SHOULD AT ALL TIMES OBSERVE ALL SAFETY PRECAUTIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENT INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION, BUT ALWAYS SHUT DOWN POWER EQUIPMENT AND OPEN THE MAIN SWITCH IN SUPPLY LINE TO EQUIPMENT.

(1) INSPECTION. - Before any adjustments are made, a thorough inspection of all connections and terminals should be made to assure freedom from faulty operation. The rectifier tube plate leads and caps should be checked for clearance to any metal object and tied to a convenient support with insulating cords to prevent accidental shorts to ground or shorts between tube caps when checking operation of the plate voltage control circuits. Inspect all door interlocks to make certain that the switch operates freely when the door is closed.

NOTE: Item numbers referred to in the following discussion may be identified by examining the photographic illustrations and the parts list in the Appendix section of this instruction book. Refer to Figure 8.

(2) POWER CIRCUIT CHECK. - Before inserting any vacuum tubes in the 20K Transmitter, the control circuit should be checked as follows:

Remove the dash pots from the time delay relay, Item 3, and the overload relays, Items 17 and 18. Place enough oil, which is furnished with the transmitter, in the time delay relay sufficient to just cover the tops of the three small die cast pins on the plunger assembly. Wipe the plungers of the over-

INSTALLATION AND INITIAL ADJUSTMENTS

load relays with a thin film of oil. Great care must be exercised not to get too much oil on the overload plungers as they will not operate properly in case of an overload if too much oil is present in the dash pot. Replace the dash pots on the relays. It will be necessary to hold the contacts of the bias interlock relay, Item 48, closed. (Item 48 is not shown in Figure 8, but is located under Item 2.) This may be accomplished by placing a piece of stiff paper between the back contact and the movable contact.

With the transmitter doors closed, operation of the filament power START button should close the filament contactors, Items 1 and 2, on the 102K Relay Panel. In addition, the time delay relay, Item 3, should be energized and after a short time delay its contacts should close. The time delay relay has been adjusted at the factory for a time delay of approximately thirty seconds and should need no further adjustment in the field. If a time delay of approximately thirty seconds is not obtained, adjustment of the relay should be made, following the instructions on the relay name plate, in order to obtain approximately thirty seconds of time delay. After the time delay relay, Item 3, operates, depress the plate power START button. The plate power contactor, Item 4, in the 102K Unit should close and hold. It should be impossible to operate this relay before the time delay relay has functioned. Check the operation of the door switch interlocks by opening any door. As soon as a door is opened, the plate contactor, Item 4, should release. Release all contactors in the transmitter by depressing the filament power STOP button. Remove the paper holding together the contacts of the bias interlock relay, Item 48, and re-energize the filament start circuit. Under this condition it should be impossible to operate the plate contactor, Item 4, by pressing the plate power START button. Check the operation of the power change relay, Item 12, in the 11K Output Circuit. Operation of the power level switch from the high to the low position should cause relay, Item 12, to close. This relay is the only contactor associated with the power change circuit of the transmitter. When the circuit check test is successful up to this point, the transmitter is ready for the insertion of vacuum tubes.

(3) FILAMENT VOLTAGE ADJUSTMENT. - Be sure the main line switch is open. Insert all tubes in their proper sockets. Refer to the illustrations in the Appendix and the tube list on page 14 for proper tube positions. Great care should be exercised when inserting the type 833A tubes so as not to damage the glass envelope. If difficulty is encountered in inserting the filament prongs in the clamping receptacles, these should be loosened and a screw driver inserted between the clamping surfaces to force them sufficiently apart that the tube may be inserted freely. The filament prong clamp should then be tightened to a snug fit. The plate and grid terminal connections should slide freely over the plate and grid caps. If this is not the case, a screwdriver should be inserted to pry the two halves of the caps apart so

INSTALLATION AND INITIAL ADJUSTMENTS

that no great force must be exerted on the tube in placing the caps on the prongs.

Turn on the main line switch. It is important that the 40E Unit is turned on and operating before application of plate power to the 20K Unit. Press the filament power START button. This should energize the filaments of all tubes in the transmitter and the bias supply. The bias interlock relay, Item 48, in the 102K Unit should now operate. Place the Tuning Selector in the 813 FILAMENT position and check the FILAMENT VOLTAGE meter. This meter reading should be 10 volts. If this reading is not obtained, the Tuning Control may be turned to the RAISE or LOWER position as required to permit adjustment of the 813 filament voltage. All other positions of the Tuning Selector connect the filament voltmeter to the 833A filament circuit. Place the Tuning Selector in the 833A FILAMENT position. Check the FILAMENT VOLTAGE meter for a reading of 10 volts, and if required, adjust this voltage by means of the Tuning Control until an exact reading of 10 volts is obtained.

Permit the equipment to operate in this manner for a period of thirty minutes before application of any plate power in order to permit proper aging of the mercury vapor rectifier tubes. This aging procedure is required only on the initial adjustment of the transmitter or when a new mercury vapor rectifier tube is installed. In subsequent operating procedure, the time delay relay will automatically provide the proper time interval.

(4) R-F CIRCUIT ADJUSTMENT.

(a) 40E FREQUENCY CONTROL UNIT. - Crystal holders, thermometers and tubes should be inserted in the 40E Frequency Control Unit. After connection of the power cord, the toggle switch on the rear of the chassis may be operated, applying power to the crystal oven heaters. The heat indicator should light. About thirty minutes is required for these ovens to reach the operating temperature of 50° Centigrade at which point the heat should be on and off about equal intervals of twenty to forty seconds.

Operation of the OSCILLATOR switch applies all filament power and plate power to the oscillator and buffer stages. Oscillation should be indicated by a reading of grid current to the 807 tube when the METER SWITCH is placed in the number 3 position.

Operation of the AMPLIFIER SWITCH should apply plate power to the 807 amplifier tube. The AMPLIFIER TUNING capacitor should be adjusted to minimum amplifier plate current as read on the right-hand meter.

The potentiometer, Item 24, accessible through the front door of the unit, adjusts the bias on the oscillator suppressor. This adjustment is set

INSTALLATION AND INITIAL ADJUSTMENTS

when the crystals are calibrated and should require no further adjustment in the field. If this adjustment has accidentally been moved, it should be set as follows. When the potentiometer is set for maximum bias, there should be no oscillation. Slowly reduce the bias until oscillation starts. The setting for operation should be just below the point required for oscillations to start. Ordinarily best stability is obtained by adjusting the bias for the highest level of output as indicated by the monitor. If the frequency does not agree with the monitor, the trimmer condensers, Item 58, across the crystals, may be adjusted to provide plus or minus ten to twenty cycles variation. The airgap of the crystal is adjusted during calibration to furnish proper frequency with these condensers set near the middle of their range.

If necessary, the frequency may be adjusted over a range of two hundred to three hundred cycles by means of the airgap in the crystal oscillator holder. This adjustment is made by removing the name plate from the top of the holder and using the special type 280A wrench supplied. Care should be taken to loosen the lock nut and not to change the airgap more than a few degrees of rotation. Turning to the right decreases the airgap and lowers the frequency.

The r-f voltage to the frequency monitor may be varied by adjusting the potentiometer, Item 25. This is accessible from the rear of the unit.

(b) INTERMEDIATE AMPLIFIER ADJUSTMENT. - Place the METER SELECTOR control in the 813 GRID position. In this position, the grid current of the 813 intermediate amplifier may be read on the meter marked GRID OR PLATE CURRENT. With the meter selector in this position, place the TUNING SELECTOR in the 813 GRID position and adjust the 813 grid tank circuit for maximum grid current reading. Check the tuning of the AMPLIFIER TUNING control in the 4OE Frequency Control Unit and adjust it for minimum plate current. With the grid circuit tuned to maximum grid current and the 4OE amplifier tuning control adjusted for minimum 807 plate current, a grid current reading to the 813 tube of approximately 10 milliamperes should be obtained. If insufficient grid current is obtained, further increase will result by moving the coupling tap on the 813 grid coil, Item 39. When a satisfactory amount of grid current has been obtained, open the neutralizing switch, Item 17, located immediately above the plate and grid circuit spars of the 833 tubes and place the Tune-Operate switch, Item 19, on the 102K relay panel in the TUNE position. Place the TUNING SELECTOR control in the 813 PLATE position. Turn on the plate power by pressing the plate power START button and adjust the 813 plate tuning for minimum 813 AMPLIFIER PLATE current by means of the TUNING CONTROL. If a resonance point, as indicated by the minimum plate current reading, does not appear within the limits of the tuning control, the clip on the inductance coil,

INSTALLATION AND INITIAL ADJUSTMENTS

Item 40, must be moved and the process repeated until resonance is indicated. A minimum plate current reading of approximately 75 milliamperes should be obtained. In this preliminary test, the grid exciter tap for the 833 power amplifier stage may be placed so as to include approximately half the used portion of the 813 plate coil. Place the METER SELECTOR switch in the 833 GRID position and read the 833 grid current on the GRID OR PLATE CURRENT meter. A grid current reading of approximately 60-80 milliamperes should be obtained with the Tune-Operate switch in the TUNE position. If this value of grid current is not obtained, the excitation tap between the 813 plate coil and the 833 grid circuit should be adjusted to obtain the proper value of grid current. Changing the adjustment of this tap will, of course, require retuning of the 813 plate circuit.

(c) NEUTRALIZATION. - Place the neutralizing coil approximately in the position shown on the 11K Output Circuit in the rear view photograph of the transmitter. Place the POWER LEVEL switch in the LOW position. Place the 500-watt loading condenser, Item 16, at full capacity. Place the movable tap on the monitor coil, Item 10, near the transmission line end of the coil. The modulation monitor indication in this way may be used to neutralize the final amplifier. Place the TUNING SELECTOR control in the 833 PLATE position. Apply plate voltage and tune the 833 plate circuit by means of the TUNING CONTROL to resonance as will be indicated by a maximum reading of the carrier meter in the modulation monitor. If no resonance point can be found, move the neutralizing coil from its original position and determine the resonance point of the final amplifier. When this has been done, the neutralizing coil may be readjusted to neutralize the radio frequency voltage in the output circuit and locked in this position. Neutralization is indicated when the modulation monitor reading is at its lowest point.

(d) OUTPUT TUNING.

CAUTION: Before applying any plate voltage to the final amplifier, make certain that the modulation monitor tap on the coil, Item 10, is near the ground end of the coil.

Close the neutralizing switch, Item 17. Leave the Tune-Operate switch in the TUNE position and the Power-Level switch in the LOW position. Apply plate voltage and adjust the power amplifier to minimum plate current. If the load provided is of the proper magnitude, that is, in the vicinity of 70 ohms, the final amplifier plate current under this condition should be of the order of 150 to 175 milliamperes.

Place the Power-Level switch in the HIGH position and check the plate current. In this position, the plate current should not be more than 330 milliamperes at a plate voltage of 1250 volts. If this loading is too

INSTALLATION AND INITIAL ADJUSTMENTS

high, it indicates that either the transmission line load is too far below 60 ohms resistive or that it has a large inductive component and must be readjusted. If, however, the test thus far is satisfactory, full plate voltage may be applied to the transmitter by placing the Tune-Operate switch in the OPERATE position. Reapply plate voltage with the Power Level switch in the HIGH position. Check the 833A PLATE tuning and by means of the power amplifier LOADING control and the 833A PLATE tuning control, adjust the power input (the product of the plate voltage and the power amplifier plate current) to the desired value for 1000 watt operation. Under this condition of operation, the plates of the 833A vacuum tubes will exhibit a normal orange-red color. Further, under conditions of full plate voltage, the static plate current of the modulator tubes will be approximately 50 milliamperes with no signal.

To arrange the transmitter for 500-watt operation, it is merely necessary to operate the Power Change switch to the LOW position, slightly retune the power amplifier tank circuit for resonance and adjust the power amplifier plate current by means of loading condenser at the rear of the transmitter, Item 16, in the LLK Output Network until the desired power input is obtained. It will not be necessary to adjust this loading condition again during routine operation as it is connected in parallel with the loading condenser controlled from the front panel and all minor adjustments of loading may be accomplished from the front of the transmitter.

After the transmitter has been arranged to work satisfactorily into its connected load, it will be well to take note of the following fact: In a pi network, when the inductive arm is varied in order to obtain minimum plate current (maximum impedance), the power factor of the input side of the network is not unity. In order to obtain maximum power from the transmitter, it is advisable to adjust the final amplifier for maximum efficiency. This adjustment may be obtained by slightly varying the final amplifier plate tuning and the final amplifier plate loading so as to maintain a constant value of plate current. A position of the tuning and loading controls will be found that will result in a maximum line current for a fixed power input. In the one kw position, it will be found that this tuning position is somewhat removed from the minimum plate current position. Also, in the one kw position, when this procedure is followed, the power output will be approximately 10% greater than that obtained when the transmitter is tuned to minimum plate current.

SECTION 4

OPERATION

1. GENERAL.

The 40E Frequency Control Unit is arranged so that the crystal ovens may be operated continuously, therefore, there is no waiting period for the crystals to come to operating frequency. The plate and filament voltage to the tubes in the 40E unit may be turned off at the end of the operating period.

2. STARTING THE EQUIPMENT.

a. Operate the OSCILLATOR switch on the 40E Frequency Control Unit to the ON position.

b. Check the oscillator cathode current, the isolation amplifier cathode current, the amplifier grid current and the plate voltage by rotating the METER SWITCH to the various positions.

c. Operate the AMPLIFIER switch to the ON position and check the cathode current.

d. If the 40E Frequency Control Unit appears to be operating satisfactorily, proceed to turn the 20K unit on.

e. Depress the FILAMENT POWER START button and check the filament voltage.

f. Rotate the 20K METER SELECTOR switch to the 813 GRID position and check the reading.

g. Rotate the METER SELECTOR switch to the 833A GRID position.

h. After the time delay relay has operated, depress the PLATE POWER START button and observe the 833A AMPLIFIER PLATE CURRENT, the 813 AMPLIFIER PLATE CURRENT, and the 833A GRID current meter readings. The modulator static plate current may be checked by reading the 833 MODULATOR PLATE CURRENT meter.

i. Rotate the METER SELECTOR switch to the 845 PLATE position, then to the 6J5G PLATE position and observe the readings.

j. Check the FILAMENT VOLTAGE in the 813 and 833 positions, the AMPLIFIER PLATE VOLTAGE and the RADIO FREQUENCY LINE CURRENT.

k. If the FILAMENT VOLTAGE readings are not correct, operate the TUNING SELECTOR to the proper positions and adjust the values with the TUNING CONTROL.

l. The audio may now be applied to the modulating system and the operation of the modulators checked.

OPERATION

m. The 20K Unit may be turned OFF by depressing the FILAMENT POWER STOP button.

3. REDUCING POWER.

The power may be reduced to the predetermined level by operating the POWER LEVEL control to the LOW position and touching up the tuning of the final amplifier plate circuit.

NOTE

It is recommended that the tuning of the power amplifier stage be checked several times daily, as the power input must be maintained within the limits specified by the Federal Communications Commission. Routine tests of harmonic distortion and audio frequency response should be made at regular intervals, weekly if possible. These tests will indicate weak or defective tubes in the audio system.

SECTION 5
OPERATORS MAINTENANCE

1. ROUTINE CHECKS.

The following checks performed once a day should reveal any deviation from normal operation of the equipment.

- a. Check plate voltage readings on the 40E and 20K Units.
- b. Check plate current readings on the 40E and 20K Units. (Make allowances for abnormal or subnormal plate voltages.)
- c. Check grid current readings.
- d. Check frequency of radio frequency output.
- e. Make distortion and frequency response measurements.
- f. Check the radio frequency line current.
- g. Examine the various components for excessive heating.

TABLE OF TYPICAL METER READINGS

<u>METER</u>	<u>1000 W. LEVEL</u>	<u>500 W. LEVEL</u>
R-F Line Current*	2.0	1.4
833A Modulator Plate Current (Static)	45	50
833A Amplifier Plate Voltage	2480	2600
833A Amplifier Plate Current	580	300
813 Amplifier Plate Current	125	125
 Grid or Plate Current:		
813 Grid Current	13	17
833 Grid Current	112	140
845 Cathode Current	100	108
6J5G Cathode Current	20	20
 Filament Voltage:		
813 Filament Voltage	10.0	10.0
833 Amplifier Filament Voltage	10.0	10.0

*Output Impedance: 250 ohms

OPERATORS MAINTENANCE

WARNING

In order to obtain satisfactory tube life the following precautions must be taken:

- a. Operate all tube filaments within $\pm 5\%$ of rated voltage.
- b. Do Not exceed rated plate current in any of the tubes during normal operation of the equipment.
- c. When tuning, do not exceed rated plate current except for periods of short duration.

Failure to observe the above precautions may result in the destruction of tubes.

2. FUSE REPLACEMENT.

a. LOCATING BLOWN FUSE.

(1) 40E FREQUENCY CONTROL UNIT. - The fuse mounting may be located by removing the rear cover.

(a) Each crystal oven heater and relay circuit is fused. Failure of the oven pilot light to glow at intervals might indicate a blown fuse in that particular circuit.

(b) The primary of the oven heater transformer is also fused, therefore, if neither oven pilot light glows, it is likely that this fuse is blown.

(c) If the R-F portion of the 40E Unit fails to function, check the primary fuse in the power supply.

(2) 20K TRANSMITTER UNIT. - All fuses are located on the rear edge of the 102K-1 Relay Unit. The equipment is supplied with fuses of correct rating in each position. Fuse failures should be replaced with spares only after the circuit in question has been carefully examined to make certain that no permanent fault exists. Always replace a fuse with one having exactly the same rating. Refer to the fuse table at the end of this section for fuse ratings.

Ordinary appliance type fuses are used, therefore, if the equipment fails to operate, inspect the fuse elements through the mica window in the top of each fuse. If the blown fuse is not apparent, determine which

OPERATORS MAINTENANCE

circuit is not functioning and refer to the fuse table and replace the fuse indicated.

(a) A blown fuse in any R-F stage circuit may cause excessive current flow in plate current in following stages which may throw the circuit breakers in the H-V power supply.

(b) Medium plate voltage failure or filament voltage failure may be due to blown fuses in the respective transformer primaries.

(c) The autotransformer is fused, therefore, since the relays and filament transformers operate from the autotransformer, failure of either of the fuses would make the entire 20K Unit inoperative.

3. TUBE REPLACEMENT.

a. GENERAL. - Distortion and low output may be the result of weak or defective tubes. Check the plate current of each tube or groups of tubes whenever distortion or low output is encountered. A good method of locating a defective tube is to replace each tube with one known to be in good condition. Extreme caution should be used in removing the plate and grid connectors from the Type 833A tubes. The connectors fit very snugly and the tube envelope may be fractured if extreme care is not practiced.

TABLE OF FUSES

20K TRANSMITTER UNIT.

