RESTRICTED SERIAL NO. 458- 2777

INSTRUCTION BOOK

For

NAVY MODEL TCZ

RADIO TRANSMITTING EQUIPMENT

Frequency Range
300 Kc to 600 Kc
2,000 Kc to 18,100 Kc

MANUFACTURED FOR

U. S. NAVY DEPARTMENT, BUREAU OF SHIPS

By

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA

Contract: NXs-491 Dated: 9 May 1942

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RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTIONS

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GUARANTEE: 2 YEARS', 1 YEAR SERVICE

The equipment, including all parts and spare parts, except vacuum tubes, shall be guaranteed for a service period of one year with the understanding that, as a condition of this contract, all items found to be defective as to design, material, workmanship, or manufacture shall be replaced without delay and at no expense to the Government, provided that such guarantee and agreement shall not obligate the contractor to make replacement of defective material unless the failure, exclusive of normal shelf life deterioration, occurs within a period of two years from the date of delivery of the equipment to and acceptance by the Government, and provided further, that if any part or parts (except vacuum tubes) fail in service or are found defective in ten per cent (10%) or more, but not less than two, of the total number of equipments furnished under the contract, such part or parts, whether supplied in the equipment or as spares, shall be conclusively presumed to be of defective design, and as a condition of contract subject to one-hundred per cent (100%) replacement of all similar units supplied on subject contract by suitable redesigned replacements. Failure due to poor workmanship while not necessarily indicating poor design, will be considered in the same category as failure due to poor design. Redesigned replacements which will assure proper operation of the equipment shall be supplied promptly, transportation paid, to the Naval activities using such equipment, upon receipt of proper notice and without cost to the Government. All defective parts originally furnished under contract shall be held subject to rejection and return to the contractor.

This period of two years and the service period of one year shall not include any portion of the time that the equipment fails to give satisfactory performance due to defective items and the necessity for replacement thereof, and provided further, that any replacement part shall be guaranteed to give one year of satisfactory service.

REPORT OF FAILURE

Report of failure of any part of this equipment, during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 31 (mimeographed form) of the Manual of Engineering Instructions, or Bureau of Ships Radio and Sound Bulletin Number 7, dated July 1, 1942, or superseding instructions.

Contract NXs-491 Contract Dated 9 May 1942

Serial Number of Equipment____________________

Date of Acceptance by the Navy____________________

Date of Delivery to Contract Destination____________________

Date of Completion of Installation____________________

Date Placed in Service____________________

Blank spaces in this book shall be filled in at time of installation. Operating personnel shall also mark the "date placed in service" on the date plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

All requests or requisitions for replacement material should include complete descriptive data covering the part desired, in the following form:

1. Name of part desired.
2. Navy Type number (if assigned) (including prefix and suffix as applicable).
3. Model designation (including suffix) of equipment in which used.
4. Navy Type designation (including prefix and suffix where applicable) of major unit in which part is used.
5. Symbol designation of part.
6. (a) Navy Drawing Number.
   (b) Manufacturer's Drawing Number.
7. Rating or other descriptive data.
8. Commercial designation.

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATORS OR OTHER ASSOCIATED POWER EQUIPMENT AND OPEN MAIN SWITCH IN POWER SUPPLY CIRCUIT. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

WARNING

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 reasonable 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 shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS

Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Whenever feasible in testing circuits, check for continuity and resistance rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS

Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

"THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF 'RADIO—SAFETY PRECAUTIONS TO BE OBSERVED'."

personnel engaged in the installation, operation and maintenance of this equipment or similar equipment is urged to become familiar with the following rules both in theory and in the practical application thereof. it is the duty of every radioman to be prepared to give adequate first aid and thereby prevent avoidable loss of life. your own life may depend on this.

electric shock first-aid treatment

Regard electrical apparatus generally, and especially all current-carrying parts, as dangerous, irrespective of voltage. Exercise great care in handling, and avoid broad contacts such as are made by standing on a metal deck or in water. Dangerous contact may result through lessened resistance when the skin and clothing are wet with perspiration. Contact with damp metal surfaces—decks, bulkheads, guns, machinery—may allow the current to ground through the moist skin and body. Electric shock is due to current passing through the body—current actually passing—irrespective of the voltage. A pressure as low as 110 volts has caused death. Current passing through the body in the region of the heart is especially dangerous. In using electric breast drills avoid the possibility of a ground. Usually electric shock does not kill instantly. Life can often be saved even though breathing has stopped.

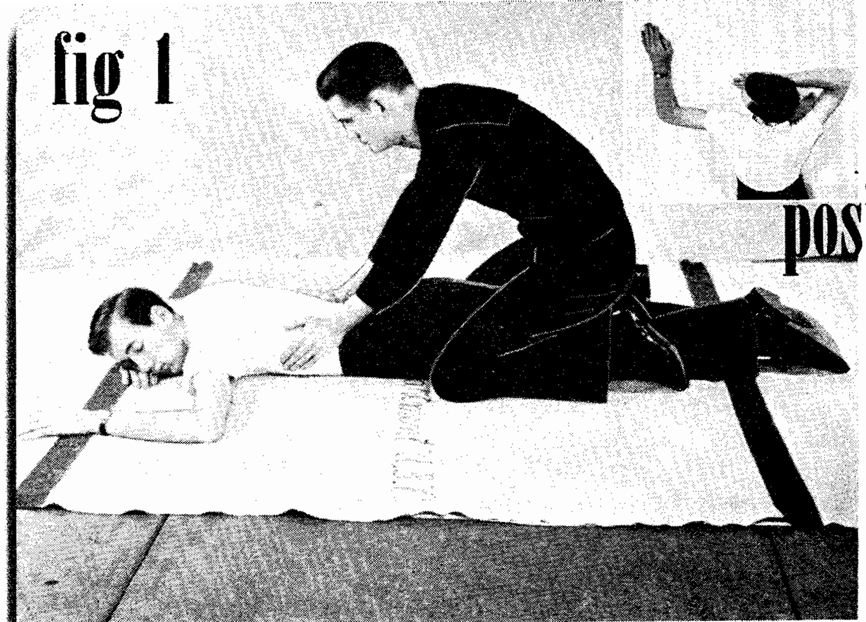
1. *Free the victim from the circuit immediately*—Use a dry nonconductor (rubber gloves, clothing, rope, board) to move either the victim or the wire. Beware of using metal or moist material. Shut off the current. If necessary to cut a live wire, use an ax or hatchet with a dry wooden handle; turn your face away from the electrical flash.

2. *Attend instantly to the victim's breathing*—Begin resuscitation at once on the spot. Do not stop to loosen clothing; every moment counts.

resuscitation by the prone pressure method of artificial respiration for gas asphyxiation, electric shock and drowning

Waste no time. When the patient is removed from the water, gas, smoke, or electric contact, get to work at once with your own hands. Send for the medical officer or nearest physician. No reliance should be placed upon any special mechanical apparatus, as it is frequently out of order and often is not available when most needed. The patient's mouth should be cleared of any obstruction such as chewing gum or tobacco, false teeth, or mucus, so that there is no interference with the entrance and escape of air.

fig 1

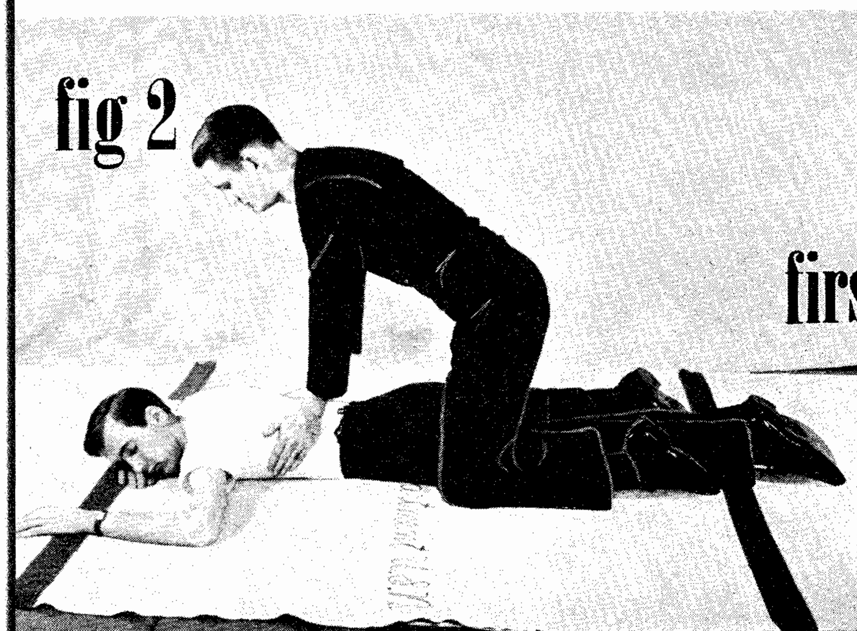


position

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

2 Kneel straddling over the patient's thighs with your knees placed at such a distance from the hip bones as will allow you to assume the position shown in Figure 1. Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers in a natural position, and the tips of the fingers just out of sight. (See fig. 1.)

fig 2

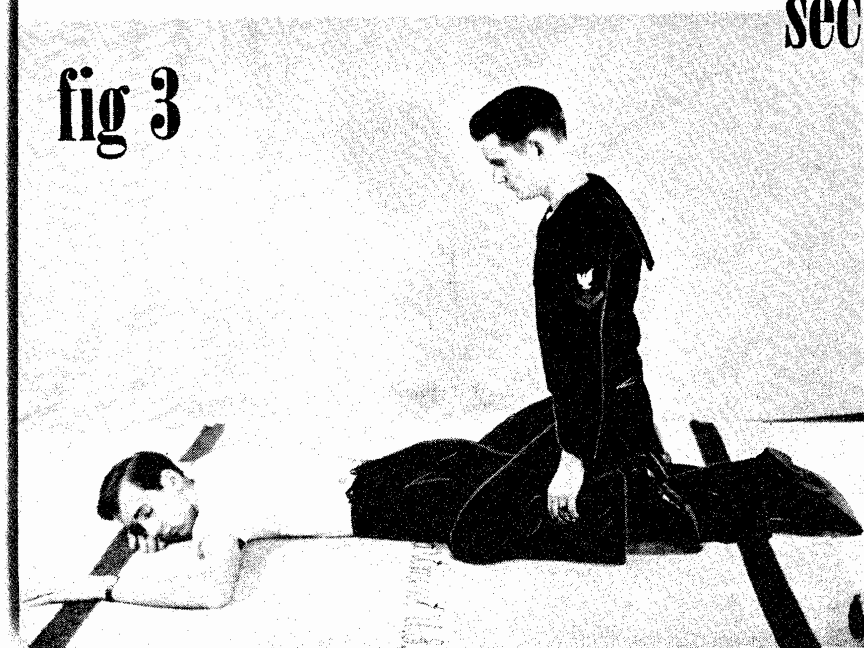


first movement

3 With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing. (See fig. 2.) Do not bend your elbows. This operation should take about two seconds.

second movement

fig 3



4 Now immediately swing backward, so as to remove the pressure completely. (See fig. 3.)

5 After two seconds, swing forward again. Thus repeat deliberately twelve to fifteen times a minute the double movement of compression and release, a complete respiration in four or five seconds.

6 Continue artificial respiration without interruption until natural breathing is restored. Do not get discouraged at the slow results that sometimes happen when resuscitating the apparently drowned. Efforts often have to be continued a long time before signs of life are apparent. Do not discontinue the efforts until certain that all chance is lost. Sometimes, even after several hours work, recovery takes place.

7 As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest, or waist. *To keep the patient warm during artificial respiration is most important and it may be necessary to cover him with blankets and work through them, as well as to apply hot-water bottles, hot bricks, etc.* Do not give any liquids whatever by mouth until the patient is fully conscious.

8 To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water or a hot drink of coffee or tea, etc. Continue to keep the patient warm and at rest.

9 Resuscitation should be carried on at the nearest possible point to where the patient received his injuries. As a general rule he should not be moved from this point until he is breathing normally of his own volition and then moved only in a lying position. Should it be necessary, due to extreme weather condition, etc., to move the patient before he is breathing normally, resuscitation should be carried on during the time that he is being moved.

10 A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched, and if natural breathing stops, artificial respiration should be resumed at once.