<u>Item No.</u>	<u>Description</u>	<u>Specification</u>	<u>Location</u>
21	Autotransformer fuse	10 amp.	Unit D
22	Autotransformer fuse	10 amp.	Unit D
23	Tuning motor fuse	5 amp.	Unit D
24	813 Fil. primary fuse	5 amp.	Unit D
25	845 Fil. primary fuse	5 amp.	Unit D
26	6J5G Fil. primary fuse	5 amp.	Unit D
27	Bias primary fuse	5 amp.	Unit D
28	833A Mod. fil. pri. fuse	10 amp.	Unit D
29	833A PA fil. pri. fuse	10 amp.	Unit D
30	1000 volt supply pri. fuse	5 amp.	Unit D

40E FREQUENCY CONTROL UNIT.

49	Crystal heat fuse (2)	1.5 amp. 250 v 1-1/4" x 1/4" cartridge	
----	-----------------------	---	--

OPERATORS MAINTENANCE

50	Crystal heat transformer fuse	.5 amp. 500 v 1-1/4" x 1/4" cartridge
51	Power transformer fuse	3 amp. 250 v 1-1/4" x 1/4" cartridge

SECTION 6

PREVENTIVE MAINTENANCE

1. GENERAL.

The greatest enemy of uninterrupted service in equipment of this type is corrosion and dirt. Corrosion itself is accelerated by the presence of dust and moisture on the component parts of the assembly.

2. CLEANING.

a. GENERAL. - It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry oil-free jet of air. Remove the dust as often as a perceptible quantity accumulates in any part of the equipment. It is important that variable condenser plates be kept free from dust to avoid flashover on modulation peaks.

b. AIR FILTER. - The air filter in this equipment is of the spun glass type and is not washable. The entering side should be cleaned off with a vacuum cleaner at regular intervals and the element replaced after it has become filled with collected matter to such an extent that the air flow is impeded.

3. RELAYS.

In general, the contact adjustment of the a-c type power contactor is not critical. Spare contacts and spare coils can be obtained and replacement made when necessary.

Never use an abrasive on the contact surfaces. Relays which have excessive hum are usually not seating properly. Dirt on the pole faces is the most likely cause of this and may be removed by washing with gasoline.

4. LUBRICATION.

a. BLOWER MOTOR. - The blower motor is equipped with oil cup which should be filled at frequent intervals. Use a light machine oil such as Socony Vacuum, Gargoyle Arctic C.

b. TUNING MOTORS. - The bearings and gears of the tuning motors should be lubricated at the same time as the blower motor with the same lubricant. Wipe off the excessive lubricant to prevent dripping.

5. CRYSTAL OVEN THERMOSTATS.

Due to vaporization of mercury at make and break of the circuit, a small amount of mercury condenses at the top of the capillary tube. This is evidenced by an increase in crystal oven temperature rise of approximately 1/2 to 1 degree per year. To correct the thermostat, remove from the crystal oven and place in dry ice until the entire mercury column has contracted into the bulb.

SECTION 7

CORRECTIVE MAINTENANCE

1. GENERAL.

In addition to the material presented in this section, the maintenance engineer will find the material found in SECTION 5 and SECTION 6 of value in correcting any trouble that may arise.

This section of the instruction book deals with trouble shooting and adjustments not normally encountered by the operating personnel.

It is well known that one of the greatest sources of trouble in equipment located near the sea is corrosion. Corrosion resulting from salt laden atmosphere may cause failure of the equipment for no apparent reason. In general, it will be found that contacts such as tube prongs, cable connectors and telephone relay contacts are most affected by corrosion. When it is necessary to operate the equipment in localities subject to corrosive atmosphere, inspection of wiping contacts, cable plugs, relays, etc., should be made more frequently in order to keep the equipment in good condition.

It is a good policy when making checks for faults in equipment, to refer to the original test data sheets in order to isolate the source of the fault. If the section of the equipment in which the fault occurs can be isolated, the trouble may be located with a minimum of effort. Continuity checks and voltage measurements in circuits still operative may be helpful in isolating the trouble. For this purpose an a-c, d-c voltmeter having an internal resistance of not less than 1000 ohms per volt and equipped with a battery for continuity and resistive measurements is necessary. An oscilloscope is very useful in tracing faults in radio frequency and audio frequency circuits of the equipment.

2. TYPICAL VOLTAGE READINGS.

Readings taken with a 1000 ohms per volt meter with a 2.5 mh series choke:

<u>Tube</u>	<u>Description</u>	<u>1000. W</u>	<u>500 W</u>
6J5G	Cathode to ground	9	9
	Plate to cathode	270	270
	Grid to ground	0	0
845	Filament CT to ground	150	150
	Grid to ground	0	0
	Plate to filament CT	950	950
833 Mods.	Filament CT to ground	0	0
	Grid to ground	66	68
	Plate to filament CT	2480	2600

CORRECTIVE MAINTENANCE

<u>Tube</u>	<u>Description</u>	<u>1000 W</u>	<u>500 W</u>
833 RF	Filament CT to ground	0	0
	Grid to ground	400	460
	Plate to filament CT	2480	2600
813	Filament CT to ground	40	40
	Grid to ground	175	190
	Filament CT to screen	140	140
	Filament CT to plate	2170	2220

3. TYPICAL AUDIO FREQUENCY DATA.

Frequency Response at 50% modulation, 1000 W carrier.

<u>Freq. CPS</u>	<u>DB</u>	<u>Freq. CPS</u>	<u>DB</u>
30	+0.5	3000	0
50	+0.1	5000	-0.4
100	0	7500	-1.8
300	0	10000	-1.3
1000	0	12000	-0.6

Input level (500 ohm input) for 100% Mod.

500W +16 dbm* 1000W +16 dbm*

Residual Noise Level Below 100% Mod. Level

500 W 70 db 1000W 67 db

Distortion, % rms

<u>1000W 100% Mod.</u>				<u>500 W 100% Mod.</u>			
<u>Freq.</u>	<u>%</u>	<u>Freq.</u>	<u>%</u>	<u>Freq.</u>	<u>%</u>	<u>Freq.</u>	<u>%</u>
50	0.85	1000	1.0	50	0.75	1000	0.8
100	0.55	5000	1.3	100	0.65	5000	1.7
400	0.70	7500	1.2	400	0.70	7500	2.2

Carrier Shift at 100% Mod. with 400 cps.

1000W -3% 500W-1.5%

*Zero level - 1 milliwatt 600 ohm base.

CORRECTIVE MAINTENANCE

4. TUBE FILAMENT VOLTAGES.

The transformers which supply voltages for heating the vacuum tubes have tapped primary windings. In event the filament rheostats do not have enough adjustment to obtain the correct filament voltage, the next higher or lower tap on the transformers may be employed. Refer to the equipment photographs for location of the various filament transformers.

5. TUBE FAILURE.

The most frequent cause of trouble in transmitting equipment is tube failure. If a fault occurs in the equipment, isolation of the circuit at fault is helpful in determining the location of the defective tube. Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within vacuum tubes is a good indication of fault in the tube circuit. Low emission tubes may be the cause of erratic or poor performance of the equipment. If there is any doubt concerning the emission of any tube, it should be checked immediately and replaced if defective. Tubes with electrical noises cause excessive distortion or hum. This fault may be more difficult to isolate to a particular tube, however, a tube suspected of faulty operation may be checked by replacing with a like tube known to be in good condition. Refer to paragraph 1. in Section 5 for a table of typical meter readings.

6. TROUBLE SHOOTING.

a. ISOLATING THE TROUBLE.

(1) Before starting any extensive set of tests, check the position of all switches and controls and make sure they are in the correct position.

(2) Check all door and panel interlocks to see that they are functioning properly.

(3) Check fuses and circuit breakers.

(4) Check the circuits in order of succession they are made operative in the process of starting the transmitter.

(5) Check all meter readings against the TABLE OF TYPICAL METER READINGS in SECTION 5.

(6) Make a visual inspection of all tubes, resistors and chokes. Tubes sputtering may indicate short circuits. Resistors and chokes may be discolored caused by a short located in their circuit.

CORRECTIVE MAINTENANCE

7. TROUBLE SHOOTING CHART.

TROUBLE	SYMPTOMS	PROBABLE CAUSE
Failure of filament voltage supply	No filament voltage on any tube. Relays won't operate	Autotransformer fuse blown. Defective autotransformer.
Failure of individual filament supplies	Certain tubes do not light	Filament transformer fuse blown. Defective filament transformer. Filament relay not closing or making contact.
Failure of plate voltage supply (medium voltage)	No type 845 plate current	Interlock switches not operating. Bias supply not operating. Overload relays open. (Dirty contacts). Power transformer fuse blown. Defective transformer. Defective tubes or chokes.
Failure of plate voltage supply. (High voltage)	No type 833 or 813 plate current	Interlock switches not operating. Bias supply not operating. Overload relays open. (Dirty contacts.) Defective transformer. Defective tubes or chokes. Plate power relay not closing.
Failure of bias supply	Plate power contactor will not operate	Bias supply rectifier tubes weak or burned out. Fuse D27 in bias supply transformer primaries blown.

CORRECTIVE MAINTENANCE

TROUBLE	SYMPTOMS	PROBABLE CAUSE
Power amplifier not neutralized	Grid current varies when tuning through resonance with the plate power to the final cut off. Maximum grid current is not obtained when the plate circuit is at resonance. Transmitter cannot be modulated 100%	Grid to plate capacity of the amplifier tubes has changed with aging. New tubes have been installed with a different grid to plate capacity than the old tubes.
Distortion	Distortion check shows more than the allowable amount.	Bias changed on the modulator tubes affecting the static plate current. Defective components in feedback network. Defective tubes.

8. SERVICING THE EQUIPMENT.

Refer to SECTION 3, INSTALLATION AND INITIAL ADJUSTMENTS of this instruction book for information on how to get at the various components for servicing. SECTION 3 also outlines the various steps which must be taken to adjust the equipment for proper operation when the servicing has been performed. Refer to SECTIONS 5 and 6 for additional information on servicing the equipment.

20K SERIES R-F TANK COMPONENTS

550-1600 Kc. *

<u>Frequency (kc)</u>	<u>Unit "B" Item 4</u>	<u>Unit "B" Item 7</u>	<u>Unit "B" Item 15A</u>
550 - 650	901 2101 00	574 0148 40	904 2151 00
650 - 825	901 3601 00	574 0148 40	904 2151 00
825 - 1000	901 3501 00	573 0148 40	904 2101 00
1000 - 1225	901 3401 00	573 0148 40	904 2101 00
1225 - 1600	901 3301 00	572 0148 40	904 3601 00

<u>Frequency (kc)</u>	<u>Unit "C" Item 31</u>
550 - 650	904 2201 00
650 - 825	904 2101 00
825 - 1000	904 2101 00
1000 - 1225	904 3601 00
1225 - 1600	904 3401 00

* Refer to the unit parts lists for description of the parts listed in this table.

TABLE SHOWING R-F COMPONENTS NECESSARY FOR COMPLETE
COVERAGE OF THE FREQUENCY 550-1700 KILOCYCLES

The data tabulated below was taken with a non-reactive load impedance of 215 ohms. If other load impedance values are encountered, changes in the tabulated component values may be required.

FREQUENCY RANGE (KC)	ITEM 7 PA TANK COIL	ITEM 4 PA. PLATE TANK CAP.	1000 W		500 W	
			ITEM VALUE M.F.D.	OUTPUT LOADING CAP. PART NUMBER	ITEM VALUE	OUTPUT LOADING CAP. PART NUMBER
550-650	982DM-8	901 3801 00	3	.0005 906 3501 00	15	.001 906 2101 00
			20	.004 906 2401 00	23	.002 906 2208 10
			21	.002 906 2208 10	24	.0005 906 3501 00
650-700	982DM-8	901 3601 00	3	.0005 906 3501 00	15	.001 906 2101 00
			20	.004 906 2401 00	23	.002 906 2208 10
			22	.001 906 2101 00		
700-800	982DM-7	901 3601 00	3	.0005 906 3501 00	15	.001 906 2101 00
			20	.004 906 2401 00	23	.002 906 2208 10
			21	.002 906 2208 10	24	.0005 906 3501 00
800-850	982DM-7	901 3601 00	3	.0005 906 3501 00	23	.002 906 2208 10
			20	.004 906 2401 00	24	.0005 906 3501 00
			22	.001 906 2101 00		
850-900	982DM-7	901 3501 00	20	.004 906 2401 00	15	.001 906 2101 00
					24	.0005 906 3501 00
900-1000	982DM-7	901 3501 00	3	.0005 906 3501 00	15	.001 906 2101 00
			21	.002 906 2208 10	24	.0005 906 3501 00
			22	.001 906 2101 00		
1000-1100	982DM-7	901 3401 00	3	.0005 906 3501 00	15	.001 906 2101 00
			21	.002 906 2208 10	24	.0005 906 3501 00
1100-1200	982DM-7	901 3401 00	3	.0005 906 3501 00	15	.001 906 2101 00
			21	.002 906 2208 10	24	.0005 906 3501 00

* Inserted in circuit by operation of Relay, Item 12.

TABLE SHOWING R-F COMPONENTS NECESSARY FOR COMPLETE COVERAGE OF THE FREQUENCY 550-1700 KILOCYCLES

The data tabulated below was taken with a non-reactive load impedance of 215 ohms. If other load impedance values are encountered, changes in the tabulated component values may be required.

FREQUENCY RANGE (KC)	ITEM 7 PA TANK COIL	ITEM 4 PA PLATE TANK CAP.	1000 W OUTPUT LOADING CAP.		500 W OUTPUT LOADING CAP.	
			ITEM	VALUE M.F.D.	ITEM	VALUE
1200-1350	982DM-7	901 3301 00	21	.002	15	.001
1350-1550	982DM-6	901 3301 00	21	.002	15	.001
1550-1600	982DM-6	901 3301 00	3 22	.0005 .001	15	.001

* Inserted in circuit by operation of Relay, Item 12.

Item 2, a .001 mfd variable capacitor is used for high power operation in addition to capacitors indicated above, in all cases.

Item 16, a .001 mfd variable capacitor is used for low power operation in addition to capacitors indicated above, in all cases.

Frequency Range (kc)	Item 31		Frequency Range (kc)	Item 15A Transmission Line Loading Cap.
	Int. Amp. Pl.	Tank Cap.		
550-700	904 2151 00		550-800	904 2151 00
700-850	904 2101 00		800-1050	904 2101 00
850-1100	904 3601 00		1050-1700	904 3601 00
1100-1350	904 3601 00			
1350-1700	904 3401 00			

When changing the operating frequency of the 20K Transmitter, it may be necessary to change the radio frequency chokes, Item 8, in the thermocouple circuit of the antenna ammeter. The three chokes required for the frequency range 550-1700 kc are as follows:

Item 8
R-F Thermo-
couple Choke

GAL090B
GAL091B
X-3779-7

Frequency Range
(kilocycles)

550-800
800-1100
1100-1700

If the frequency range of the 40E exciter is to be changed, it will be necessary to place the band switch, Item 64, in the proper position (see 40E Unit Schematic, drawing 765B). A lever is provided on the band switch shaft for this purpose. This lever is located on the bottom side of the compartment shield and the band position numbers are engraved on the side of the shield adjacent to the right side of the relay, Item 4. (See photograph of 40E Frequency Control Unit, Inside View.)

20K

UNIT A - 82H-4 METER PANEL

SECTION 8
PARTS LIST

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	RF Line current meter	METER: A-C thermocouple assembly; 0-3 amperes R-F; 12 ohms; 0.6 MA; 6 ohms lead resistance; 3" x 3" x 3".	49100	733	459 0132 00
2	833A Mod. plate current meter	METER: D-C milliammeter; 0-800 MA; 40 scale divisions 20 MA per division; 0.125 ohms; 2%; permanent magnet moving coil.	49100	731	450 0010 00
3	833A plate voltage meter	METER: D-C volt meter; 0-4 kilovolts; 2%; 40 scale divisions 100 volts per division; 0-10 MA d-c.	49100	731 - Special	458 0132 00
4	833A plate current meter	METER: 0-1000 MA d-c; 50 scale divisions 20 MA per division; 2% accuracy; 2-3/32" x 3" x 3-1/8".	41970	27	450 0011 00
5	813 amp. plate current meter	METER: 0-300 MA d-c; 60 scale divisions 5 MA per division; 0.33 ohms 2%.	49100	731	450 0008 00
6	Grid or plate current meter	METER: 0-200 MA d-c; 40 scale divisions 5 MA per division; 48 ohms.	49100	731 - Special	458 0742 00
7	Filament voltage meter	METER: 0-15 v a-c; 30 scale divisions 0.5 volts per division; 210 ohms 2%; 5 v - 0.2 watts 10 v - 0.5 watts 15 v - 1.25 watts power consumption.	49100	734	452 0003 00
8	Meter Lamp bulb	BULB: 110 v; 55 MA; 6 watts candelabra base; 9/16" diam; 1-7/8" long.	18860	S-6	262 3330 00

UNIT B - 11K-4 OUTPUT CIRCUIT

PARTS LIST

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	Plate voltage meter multiplier	RESISTOR: Fixed; 100,000 ohms $\pm 1\%$; 14.4 watts; wire wound; 1200 v max; 12 MA max; 5/8" diam; 5" long.	34500		728 1004 00
2	High power var. loading cap.	CAPACITOR: 500 mmf per sect; variable; dual section; 3-3/8" x 4-1/8" x 10-15/16".	6500	XV-500-KD	920 3900 00
3	High power fixed loading cap.	CAPACITOR: Mica; 0.0005 mf $\pm 5\%$; 5000 TV; 60 cps; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 3501 00
4*	833A amp. plate tank cap.	CAPACITOR: Mica; 0.0001 mf $\pm 5\%$; 20,000 TV; tubular case; 60 cps; cast aluminum ends; 4" x 5" x 6-1/2".	9110	51	901 3801 00
		CAPACITOR: Mica; 0.0006 mf $\pm 5\%$; 15,000 TV; tubular case; 60 cps; cast aluminum ends; 4" x 5" x 6-1/2".	9110	51	901 3601 00
		CAPACITOR: Mica; 0.0005 mf $\pm 5\%$; 20,000 TV; tubular case; 60 cps; cast aluminum ends; 4" x 5" x 6-1/2".	38110 9110	77 51	901 3501 00
		CAPACITOR: Mica; 0.0004 mf $\pm 5\%$; 20,000 TV; tubular case; 60 cps; cast aluminum ends; 4" x 5" x 6-1/2".	9110	51	901 3401 00
		CAPACITOR: Mica; 0.0003 mf $\pm 5\%$; 20,000 TV; tubular case; 60 cps; cast aluminum ends; 4" x 5" x 6-1/2".	9110	51	901 3301 00
* RF components used in a particular transmitter will depend on the operating frequency.					

PARTS LIST

UNIT B - 11K-4 OUTPUT CIRCUIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
5	833A amp plate blocking capacitor	CAPACITOR: Mica; 0.002 mf $\pm 5\%$; 8000 TV; 14-24 brass stud terminals; 2-3/8" x 3-7/8" x 4".	9110	30B	911 2202 00
6	H.V. bypass capacitor	CAPACITOR: Mica; 0.0005 mf $\pm 10\%$; 8000 TV; 14-24 brass stud terminals; 2-3/8" x 3-7/8" x 4".	9110	30B	911 3502 00
7*	833A amp. plate tank coil	COIL: 113 ^{microhenry's} mh ; 41 turns; 15-1/4" long; 8-1/2" wide; X801 neutralizing coil.	8300	AGD-148D 73.5	574 0148 40
		COIL: 72.5 ^{micro} mh; 33 turns; 15-1/4" long; 8-1/2" wide; X801 neutralizing coil.	8300	GC-148D	573 0148 40
		COIL: 49.8 mh; 26 turns; 15-1/4" long; 8-1/2" wide; X801 neutralizing coil.	8300	GB-148D	572 0148 40
8	RF choke line current meter leads	COIL, CHOKE: RF; 1 mh; 1 amp; 2.5 ohms $\pm 10\%$; multiple-pi-duo-lateral wound; ceramic form; 1-1/2" diam; 4" long.	31690	4534	240 3000 00
9	833A amp. RF plate choke	COIL, CHOKE: 4 mh; #22 double silk enameled wire; 3-1/2" high; 6-1/2" long.	8300	Y-2582	508 2582 00
10	Monitor coupling coil	COIL: #22 copper wire; coil rider; 56 turns; 1-13/16" wide; 3-7/8" long.	8300	GA-700C	571 0700 30
11	Thermocouple, line current meter	METER: A-C meter assembly; 0-3 amps RF; 1.2 watts.	49100		459 0230 00
*	RF components used in	a particular transmitter	will depend on the operating frequency.		

PARTS LIST

UNIT B - 11K-4 OUTPUT CIRCUIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR.CODE NO.	MFR.TYPE or CAT. NO.	PART NUMBER
12	Power change relay	RELAY: Circuit control; ac; 540 ohms; 110 v; 0.06 amps; mount in any position.	28600	1507-MX	407 1000 00
13	Tuning motor assembly	MOTOR ASSEMBLY: 3.44 rpm; rated load 7 in-lb; 2-3/16" x 3-3/16" x 3-3/4".	8300	GA-1304C	571 1304 30
		MOTOR: Permanent split phase reversible 24 v; 60 cps; 2.4 amps; 36 watts.	1040	12	230 7000 00
14	Tuning motor assembly	MOTOR ASSEMBLY: 3.44 rpm; rated load 2.5 in-lb; 2-3/16" x 3-3/16" x 3-3/4"	8300	GA-1304C	573 1304 30
		MOTOR: Permanent split phase reversible; 2.4 amps; 36 watts; 24v; 60 cps.	1040	12	230 7000 00
15	Low power fixed loading capacitor	CAPACITOR: Mica; 0.001 mf $\pm 5\%$; 5000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 2101 00
15A*	Trans. line pad capacitor	CAPACITOR: Mica; 0.0015 mf $\pm 5\%$; 6000 TV; 60 cps; tubular case; cast aluminum ends; 2-1/2" x 2-13/16" x 3-13/16".	9110	59	904 2151 00
		CAPACITOR: Mica; 0.001 mf $\pm 5\%$; 6000 TV; 60 cps; tubular case; cast aluminum ends; 2-1/2" x 2-13/16" x 3-13/16".	9110	6L	904 2101 00
		CAPACITOR: Mica; 0.0006 mf $\pm 5\%$; 6000 TV; 60 cps; tubular case; cast aluminum ends; 2-1/2" x 2-13/16" x 3-13/16".	9110	59	904 3601 00
*	RF components used in	a particular transmitter	will depend on the operating frequency.		

PARTS LIST

UNIT B - 11K-4 OUTPUT CIRCUIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
15B	Inductance	COIL ASSEMBLY: #14 copper wire; 56 turns; coil rider.	8300		508 2140 20
16	Low power var. loading capacitor	CAPACITOR: Variable; dual section; 500 mmf per section; 1/4" shaft; 3-6-32 mtg. holes; 1-15/16" x 4-1/8" x 11-5/16".	6500	X	920 3900 00
17	Neutralizing switch	SWITCH: Knife switch; single pole single throw; 25 amps; copper blades and clips; 3/4" x 2".	44970	707	260 4010 00
18	Int. amp. plate resis. bypass	CAPACITOR: Mica; 0.001 mf $\pm 5\%$; 5000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 2101 00
19	Int. amp. plate resistors (2)	RESISTOR: Fixed; 5000 ohms $\pm 10\%$; 160 watts; wire wound; 895 v max; 179 ma max; 1-7/32" diam; 8-1/2" long.	34500	0714	710 6542 00
20	High power fixed loading capacitor	CAPACITOR: Mica; 0.004 mf $\pm 5\%$; 6000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 2401 10
21	High power fixed loading capacitor	CAPACITOR: Mica; 0.004 mf $\pm 5\%$; 6000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 0208 10
22	Low power fixed loading capacitor	CAPACITOR: Mica; 0.002 mf $\pm 5\%$; 5000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 2101 00

PARTS LIST

UNIT B - 11K-4 OUTPUT CIRCUIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
23	Low power fixed loading capacitor	CAPACITOR: Mica; 0.004 mf $\pm 5\%$; 3000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 2401 00
24	Low power fixed loading capacitor	CAPACITOR: Mica; 0.0005 mf $\pm 5\%$; 5000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 3501 00

PARTS LIST

UNIT C - 33J-6 RF AND MODULATOR UNIT

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	Int. amp. grid resistor	RESISTOR: Fixed; 15,000 ohms $\pm 10\%$; wire wound; 4 watts; 274 v max; 18 ma max; 11/32" diam; 1-3/4" long.	34500	Brown Devil	710 1154 20
2	Int. amp grid meter shunt	RESISTOR: Fixed; 0.25 ohms $\pm 1\%$; wire wound; 1 watt; 0.50 v max; 2,000 ma max; 9/16" diam; 1" long.	23600	WW4	722 0256 00
3	Int. amp screen dropping resistor	RESISTOR: Fixed; 40,000 ohms $\pm 10\%$; 34 watts; wire wound; 1175 v max; 29 ma max; 21/32" diam; 4" long.	34500		710 4404 20
4	Power amp. grid meter shunt	RESISTOR: Fixed; 0.25 ohms $\pm 1\%$; wire wound; 1 watt; 0.50 v max; 2,000 ma max; 9/16" diam; 1" long.	23600	WW4	722 0256 00
5	Power amp. grid resistor	RESISTOR: Fixed; 2000 ohms $\pm 10\%$; 100 watts; wire wound; 445 v max; 223 ma max; 27/32" diam; 6-1/2" long.	34500	0611	710 5242 00
6	Parasitic suppressor resistor	RESISTOR: Fixed; 50 ohms $\pm 20\%$; 7 watts; brass sprayed ends; 3/8" diam; 4" long.	6400	Globar - A	712 1400 00
7	Parasitic suppressor resistor	RESISTOR: Fixed; 50 ohms $\pm 20\%$; 7 watts; brass sprayed ends; 3/8" diam; 4" long.	6400	Globar - A	712 1400 00
8	Feed-back resistor (4)	RESISTOR: Fixed; 50,000 ohms $\pm 5\%$; 7.2 watts; wire wound; 600 v max; 12 ma max; 7/16" diam; 2" long.	34500	20 watt BD	710 2504 10
9	Feed-back resistor (2)	RESISTOR: Fixed; 5000 ohms $\pm 10\%$; 2 watts; 100 v max; 20 ma max; 5/16" diam; 1-3/4" long.	23600	BT2	706 5420 00

PARTS LIST

UNIT C - 33J-6 RF AND MODULATOR UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
10	Modulator grid resistor (2)	RESISTOR: Fixed; 100,000 ohms $\pm 10\%$; 2 watts; 447 v max; 4.4 ma max; 5/16" diam; 1-3/4" long.	23600	BT2	706 1004 20
11	Audio driver grid resistor (2)	RESISTOR: Fixed; 250,000 ohms $\pm 10\%$; 2 watts; 500 v max; 2 ma max; 5/16" diam; 1-3/4" long.	23600	BT2	706 2504 20
12	Speech amp. plate resistor (2)	RESISTOR: Fixed; 50,000 ohms $\pm 10\%$; 6 watts; 600 v max; 12 ma max; wire wound; 21/32" diam; 2" long.	34500	0224	710 3504 20
13	Speech amp. plate dropping resistor	RESISTOR: Fixed; 25,000 ohms $\pm 10\%$; 533 v max; 21 ma max; wire wound; 11 watts; 21/32" diam; 2" long.	34500	0213	710 3254 20
15	Audio driver grid coupling resistor (2)	RESISTOR: Fixed; 1 megohm $\pm 20\%$; 0.25 watt; 500 v max; 0.50 ma max; 1/4" diam; 1-1/4" long.	23600	BTL	704 1457 40
16	Speech amp. cathode resistor	RESISTOR: Fixed; 500 ohms $\pm 10\%$; 10 watts; 70 v max; 141 ma max; wire wound; 11/32" diam; 1-3/4" long.	34500	Brown Devil	710 1500 20
17	Speech amp. cathode meter shunt	RESISTOR: Fixed; 0.25 ohms $\pm 1\%$; wire wound; 1 watt; 0.50 v max; 2000 ma max; 9/16" diam; 1" long.	23600	WW4	722 0256 00
19	Input trans. terminating resistor (2)	RESISTOR: Fixed; 7500 ohms $\pm 10\%$; 2 watts; 120 v max; 16.3 ma max; 5/16" diam; 1-3/4" long.	23600	BT2	706 7500 20
20	Speech amp. grid resistor (2)	RESISTOR: Fixed; 500 ohms $\pm 20\%$; 2 watts; 31.6 v max; 63.2 ma max; 5/16" diam; 1-3/4" long.	23600	BT2	706 5004 20

PARTS LIST

UNIT C - 33J-6 RF AND MODULATOR UNIT (Cont)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
25	Int. amp. grid coupling capacitor	CAPACITOR: Mica; 0.001 mf $\pm 10\%$; 5000 TV; 2000 WV; 6-32 screw terminals; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-50 XM	950 2101 20
26	Int. amp grid tank bypass	CAPACITOR: Mica; 0.01 mf $\pm 10\%$; 2500 TV; 1200 WV; 6-32 screw terminals; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-50 XM	925 1101 20
27	Int. amp. grid tuning capacitor	CAPACITOR: Variable; single section receiving type; 18-475 mmf; 6-32 screw terminals; 3-3/8" x 3-13/16" x 4-1/8".	6500	X	921 1400 00
28	Int. amp. filament bypass (2)	CAPACITOR: Mica; 0.01 mf $\pm 10\%$; 2500 TV; 1200 WV; 6-32 screw terminals; 3-3/8" x 3-13/16" x 4-1/8".	9110 40300 42100	9L A-50 XM	925 1101 20
29	Int. amp. screen bypass	CAPACITOR: Mica; 0.0005 mf $\pm 10\%$; 5000 TV; 2000 WV; 6-32 screw terminals; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-50 XMB	950 3501 20
30	Int. amp. plate blocking capacitor	CAPACITOR: Mica; 0.001 mf $\pm 10\%$; 5000 TV; 60 cps; 10-32 screw terminals; 1-1/4" x 2-1/4" x 3-1/8".	9110	6L	906 2102 00
31*	Int. amp. plate capacitor	CAPACITOR: Mica; 0.002 mf $\pm 5\%$; 6000 TV; 60 cps; tubular case; 2-1/2" x 2-13/16" x 3-13/16".	9110	59	904 2201 00
		CAPACITOR: Mica; 0.001 mf $\pm 5\%$; 6000 TV; 60 cps; tubular case; 2-1/2" x 2-13/16" x 3-13/16".	9110	6L	904 2101 00
*	RF components used in	a particular transmitter	will depend on the operating frequency.		

PARTS LIST
UNIT C - 33J-6 RF AND MODULATOR UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
		CAPACITOR: Mica; 0.0006 mf $\pm 5\%$; 6000 TV; 60 cps; tubular case; 2-1/2" x 2-13/16" x 3-13/16".	9110	59	904 3601 00
		CAPACITOR: Mica; 0.0004 mf $\pm 5\%$; 6000 TV; 60 cps; tubular case; 2-1/2" x 2-13/16" x 3-13/16".	9110	59	904 3401 00
32	Power amp. grid bypass	CAPACITOR: Mica; 0.001 mf $\pm 10\%$; 5000 TV; 2000 WV; 6-32 screw terminals; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-50 XM	950 2101 20
33	Power amp. filament bypass (2)	CAPACITOR: Mica; 0.01 mf $\pm 10\%$; 2500 TV; 1200 WV; 6-32 screw terminals; 3-3/8" x 3-13/16" x 4-1/8".	9110 40300 42100	9L A-50 XM	925 1101 20
34	Audio driver plate blocking capacitor (2)	CAPACITOR: Paper; 0.25 mf $\pm 10\%$; 1200 TV; 600 WV; wire leads; 11/16" x 1-3/4" x 2-5/32".	9110	CCA-AY	931 1022 00
35	Speech amp. decoupling capacitor	CAPACITOR: Oil-filled paper; round case; 1.0 mf $\pm 10\%$; 3000 TV; 15,000 WV; solder lugs; aluminum case; 1-1/2" diam; 4-1/2" long.	9110	TLA	930 7200 00
36	Feedback capacitor (2)	CAPACITOR: Paper; rectangular aluminum case; 0.5 mf $\pm 10\%$; 1200 TV; 600 WV; wire leads; 11/32" x 1-7/8" x 3".	9110	CCA-AY	931 4200 00
39	Int. amp. grid tank coil	COIL: #22 copper wire; coil rider; 56 turns; 1-13/16" wide; 3-7/8" long.	8300	GA-700C	571 0700 30
*	RF components used in	a particular transmitter will depend on the operating frequency.			

PARTS LIST

UNIT C - 33J-6 RF AND MODULATOR UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
40	Int. amp. plate tank coil	COIL: 40 Turns of 3" I. D. Edgewise Ribbon; 1/16" x 1/4"; motor driven contact disc; 4-1/4" diam; 9-1/4" long.	8300	Y-6323G	508 6323 70
41	Int. amp. plate choke	COIL, CHOKE: Winding 5-1/2" of quadruple bank, #24 DSC wire; soldering lugs; ±1%; 7" long; 1" diam.	8300	GA-460A	571 0460 10
42	Parasitic suppressor coil (2)	COIL:			
43	Audio driver transformer	TRANSFORMER: Pri: 3000 v; 80 ma; Sec: 3000 v; 50 ma max; 4" x 4" x 5-3/16".	7800	7E6	667 5630 00
44	Speech amp. input transformer	TRANSFORMER: Pri: 77 ohms; line to grid; 500 to 15,000 ohms ±1 db from 30 to 15,000 cps; 2-5/8" x 3-1/8" x 3-5/8".	44500	T-44212	667 6760 00
50	Modulator grid coupling capacitor (2)	CAPACITOR: Oil-filled paper; 0.25 mf ±10%; 4000 TV; 2000 WV; 10-32 screw terminals; lead plated steel case; 1-1/16" x 2-1/8" x 2-7/8".	9110	TJU	930 7220 00
51	Feedback capacitor (4)	CAPACITOR: Mica; 0.00005 mf ±10%; 5000 TV; 2000 WV; 6-32 screws in case; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-50 XM	950 4501 20
53	Input trans. terminating capacitor (2)	CAPACITOR: Mica; 1,000 mmf ±10%; wire lead terminals; 1/2" diam; 1-5/8" long.	40300 9110 42100	C 1W MW	909 2103 20
55	Audio driver freq. comp. grid capacitor (2)	CAPACITOR: Paper; 0.03 mf ±10%; 1200 TV; 600 WV; cardboard case; wire lead terminals; 1/2" diam; 1-5/8" long.	9110	DT	931 3520 00

PARTS LIST
UNIT C - 33J-6 RF AND MODULATOR UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
60	<p>Feedback capacitor (2)</p> <p>Int. amp. grid tuning motor</p> <p>Int. amp. plate tuning motor</p>	<p>CAPACITOR: Mica; 2000 mmf $\pm 10\%$; 900 TV; 500 WV; 1/4" x 3/4" x 3/4" with 1-1/4" radial wire leads.</p> <p>MOTOR: Permanent split phase reversible; 24 v; 60 cps; 2.4 amps; 36 watts; 2" x 2-3/16" x 3-3/4".</p> <p>MOTOR ASSEMBLY: 3.44 rpm; rated load 2.5 in-lb; 2-3/16" x 3-3/16" x 3-3/4".</p> <p>MOTOR: Permanent split phase reversible; 2.4 amps; 36 watts; 24 v; 60 cps.</p>	<p>9110 40300</p> <p>8300</p> <p>8300</p> <p>1040</p>	<p>1WLS GLS</p> <p>GA-1304C</p> <p>GC-1304C</p> <p>R</p>	<p>909 2203 20</p> <p>571 1304 30</p> <p>573 1304 30</p> <p>230 7000 00</p>

PARTS LIST

UNIT D - 102K-1 RELAY AND POWER UNIT

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	Main fil. power contactor	RELAY: Power contactor; 2 poles normally open; 15 amps; 110 v; 60 cps operate coil; 2-3/4" x 3" x 5".	28600	5055	401 9000 00
2	833 Fil. power contactor	RELAY: Power contactor; 2 poles normally open; 15 amps; 110 v; 60 cps operate coil; 2-3/4" x 3" x 5".	28600	5055	401 9000 00
3	Time delay relay	RELAY: Time delay; continuous duty; 110 v; 60 cps; 1 normally open contact; 2-30 sec. delay; 3 amps; 220 v max; 3" x 3-1/8" x 5-7/8".	900	Bul 811	402 0005 00
4	Plate power contactor	RELAY: Power contactor; 3 NO circuits; 25 amps; 110 v; 60 cps operate coil; 3" x 3" x 5-7/8".	900	702	401 5800 00
5	6J5G fil. trans.	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 20 VA; 50/60 cps; Sec: 6.3 v; 20 VA; 3.0 amps rms; 2-9/16" x 2-13/16" x 3-5/16".	7800	2B1-20	662 5083 00
6	833 Mod. fil. trans.	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 230 VA; 50/60 cps; Sec: 10, 11, 11.5 v; 20 amps rms; 230 VA; 4-9/16" x 4-5/8" x 5-3/4".	7800	2B3-60	662 5112 00
7	833 amp. fil. trans.	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 230 VA; 50/60 cps; Sec: 10, 11, 11.5 v; 20 amps rms; 230 VA; 4-9/16" x 4-5/8" x 5-3/4".	7800	2B3-60	662 5112 00