11 In carrying out resuscitation it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. The relief operator should kneel behind the one giving the artificial respiration and at the end of the movement, the operator crawls forward while the relief takes his place. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.

practice in the performance of artificial respiration on a voluntary subject should be obtained by everyone

I GENERAL DESCRIPTION

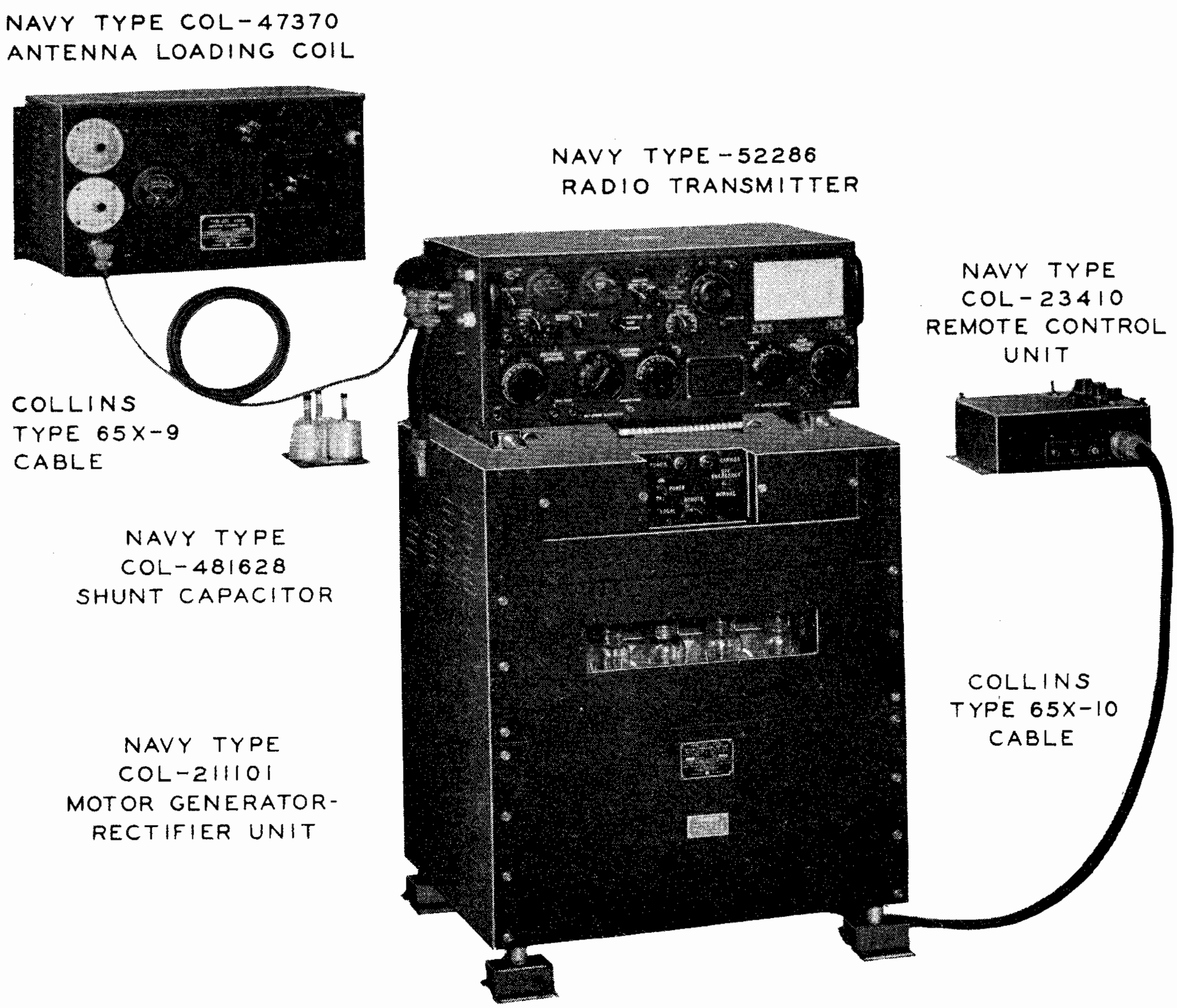


Fig. 1 Complete TCZ Equipment
Navy Type COL–211101 Power Unit Shown

GENERAL DESCRIPTION

1.1. EQUIPMENT

1.1.1. Main Components

1.1.1.1. The Navy Model TCZ Series Radio Transmitting Equipment covered by these instructions consists of the Transmitter Unit, an Antenna Load Coil Unit, a Control Unit, a Power Supply Unit, an Antenna Shunt Capacitor, and the necessary power and control cables. The Power Supply Unit may be either of two models, a motor generator-rectifier power unit designed to operate from a 115 volt 50/60 cps power source or a dynamotor power unit designed to operate from a 115 volt d-c power source.

The units which constitute the complete Model TCZ Equipment, with overall dimensions and weights of all major items, are tabulated and appear on pages 2 and 3.

1.1.1.2. The accessories necessary to complete the installation but not supplied with the equipment on the contract are listed below:

1. Microphone—Carbon of 40 ohms Internal Resistance or Dynamic of 200 ohms Internal Resistance for RED coded circuit per Navy Specifications RE8944A.
   (a) Cord—3 Conductor, Shielded
   (b) Cord Plug—3 Circuit, Tip 3/16″ Dia. and 1 3/16″ Long.

2. Telegraph Key—Any Type
   (a) Key Cord—2 Conductor
   (b) Cord Plug—2 Circuit, Tip 3/16″ Dia. and 1 3/16″ Long.

3. Headphones—500 ohm Impedance
   (a) Cord Plug—2 Circuit, Tip 1/4″ Dia. and 1 5/32″ Long.

1.1.2. Tube Complement

Symbol Designation	Type Number	Quantity	Circuit Function
V101	837	1	High Frequency Oscillator
V102	1625	1	1st Multiplier
V103	1625	1	2nd Multiplier
V104	813	1	Power Amplifier
V105	811	1	Modulator
V106	811	1	Modulator
V201	12SJ7	1	1st Audio Amplifier
V202	6V6GT	1	Audio Driver
V203	6V6GT	1	Sidetone Amplifier
V301	12SJ7	1	Calibration Oscillator
V302	12SJ7	1	MCW Oscillator
V401	1625	1	Low Frequency Oscillator
V1801	866/866A	1	L.V. Rectifier
V1802	866/866A	1	L.V. Rectifier
V1803	866/866A	1	H.V. Rectifier
V1804	866/866A	1	H.V. Rectifier

EQUIPMENT FOR AC OPERATION

			OVERALL DIMENSIONS (Height, Width, Depth) (Inches)		Volume (Cubic Feet)		Weight (Pounds)	
Name of Unit	Collins Type Number	Navy Type Designation	Crated	Uncrated	Crated	Uncrated	Crated	Uncrated
Radio Transmitter	17H-2	COL-52286	20x22x34	10¾x23-9/16x13¼	8.65	1.95	135	66.0
Motor Generator-Rectifier Power Unit	413D-1	COL-211101	28x31x34	29-7/16x23-7/16x20⅛	17.0	8.5	445	320.0
Remote Control Unit	314N-2	COL-23410		4¾x9-31/32x6-9/16		.175		8.0
Antenna Loading Coil (300-600 kc)	180H-3	COL-47370		10-7/32x18⅝x10¾		1.2		14.5
Antenna Shunt Capacitor	195D-1	COL-481628		3⅞x5x4⅛		0.045		1.6
Control Cable (Transmitter to Power Unit)	65X-7	—		10.5″ long		—		
Power Cable (Transmitter to Power Unit)	65X-8	—	20x31x35	10.5″ long	12.6	—	145	
Load Coil Cable (Transmitter to Load Coil)	65X-9	—		10′ long		—		
Remote Control Cable (Remote Unit to Power Unit)	65X-10	—		10′ long		—		
Instruction Books (2)	—	—		11x8½x1		0.108		
CFI Crystal (200 kc)	—	-40127		2½x1-5/16		—		2 oz.
Spare Parts	—	—	15x19x35	—	5.8	—	142	100

EQUIPMENT FOR DC OPERATION

Name of Unit	Collins Type Number	Navy Type Designation	OVERALL DIMENSIONS (Height, Width, Depth) (Inches) Crated	Uncrated	Volume (Cubic Feet) Crated	Uncrated	Weight (Pounds) Crated	Uncrated
Radio Transmitter	17H-2	COL-52286	20x22x34	10¾x23-9/16x13¼	8.65	1.95	135	66.0
Dynamotor Assembly Power Unit	413D-2	COL-211102	28x31x34	29-7/16x23-7/16x20⅛	17.0	8.5	335	210.0
Remote Control Unit	314N-2	COL-23410		4¾x9-31/32x6-9/16		.175		8.0
Antenna Loading Coil (300-600 kc)	180H-3	COL-47370		10-7/32x18⅝x10¾		1.2		14.5
Antenna Shunt Capacitor	195D-1	COL-481628		3⅞x5x4⅛		0.045		1.6
Control Cable (Transmitter to Power Unit)	65X-7	—		10.5″ long		—		
Power Cable (Transmitter to Power Unit)	65X-8	—	20x31x30	10.5″ long	10.7	—	120	
Load Coil Cable (Transmitter to Load Coil)	65X-9	—		10′ long		—		
Remote Control Cable (Remote Unit to Power Unit)	65X-10	—		10′ long		—		
Instruction Books (2)	—	—		11x8½x1		0.108		
CFI Crystal (200 kc)	—	-40127		2½x1-5/16		—		2 oz.
Spare Parts	—	—	15x19x35	—	5.8	—	142	100

1.2. GENERAL

1.2.1. The Model TCZ Series Radio Transmitting Equipment has been designed for installation aboard ship. Particular care has been taken in the design to insure mechanical construction that will withstand the vibration and shock incident to normal service. All materials used in the construction of the equipment are, insofar as practicable, resistant to corrosion resulting from the chemical action of a moist saline atmosphere.

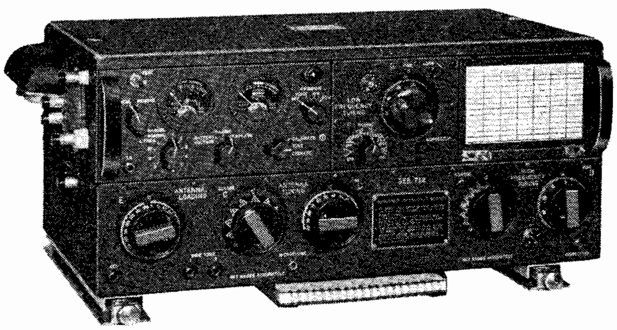


Fig. 2 Type -52286 Transmitter

1.2.2. Sub-assembly type of construction has been used extensively in the Type -52286 Transmitter. This type of construction facilitates the removal of component parts without major disassembly of the unit. The MCW-CFI , the Audio Amplifier, and the L-F Oscillator Units are connected by multiterminal plugs to facilitate removal for servicing. An effort has been made to make all

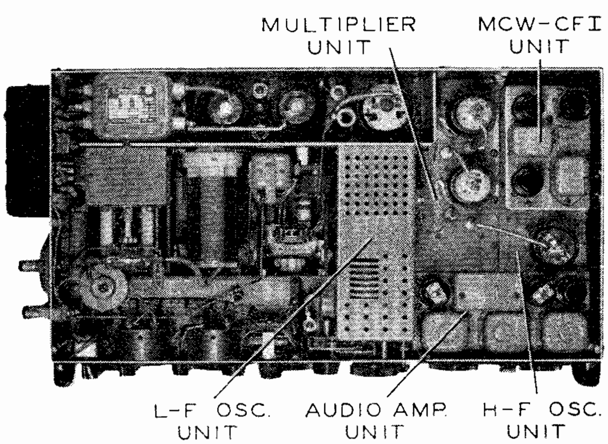


Fig. 3 Type -52286 Transmitter
Top View Open—Units in Place

components that may require replacement easily accessible.

1.2.3. The Collins Autotune System has been incorporated in the Model TCZ Series Equipment to permit rapid frequency change. The Autotune system is an electrically controlled means of mechanically repositioning adjustable elements such as switches, variable inductors and variable capacitors. The accuracy of repositioning is of a very high order and is not seriously affected by wear, humidity or temperature changes. No tools are necessary for the changing of the position of any of the controls. Eleven Autotune positions are available, permitting transmission on any one of eleven preset frequencies. Ten of the frequencies are in the frequency range 2000 kc to 18,100 kc, and one is in the frequency range 300 kc to 600 kc.

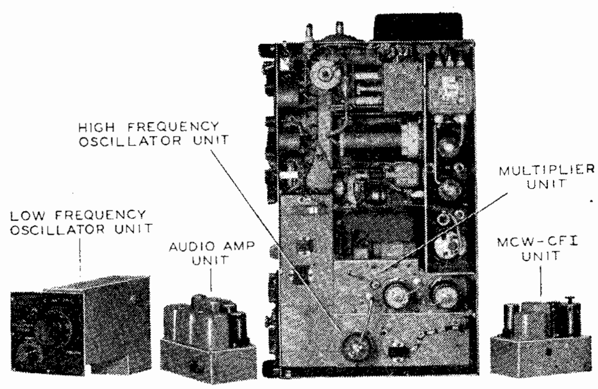


Fig. 4 Type -52286 Transmitter
Top View Open—Units Removed

1.3. TYPES OF EMISSION

1.3.1. CW, MCW and VOICE modulated types of emission are available with the TCZ equipment. The audio system is capable of modulating the carrier (100 watts nominal) at least 90% for MCW or VOICE emission. Keying speeds up to 30 words per minute may be used when operating with CW and MCW emission without objectionable chirp or distortion of the length of the keyed characters.

1.4. AUDIO INPUT

1.4.1. Either of two types of microphone may be used with this equipment. An input circuit has been incorporated in the equipment to permit the use of either a carbon or dynamic type of microphone. When the microphone switch, S201, is in DYNAMIC position, an audio input of 16 millivolts to the MICROPHONE jack, J102, is required for 90% modulation. When the microphone switch is in the CARBON position 1.45 volt audio input at J102 is required for 90% modulation. The audio frequency response is uniform within 3 db between 300 cps and 4000 cps. The audio frequency distortion is less than 15% rms at 1000 cps and with 90% modulation of the carrier (100 watts nominal).

1.5. FREQUENCY RANGE

1.5.1. Two bands of transmission frequencies are available with the TCZ equipment. Output may be obtained in the low frequency range of 300 kc to 600 kc and in the high frequency range of 2000 kc to 18,100 kc.

1.5.2. When operating in the frequency range 300 kc to 600 kc an external power amplifier plate tank and antenna loading circuit must be used. The necessary circuit is incorporated in the Type COL–47370 Antenna Loading Coil Unit. Selecting low frequency output automatically makes the proper connections from the power amplifier plate to the external tank circuit.

1.5.3. The output circuits of the transmitter have been designed to match antennas from 20 feet to 35 feet in length in the frequency range 300 kc to 600 kc and in the range 2000 kc to 18,100 kc.

NOTE: While the low frequency oscillator will operate over a range of 200 to 1500 kc, the actual output of the transmitter is limited to approximately a 300 to 600 kc range by the Type COL–47370 loading coil when operating in the L-F position.

1.6. FREQUENCY CHANGE SYSTEM

1.6.1. The Autotune frequency system employed in the TCZ equipment is an electrically controlled mechanical system of positioning the transmitter tuning elements. The positioning elements are driven by a single motor. The system will operate to change the frequency of transmission in less than 25 seconds at normal room temperature and with normal operating voltage. A detailed description of both the mechanical and electrical portions of the Autotune is given in the FUNCTIONAL CHARACTERISTICS section of this Maintenance Manual.

1.6.2. Manual frequency change and tuning adjustments may be made without disturbing the Autotune stop ring adjustments if the CHANNEL selector switch is placed in the MANUAL position and the Autotune mechanism allowed to operate.

1.7. POWER OUTPUT

1.7.1. The power delivered to the antenna varies with frequency and antenna characteristics.

1.7.2. The following table shows the power output obtainable within the two bands of frequencies, 300 kc to 600 kc and 2000 kc to 18,100 kc, with normal supply voltage and antennas having the characteristics listed under Antenna Resistance and Antenna Reactance:

Frequency	Antenna Reactance	Antenna Resistance	Power Output	See Note
300 kc	—j4500 ohms	20.0 ohms	16 watts	(1)
400 kc	—j3400 ohms	16.0 ohms	24 watts	(1)
500 kc	—j2600 ohms	14.0 ohms	33 watts	(1)
600 kc	—j2100 ohms	12.0 ohms	41 watts	(1)
2000 kc	—j 500 ohms	2.1 ohms	31 watts	(2)
3000 kc	—j 200 ohms	3.1 ohms	60 watts	(2)
4000 kc	0 ohms	6.1 ohms	80 watts	(2)
5500 kc	+j 380 ohms	25.0 ohms	90 watts	(2)
7000 kc	0 ohms	3500.0 ohms	90 watts	(2)
9000 kc	—j 350 ohms	50.0 ohms	90 watts	(2)
11500 kc	0 ohms	50.0 ohms	90 watts	(2)
13500 kc	+j 350 ohms	100.0 ohms	90 watts	(2)
15500 kc	0 ohms	1500.0 ohms	75 watts	(2)
18000 kc	—j 350 ohms	200.0 ohms	65 watts	(2)

Note: (1) Measurements were made using the Type COL–47370 Antenna Loading Coil.
(2) Measurements were made while operating into a fixed antenna without a loading coil.

1.8. POWER SOURCE

1.8.1. The Model TCZ Equipment may be operated from either of two power sources, 115 volt 50/60 cps a.c. or 115 volt d.c. The source of power that is required depends on the type of power unit that is supplied for the particular installation. If the Type COL–211101 Motor Generator-Rectifier Power Unit is supplied, a 115 volt a-c source of power capable of 4500 watts with good voltage regulation is necessary. A rectifier heating system is used for low temperature operation in the A.C. Power Unit. The equipment should not be operated in a strong draft of air or the effect of the heaters will be nullified. If the Type COL-211102 Dynamotor Assembly is supplied, a 115 volt d-c source of power will be required. Short, heavy power connections are necessary for proper operation of the power units.

IMPORTANT: Carefully check the unit nameplate to determine which source of power is required so as to prevent the damaging of the unit by connecting the wrong power source to the input terminals.

1.9. CONTROL

1.9.1. The emission of the transmitter may be controlled from the Type COL–52286 Transmitter panel, the Type COL–23410 Remote Control Unit or a standard Navy Radiophone Unit. The type of emission and the frequency channel may be selected from the transmitter panel or the remote control unit.

1.9.2. The Type –52286 Transmitter controls consist of a TEST switch, a LOCAL-REMOTE switch, a CHANNEL selector switch, a metered circuit selector switch, a power level switch, an EMISSION selector switch, LOW FREQUENCY oscillator TUNING, HIGH FREQUENCY oscillator TUNING, ANTENNA TUNING—COARSE, ANTENNA TUNING — FINE, and ANTENNA LOADING controls, KEY, MICROPHONE and Throttle Switch jacks for control of emission and two jacks when properly connected for SIDETONE monitoring.

1.9.3. The controls on the Type COL–23410 Remote Control Unit consist of a CHANNEL selector switch, and EMISSION selector switch, a MICROPHONE jack, and a TELEGRAPH KEY jack.

1.10. OVERLOAD PROTECTION

1.10.1. A time delay relay has been connected in the rectifier plate transformer primary circuit in the Type COL–211101 A.C. Power Supply Unit to prevent the application of plate voltage to the rectifiers before the tubes have reached operating temperature. The plate transformer primaries are fused to protect the circuit components from being damaged by an overload in the output of the rectifier circuit.

1.10.2. The input circuits to the motors and the output circuits of the generators in both units are fused.

1.11. ACCESSORIES

1.11.1 In addition to the transmitter proper, a power unit, a remote control unit, an antenna shunt capacitor, and an antenna loading coil unit are furnished to complete the installation.

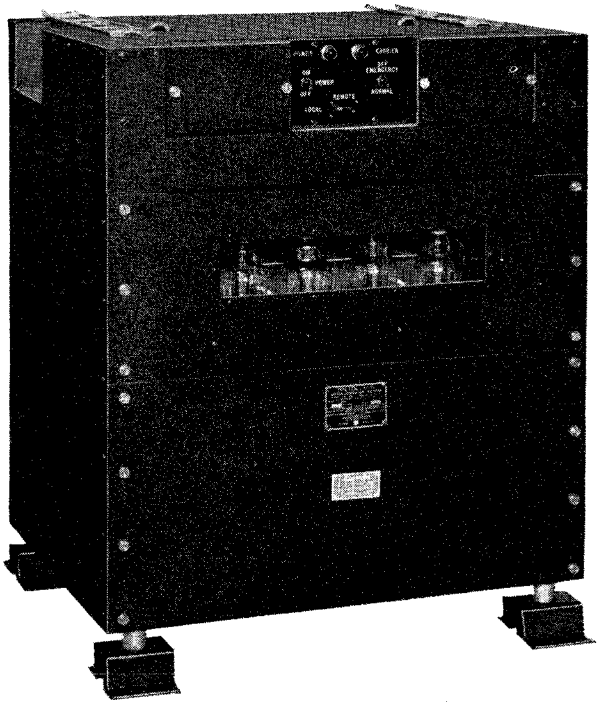


Fig. 5 Type COL–211101 Motor-Generator-Rectifier Power Unit

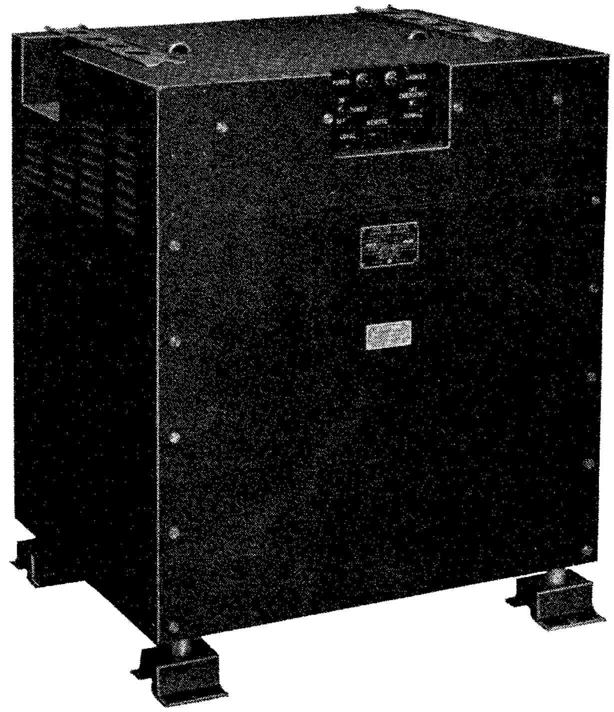


Fig. 6 Type COL–211102 Dynamotor Assembly

1.11.1.1. The power supply unit may be either of two models, the Type COL–211101 A.C. Power Supply Unit designed for operation from a 115 volt 60 cps a-c power source or the Type COL–211102 D.C. Power Supply Unit designed for operation from a 115 volt d-c power source. The Type COL–211101 A.C. Power Supply Unit utilizes two rectifier systems and a motor generator to supply the voltages necessary for the operation of the equipment. The Type COL-211102 D.C. Power Supply Unit utilizes two dynamotors. Both units are supplied with a terminal strip to permit the connecting of the standard Navy Radiophone Unit.

1.11.1.2. The Type COL–23410 Remote Control Unit permits the control of power, the selection of the type of emission, the control of the emission and the selection of the frequency channel from a remote position. The unit also contains a loudspeaker, a headphones cord plug receptacle and an audio level control. The input circuits of the speaker

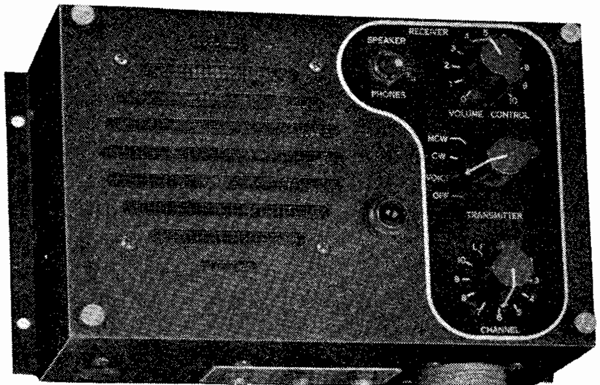


Fig. 7 Type COL–23410 Remote Control Unit

and phones jack are brought out to a terminal strip so that the output of the installation receiver may be easily connected to the unit. Either speaker or headphones reception may be selected by the operation of a toggle switch.

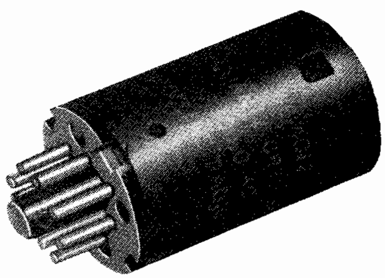


Fig. 8 Type –40127 Crystal Holder

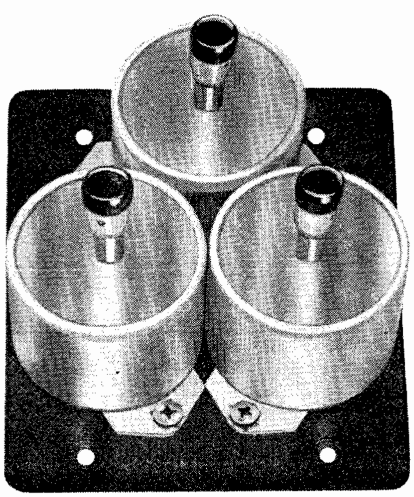


Fig. 9 Type –481628 Antenna Shunt Capacitor

1.11.1.3. The external load coil is used only when low frequency operation (300 kc to 600 kc) is selected. The antenna should be connected to the terminal on the load coil and a connection made from the LOAD COIL terminal on the unit to the transmitter. A relay located in the Type COL–47370 Antenna Load Coil Unit, operated by the telegraph key, TEST switch or the push-to-talk switch on the microphone, connects the tank circuit that is located in the load coil unit to the antenna when operating in the low frequency range. During operation in the frequency range 2000 kc to 18,100 kc the relay remains unoperated and the normally closed contacts connect the output of the transmitter directly to the antenna.

Fig. 10 Type COL–47370 Antenna Loading Coil

1.11.1.4. The Type COL–481628 Antenna Shunt Capacitor is furnished to permit operation in the range 2000 to 3000 kc using a short whip-type antenna.

1.11.1.5. The 200 kc Type –40127 Crystal Unit is mounted in an octal base holder for convenience in mounting in the crystal oscillator calibration unit.

1.11.1.6. Power, control and unit-interconnecting cables are furnished together with the fittings and plug connectors necessary to complete the installation.

1.11.1.7. Complete sets of Phillips and Bristo wrenches are fastened beneath the transmitter cover.

1.12. ABBREVIATIONS

1.12.1. Throughout the Maintenance Manual abbreviations are used in place of some of the more common radio terms and phrases. The terms and definitions listed below should help in the understanding of the sections of this book that follow.

a. P.A.—Power Amplifier

b. CW—Continuous-Wave

c. MCW—Modulated Continuous-Wave

d. VOICE—Voice modulated radio-frequency

e. H-F OSCILLATOR—High-Frequency Oscillator (1000 kc to 1510 kc output)

f. L-F OSCILLATOR—Low-Frequency Oscillator (200 kc to 1500 kc output)

g. CFI—Calibration Frequency Indicator

h. 1st MULTIPLIER—First radio-frequency multiplier stage

i. 2nd MULTIPLIER — Second radio-frequency multiplier stage

j. LOCAL—Control of the power and emission from the transmitter panel

k. REMOTE — Control of the transmitter power and emission from the Remote Control Unit

l. R-F—Radio Frequency

m. A-F—Audio Frequency

1.13. SYMBOL DESIGNATIONS

1.13.1. The Symbol Designations used throughout this book refer to the symbols used on the schematic diagrams and photographs. These designations are also used in the Parts List and Spare Parts Lists to identify circuit components with component part numbers and description. Table XV, List of Major Units, gives a complete tabulation of symbol designations used in this equipment.