PARTS LIST
UNIT D - 102K-1 RELAY AND POWER UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
8	845 cathode resistor	RESISTOR: Fixed; 1000 ohms $\pm 10\%$; 50 watts; 224 v max; 224 ma max; wire wound; soldering lugs; $2\frac{1}{32}$ " diam; 4" long.	34500	0405	710 4142 00
9	845 plate current meter shunt	RESISTOR: Fixed; 0.25 ohms $\pm 1\%$; 1 watt; 0.50 v max; 2000 ma max; wire wound; $\frac{9}{16}$ " diam; 1" long.	23600	WW4	722 0256 00
10	Main fil. circuit rheostat	RESISTOR: 3 terminal rheostat; 4 ohms; 50 watts $\pm 5\%$; 3500 ma max; $2\text{-}\frac{5}{16}$ " diam; $2\text{-}\frac{1}{4}$ " long.	34500	"J"	736 4200 00
11	833 fil. rheostat	RESISTOR: 3 terminal rheostat; 3 ohms; 100 watts; 5750 ma max; $3\text{-}\frac{1}{8}$ " diam; $2\text{-}\frac{5}{8}$ " long.	34500	"J"	738 3000 00
12	Tuning resistor (3)	RESISTOR: Fixed; heater element; 20 ohms $\pm 10\%$; 110 v max; 6 amps max; 660 watts; $2\text{-}\frac{1}{4}$ " diam; $3\text{-}\frac{5}{8}$ " long.	48500		711 0003 00
13	Autotrans. control and fil. power	TRANSFORMER: Pri: 210, 220, 230 v; 600 VA; 50/60 cps; Sec; 110 v; 5.45 amps rms; 600 VA; $4\text{-}\frac{9}{16}$ " x $5\text{-}\frac{1}{4}$ " x $5\text{-}\frac{3}{4}$ ".	7800	4D-61	664 1333 00
14	Tuning motor transformer	TRANSFORMER: Pri: 110 v; 145 VA; 50/60 cps; Sec: 24 v; 1.5 amps rms; 4" x 4" x $5\text{-}\frac{3}{16}$ ".	7800	4A-50	664 3971 00
15	813 fil. transformer	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 60 VA; 50/60 cps; sec: 10, 11.5 v; 5.0 amps rms; $3\text{-}\frac{7}{16}$ " x $3\text{-}\frac{9}{16}$ " x $4\text{-}\frac{3}{8}$ ".	7800	2B1-40	662 5750 00

PARTS LIST
UNIT D - 102K-1 RELAY AND POWER UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
16	845 fil. transformer	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 125 VA; 50/60 cps; Sec: 2.5 v CT; 10 v CT; 10 amps rms; 4" x 4" x 5-3/16".	7800	2B3-50	662 5123 00
17	Plate power over-load relay	RELAY: Overload; Solenoid; 16 amps; 60 cps; 1 normally closed circuit; 3 amps; 220 v max; 3" x 3-1/8" x 5-7/8".	900	Bul 810	403 6000 00
18	Plate power over-load relay	RELAY: Overload; Solenoid; 16 amps; 60 cps; 1 normally closed circuit; 3 amps; 220 v max; 3" x 3-1/8" x 5-7/8".	900	Bul 810	403 6000 00
19	Tune-Operate switch	SWITCH: 3 PST; 15 amps 250 v AC; 2-5/16" x 2-7/8" x 2-7/8".	21600		260 3100 00
20	813 cathode resistor	RESISTOR: Fixed; 250 ohms $\pm 10\%$; 25 watts; wire wound; 79 v max; 315 ma max; lug terminals; 21/32" diam; 2" long.	34500	0201	710 3250 20
21	Autotransformer fuse	FUSE: Plug; 10 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1100 00
22	Autotransformer fuse	FUSE: Plug; 10 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1100 00
23	Tuning motor fuse	FUSE: Plug; 5 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1050 00
24	813 fil. power pri. fuse	FUSE: Plug; 5 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1050 00

PARTS LIST
UNIT D - 102K-1 RELAY AND POWER UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
25	845 fil. power pri. fuse	FUSE: Plug; 5 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1050 00
26	6J5G fil. power pri. fuse	FUSE: Plug; 5 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1050 00
27	Bias power pri. fuse	FUSE: Plug; 5 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1050 00
28	833 Mod. fil. power pri. fuse	FUSE: Plug; 10 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1100 00
29	833 PA fil. power pri. fuse	FUSE: Plug; 10 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1100 00
30	Pri. fuse 1000 v supply	FUSE: Plug; 5 amps; 125 v; 1-1/4" diam; 1-1/4" long.	13260	Plug	264 1050 00
31	Adjusting motor	MOTOR ASSEMBLY: 3.44 rpm; rated load 7 in-lb; 2-3/16" x 3-3/16" x 3-3/8". MOTOR: Permanent split phase reversible; 2.4 amps; 36 watts; 24 v; 60 cps.	8300	GA-1304C	571 1304 30
32	Adjusting motor	MOTOR ASSEMBLY: 3.44 rpm; rated load 7 in-lb; 2-3/16" x 3-3/16" x 3-3/8". MOTOR: Permanent split phase reversible; 2.4 amps; 36 watts; 24 v; 60 cps.	8300	GA-1304C	571 1304 30
33	Door switch	SWITCH: Normally open; with over travel and pigtail leads; 19/32" x 7/8" x 1-9/16".	21600	3591-HN	260 2040 00
48	Bias interlock relay	RELAY: Light duty circuit control; SPDT; 6 ohm; 500 ma; 3 v; base 1-3/4" x 2-3/4".	28600	1015	407 4800 00

PARTS LIST

UNIT E - 101K-2 CONTROL PANEL

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	Fil. power control station	SWITCH: 1 NO, 1 NC; push button station; 1-15/16" x 2-3/16" x 2-9/16".	900	N-1010	260 2010 00
2	Plate power control station	SWITCH: 1 NO, 1 NC; push button station; 1-15/16" x 2-3/16" x 2-9/16".	900	N-1010	260 2010 00
3	Power level control	SWITCH: 1 pole, 3 position, 1 section; 1-9/16" diam; 4-3/32" long.			259 9900 00
4	Tuning selector control	SWITCH: 4 pole, 6 position, 4 sections; non-shortening type; 1-9/16" diam; 4-3/32" long.	7000		259 8700 00
5	Tuning control	SWITCH: Jack; DPDT; off normal; 1-1/4" x 1-13/16" x 2-3/16".	30300	Y-18914	260 3080 00
6	Meter selector switch	SWITCH: 2 pole, 4 position, 1 section; non-shortening rotor sector; 1-9/16" diam; 4-3/32" long.	7000		259 2500 00
7A	Fil. pilot lamp socket	SOCKET: Clear white bulls eye; finished with spring to hold disc; 1-5/16" diam; 2-3/4" long.	12000	75	262 1360 00
7B	Fil. pilot jewel (Green)	DISC: Colored disc-green; Type 75 mounting; 13/16" diam.			262 2370 00
7C	Fil. pilot lamp bulb	LAMP: Light bulb; 125 v; 0.027 amps; 3 watts; 3/4" diam; 1-3/4" long.	18860		262 3310 00
8A	Plate pilot lamp socket	SOCKET: Clear white bulls eye; finished with spring to hold disc; 1-5/16" diam; 2-3/4" long.	12000	75	262 1360 00

PARTS LIST

UNIT E - 101K-2 CONTROL PANEL (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
8B	Plate pilot jewel (Red)	DISC: Colored disc-red; Type 75 mounting; 13/16" diam.	12000		262 2360 00
8C	Plate pilot lamp bulb	LAMP: Light bulb; 125 v; 0.027 amps; 3 watts; 3/4" diam; 1-3/4" long.	18860	S-6	262 3310 00

PARTS LIST

UNIT F - 403K-1 POWER SUPPLY

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1.	Bias bleeder resistor	RESISTOR: Tapped, ten equal sections, multi-lug; wire wound; 150 watts; 250 ohm; 19.3 v per section; 787 ma max; 1-1/4" diam; 8-1/2" long.	34500		717 3250 20
2	Bleeder resistor 1000 v supply (2)	RESISTOR: Fixed; 50,000 ohm; 30 watts; 1250 v max; 25 ma max; wire wound; 21/32" diam; 4" long.	34500	0420	710 4504 20
5	5Z3 fil. transformer	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 30 VA; 50/60 cps; Sec: 5 v CT; 6.0 amps rms; 2-9/16" x 3" x 3-5/16".	7800	2B1-21	662 5093 00
6	Bias power transformer	TRANSFORMER: Pri: 105, 110, 115, 120, 125 v; 185 VA; 50/60 cps; Sec: 365-285-200-0-200-285-365; 0.36 amps rms; 265 VA; 4-9/16" x 5" x 5-3/4".	7800	2A4-61	662 5151 00
7	Filter reactor, bias supply (2)	REACTOR: 4.0 hy; 0.5 amps; 25 ohm $\pm 5\%$; bias rectifier filter reactor.	7800	8A-60	668 5170 00
8	866A fil. transformer	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 50 VA; 50/60 cps; Sec: 2.5 v CT; 10 amp rms; 50 VA; 3-7/16" x 3-1/2" x 4-3/8".	7800	2B3-40-1"	662 5390 00
9	Filter reactor, LV supply (2)	REACTOR: 8.0 hy; 0.3 amps; 84 ohm; 3000 TV; 4" x 4" x 5-3/16".	7800	8A-50	668 4571 00
10	872A Fil. transformer	TRANSFORMER: Pri: 100, 105, 110, 115, 120 v; 125 VA; 50/60 cps; Sec: 5 v CT; 25 amps rms; 125 VA; 4" x 4-3/4" x 5-3/16".	7800	2B3-51	662 5131 00
11	Filter capacitor, bias supply	CAPACITOR: Oil-filled paper; 15 mf $\pm 10\%$; 1200 TV; 600 WV; 1-3/4" x 3-3/4" x 4-5/8".	9110	KG-3150	930 1320 00

PARTS LIST

UNIT F - 403K-1 POWER SUPPLY

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
12	Filter capacitor, 1000 v supply	CAPACITOR: Oil-filled paper; 4.0 mf $\pm 10\%$; 3000TV; 1500 WV; 10-32 screw and nut terminals 1-1/4" x 4-11/16" x 5-1/2".	9110	TJU	930 3620 00

PARTS LIST

UNIT G - 418K-1 POWER SUPPLY

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	Plate power transformer 1000 v supply	TRANSFORMER: Pri: 110 v; 450 VA; 50/60 cps; Sec: 1500/1500 or 1250/1250; 0.14 or 0.212 amps rms; 530 VA; 6-7/8" x 7" x 7-1/2".	7800	2A4-61L	662 1361 00
2	Plate power trans. 2500 v supply	TRANSFORMER: Pri: 220 v; 3780 VA; 50/60 cps; 3 phase; Sec: 1280 v; 69 amps rms; 11-1/2" x 19-1/4" x 20-1/4".	7800	4E-80L-2.25"	664 5040 00
3	Filter reactor, 2500 v supply	REACTOR: 15 hy; 1.0 amps; 65 ohm; 5000 TV; 8-1/4" x 9-1/4" x 9-1/2".	7800	8C-71-S-L	668 3530 00
4	Ventilating blower assembly	BLOWER ASSEMBLY: MOTOR: Alternating current motor; 1/20 hp; 110 v; 60 cps; single phase; 1.4 amp; 1750 rpm; 4-3/4" x 5" x 8".	8300 7280	S	520 0719 00 230 6000 00
		WHEEL: 4-1/2" diam; 2-1/2" wide.	44700	OA	009 2080 00
		WHEEL: 4-1/2" diam; 2-1/2" wide.	44700	OA	009 2090 00

PARTS LIST

UNIT H - 417K-1 MODULATOR UNIT

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	Modulation transformer	TRANSFORMER: Class B Mod; Pri #1: 2125 ohm; Pri #2: 2125 ohm; 0.25 amp - balanced; Sec: 5200 ohm; 600 watts; Freq. ± 1 db 30-10,000 cps; 9-1/8" x 10-1/2" x 11-1/2".	7800	7F-Spl	667 7020 00
2	Coupling condenser	CAPACITOR: Oil-filled paper; 4.0 mf $\pm 10\%$; 6000 TV; 3000 WV; 3-3/4" x 4-9/16" x 4-13/16".	9110	TJU-30040	930 4320 00
3	Modulation reactor	REACTOR: 50 hy; 0.75 amps; 10,000 TV; 11" x 12-3/4" x 13-13/16".	7800	8C-90L	668 5870 00
4	Bleeder resistor 2500 v supply	RESISTOR: Fixed; 40,000 ohms $\pm 10\%$; 33 watts; wire wound; 1520 v max; 38 ma max; 27/32" diam; 6-1/2" long.	34500	0621	710 5404 20
5	Filter capacitor 2500 v supply	CAPACITOR: Oil-filled paper; 4.0 mf $\pm 10\%$; 6000 TV; 3000 WV; 3-3/4" x 4-9/16" x 4-13/16".	9110	TJU-30040	930 4320 00

PARTS LIST

40E FREQUENCY CONTROL UNIT

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
1	Power transformer	TRANSFORMER: Pri: 110 v; 50/60 cps; 230 VA; Sec. #1: 500/500 v; Sec. #2: 5.0 v; 3.0 amps rms; Sec. #3: 6.5 and 2.5 v CT; 4.5 amps rms; 230 VA; 4-5/16" x 4-1/2" x 5-7/32".	7800	2D5-60	662 4731 00
2	Crystal heater transformer	TRANSFORMER: Pri: 115 v; 25 VA; 50/60 cps; Sec: 12-10-7.5 v; 2 amps rms; 25 VA; 2-9/16" x 2-13/16" x 3-5/16".	7800	2B3-20	664 4541 00
3	Filter choke (2)	COIL, CHOKE: 10 hy; 0.2 amps; 105 ohm; 3000 TV; 2-15/16" x 3-7/16" x 3-1/2".	7800	8A-31	668 4530 00
4	Crystal heat control relay (2)	RELAY: Single wound quick acting; dc; 2500 ohm; 6 to 12 v; single point; 1-15/64" x 1-3/8" x 4".	6160	C	970 1002 00
5	Oscillator screen RF choke	COIL, CHOKE: Dual section duolateral winding 1 mh; 0.125 amps max; 18 ohm; 1/2" diam; 2" long.	32200	35M	240 2300 00
6	Buffer plate RF choke	COIL, CHOKE: RF multiple-section duolateral wound; 2.5 mh; 0.125 amps max; 35 to 50 ohm; wire lead terminals; 1/2" diam; 2" long.	32200	R-100	240 2000 00
7	Amplifier plate RF choke	COIL, CHOKE: RF; section wound; 8 mh; 0.125 amp max; 70 ohm; 1-3/32" x 1-13/16".	21400	CH-8	240 4000 00
8	Amplifier plate tank coil	COIL, CHOKE: 106 turns; 1-1/2" diam; 2-1/8" long; soldering lugs; #20 wire.	8300	GA-315D	571 0315 40
9	Crystal oven heater Unit (2)	RESISTOR: 22 ohm; 1/2 amp.			Special

PARTS LIST

40E FREQUENCY CONTROL UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
10	Crystal heater indicator resistor (2)	RESISTOR: Fixed; 50 ohm $\pm 10\%$; 2 watts 10 v max; 200 ma max; 5/16" diam; 1-3/4" long; wire wound.	23600	BW2	709 5020 00
11	Crystal resistor	RESISTOR: Fixed; 50,000 ohm $\pm 10\%$; 1/2 watt; 158 v max; 3.1 ma max; moulded bakelite; 3/16" diam; 5/8" long.	23600	BT1/2	702 5042 00
12	Oscillator suppressor grid resistor	RESISTOR: Fixed; 50,000 ohm $\pm 10\%$; 1/2 watt; 158 v max; 3.1 ma max; moulded bakelite; 3/16" diam; 5/8" long.	23600	BT1/2	702 5042 00
13	Buffer grid resistor	RESISTOR: Fixed; 25,000 ohm $\pm 10\%$; 1/2 watt; 112 v max; 4.4 ma max; moulded bakelite; 3/16" diam; 5/8" long.	23600	BT1/2	702 2542 00
14	Buffer screen resistor	RESISTOR: Fixed; 50,000 ohm $\pm 10\%$; 2 watts; 316 v max; 6.3 ma max; moulded bakelite; 5/16" diam; 1-3/4" long.	23600	BT2	706 5042 00
15	Amplifier grid resistor	RESISTOR: Fixed; 25,000 ohm; 2 watts; 223 v max; 8.9 ma max; 5/16" diam; 1-3/4" long.	23600	BT2	706 2542 00
16	Amplifier screen resistor	RESISTOR: Fixed; 20,000 ohm $\pm 10\%$; 4 watts; 316 v max; 15 ma max; wire wound; 13/32" diam; 1-3/4" long.	34500	Brown Devil	710 1204 20
17	Buffer cathode resistor	RESISTOR: Fixed; 10 000 ohm $\pm 10\%$; 10 watts; 100 v max; 100 ma max; wire wound; 13/32" diam; 1-3/4" long.	34500	Brown Devil	710 1142 00

PARTS LIST

40E FREQUENCY CONTROL UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
18	Bleeder resistor	RESISTOR: Fixed; 5000 ohm $\pm 10\%$; 8 watts; 200 v max; 40 ma max; wire wound; 13/32" diam; 1-3/4" long.	34500	Brown Devil	710 1542 00
19	Bleeder resistor	RESISTOR: Fixed; 3000 ohm $\pm 10\%$; 9 watts; 169 v max; 56 ma max; 13/32" diam; 1-3/4" long; wire wound.	34500	Brown Devil	710 1342 00
20	Bleeder resistor	RESISTOR: Fixed; 5000 ohm $\pm 10\%$; 8 watts; 200 v max; 40 ma max; wire wound; 13/32" diam; 1-3/4" long.	34500	Brown Devil	710 1542 00
21	Oscillator cathode meter shunt	RESISTOR: Fixed; 2.04 ohm $\pm 1\%$; 1 watt; 1.428 v max; 700 ma max; wire wound; 9/16" diam; 9/16" long.	23600	WW3	721 0007 00
22	Buffer cathode meter shunt	RESISTOR: Fixed; 2.04 ohm $\pm 1\%$; 1 watt; 1.428 v max; 700 ma max; wire wound; 9/16" diam; 9/16" long.	23600	WW3	721 0007 00
23	Amp. grid meter shunt	RESISTOR: Fixed; 25 ohm $\pm 1\%$; 1 watt; 5 v max; 200 ma max; wire wound; 9/16" diam; 9/16" long.	23600	WW3	721 2506 00
24	Osc. Suppressor bias potentiometer	RESISTOR: Potentiometer; 1000 ohm linear taper; 70 ma max; wire wound; 1-5/8" diam; 1-19/32" long.			377 0007 00
25	Monitor potentiometer	RESISTOR: Potentiometer; carbon; 10,000 ohm $\pm 20\%$; 1-1/4" diam; 1-3/16" long.	23600		376 1160 00
26	Crystal coupling capacitor	CAPACITOR: Mica; 2000 mmf $\pm 10\%$; 900 TV; 500 WV; 1/4" x 3/4" x 3/4".	40300 42100 9110	C MW 1W	909 2203 20