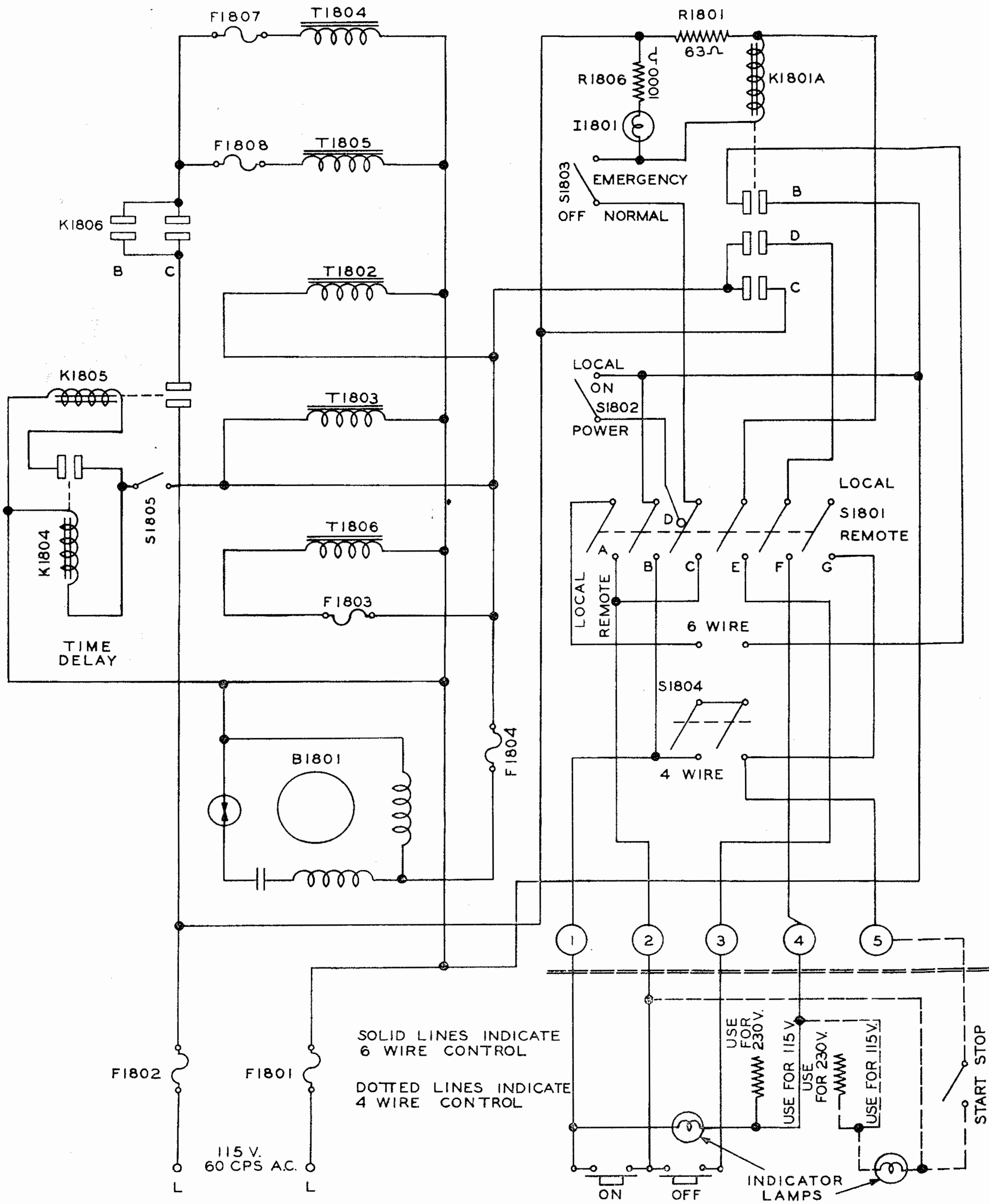


Fig. 11 Simplified Power Control Circuits for A.C. Power Unit
(Dwg. No. 500 1458 00B)

2.1. POWER CONTROL CIRCUITS FOR A-C SUPPLY

2.1.1. Operational description of the Power Control Circuits is divided into two separate sections. One section pertains to the operation of the primary power circuit in the Power Unit and the other section to the explanation of the power control circuits in the transmitter unit. (See Paragraph 2.3.)

2.1.2. Refer to Figure 94. It will be noted that the external power control circuits are of the standard 4 wire and 6 wire types. The 6 wire control is designed for momentary contact operation while the 4 wire control is designed for a start-stop switch of the toggle or knife-blade type.

2.1.3. The power mains are fused by F1801 and F1802. These fuses protect all the power components in the Power Unit. In addition to the power mains fuses, there are individual protective fuses in the primary circuits of each separate power supply in the Power Unit. Fuse sizes should be strictly adhered to when replacements are necessary.

2.1.4. Refer to Figure 11. Operation of filament power relay K1801 completes the circuits necessary for application of primary power to the rectifier filament transformers, the motor of the direct current motor-generator set, and the time delay relay K1804. Subsequent operation of interlock relay K1805 and plate power relay K1806 applies primary power to the plate power transformers T1804 and T1805.

2.1.5. Assuming proper power connections are made to the power unit, the LOCAL-REMOTE switch S1801 in the LOCAL position, the EMERGENCY switch S1803 in the NORMAL position and the LOCAL POWER switch S1802 in the ON position, the coil of filament power relay K1801 would be energized through fuse F1801, the contacts of LOCAL POWER switch S1802, the "D" contacts of LOCAL-REMOTE switch, S1801, the contacts of EMERGENCY switch, S1803, the coil of filament power relay, K1801, the limiting resistor, R1801, and fuse F1802. Operation of filament power relay K1801 energizes the primaries of the filament transformers, T1802 and T1803, the primary of the keying relay power supply transformer, T1806, and the motor of the motor-generator set, through the fuse, F1802, the "C" contacts of filament power relay K1801, the primaries of T1802, T1803, T1806 and B1801, the coil of time delay relay K1804, and fuse F1801. The rectifier filaments, the transmitter filaments, the coil of the interlock relay K1805, and the keying supply will now be energized. As soon as the time delay relay K1804, has operated, the circuit through the coil of the interlock relay K1805 will be completed. The circuit for completing the plate power circuit is through the fuse, F1801, the primaries of transformers T1804 and T1805, the contacts of plate power control relay K1806 and the contacts of the interlock relay, K1805; however, the coil of the plate power control relay, K1806, is controlled by the power control circuit in the transmitter proper, the explanation of which will be given in the second section of this operational description, Paragraph 2.3.

2.1.6. With the LOCAL-REMOTE switch S1801 in the REMOTE position, the EMERGENCY switch, S1803, in the NORMAL position, the LOCAL power switch, S1802 in the OFF position, the 4 wire-6 wire selection switch, S1804, in the 6 wire position and a 6 wire control system connected to the terminals provided, the circuit for energizing the filament power relay, K1801A, would be through fuse F1801, the B contacts of LOCAL-REMOTE switch, S1801, the START contacts of the remote power control buttons, the C contacts of LOCAL-REMOTE switch, S1801, the contacts of the EMERGENCY switch, S1803, the coil of the filament control relay, K1801, the limiting resistor, R1801, and fuse F1802. A hold-in circuit for the filament power relay K1801 is necessary when the 6 wire system for control is used which is as follows: Through fuse F1801, the B contacts of the filament control relay, K1801, the contacts of the 4 wire-6 wire selector switch S1804, the A and C contacts of LOCAL-REMOTE switch S1801, the contacts of EMERGENCY switch S1803, the coil of the filament power relay, K1801, the limiting resistor, R1801, and the fuse, F1802. Indicator lamp I1801 is effectively in shunt with the coil of filament power relay K1801, and lights when the filament circuits are energized.

2.1.7. After the filament power relay, K1801, has operated, the filament transformer primaries, the motor B1801, the keying relay power supply transformer, and the time delay relay K1804, will be energized and the plate transformers can be excited by completion of the plate power circuit by the closing of the contacts on the interlock relay, K1805, and the plate power control relay, K1806. The energizing of the coil of the plate power control relay, K1806, is accomplished by circuits in the transmitter unit and will be discussed in the second section of this operational description. See Paragraph 2.3.

2.1.8. The circuit for removing the primary power from the power components by the 6 wire system starts at one set of contacts on the STOP button and goes through the C contacts of LOCAL-REMOTE switch S1801, the contacts of EMERGENCY switch S1803 and to one side of the coil of the filament power relay, K1801. The other set of contacts on the STOP button connects to the other side of the coil of relay K1801 through the E contacts on the LOCAL-REMOTE switch, S1801, thereby shorting the K1801 relay coil when the STOP button is depressed. The energy normally in the coil of the filament power relay, K1801, is then dissipated in the limiting resistor, R1801, and the contacts of this relay, K1801, opens and removes the power from filament transformer primaries, motor winding and keying supply transformer and from the plate transformers primaries by virtue of the interlock relay, K1805.

2.1.9. An indicator lamp incorporated in the 6 wire control system will be turned on when the filaments of the tubes are turned on in the power unit, providing LOCAL-REMOTE switch S1801 is in the REMOTE position. This lamp is energized from the power source by the "C" and "D" contacts of filament power relay K1801 through "B" and "F" contacts of LOCAL-REMOTE switch S1801.

2.1.10. With 110 volt 60 cps power applied to the Power unit input terminals, the LOCAL-REMOTE switch, S1801, in the REMOTE position, the EMERGENCY switch S1803 in the NORMAL position, the LOCAL POWER switch S1802 in the OFF position, and the 4 WIRE-6 WIRE selector switch S1804 in the 4 wire position, the filament power relay, K1801A will be energized through the fuse F1801, the B contacts of LOCAL-REMOTE switch S1801, the contacts of the 4 wire-6 wire selector switch, S1804, the contacts of the START-STOP switch of the 4 wire Remote Control system, the C contacts of LOCAL-REMOTE switch S1801, the contacts of EMERGENCY switch S1803, the coil of filament power relay K1801, the limiting resistor R1801, and the fuse F1802. As there is no hold-in circuit involved other than the contacts of the 4 wire control system START-STOP switch, the power can be removed from the power circuits simply by opening the START-STOP switch.

2.1.11. Note that incorporated in the 4 wire control system is an indicator lamp which gets its excitation from the power source through the fuse, F1801, the B contacts on LOCAL-REMOTE switch S1801, the 4 wire contacts of S1804, the START-STOP switch in the REMOTE Control system, the indicator lamp, the F contacts of the LOCAL-REMOTE switch, S1801, the D and C contacts of the filament control relay, K1801, and the fuse F1802.

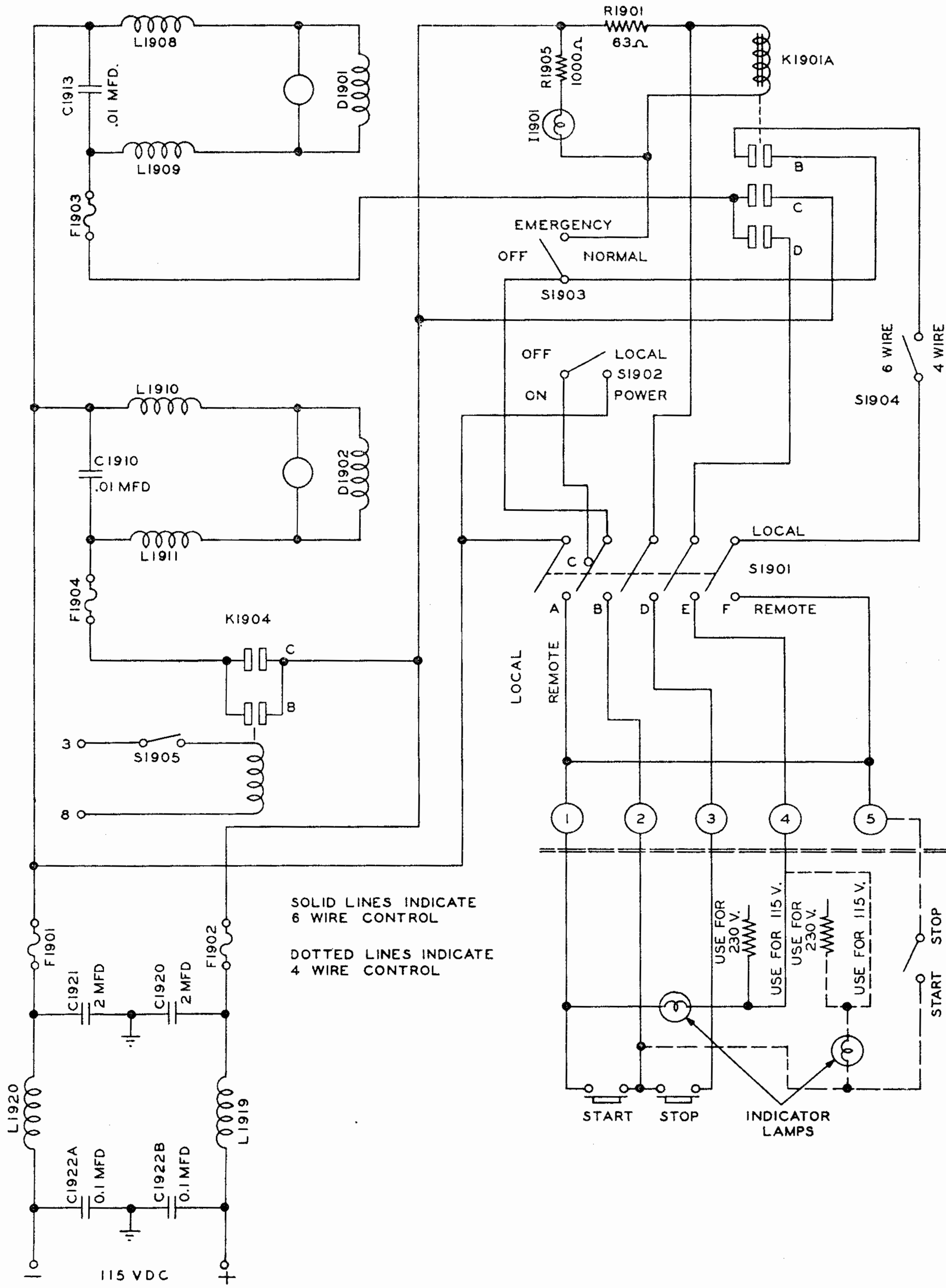


Fig. 12 Simplified Power Control Circuits for D.C. Power Unit (Dwg. No. 500 1457 00B)

2.2. POWER CONTROL CIRCUITS FOR D-C SUPPLY

2.2.1. The power control circuits for the TCZ transmitting equipments employing the d.c. power unit are much the same as those for the a.c. power unit. The principal difference being the absence of the time delay relay and the interlock relay in the plate supply circuit. The interlocking effect is taken care of automatically by the absence of relay power when the filament dynamotor is not rotating. As a result, it is impossible to apply power to the H.V. Dynamotor when the tube filaments are not energized.

2.2.2. Operation of filament power relay K1901 completes the circuits necessary for application of power to the filament and relay-power dynamotor. See Figure 10. Assuming correct power input to the d.c. power bay, the EMERGENCY switch S1903, placed in the NORMAL position, the LOCAL POWER switch, S1902, in the ON position, the LOCAL-REMOTE switch in the LOCAL position, the filament power relay K1901, will be energized through power line fuse F1901, the contacts of LOCAL POWER switch S1902, the "C" contacts of LOCAL-REMOTE switch S1901, the contacts of EMERGENCY switch S1903, the coil of filament power relay K1901, the limiting resistor, R1901, and the fuse F1902.

2.2.3. Operation of the filament power relay K1901 will make filament power available for the transmitter tubes and relay current available for the transmitter relays including the plate power relay K1904, which, when energized by closing of control circuits in the transmitter proper, will start the plate power dynamotor, D1902. The circuit for operating the filament and relay power dynamotor is through fuse F1901, the primary windings of dynamotor D1901, the C contacts of filament control relay K1901 and fuse F1902. The circuit for operating the High Voltage plate dynamotor D1902 is through fuse F1901, the windings of high voltage dynamotor D1902, the C contacts of plate power relay K1904 and the fuse F1902. Operation of the plate power relay K1904, is accomplished by the transmitter power control circuits which are described in paragraph 2.3. Operation of filament power relay K1901 is indicated by indicator lamp I1901 which is in parallel with the coil of relay K1901.

2.2.4. For operation of the power bay by remote control using the 6 wire control system, the LOCAL-REMOTE switch, S1901, will be in the REMOTE position, the LOCAL POWER switch will be in the OFF position, the EMERGENCY switch S1903 will be in the NORMAL position, the 4 WIRE-6 WIRE selector switch will be in the 6 WIRE position, and a standard 6 wire remote control system will be attached to the terminals provided. The circuit for energizing the filament power relay K1901, is through power line fuse F1901, "A" contacts on LOCAL-REMOTE switch, S1901, the START contacts of the Remote Control push button, the "B" contacts on LOCAL-REMOTE switch S1901, the contacts of EMERGENCY switch S1903, the coil of the filament power relay, K1901, the limiting resistor, R1901, and the fuse, F1902. A hold-in circuit formed by contacts "A" and "F" of LOCAL-REMOTE switch S1901, the contacts of the 4 wire-6 wire change-over switch, the "B" contacts of the filament power relay, K1901, the contacts of the EMERGENCY switch, S1903, the coil of the filament power relay, K1901, the limiting resistor, R1901, and the line fuses F1901 and F1902 prevents the filament power relay, K1901, from releasing when the remote control power push-button is released.

2.2.5. Pressing the stop button of the 6 wire remote control system will short circuit the coil of the filament control relay, K1901, and the power circuits will open. The power used in energizing the coil of filament power relay K1901 will be dissipated in the limiting resistor, R1901, when the stop button is depressed.

2.2.6. With the 4 wire power control system attached to the power unit, the LOCAL-REMOTE switch, S1901, in the REMOTE position, the EMERGENCY switch, S1903 in the NORMAL position, the LOCAL POWER switch in the OFF position, the 4 WIRE-6 WIRE selector switch in the 4 WIRE position, the filament power relay K1901 will be energized through fuse F1901, the A contacts of LOCAL-REMOTE switch S1901, the 4 WIRE control START-STOP switch, the B contacts of the LOCAL-REMOTE switch S1901, the contacts of the EMERGENCY switch S1903, the coil of the filament power relay K1901, the limiting resistor R1901, and the fuse F1902. No hold-in circuit is necessary for the 4 wire control system.

2.2.7. Operation of the filament power relay K1901, makes power available for the plate power control relay K1904 in the primary circuit of dynamotor D1902 and, with the closing of the plate-power relay K1904, high voltage will be available for the plates of the transmitter tubes.

2.2.8. In the 6 wire control system, the circuit for the remote indicator lamp is from fuse F1901 through the "A" contacts on LOCAL-REMOTE switch S1901, the remote indicator lamp, the "E" contacts on LOCAL-REMOTE switch S1901, the "D" and "C" contacts on the filament power relay K1901, and fuse F1902.

2.2.9. In the 4 wire system the circuit for the remote indicator lamp is from fuse F1901 through the "A" contacts on LOCAL-REMOTE switch S1901, the contacts of the remote START-STOP switch, the indicator lamp, the "E" contacts on LOCAL-REMOTE switch S1901, the "D" and "C" contacts on filament power relay K1901, and the fuse F1902.

2.3. TRANSMITTER POWER CONTROL CIRCUITS

2.3.1. The following paragraphs describe the operation of the control circuits in the Type COL–52286 transmitter.

2.3.2. Closing these circuits energizes the plate supply primary relay K1806/K1904 which applies plate power to all of the transmitting tubes providing the power unit control circuits are in operation as explained in the preceding paragraphs.

2.3.3. Primary power for application to the transformers, motors and dynamotors is controlled by contactors located in the power units.

2.3.4. All relays in the transmitter proper are energized by the 28 volt output of the power unit.

2.3.5. Figure 13 shows a simplified schematic of the transmitter power control circuits.

2.3.6. With the LOCAL-REMOTE switch, S107, in the LOCAL position, the EMISSION selector switch, S110, in the VOICE position, the circuit necessary for the operation of the "voice" relay, K104 is completed through the coil of "voice" relay K104A, the contacts of EMISSION selection switch, S110, and the contacts of LOCAL-REMOTE switch S107. If power level switch, S106, is in either the TUNE or OPERATE position, it is necessary to operate the TEST switch, S104, or to complete the circuit through the throttle switch jack, J101, the circuit through the MICROPHONE jack, J102, or the circuit through the KEY jack, J103, before the power contactor, K1806/K1904, will operate.

2.3.7. If the EMISSION selector switch, S110, is operated to the CW position, the circuit necessary for the operation of the plate power contactor, K1806/K1904, is completed and power is applied to the primary circuit of the plate supply. Operating the EMISSION selector switch, S110, to the CW position completes the circuit necessary for the operation of CW relay K103 through the contacts of LOCAL-REMOTE switch, S107, the contacts of EMISSION selector switch, S110, and the coil of CW relay, K103. When CW relay K103 has operated, the coil of plate

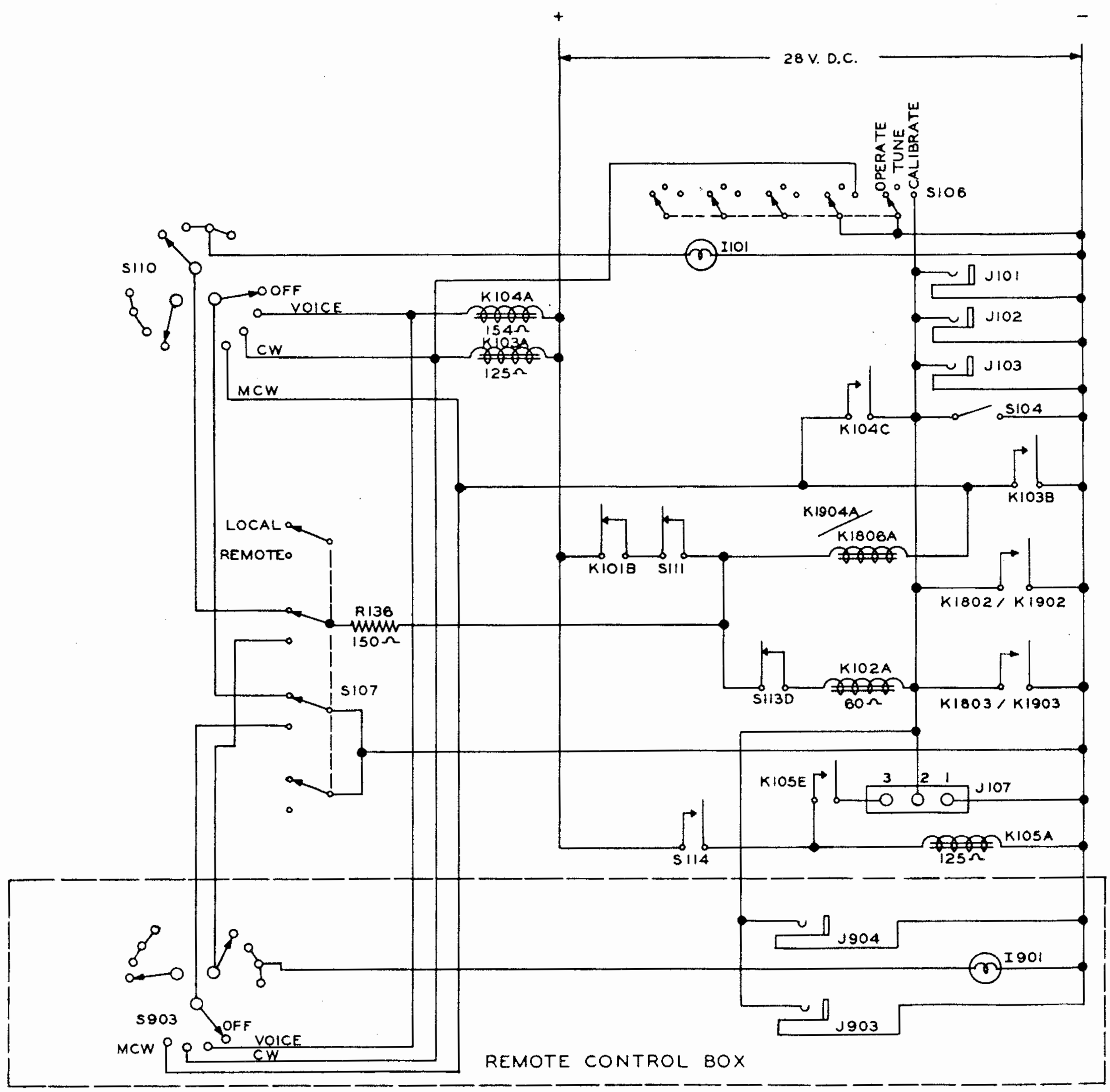


Fig. 13 Simplified Transmitter Power Control Circuits
(Dwg. No. 500 1459 00C)

power contactor K1806/K1904 is energized through the "B" contacts of CW relay K103, the coil of plate power contactor K1806/K1904, the contacts of the Autotune limit switch, S111, and the "B" contacts of the Autotune motor control relay, K101.

2.3.8. If the EMISSION selector switch, S110, is operated to the MCW position, plate power contactor K1806/K1904 is energized by the circuit through the "B" contacts of Autotune motor control relay K101, the contacts of the Autotune limit switch, S111, the coil of plate power contactor K1806/K1904, the contacts of EMISSION selector switch S110, and the contacts of LOCAL-REMOTE switch S107. Operation of the plate power contactor K1806/K1904 applies primary power to the plate supply.

2.3.9. If the power level switch S106 is operated to the CALIBRATE position, CW relay K103 is operated through the coil of CW relay K103 and the contacts of power level switch S106. The plate power contactor, K1806/K1904 will be operated by the circuit through the "B" contacts of Autotune motor control relay K101B, the contacts of the Autotune limit switch, S111, the coil of plate power contactor K1806/K1904, and the "B" contacts of CW relay K103.

2.3.10. The transmitter panel pilot lamp, I101, will be energized when the EMISSION selector switch, S110, is in any position other than the OFF position. The pilot lamp will be energized through the "B" contacts of Autotune motor control relay K101, the contacts of the Autotune limit switch S111, the resistor R136, the contacts of LOCAL-REMOTE switch S107, the contacts of EMISSION selector switch S110, and the pilot lamp I101.

2.3.11. When the LOCAL-REMOTE switch S107 is placed in the REMOTE position control of all power circuits is transferred from the transmitter panel controls to the controls located on the remote control unit.

2.3.12. To complete the circuit necessary for operation of plate power contactor K1806/K1904, when the EMISSION switch S903 is placed in the VOICE position, the telegraph key must be operated or the microphone jack J903, circuit must be completed. The "voice" relay K104 is operated by the circuit through the coil of "voice" relay K104, the contacts of EMISSION selector switch S903, and the contacts of LOCAL-REMOTE switch S107. The power contactor K1806/K1904 is operated by the circuit through the "B" contacts of Autotune motor control relay K101, the contacts of Autotune limit switch, S111, the coil of plate power contactor K1806/K1904, the "C" contacts of "voice" relay K104 and the telegraph key or the microphone jack, J903.