PARTS LIST

40E FREQUENCY CONTROL UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO	MFR. TYPE or CAT. NO.	PART NUMBER
27	Osc. supp. coupling capacitor	CAPACITOR: Mica; 6000 mmf $\pm 10\%$; 600 TV; 300 WV; 11/32" x 3/4" x 3/4".	40300 9110	C 1W	909 2603 20
28	Buffer grid coupling capacitor	CAPACITOR: Mica; 3 mmf - 30 mmf; trimmer condenser; 500 TV; 3/4" x 5/8" x 5/8".	21400 32200 42100	MEX M-3 TPSF	918 1000 00
29	Amp. grid coupling capacitor	CAPACITOR: Mica; 1000 mmf $\pm 10\%$; 900 TV; 500 WV; 1/4" x 3/4" x 3/4".	40300 9110 42100	C 1W MW	909 2103 20
30	Amp. Pl. coupling capacitor	CAPACITOR: Mica; 0.002 mf $\pm 10\%$; 2500 TV; 1200 WV; 6-32 screw terminals; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-25 XM	925 2201 20
31	Amp. plate tank capacitor	CAPACITOR: Midget variable; 320 mmf; single section; midline plates; 1-15/16" x 2-3/32" x 3-9/32".	21400	MC	922 1400 00
32	Amp. plate tank capacitor	CAPACITOR: Mica; 0.0001 mf $\pm 10\%$; 5000 TV; 2000 WV; 6-32 screw terminals; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-50 XM	950 3101 20
33	Amp. plate tank capacitor	CAPACITOR: Mica; 0.0002 mf $\pm 10\%$; 5000 TV; 2000 WV; 6-32 screw terminals; 0.5" x 1.3" x 1.8".	9110 40300 42100	9L A-50 XM	950 3201 20
34	Osc. cathode bypass capacitor	CAPACITOR: Mica; 0.006 mf $\pm 10\%$; 1000 TV; 500 WV; soldering lugs; 11/32" x 1-1/32" x 2-9/32".	40300	BE-10	910 2605 20
35	Osc. plate bypass capacitor	CAPACITOR: Mica; 0.006 mf $\pm 10\%$; 1000 TV; 500 WV; soldering lugs; 11/32" x 1-1/32" x 2-9/32".	40300	BE-10	910 2605 20

PARTS LIST

40E FREQUENCY CONTROL UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO.	PART NUMBER
36	Buffer cathode by-pass capacitor	CAPACITOR: Mica; 0.006 mf $\pm 10\%$; 1000 TV; 500 WV; soldering lugs; 11/32" x 1-1/32" x 2-9/32".	40300	BE-10	910 2605 20
37	Buffer screen by-pass capacitor	CAPACITOR: Mica; 0.006 mf $\pm 10\%$; 1000 TV; 500 WV; soldering lugs; 11/32" x 1-1/32" x 2-9/32".	40300	BE-10	910 2605 20
38	Amp. cathode by-pass capacitor	CAPACITOR: Mica; 0.006 mf $\pm 10\%$; 1000 TV; 500 WV; soldering lugs; 11/32" x 1-1/32" x 2-9/32".	40300	BE-10	910 2605 20
39	Amp. screen by-pass capacitor	CAPACITOR: Mica; 0.006 mf $\pm 10\%$; 1000 TV; 500 WV; soldering lugs; 11/32" x 1-1/32" x 2-9/32".	40300	BE-10	910 2605 20
40	Filter capacitor (4)	CAPACITOR: Paper; oil-filled; 4 mf $\pm 20\%$; 1200 TV; 600 WV; aluminum case; soldering lugs; 1-1/2" diam.	9110	TL	930 3400 00
41	Crystal heat control rectifier (2)	RECTIFIER: Dry disc rectifier; 2-20 v ac; .575 - 11.82 v dc; 5.5 ma dc - 118.2 ma dc; 1/2" x 1-1/16".	8460	M-2	353 3000 00
42	Crystal (2)	CRYSTAL: "AT" cut			-----
43	Crystal heat control thermostat (2)	THERMOSTAT: -5 to +150° C; 12" long; gas filled.	44180		292 1900 00
44	Crystal selector switch	SWITCH: 2 pole; 2 position; 1 section non-shortening with 60° detent; 1-9/16" diam.	7000		259 1030 00

PARTS LIST

4OE FREQUENCY CONTROL UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NUMBER	MFR. TYPE or CAT. NO.	PART NUMBER
45	Meter switch	SWITCH: 2 pole; 4 position; 1 section non-shortening rotor sector; 1-9/16" diam	7000		259 2500 00
46	Crystal heat control switch	SWITCH: Toggle; SPST; 250 v; 3 amps; 7/16" x 1-3/16" x 1-19/32".	21600	20994-DP	260 1030 00
47	Rectifier power switch	SWITCH: Toggle; SPST; 250 v; 3 amps; 7/16" x 1-3/16" x 1-19/32".	21600	20994-DP	260 1030 00
48	Amp. power switch	SWITCH: Toggle; DPDT; soldering lugs; 125 v; 3 amps; 5/8" x 1-3/8" x 1-9/16"	21600	20905-CL	260 1020 00
49	Crystal heater fuse (2)	FUSE: Radio receiver; 1-1/2 amp; 250 v; 1/4" diam; 1-1/4" long.	29200 5300	3AG 3AG	264 4060 00
50	Crystal heater transformer fuse	FUSE: Radio amplifier; glass enclosed cartridge; 1/2 amp; 250 v; 1/4" diam; 1-1/4" long.	29200 5300	3AG 3AG	264 4030 00
51	Power transformer fuse	FUSE: Radio receiver; glass enclosed cartridge; 3 amp; 250 v; 1/4" diam; 1-1/4" long.	29200 5300	3AG 3AG	264 4080 00
52	Filament pilot light	LAMP, PILOT: Light bulb; 6.8 v; 0.25 amps; 7/16" diam; 1-1/8" long	18860 38470	44 R44	262 3220 00
53	Amplifier pilot light	LAMP, PILOT: Light bulb; 6.8 v; 0.25 amps; 7/16" diam; 1-1/8" long.	18860 38470	44 R44	262 3220 00
54	Crystal heat pilot light (2)	LAMP, PILOT: Light bulb; 6.8 v; 0.25 amps; 7/16" diam; 1-1/8" long	18860 38470	44 R44	262 3220 00
55	Meter	METER: 0-1 ma dc; 2%; 50 scale divisions	49100	301	458 0413 00
56	Amplifier meter	METER: 0-100 ma dc; 50 scale divisions; 2 ma per division; 2%; 1.0 ohm	49100	301	450 0022 00

PARTS LIST

40E FREQUENCY CONTROL UNIT (Cont.)

ITEM	FUNCTION	DESCRIPTION	MFR. CODE NO.	MFR. TYPE or CAT. NO	PART NO.
57	Voltmeter multiplier	RESISTOR: Fixed; 500,000 ohm $\pm 1\%$; 0.32 watt; 400 v max; 0.8 ma max; wire wound; 9/16" diam; 1" long	23600	WW4	722 5004 60
58	Crystal capacitor (2)	CAPACITOR: Midget variable; 1-12 mmf; soldering lugs; 9/16" diam; 1-1/8" long	30900	22-5230	922 3100 00
59	Osc. screen resistor	RESISTOR: Fixed; 1000 ohm $\pm 10\%$; 2 watts; 44.7 v max; 44.7 ma max; 11/32" diam; 1-3/4" long.	23600	BT2	706 1420 00
60	Amplifier plate resistor	RESISTOR: Fixed; 47 ohm $\pm 10\%$; 6.86 v max; 146 ma max; 7/32" diam; 19/32" long.	900	GB	703 4720 00
61	Amplifier screen resistor	RESISTOR: Fixed; 47 ohm $\pm 10\%$; 6.86 v max; 146 ma max; 7/32" diam; 19/32" long	900	GB	703 4720 00
62	Crystal thermometer	THERMOMETER:	21820	GSP-9A	292 0014 00
64	Band switch	SWITCH: 3 pole, 4 position; 1 section; position #1 is off with rotor lugs in common lug position; 2 non-shortening rotor sector contact; 1 fan blade sector; 1-9/16" diam.	7000	Midget "Align Aire"	259 9700 00

LIST OF MANUFACTURERS

<u>Code No.</u>	<u>Name Address</u>	<u>Code No.</u>	<u>Name Address</u>
900	Allen Bradley Co. 136 West Greenfield Ave. Milwaukee 4, Wisconsin	13260	Economy Fuse and Mfg. Co. Greenview Ave. and Diversey Pkwy. Chicago, Illinois
1040	Alliance Mfg. Co. Alliance, Ohio	18860	General Electric Review Schenectady, New York
5300	Bussmann Mfg. Company Div. of the McGraw Elec. Co. University at Jefferson St. Louis 7, Missouri	21400	Hammarlund Mfg. Co. Inc. 46 West 34th Street New York 1, New York
6400	Carborundum Company Niagara Falls, New York	21600	Arrow Hart Hegman Elect Co. 103 Hawthorne St. Hartford, Connecticut
6500	Allen D. Cardwell Mfg. Corp. Plainville, Connecticut	21820	H. B. Instrument Co. 2518 North Broad Street Philadelphia 32, Penn.
7000	Centralab 900 E. Keefe Ave. Milwaukee 1, Wis.	23600	International Resistance Co. 401 North Broad Street Philadelphia 8, Penn.
7280	Century Electric Company 1806 Pine Street St. Louis, Missouri	28600	Leach Relay Company Inc. 5915 5927 Avalon Blvd. Los Angeles 3, Calif.
7800	Chicago Transformer Corp. 3501 Addison Street Chicago 18, Illinois	29200	Littelfuse Incorporated 4757 Ravenswood Avenue Chicago 40, Illinois
8160	C. P. Clare and Co. 4719 West Sunnyside Ave. Chicago 3, Illinois	30300	P. R. Mallory & Co., Inc. 3029 East Washington St. Indianapolis 6, Indiana
8300	Collins Radio Co. 855-35th St. N.E. Cedar Rapids, Iowa	30900	Meissner Manufacturing Co. Mt. Carmel, Illinois
8460	Conant Electric Lab. 6500 O Street Lincoln 5, Nebraska	31690	J. W. Miller Inc. 5917 South Main St. Los Angeles 3, Calif.
9110	Cornell Dubilier Corp. 333 Hamilton Blvd. South Plainfield 6, N. J.	32200	National Company Inc. 61 Sherman Street Malden 48, Mass.
12000	Drake Manufacturing Co. 1713 West Hubbard St. Chicago 22, Illinois		

LIST OF MANUFACTURERS

<u>Code No.</u>	<u>Name</u> <u>Address</u>	<u>Code No.</u>	<u>Name</u> <u>Address</u>
34500	Ohmite Manufacturing Co. 4835 West Flournoy St. Chicago 44, Illinois	44500	Thordarson Electric Manufacturing Co. 500 West Huron St. Chicago 10, Ill.
38110	Radio Corp. of America Camden, New Jersey	44700	Torrington Mfg. Co. Torrington, Conn.
38470	Raytheon Mfg. Co. 55 Chapel Street Newton 58, Mass.	44970	Trumbull Electric Manufacturing Co. 1936 Woodford Ave. Plainville, Conn.
40300	Sangamo Electric Co. 1935 Funk Street Springfield, Illinois	48500	Watlow Electric Manufacturing Co. 1320 North 23rd St. St. Louis 6, Missouri
41970	Simpson Electric Co. 5200 18 W. Kinzie St. Chicago 44, Illinois	49100	Weston Electric Instrument Company Newark 5, N. J.
42100	Solar Manufacturing Corp. 285 Madison Ave. New York 17, New York		
44180	Taylor Instrument Co. Rochester 1, New York		

CABLE WIRE CODE

Numerals refer to RMA Color Code
Letters refer to Wire Size and Type

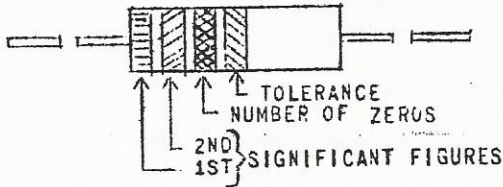
40E FREQUENCY CONTROL UNIT

Color Code	Body Color	First Tracer Color	Wire Construction
A0	black		No. 18 AWG Stranded Tinned Copper Rubber Composition Wall Glazed Cotton Braid Insulation 3 amp 500 volt DC rating
A1	brown		
A2	red		
A3	orange		
A4	yellow		
A5	green		
A6	blue		
A9	white		
A02	black	red	
A32	orange	red	
A52	green	red	
A62	blue	red	
A92	white	red	

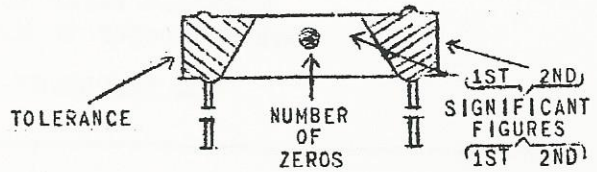
20K TRANSMITTER UNIT

Color Code	Body Color	First Tracer Color	Second Tracer Color	Wire Construction
C90	white	black		No. 18 AWG stranded Tinned Copper Fire Resistant Insulation 1000 volt rating
C92	white	red		
C93	white	orange		
C95	white	green		
C96	white	blue		
C902	white	black	red	
C903	white	black	orange	
C906	white	black	blue	
C925	white	red	green	
D0	black				No. 16 AWG Stranded Tinned Copper Fire Resistant Insulation 1000 volt rating
D92	white	red		
D93	white	orange		
F9	white			No. 12 AWG Stranded Tinned Copper Fire Resistant Insulation 1000 volt rating
F90	white	black		
F91	white	brown		
F95	white	green		
F96	white	blue		
F902	white	black	red	
F903	white	black	orange	
F905	white	black	green	
F906	white	black	blue	

COLOR CODE FOR FIXED RESISTORS—VALUES IN OHMS



Resistor with axial wire leads.



Resistor with radial wire leads.

BODY		END		DOT OR BAND		END	
1st Band		2nd Band		3rd Band		End Band	
Color	Value	Color	Value	Color	Value	Color	Tolerance
Black.....	0	Black.....	0	Gold.....	0.1	Gold.....	(J) ± 5%
Brown.....	1	Brown.....	1	Silver.....	0.01	Silver.....	(K) ± 10%
Red.....	2	Red.....	2	Black.....	None	None.....	(M) ± 20%
Orange.....	3	Orange.....	3	Brown.....	0		
Yellow.....	4	Yellow.....	4	Red.....	00		
Green.....	5	Green.....	5	Orange.....	000		
Blue.....	6	Blue.....	6	Yellow.....	0000		
Violet.....	7	Violet.....	7	Green.....	00000		
Grey.....	8	Grey.....	8	Blue.....	000000		
White.....	9	White.....	9	Violet.....	0000000		
				Grey.....	00000000		
				White.....	000000000		

EXAMPLE FOR AXIAL-LEAD RESISTOR

Band	Color	Significant Figures		Number of Zeros	Tolerance
		1st	2nd		
1	Red	2	...	....	...
2	Orange	...	3	....	...
3	Yellow	...	...	0000	±5%
4	Gold	...	...	....	±5%

The resistance of this resistor is 230,000 ohms ±5%

EXAMPLE FOR RADIAL-LEAD RESISTOR

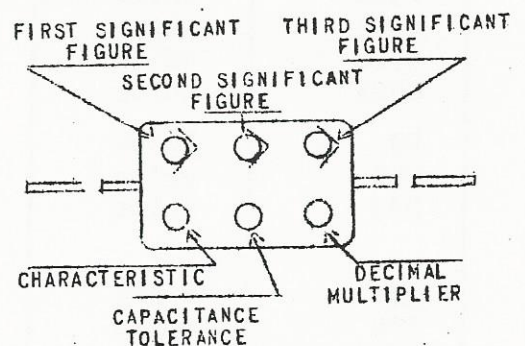
Position	Color	Significant Figures		Number of Zeros	Tolerance
		1st	2nd		
Body	Orange	3	...	...	...
End	Blue	...	6	....	...
Dot	Green	...	...	00000	±10%
End	Silver	...	...	...	±10%

The resistance of this resistor is 3,600,000 ohms ±10%

COLOR CODE FOR FIXED MICA CAPACITORS

Color	CAPACITANCE *		Tolerance	Characteristic
	Significant Figure	Decimal Multiplier		
Black	0	1	20 per cent (M)	A
Brown	1	10	1 per cent	B
Red	2	100	2 per cent (G)	C
Orange	3	1,000	3 per cent	D
Yellow	4	...	4 per cent	E
Green	5	...	5 per cent	F
Blue	6	...	6 per cent	G
Violet	7	...	7 per cent	...
Grey	8	...	8 per cent	...
White	9	...	9 per cent	...
Gold	...	0.1	5 per cent (J)	...
Silver	...	0.01	10 per cent (K)	...

* Capacitance in micromicrofarads.



Color code scheme for JAN standard fixed mica capacitors. The significance of the letters denoting "characteristic" will be found in the Joint Army-Navy Specification JAN-C-5.

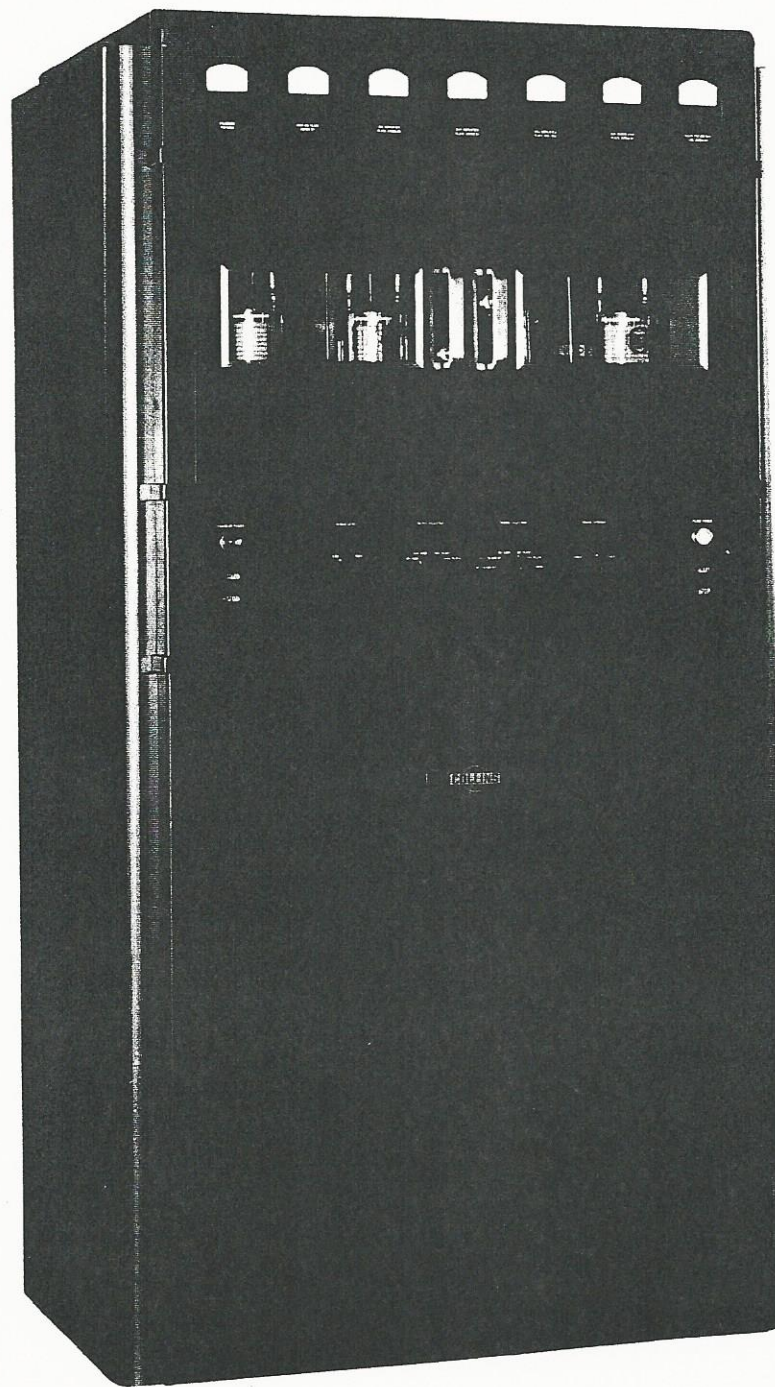


FIG. 1 20K TRANSMITTER

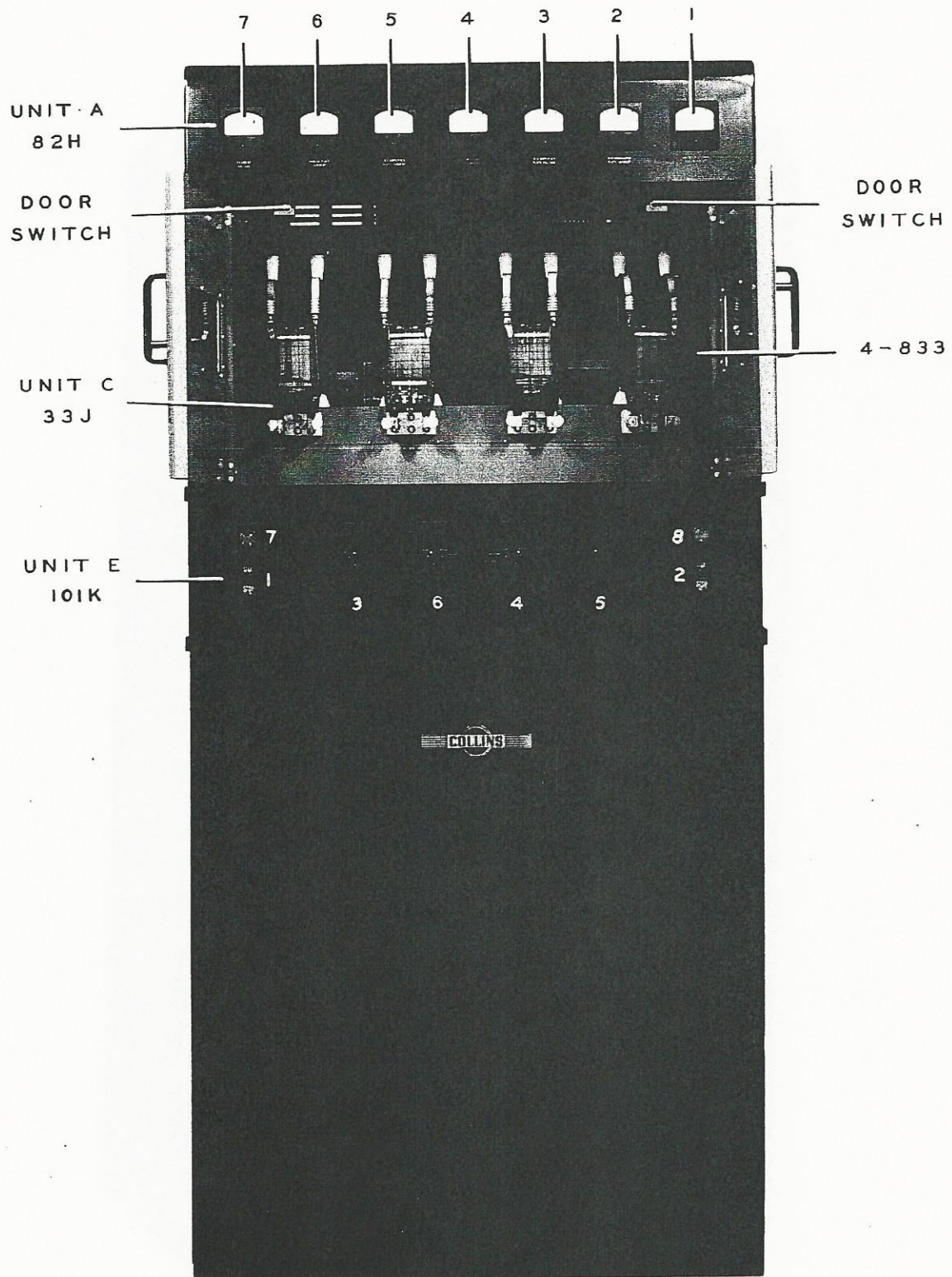


FIG. 2 20K TRANSMITTER
FRONT VIEW OPEN

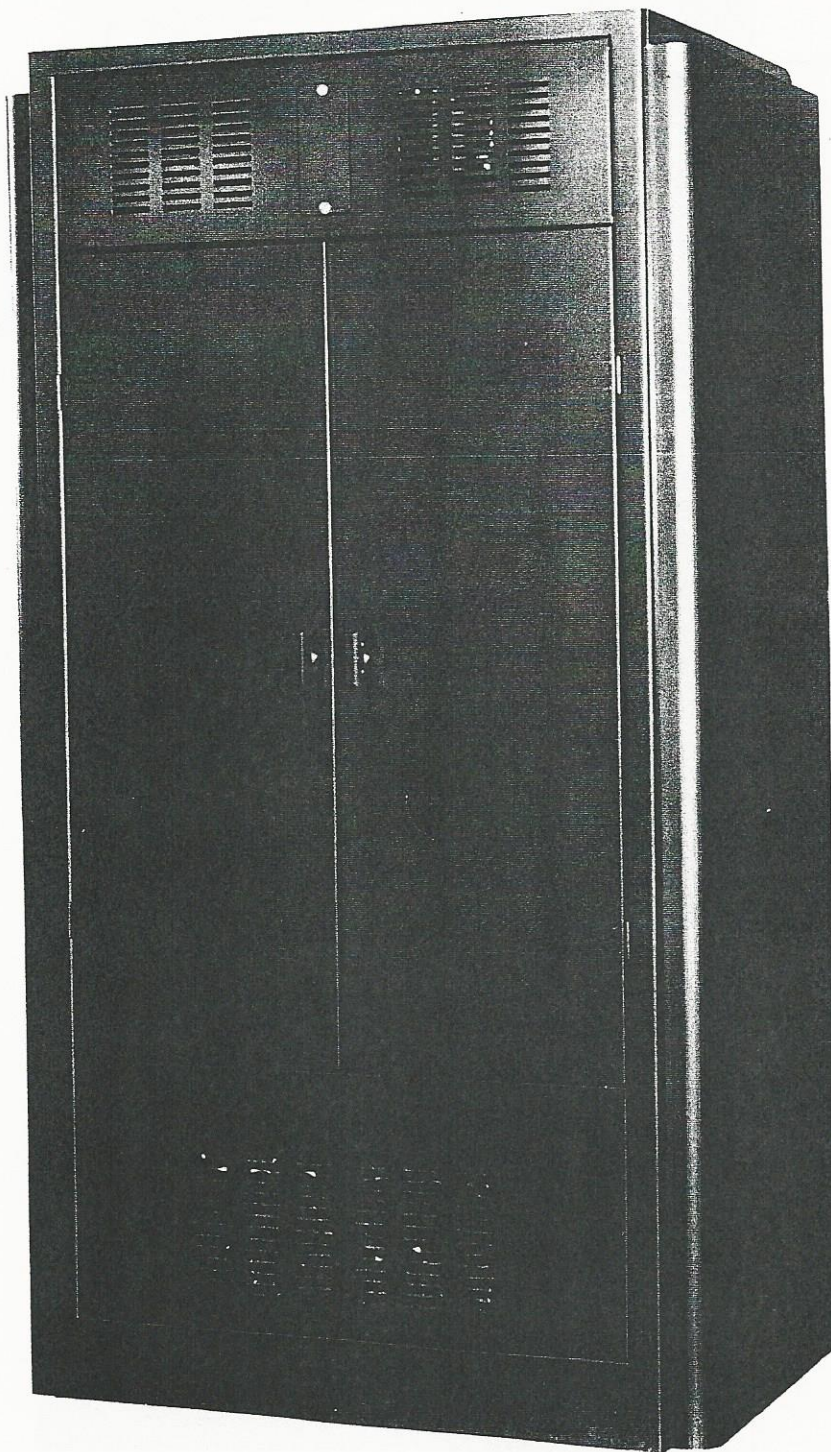


FIG. 3 20K TRANSMITTER
REAR VIEW

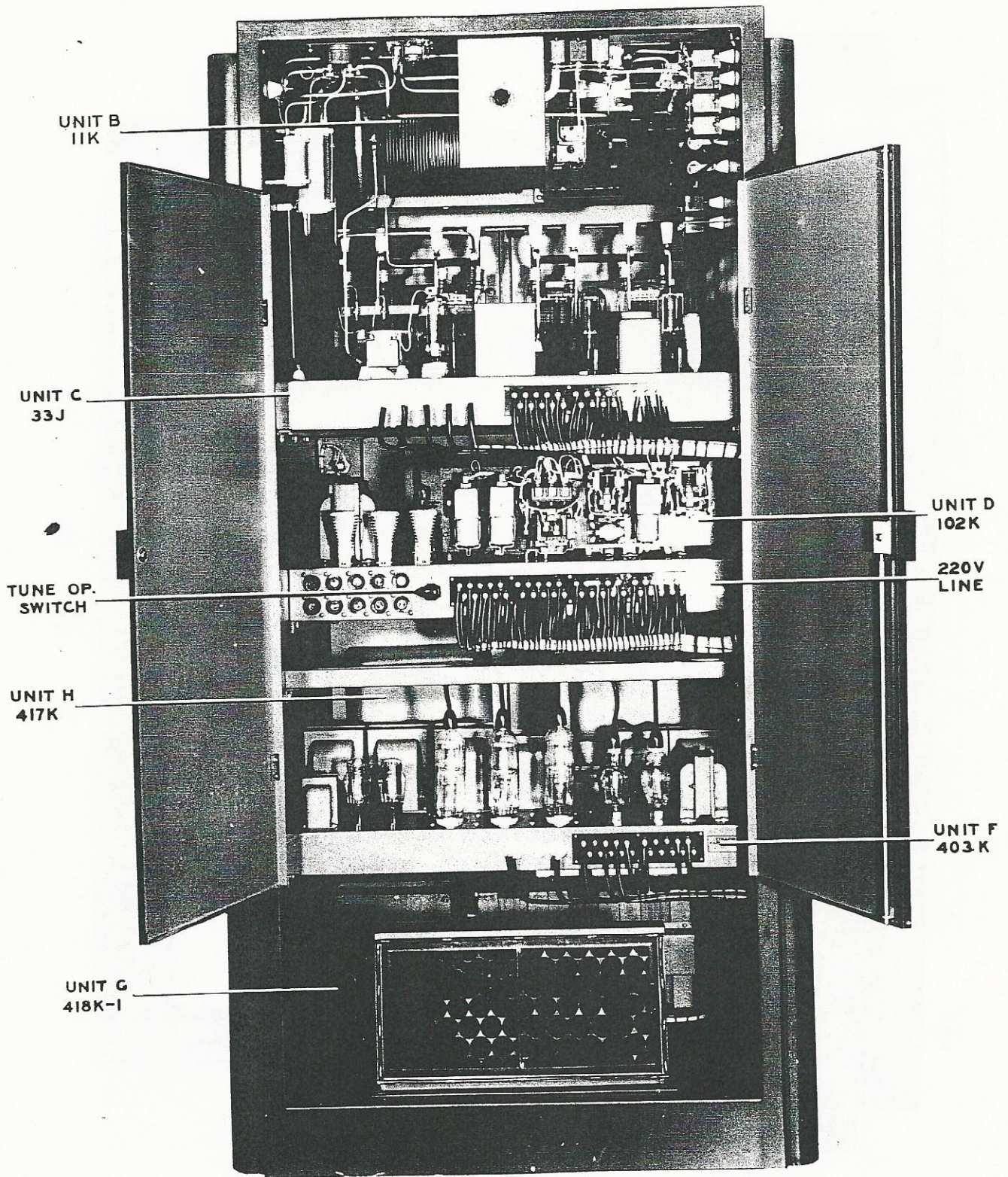


FIG. 4 20K TRANSMITTER
REAR VIEW OPEN

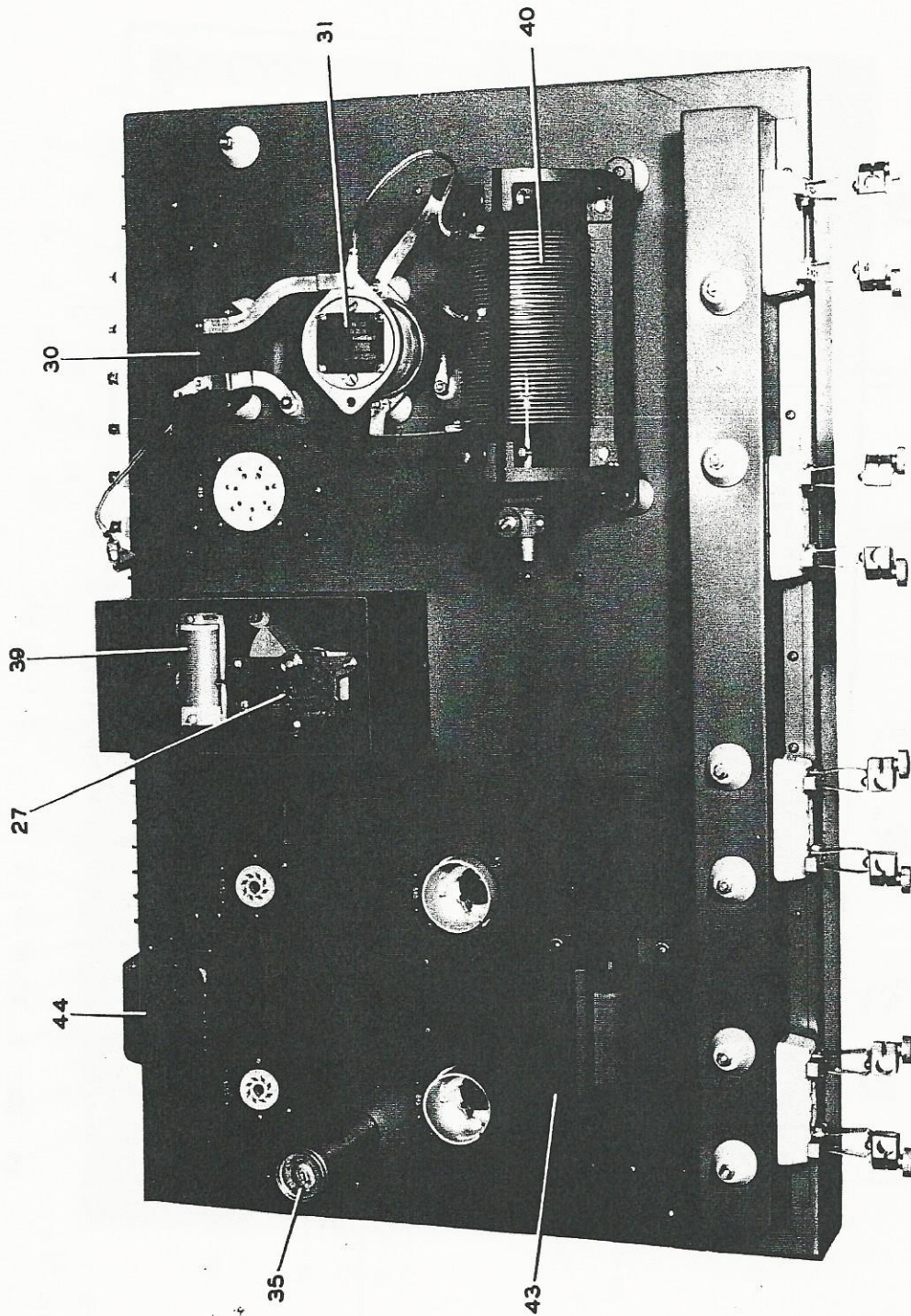


FIG. 6 33J R-F UNIT
TOP VIEW

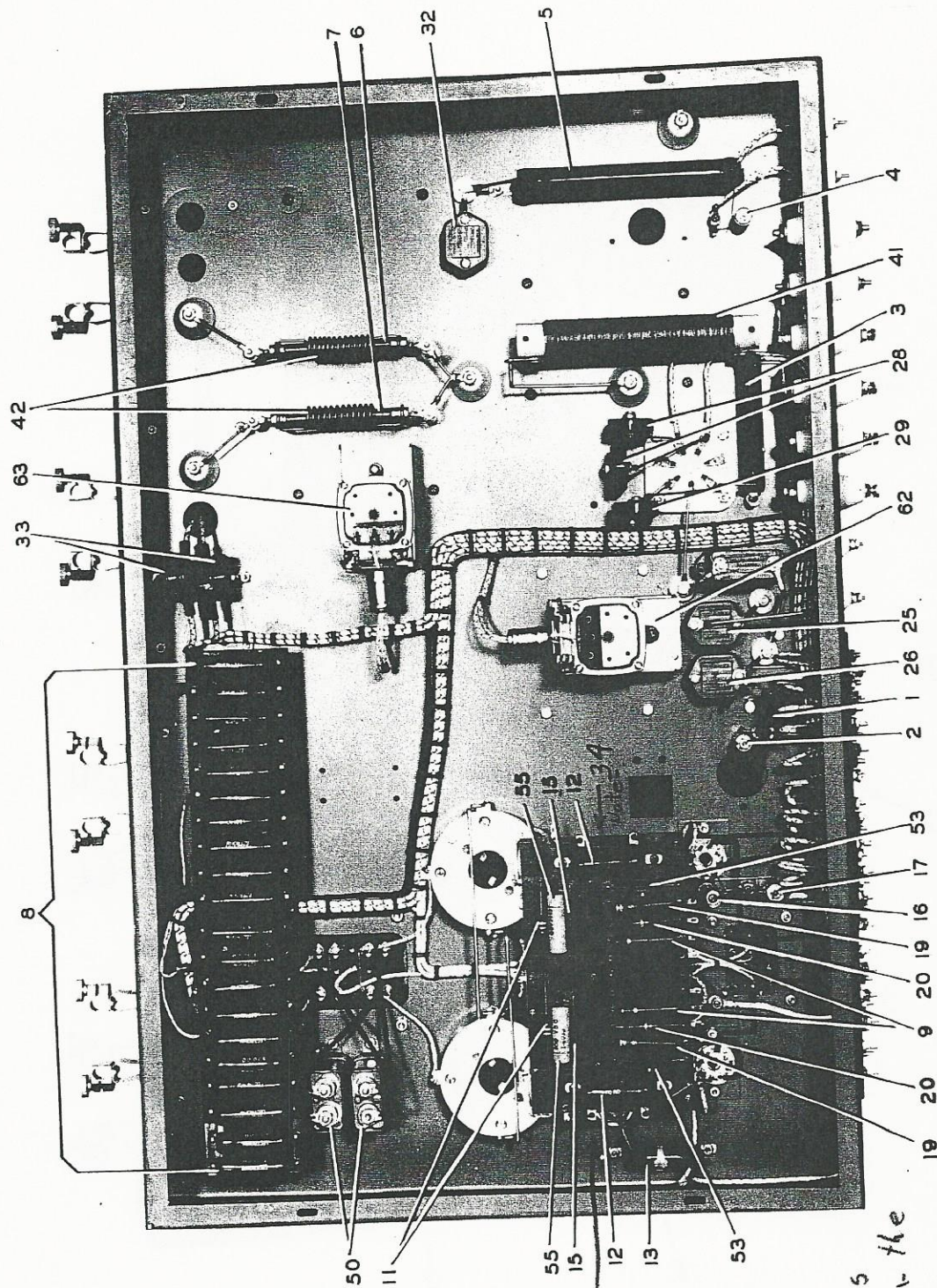


FIG.7 33J R-F UNIT
BOTTOM VIEW

34
see note

Note- Item 34 is
located under the
sub-chassis.