2.3.13. If the EMISSION selector switch S903 is operated to the CW position, the CW relay K103 is operated by the circuit through the coil of K103, the contacts of EMISSION selector switch S903 and the contacts of LOCAL-REMOTE switch S107. The operation of CW relay K103 completes the circuit necessary for the operation of the primary power contactor, K1806/K1904. Power contactor K1806/K1904 is operated by the circuit through "B" contacts of Autotune motor control relay K101, the contacts of Autotune limit switch S111, the coil of plate power contactor K1806/K1904, and the "B" contacts of CW relay K103. The operation of power contactor K1806/K1904 applies power to the primary circuits of the plate supply.

2.3.14. If the EMISSION selector switch S903 is operated to the MCW position, plate power contactor K1806/K1904 is energized through the "B" contacts of Autotune motor control relay K101, the contacts of Autotune limit switch S111, the coil of plate power contactor K1806/K1904, the contacts of EMISSION control switch S903 and the contacts of LOCAL-REMOTE switch S107.

2.3.15. The pilot lamp I901 is energized when the EMISSION switch S903 is in any position other than the OFF position.

2.3.16. The pilot lamp I901 is energized by the circuit through the "B" contacts of Autotune motor control relay K101, the contacts of Autotune limit switch S111, resistor R136, the contacts of EMISSION selector switch S903 and the pilot lamp I901.

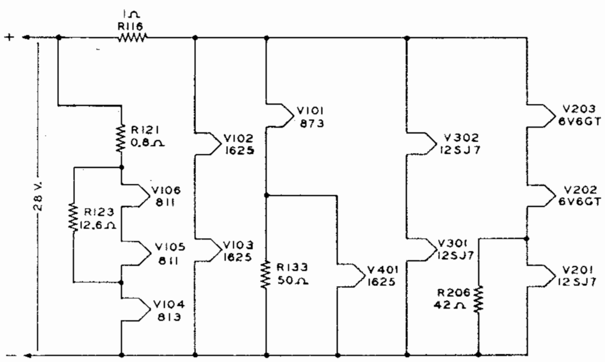


Fig. 14 Filament Circuits
(Dwg. No. 500 1454 00A)

2.4. FILAMENT CIRCUITS

2.4.1. The filament power circuits of the transmitter are a combination of series and parallel connections. The filaments are supplied with power from the 28 volt d-c source. Figure 14 shows the filament connections in simplified form. Filament power is applied to the h-f oscillator tube, V101, the frequency multiplier tubes, V102 and V103, the audio amplifier tube, V201, the audio driver tube, V202, the sidetone amplifier tube, V203, the calibration frequency oscillator tube, V301, the MCW oscillator tube, V302, the l-f oscillator tube, V401, the power amplifier tube, V104, and the modulator tubes, V105 and V106, when the filament power relay K1801/K1901 is operated. The overload fuse, F1805/F1905 breaks the filament circuits when an overload occurs in the filament or associated circuits.

2.5. EMISSION SELECTION AND CARRIER CONTROL

2.5.1. See Figure 15. The switch S110 is a combination transmitter ON-OFF switch and EMISSION selector switch. Selecting VOICE emission by the operation of S110 operates relay K104. Relay contacts K104B disconnect the output of the MCW oscillator, V302, from the input to the speech amplifier. Relay contacts K104C connect the coil of relay K1806/K1904 to the emission control circuits of J101, J102, J103, the TEST switch, S104, and the remote circuits, J903, J904, K1803B/K1903B and K1802C/K1902C. Selecting CW emission completes the circuit necessary for

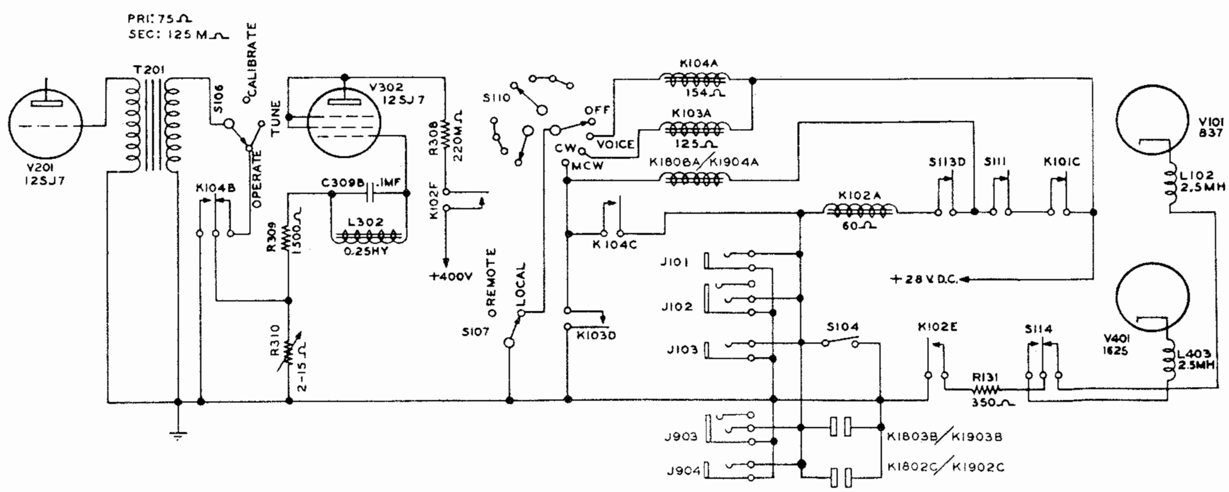


Fig. 15 Emission Selection and Carrier Control Circuits
(Dwg. No. 500 1456 00B)

the operation of relay K103. Relay contacts K103D complete the circuit necessary for the operation of K1806/K1904 which, in turn, applies primary power to the plate supply. Selecting MCW emission operates relay K1806/K1904, the primary power contactor.

2.5.2. The r-f carrier is controlled by opening the cathode circuit of the oscillator and removing the screen voltage from the power amplifier. The carrier control relay, K102, has six sets of contacts. Relay contacts K102E complete the oscillator cathode circuit by grounding resistor R131. Relay contacts K102E and resistor R131 serve as a cathode return for both the h-f oscillator, V101, and the l-f oscillator, V401. The desired oscillator circuit is selected by the operation of switch S114. Switch S114 operates in conjunction with Control A. The MCW oscillator, V302, is in operation whenever relay K102 is in the operated position. The voltage developed across the resistor, R310, is applied to the input of the speech amplifier through the relay contacts K104B, the power level switch, S106, and the input transformer T201. Relay contacts K102F apply plate voltage to V302. During periods of CW transmission the output of the MCW oscillator is fed through the speech amplifier to the sidetone amplifier and the keying may be monitored by listening to the output of the sidetone amplifier. When switch, S106, is in the CALIBRATE position, the circuit from the output of the MCW oscillator to the input of the speech amplifier is broken. The carrier control relay K102 may be operated by closing the circuits of the Throttle Switch jack, J101, the MICROPHONE jack J102, the KEY jack J103, the TEST switch S104, the remote microphone jack J903, the remote key jack J904, or by operation of relays K1803B/K1903B and K1802C/K1902C. Switch S113D is operated in conjunction with the output network switch, S113, and breaks the energizing circuit to the coil of relay K102 whenever S113 is operated, thus removing excitation from the r-f circuits to prevent arcing at the switch contacts. The Autotune limit switch, S111, and the Autotune motor relay contacts K101C are also connected in series with relay coil K102A so that when S111 or K101 operates, the holding circuit for K102 will be broken and arcing at all switch contacts will be prevented.

2.6. APPLICABLE REMOTE CONTROL CIRCUITS

2.6.1. Terminals 1 to 12 on J1805/J1905 in the power units are intended for use with external or remote carrier control and microphone circuits. See Figure 94. Terminals 1 to 5 inclusive are used for primary power control of the power bays while terminals 5 to 12 are used for carrier control and microphone circuits.

2.6.2. Operation of relays K1803/K1903 and K1802/K1902 completes the circuits necessary to operate the carrier control relay K102. The keying relay K1803/K1903 is energized by closing the circuit between terminals 5 and 6 of J1805/J1905. Keying relay K1803 in the A.C. Power bay gets energizing current from rectifier CR1801, while keying relay K1903 in the D.C. Power bay gets energizing current directly from the power mains. For phone operation utilizing the remote circuits connected to J1805/J1905, the carrier control relay, K102, is operated by the closing of contacts K1802C/K1902C. The coil of K1802/K1902 is energized by a connection from terminal No. 8 to terminal No. 11 which is made through suitable relays controlled by push-buttons on handsets or chestset microphones. Contacts on carrier relay K1802/K1902 also connect the microphone circuit from the transmitter proper to terminals 9 and 10 of terminal board J1805/J1905 through transformer T1801/T1901. Carrier relay K1802/K1902 gets energizing current from a special winding on G1801/D1901 which supplies 12 to 14 volts at 1.2 amps. of filtered d.c. for this purpose. This winding also furnishes button current for remote carbon button microphones and current for other control relays that may be involved.

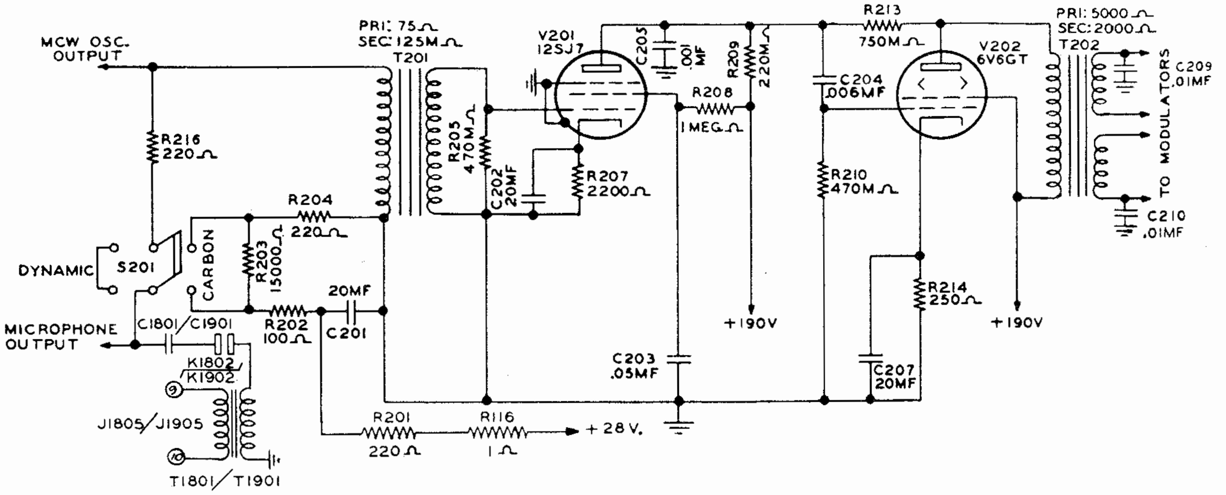


Fig. 16 Speech Amplifier Circuits (Dwg. No. 500 1453 00A)

2.7. AUDIO CIRCUITS

2.7.1. The audio system consists of a two stage speech amplifier, push-pull modulators, a sidetone amplifier, and an MCW audio tone oscillator.

2.7.2. Speech Amplifier

2.7.2.1. Refer to Figure 16. Either of two types of microphones may be used with this equipment. The input to the speech amplifier has been designed so that by operating a switch, proper connections are made to the MICROPHONE jack, J102, (Fig. 28) to match the output of either a carbon or dynamic type of microphone. The microphone circuit selector switch, S201, is located beneath the tuning chart on the front panel of the transmitter. If S201 is placed in the CARBON position, limiting resistors R201 and R202 are connected between the positive terminal of the 28 v d-c power source and the MICROPHONE jack, J102, to provide the voltage necessary for the operation of the carbon type of microphone. The operation of S201 also connects resistor R203 between J102 and the input circuit of the speech amplifier to reduce the level of the output of the carbon microphone to the level of the output of a dynamic microphone. Thus, no audio gain control has been provided because the level of the input to the speech amplifier is the same when using a dynamic microphone as it is when using a carbon microphone. If S201 is placed in the DYNAMIC position the voltage is removed from the input circuit and the MICROPHONE jack, J102, is connected in series with resistor R216 and the primary of the input transformer, T201. The two stage speech amplifier employs a Type 12SJ7 tube, V201, as first amplifier, and a Type 6V6GT tube, V202, as second amplifier. The output of the microphone is coupled by the input transformer, T201, to the grid of V201. The output of V201 is coupled to the grid of V202 by the capacitor C204. The output of the audio driver tube, V202, is coupled to the grids of the modulator tubes V105 and V106 by transformer T202.