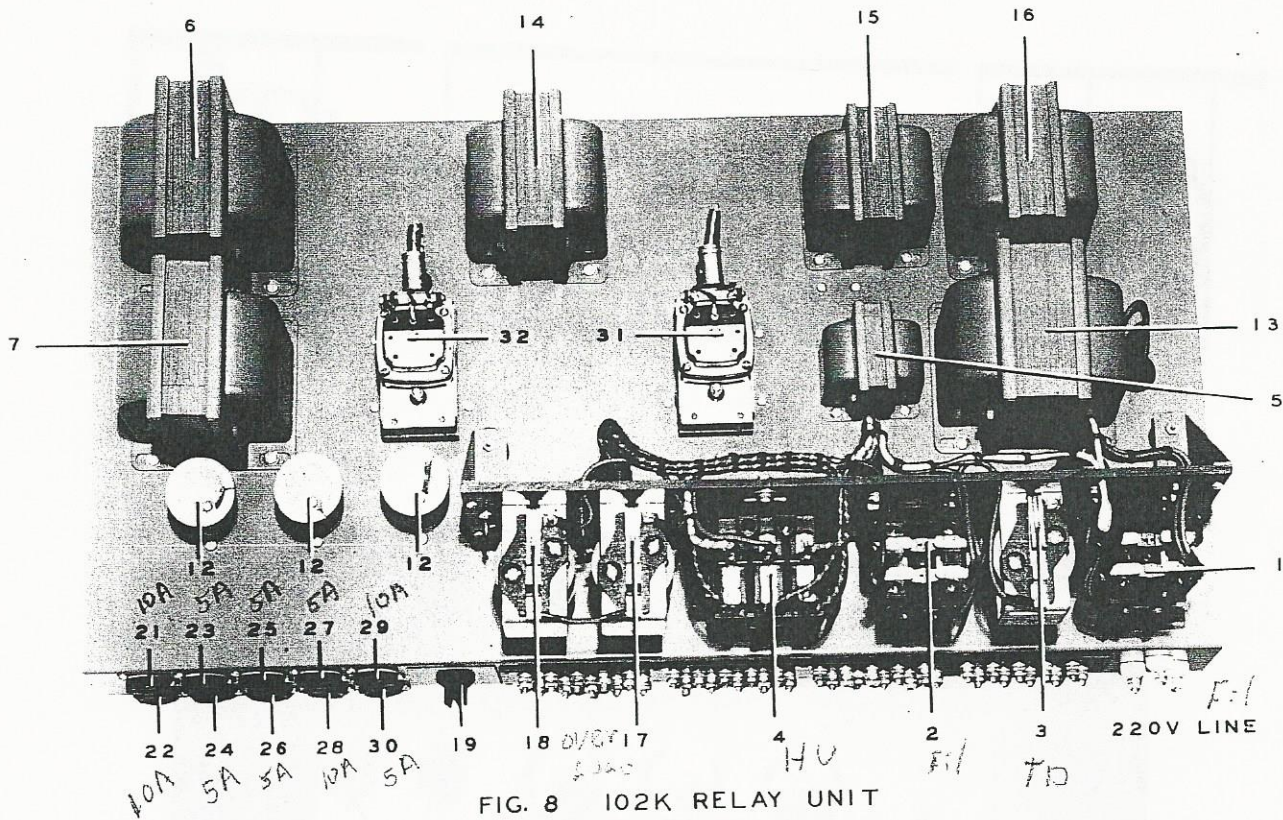


FIG. 8 102K RELAY UNIT
TOP VIEW

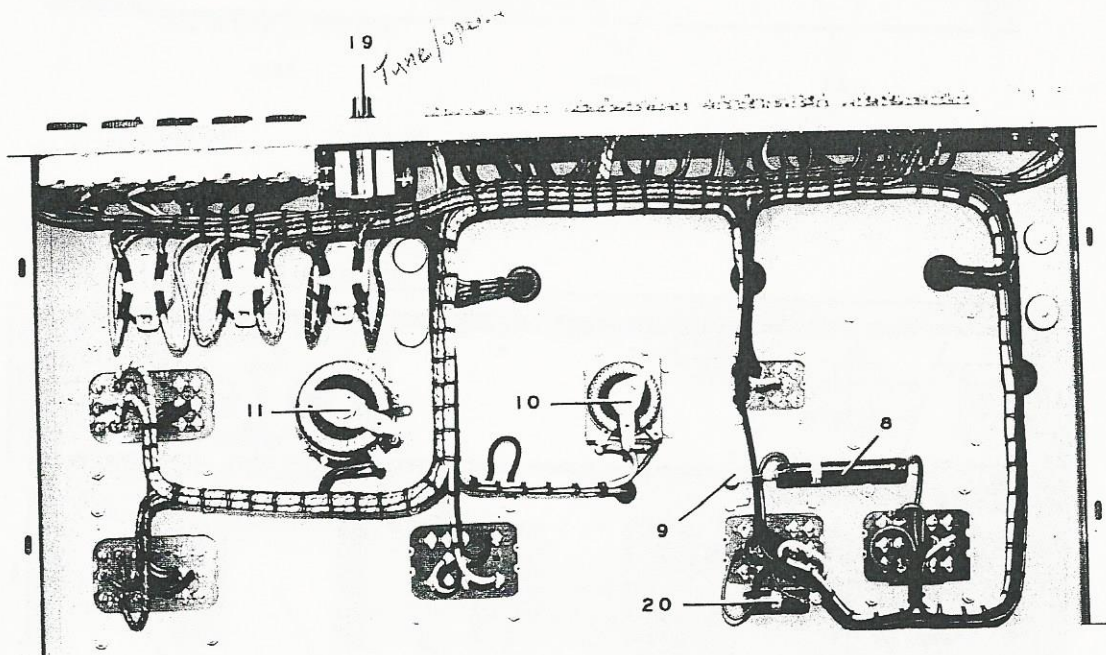


FIG. 9 102K RELAY UNIT
BOTTOM VIEW

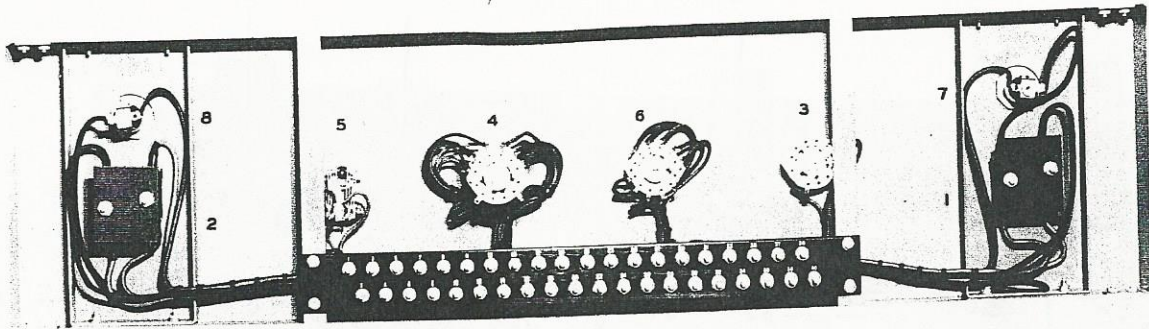


FIG. 10 101K CONTROL PANEL
REAR VIEW

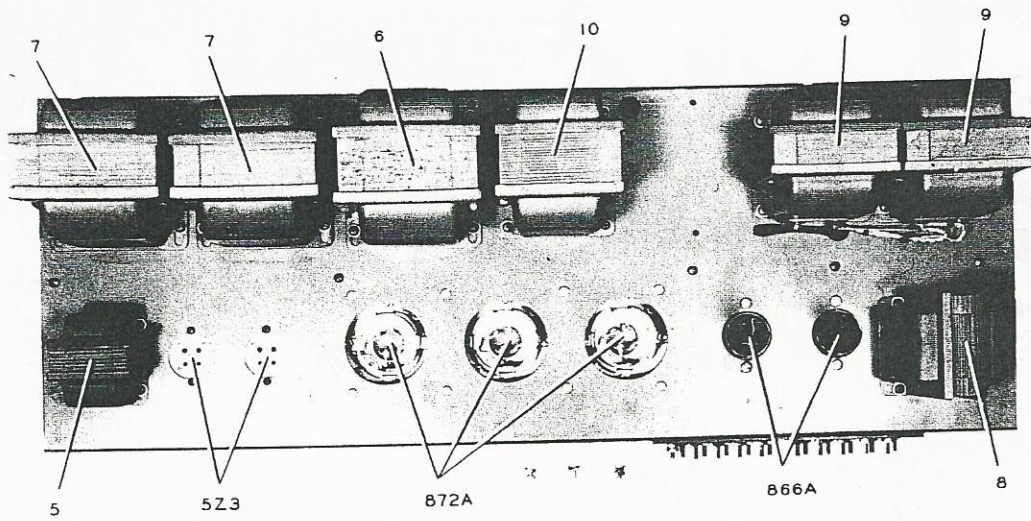


FIG. 11 403K POWER SUPPLY
TOP VIEW

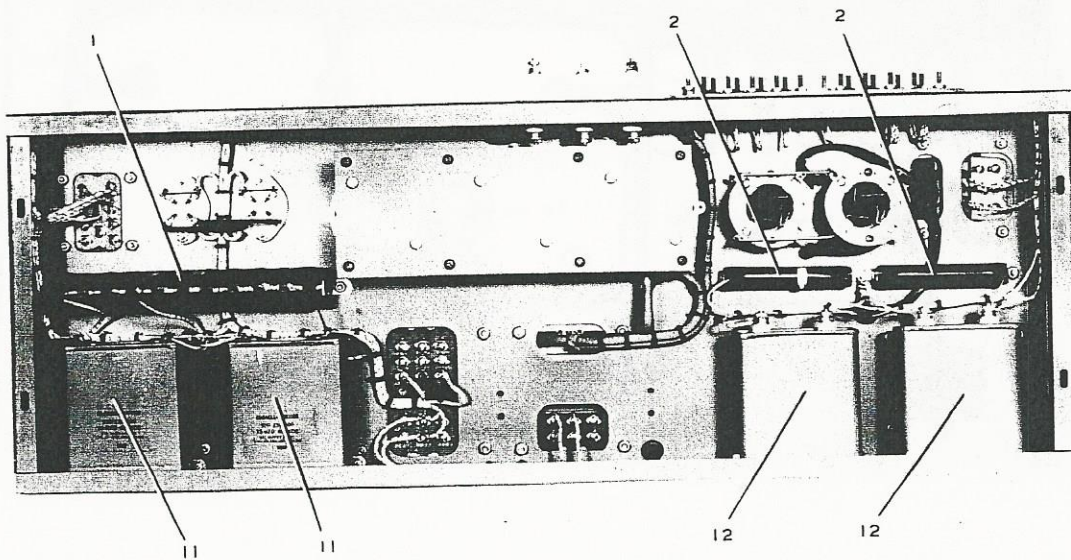
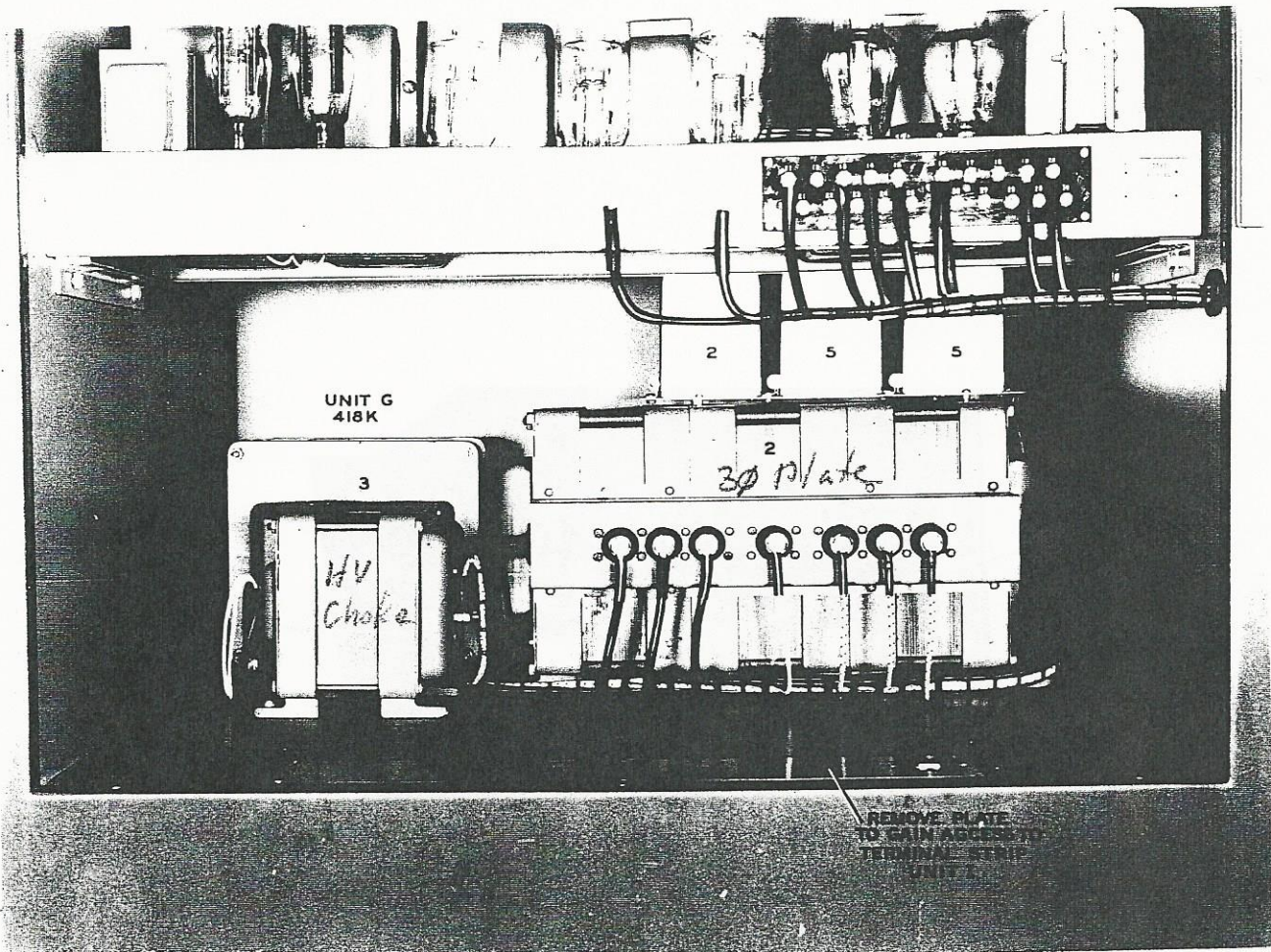
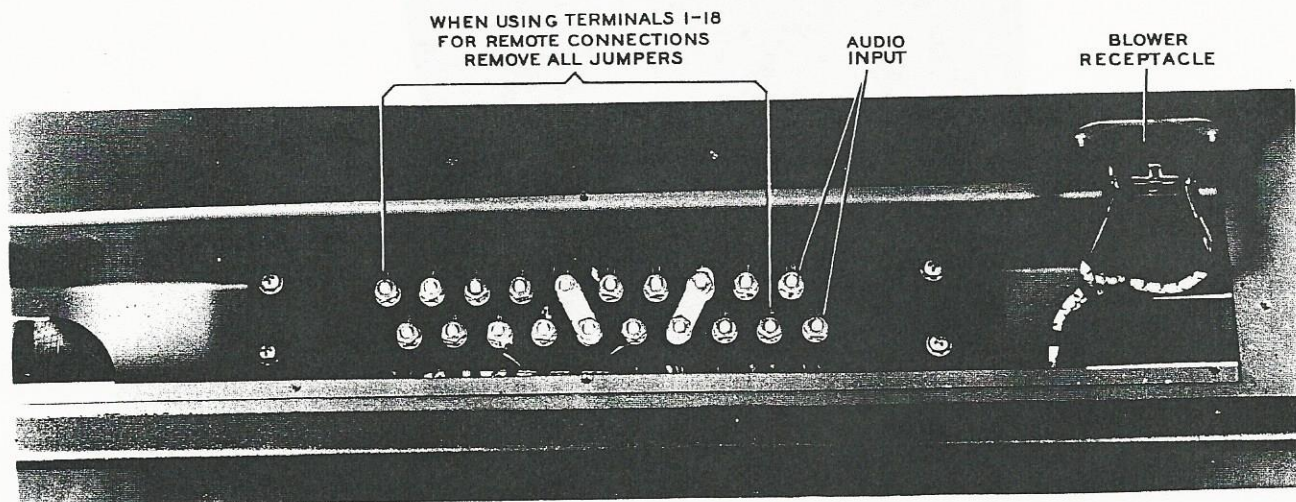


FIG. 12 403K POWER SUPPLY
BOTTOM VIEW



418K POWER SUPPLY



EXTERNAL CONNECTIONS
COVER PLATE REMOVED

FIG.13 418K POWER SUPPLY AND UNIT I TERMINAL STRIP

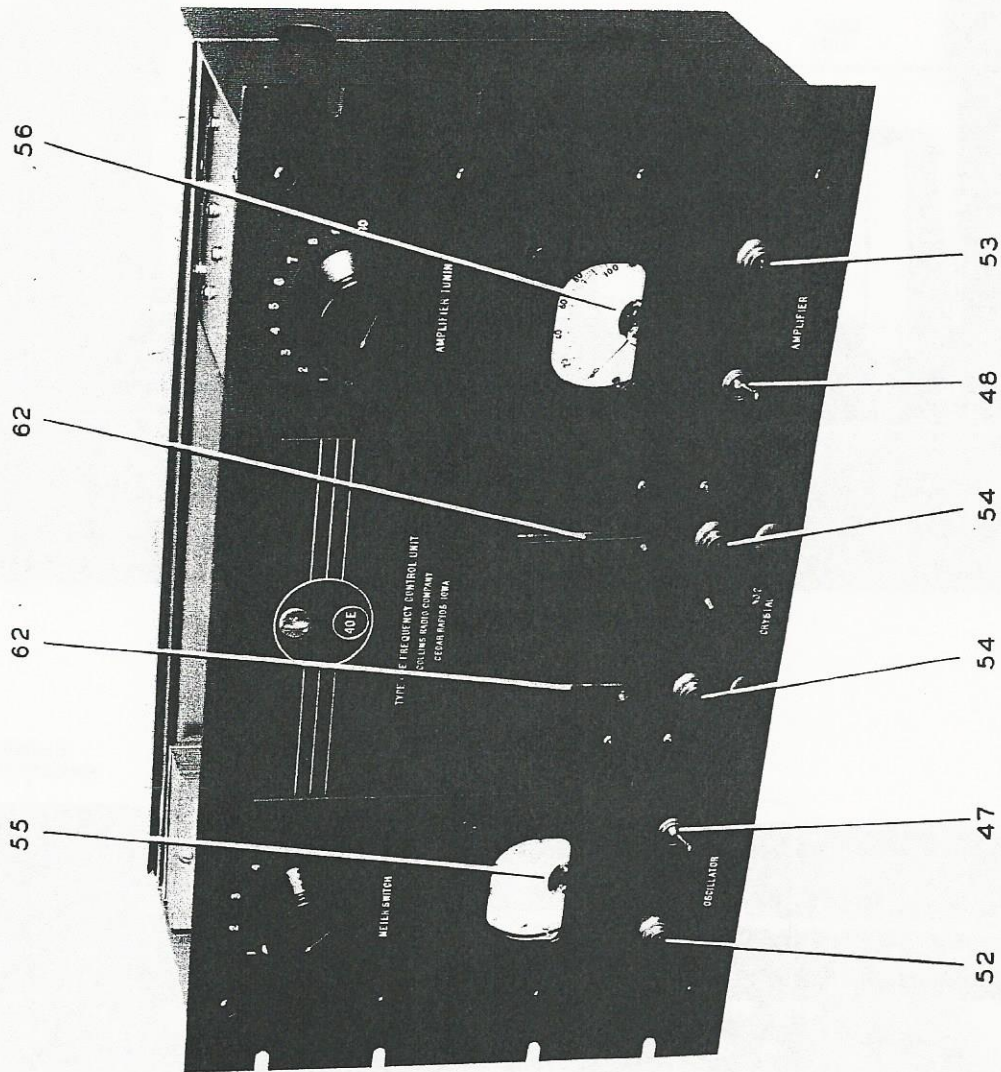


FIG. 14 40E FREQUENCY CONTROL UNIT
FRONT VIEW

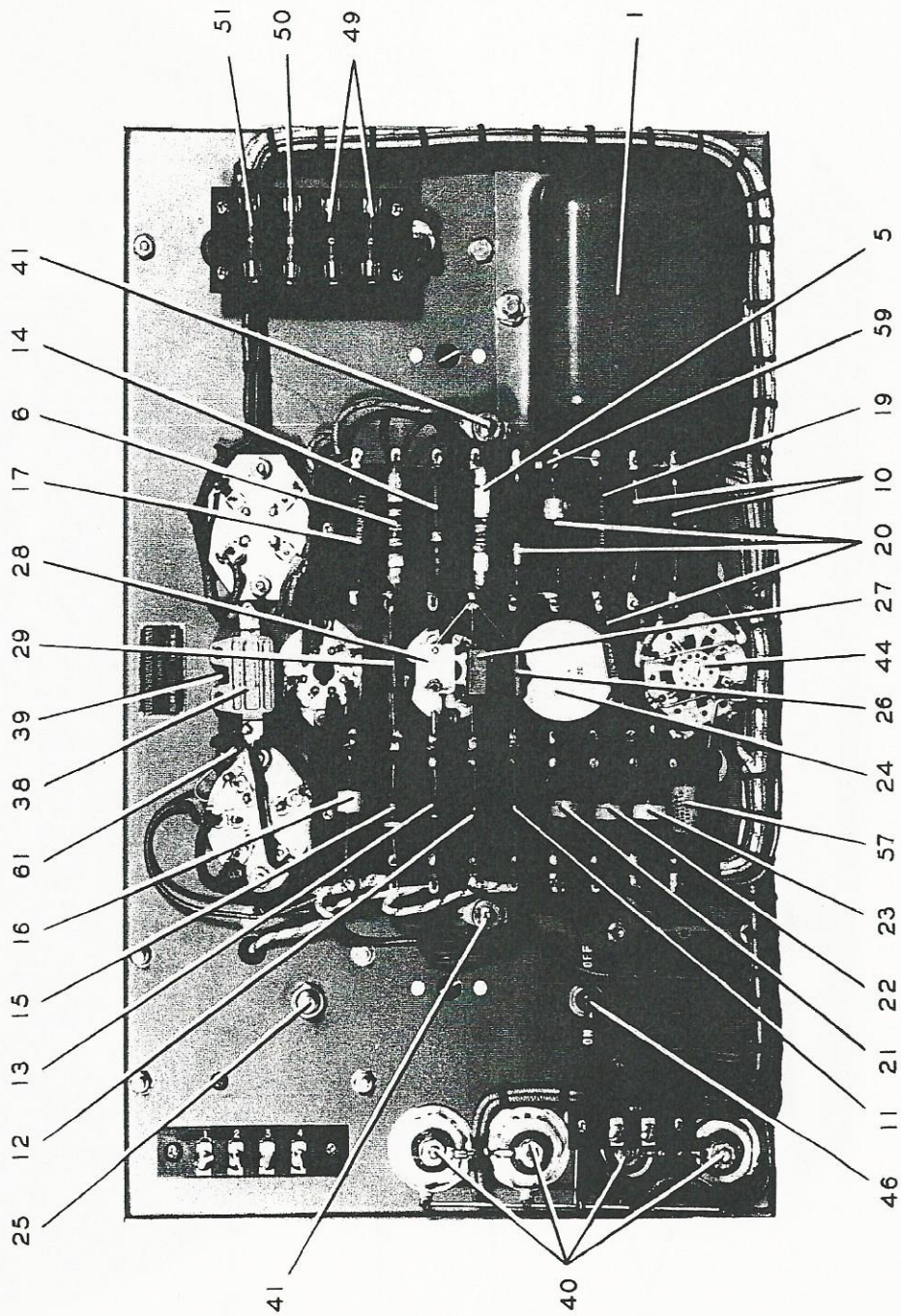


FIG. 15 40E FREQUENCY CONTROL UNIT
REAR VIEW - COVER REMOVED

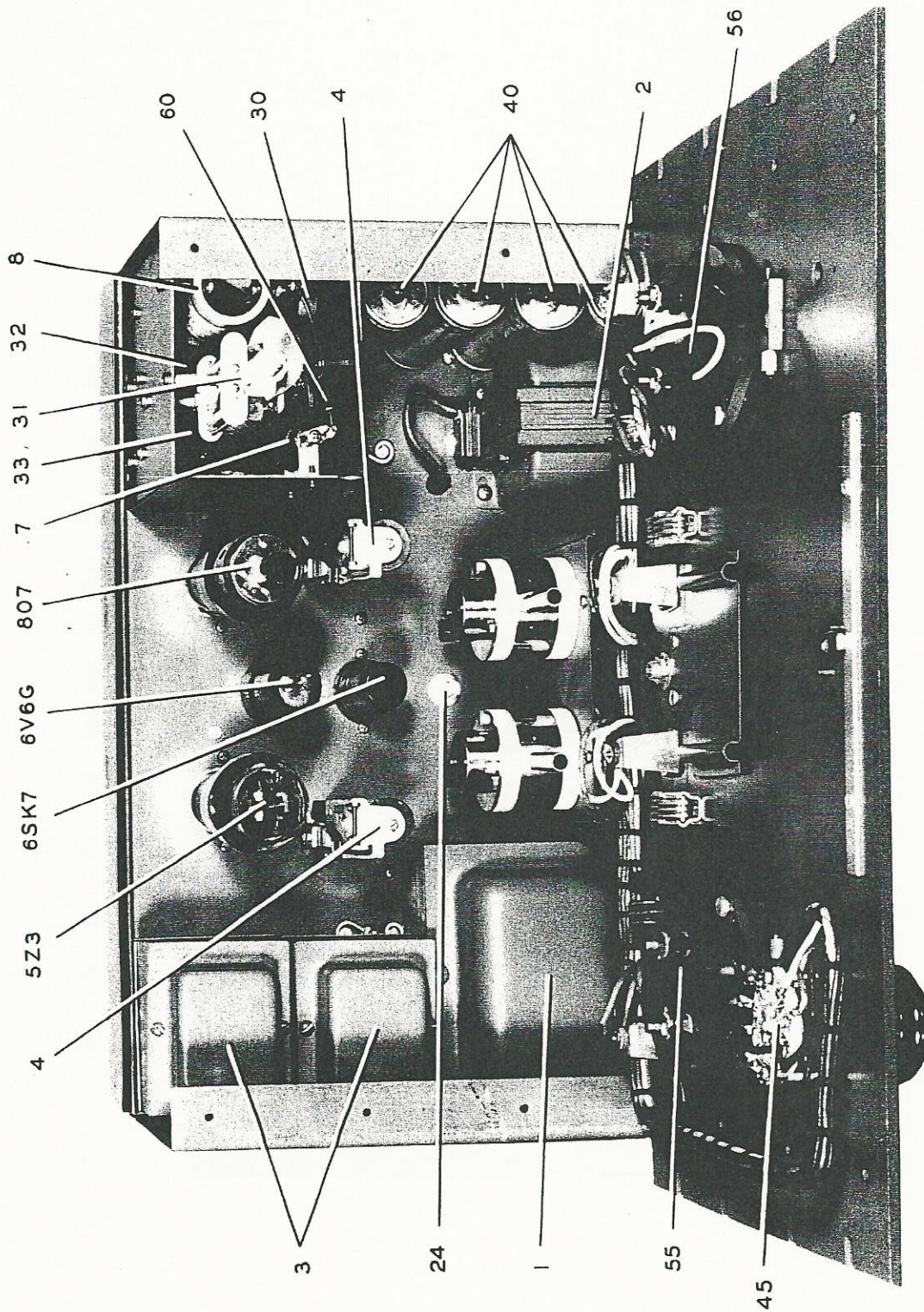


FIG. 16 40E FREQUENCY CONTROL UNIT
INSIDE VIEW

280A
CRYSTAL HOLDER
ADJUSTING TOOL

297
CRYSTAL OVEN

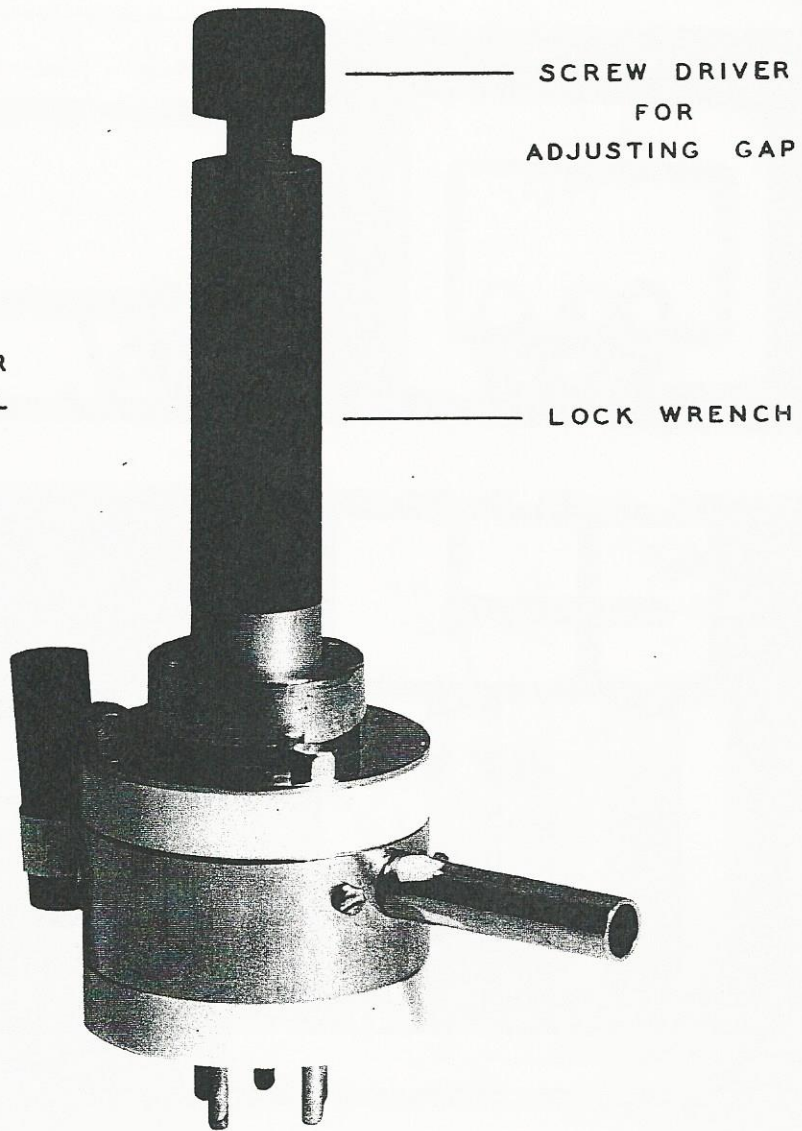


FIG. 17

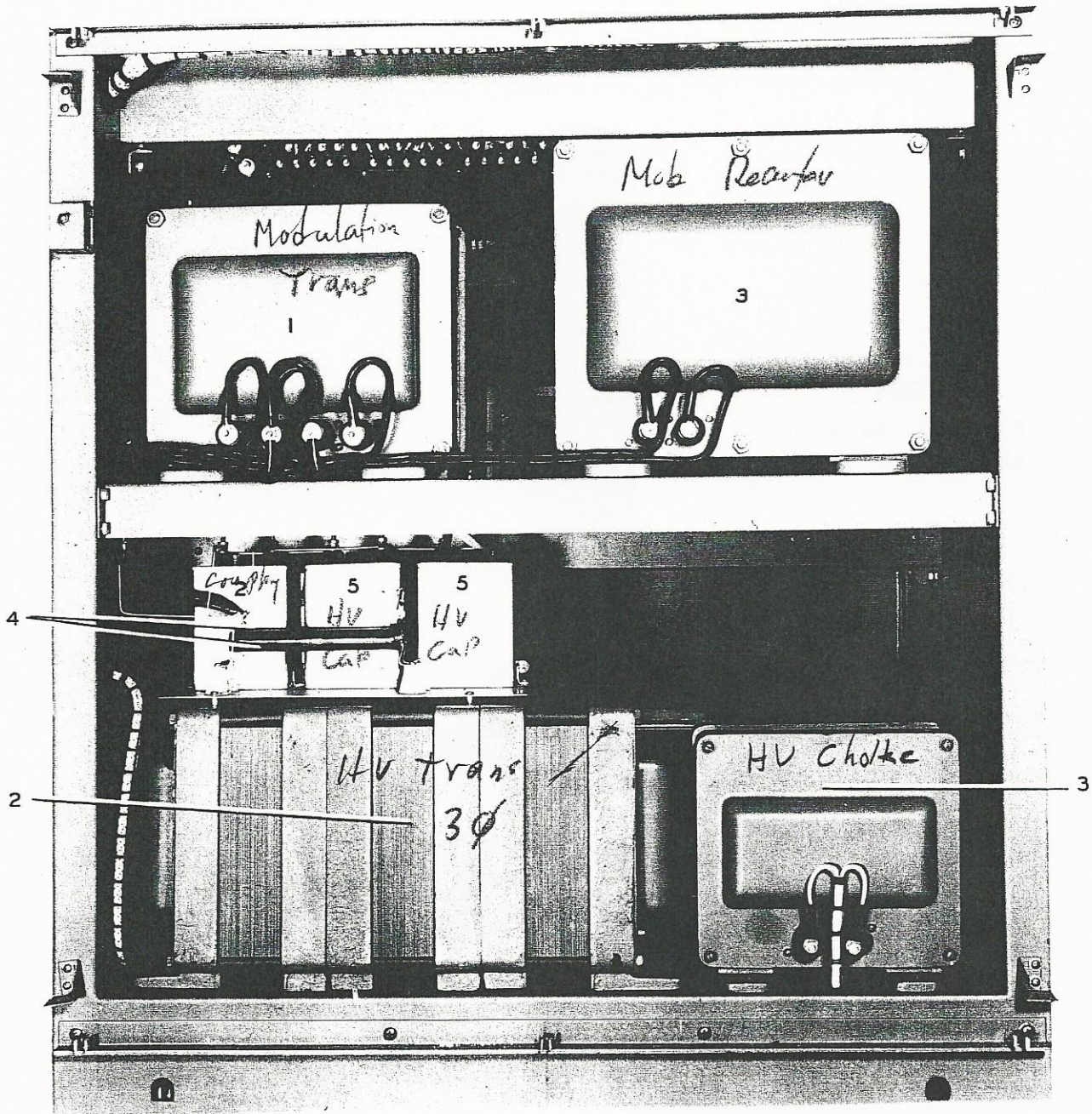


FIG. 18 417K MODULATOR UNIT AND 418K POWER SUPPLY

SERVICE REPORT
REPLACEABLE COMPONENTS

Please fill out this form and submit it by mail to the COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA, USA, when reporting failure of component parts. A properly completed report must be submitted for each part before any accounts will be adjusted. An accurate report will assure the correct replacement part.

IDENTIFICATION OF COMPONENT

Owner _____
Equipment Type No. _____ Serial No. _____
Unit Type No. _____ Serial No. _____
Component Item No. _____ Stock No. _____
Description of Component _____

SERVICE DATA

Date Equipment Received _____ Date in Service _____
Date of Failure _____ Hours of Service _____

NATURE OF FAILURE

OPERATING DATA AND CONDITIONS (At time of failure)

Line Voltage _____ Abnormal Meter Readings _____
Ambient Temperature _____ OF. Electrical Storm? _____
Associated Fuse Failure _____
Additional Comments _____

PRESENT STATUS OF EQUIPMENT

Out of Service _____ Component Replaced _____
Temporary Repair (state nature) _____
Date of Report _____ Signed _____

-0-

THESE ENTRIES TO BE MADE BY THE COLLINS RADIO COMPANY

Received _____ R.T. No. _____ Replacement Order No. _____

Results of Factory Test: _____

Disposition _____

0

6 2 2 4
1230 4 25 10
600 41