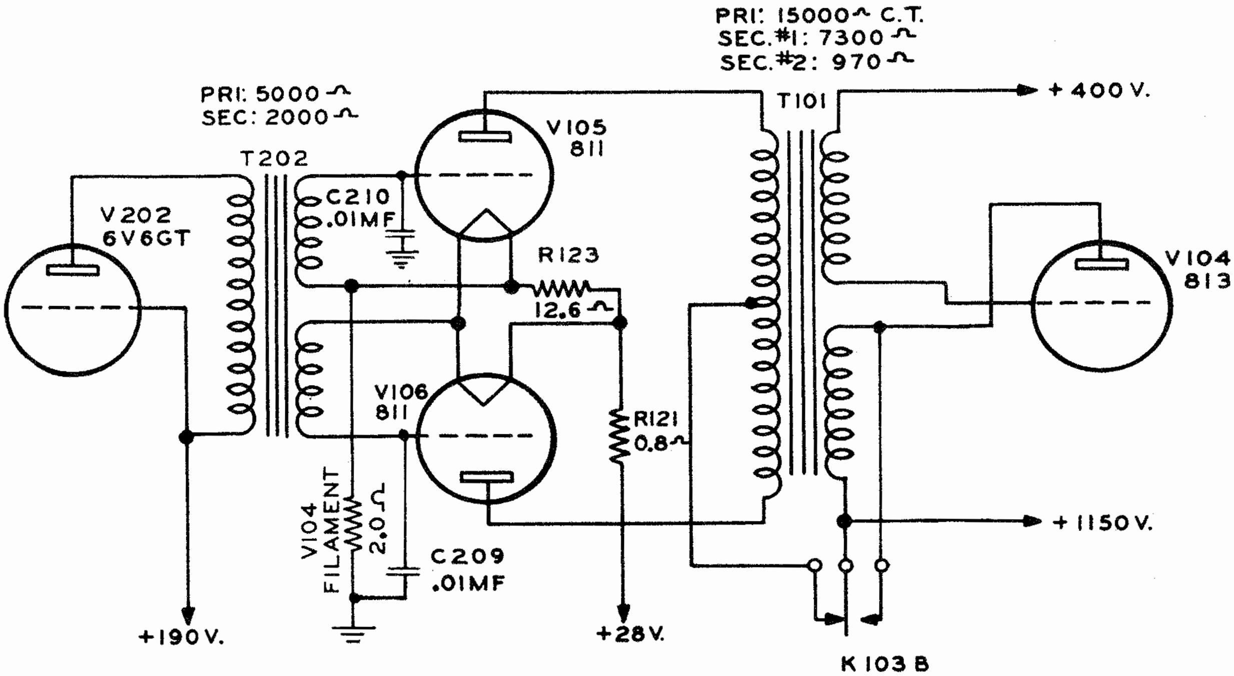


Fig. 17 Modulator Circuits (Dwg. No. 500 0223 00A)

2.7.3. Modulator

2.7.3.1. The modulator employs two Type 811 high mu triodes connected in push-pull, and operating Class B. Refer to Figure 17. The modulators are capable of modulating the carrier (100 watts nominal) at least 90% with full voltage applied to the power amplifier. While the 811 is essentially a zero bias tube when used with plate voltages as high as 1150 volts d.c., it becomes necessary to apply some bias to the grid of the tube to keep the static plate current at a safe value. In this application the bias is obtained from the 28 volt d-c supply by utilizing the average voltage drop through the filaments of the tubes to obtain equal voltage for application to the grids of both modulator tubes. The output of the modulators is coupled to the r-f circuits by modulation transformer T101. Both the screen and plate of the power amplifier tube, V104, are modulated. The full output voltage of 1150 volts d.c., is applied to the plates of the modulator tubes, V105 and V106. Relay contacts K103B remove plate voltage from the modulators when CW emission is selected.

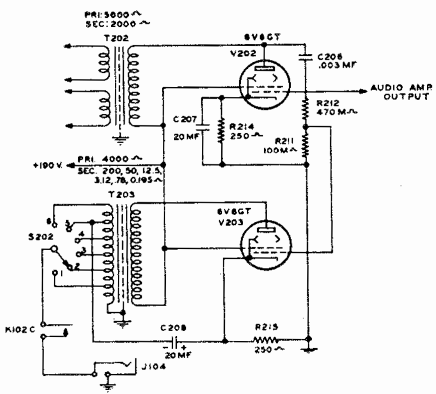


Fig. 18 Sidetone Amplifier Circuit (Dwg. No. 500 0226 00A)

2.7.4. Sidetone Amplifier

2.7.4.1. A sidetone amplifier, Figure 18, is incorporated in the same unit as the two stage speech amplifier. The amplifier employs a Type 6V6GT beam pentode tube V203. The output of the audio driver V202 in addition to being applied to the primary of coupling transformer T202, is applied to a voltage dividing system consisting of C206, R211 and R212. The grid of the sidetone amplifier V203 is coupled to the junction of R211 and R212 and the voltage developed across resistor R211 drives the grid of V203 to provide sufficient output from the sidetone amplifier to operate headphones or speaker. The output of V203 is coupled to the SIDETONE jack, J104, by the transformer T203 through the switch S202 and relay contacts K102C. The turns-ratio of transformer T203 may be varied by operating the sidetone OUTPUT switch S202. The output of the sidetone amplifier is keyed by the operation of the carrier control relay K102. The SIDETONE jack, J105, may be connected in parallel with J104 by connecting a jumper between terminals 26 and 27 of cable connector J106. The necessary plate and screen voltages for the sidetone amplifier are obtained by tapping the bleeder system of the low voltage output of the power unit.

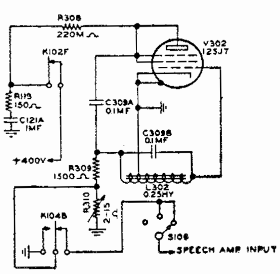


Fig. 19 MCW Oscillator Circuit
(Dwg. No. 500 0219 00A)

2.7.5. MCW Oscillator

2.7.5.1. The MCW audio tone oscillator, Figure 19, utilizes a Type 12SJ7, V302, triple grid tube connected as a triode. The oscillator is in operation whenever the carrier control relay, K102, is operated. Relay contacts K102F apply voltage to the plate and screen of V302 when K102 is operated. The audio frequency of the output of the tone oscillator is fixed. The voltage developed across resistor R310 is coupled to the input of the speech amplifier through relay contacts K104B and the power level switch, S106. When VOICE emission has been selected, relay contacts K104B disconnect the output of the MCW oscillator, V302, from the input circuit of the speech amplifier. During periods of CW transmission the MCW oscillator is keyed and the output is fed to the input of the speech amplifier and the input of the sidetone amplifier to provide a means of monitoring the keying.

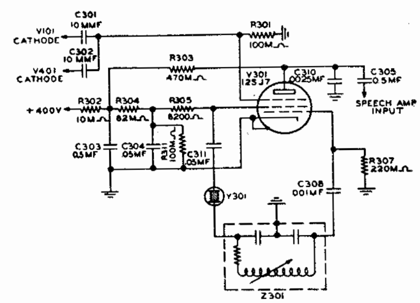


Fig. 20 CFI Oscillator Circuit
(Dwg. No. 500 0221 00A)

2.8. CFI OSCILLATOR CIRCUIT

2.8.1. The calibration oscillator, Figure 20, employs a Type 12SJ7 tube V301, and is located in the same unit as the MCW tone oscillator. A 200 kc quartz crystal unit is mounted in a sealed holder and plugs into an eight terminal socket on top of the chassis. The grid tank circuit, Z301, is built into a shield can with the inductor tuning screw protruding through the side of the can. The output frequency of this oscillator may be varied slightly by adjusting the tuning screw. Screen and plate voltages are applied to the tube when the power level switch S106 is operated to the CALIBRATE position. Operating S106 to either the TUNE or OPERATE position removes high voltage from V301 thus disabling the oscillator circuit. A portion of the output of the h-f oscillator V101 is coupled to the suppressor grid of V301 by the capacitor, C301. A portion of the output of the l-f oscillator V401 is coupled to the suppressor by capacitor C302. The screen and plate voltages for V301 are ob-

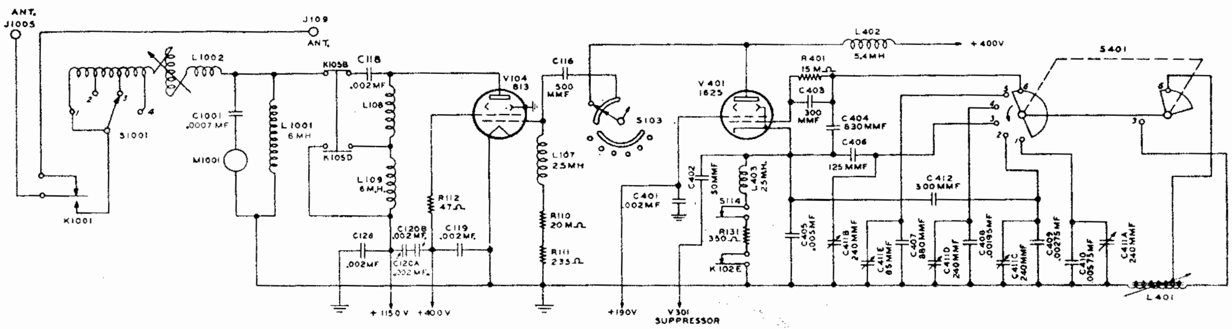


Fig. 21 Low Frequency R-F Circuits (Dwg. No. 500 1460 00C)

tained from the low voltage section of the power unit. The beat note developed between the output of the h-f or l-f oscillator and the 200 kc signal generated within V301 is coupled to the input of the speech amplifier by capacitor C305. The circuit from the output of V301 to the input of the speech amplifier is completed when the power level switch, S106, is operated to the CALIBRATE position.

2.9. RADIO-FREQUENCY CIRCUITS

2.9.1. The Type -52286 Transmitter employs two r-f systems. One system covers the frequency range 300 kc to 600 kc and the other system the frequency range 2000 kc to 18,100 kc. Separate oscillator tubes are employed for each frequency range. The same power amplifier tube serves both systems.

2.9.1.1. Low-Frequency Circuits

Refer to Figure 21. The l-f oscillator V401 employs a Type 1625 beam pentode tube. This oscillator operates in the frequency range 200 kc to 1500 kc. This frequency range is covered in six bands. Refer to the oscillator calibration curves, Sect. VI, for the frequency coverage of the individual bands. A combination of capacitive and inductive grid tuning is employed. The COARSE tuning switch S401 varies the grid circuit capacity by increasing the number of padding capacitors connected in the circuit as S401 is rotated toward the lowest frequency position. Switch S401 also changes the tap on the grid inductor L401 to vary the inductance in the grid circuit. Trimmer capacitors have been connected in parallel with the padding capacitors to provide means of fine adjustment of grid circuit capacity. These trimming capacitors are of the ceramic type and the capacity of each may be varied by rotating one plate with respect to the other. In spite of the small physical size, this type of capacitor provides a means of varying the capacity over a wide range. With the end-points of the frequency band set and the trimmer capacitors adjusted to give some overlap in each position of switch S401, all fine frequency adjustments within the frequency range of each switch position are made by varying the inductance of the inductor L401. The inductance of L401 is altered by adjusting the position of the core, which is actuated by the tuning screw that is accessible through the coil shield. The position of the tuning core within the inductor is determined by Control G. When l-f operation is desired and the L.F. position (13) of control "A" has been selected, the cathode circuit of the oscillator V401 is coupled through the contacts of switch S114 and resistor R131 to relay contacts K102E of the carrier control relay K102. Operation of K102 completes the cathode circuit to ground. Screen voltage for V401 is obtained by tapping the low voltage output bleeder. The output of the oscillator V401 is coupled to the grid of the power amplifier tube V104 by S103 when Control "A" is operated to the L.F. position. Selecting l-f operation operates relay K105 which connects the plate circuit of V104 to the external loading coil. The h-f output network is completely removed from the circuit by the operation of K105. Relay contacts K105D remove the shorting connection across the plate choke, L109. Screen voltage for V104 is obtained from the low voltage output of the power unit. The full voltage of the high voltage section of the power bay is applied to the plate of V104. The external loading coil in addition to being an antenna loading coil is also the power amplifier plate tank circuit. A tapped inductor and variometer provide means of adjusting the loading and the power amplifier plate tank tuning.

2.9.1.2. Antenna keying relay K1001 in the low frequency load coil unit is connected to the keying circuit and is operated in synchronism with carrier relay K102 when the telegraph key, test key, or microphone switch is operated.

2.9.1.3. High-Frequency Exciter Circuits

The h-f oscillator, Figure 22, employs a beam pentode Type 837 tube, V101, in a variable frequency oscillator circuit. The oscillator operates within the frequency range 1000 kc to 1510 kc. This frequency range is covered in two bands, 1000 kc to 1225 kc, and 1225 kc to 1510 kc. The band of frequencies within which output is obtained, is dependent on the position of h-f oscillator range switch S101. Capacitors C101 and C135 are connected in the grid circuit of the h-f oscillator tube, V101, by h-f oscillator range switch S101 which is operated by Control "A". Alternate positions of Control "A" add or remove the padding capacitors C101 and C135. With Control "A" in the 2.0 mc to 2.4 mc position h-f oscillator range switch S101 is closed, giving the maximum grid circuit capacitance and consequently the lowest frequency output. Therefore, when Control "A" is in the 2.0 mc to 2.4 mc position, oscillator output is obtained in the frequency range 1000 kc to 1225 kc. When Control "A" is rotated to the 2.4 mc to 3.0 mc position, h-f oscillator range switch S101 is opened, removing capacitors C101 and C135 from the circuit, and oscillator output is obtained in the frequency range 1225 kc to 1510 kc. When Control "A" is operated to the 3.0 mc to 3.6 mc position, h-f oscillator range switch S101 is again operated to the closed position and oscillator output is obtained in the frequency range 1000 kc to 1225 kc. In the remaining nine h-f positions of Control "A", h-f oscillator range switch S101 is alternately opened and closed to give oscillator output as indicated above. Trimming capacitors C134 and C135 have been provided to aid in setting the end-points of the two frequency bands. When setting the h-f end of the 1000 kc to 1225 kc band, the grid capacity is trimmed using variable capacitor C135. When the h-f end of the 1225 kc to 1500 kc band is set, the grid tuning capacity is trimmed by using variable capacitor C134. Fine frequency adjustment within each band is made by vary-

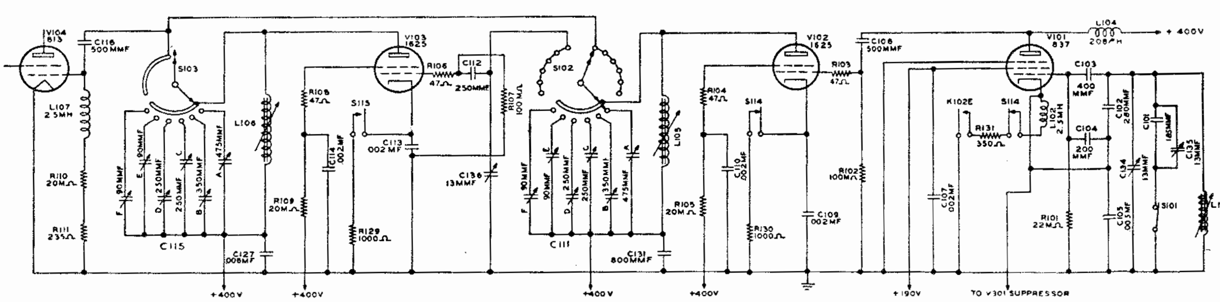


Fig. 22 High Frequency R-F Exciter Circuits
(Dwg. No. 500 0229 00C)

ing the inductance of grid tuning inductor L101. The inductance of L101 is varied by adjusting the position of the tuning slug within the coil. The position of the tuning slug is determined by Control "B". Approximately 20 revolutions of Control "B" will cover the entire frequency range of the band upon which the oscillator is operating, with some overlap on both ends of the band. A portion of the output of the h-f oscillator V101 is fed to the suppressor grid of the CFI oscillator tube, V301, to permit the calibration of h-f oscillator tube V101 against the crystal oscillator circuit of CFI oscillator tube V301. When h-f operation has been selected, rotating Control "A" to any one of the twelve h-f positions will close the cathode circuit of h-f oscillator tube V101 through cathode choke L102, the contacts of oscillator selecting switch S114 and the cathode resistor R131, to keying relay contacts K102E. The operation of keying relay K102 completes the cathode circuit to ground. Screen voltage for h-f oscillator tube V101 is obtained by tapping the bleeder across the low voltage output of the power bay. The full voltage of the low voltage section of the power unit is applied to the plate of h-f oscillator tube V101.

2.9.1.4. To obtain r-f output in the frequency range 2000 kc to 18,100 kc, the output of the h-f oscillator must be multiplied from two to twelve times. The frequency multiplier tubes, V102 and V103, are inoperative when l-f operation has been selected. The frequency multiplier stages employ Type 1625 beam pentode tubes. The first multiplier tube may operate as a frequency doubler, tripler, or quadrupler. The number of times that the frequency of the output of the h-f oscillator tube, V101, is multiplied is dependent upon the position of first multiplier range switch S102. The position of first multiplier range switch S102 is determined by Control "A". Twelve h-f positions and one l-f position of Control "A" are available. The twelve h-f positions permit the selection of any output frequency within the frequency range 2000 kc to 18,100 kc.

The 13 positions of Control "A" and the frequency range covered by each are tabulated below:

HIGH FREQUENCY TUNING—COARSE

Control Position "A"	Frequency Range
1	2.0 to 2.4 mc
2	2.4 to 3.0 mc
3	3.0 to 3.6 mc
4	3.6 to 4.0 mc
5	4.0 to 4.8 mc
6	4.8 to 6.0 mc
7	6.0 to 7.2 mc
8	7.2 to 9.0 mc
9	9.0 to 10.8 mc
10	10.8 to 12.0 mc
11	12.0 to 14.4 mc
12	14.4 to 18.1 mc
13	300 kc to 600 kc

In the first six positions of Control "A", only the first frequency multiplier tube, V102, is in operation. First multiplier range switch S102 connects the output circuit of the first frequency multiplier tube V102 to the input circuit of the final amplifier tube V104. With Control "A" in Position 1 or 2, first multiplier tube V102 is operating as a frequency doubler. With Control "A" in Position 3 or 4, first multiplier tube V102 is operating as a frequency tripler. With Control "A" in Position 5 or 6, first multiplier tube V102 is operating as a frequency quadrupler. First multiplier range switch S102 is a twelve-position switch and connects padding capacitors across the first multiplier tube V102 plate tuning inductor L105. The capacity of the tank circuit is reduced as Control "A" is rotated in a clockwise direction, thus increasing the frequency of the output of first multiplier tube V102 as Control "A" is rotated through Positions 1 through 6. When Control "A" is rotated to Position 7, the second multiplier tube, V103 is placed in operation. First multiplier range switch S102 acts to connect the output circuit of first multiplier tube V102 to the grid circuit of second multiplier tube V103 and breaks the circuit from

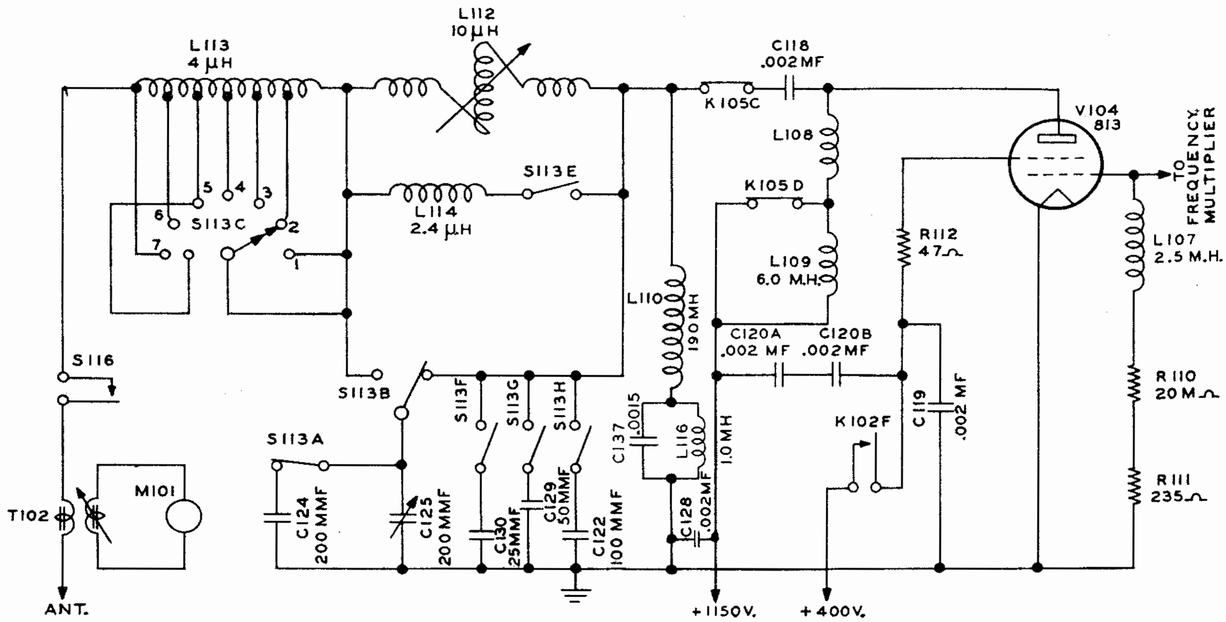


Fig. 23 High Frequency P.A. Circuits
(Dwg. No. 500 0222 00A)

the first multiplier tube V102 output circuit to the grid circuit of final amplifier tube V104. The second multiplier tube V103 operates only as a frequency tripler. Control "A", when in Positions 7 to 12 inclusive, also operates second multiplier operating switch S115 to connect the cathode of second multiplier tube V103 through bias resistor R129 to ground. The first multiplier tube, V102, operates as a frequency doubler when Control "A" is in Position 7 or 8, as a frequency tripler when Control "A" is in Position 9 or 10, and as a frequency quadrupler when Control "A" is in Position 11 or 12. Second multiplier range switch section S103 connects the sections of padding capacitor C115 across the second multiplier tube V103 plate inductor, L106. Capacitors C111 and C115 are of the ceramic type and the capacity of each section may be adjusted by rotating one plate in respect to the other. The frequency multiplier stages are aligned by adjusting the capacity of C111 and C115 and the inductance of the plate tank inductors L105 and L106. The tuning slugs within inductors L105 and L106 are ganged with the tuning slug of L101, but may be adjusted in respect to each other and with respect to the tuning slug of L101, to obtain proper tracking within each frequency band. Plate and screen voltages for the frequency multiplier tubes, V102 and V103, are furnished by the low voltage section of the power bay. The voltage for application to the tube screens is dropped from the 400 volt output of the power unit to approximately 270 volts by dropping resistors R105 and R109.

2.9.1.5. **Power Amplifier and Output Network**

The power amplifier stage, Figure 23, employs a Type 813 beam pentode tube and operates as a straight amplifier at all frequencies. When the transmitter is operating in the frequency range 300 kc to 600 kc, the output of the l-f oscillator is capacitively coupled to the grid of the power amplifier. When the transmitter is operating in the frequency range 2.0 mc to 6.0 mc the output of the first frequency multiplier tube, V102, is coupled to the grid of the power amplifier tube through first multiplier range switch S102 contacts and capacitor C116. When the transmitter is operating in the frequency range 6.0 mc to 18.1 mc the output of the second frequency multiplier tube, V103 is coupled to the grid of the final amplifier tube, V104, through second multiplier range switch S103 contacts and capacitor C116. When l-f operation has been selected, output circuit selecting relay K105 operates to connect the plate circuit of the final amplifier tube, V104, to external loading coil terminal J117. With output circuit selecting relay K105 in the normal unoperated position, the plate circuit of final amplifier tube V104 is connected to the output network that is incorporated in the transmitter proper. Screen voltage for the power amplifier is supplied by the low voltage section of the power unit. Screen voltage is applied to final amplifier tube V104 when the keying relay K102 is operated through relay contacts K102F. The operation of output circuit selecting relay K105 performs four functions, namely, (1) connects the output of the power amplifier to external loading coil terminal J117, (2) disconnects the antenna tuning and power amplifier plate tank circuit, (3) adds an additional r-f choke, L109, in series with the power amplifier feed choke L108, and (4) connects the positive 28 volt d-c lead to external relay connector J107. When output circuit selecting relay K105 is in the normal or unoperated position, the output of the power amplifier tube is coupled to the plate tank and antenna coupling network in the transmitter proper through the capacitor C118 and the r-f choke, L109, is shorted out. The full output voltage of the high voltage section of the power unit is applied to the plate of final amplifier tube V104.

2.9.1.6. The output network is designed to operate as either a pi or L section. The multisection output network switch S113 connects the capacitors and inductors in the proper positions to permit matching the power amplifier plate circuit to most aircraft antennas at any frequency within the frequency range 2000 kc to 18,100 kc.

2.9.1.7. The following table will help the operator to better understand the operation of the output network switch S113:

Control "C" Position	S113A	S113B	S113C	S113E	S113F	S113G	S113H
1	Operated by the rotation of C125. (Operated when dial E reads in 0-100 range.)	1	1	OPEN	OPEN	OPEN	OPEN
2		1	2	OPEN	OPEN	OPEN	OPEN
3		1	3	OPEN	OPEN	OPEN	OPEN
4		1	4	OPEN	OPEN	OPEN	OPEN
5		1	5	OPEN	OPEN	OPEN	OPEN
6		1	6	OPEN	OPEN	OPEN	OPEN
7		1	7	OPEN	OPEN	OPEN	OPEN
8		2	7	OPEN	CLOSED	CLOSED	CLOSED
9		2	7	OPEN	OPEN	OPEN	CLOSED
10		2	7	OPEN	OPEN	CLOSED	OPEN
11		2	7	OPEN	CLOSED	OPEN	OPEN
12		2	7	OPEN	OPEN	OPEN	OPEN
13		2	7	CLOSED	OPEN	CLOSED	OPEN

2.9.1.8. The variometer, L112, is operated by Control "D". The variable capacitor C125 is operated by Control "E". The above controls are connected to the Autotune system, but may be manually operated without disturbing the positions of the Autotune stop rings if the CHANNEL selector switch S108 is placed in the MANUAL position and the Autotune system allowed to operate. The network will tune and deliver rated power to antennas 17 feet to 60 feet in length throughout the frequency range 3000 kc to 18,100 kc. If operation in the range 2000 kc to 3000 kc is desired, it may be necessary to connect the Type –481628 Antenna Shunt Capacitor (Figure 9) across the network output.

2.10. AUTOTUNE SYSTEM

2.10.1. The Collins Autotune System is an electrically controlled means of mechanically repositioning adjustable elements such as tap switches, variable inductors, variable capacitors, etc. Any combination of these items such as are used in transmitting equipment can be tuned to any one of eleven preselected frequencies in a period of twenty-five seconds at normal room temperature and with a normal supply voltage, by the use of the Autotune system. Provisions have also been made to permit manual tuning of the radio equipment.

2.10.2. The Autotune assembly consists of a group of positioning mechanisms, one of which is applied to each tuning element to perform the same function as a manual tuning knob. Each positioning mechanism provides precise angular setting of the tuning control to any one of eleven angular positions, each of which is readily adjustable. The settings for each frequency and for each control are entirely independent.

2.10.3. The positioning accuracy of the Autotune mechanism is of a very high order. Each setting is inherently independent of wear, backlash, alignment, supply voltage, etc. The accuracy of the settings is comparable to that of vernier manual controls. The parts are machined within close limits and although operation is most precise, there are no delicate adjustments or fragile mechanisms. Permanently lubricated bearings are used in many places and the assembly is enclosed and protected from dust and corrosion.

2.10.3.1. Mechanical Details

Refer to Figure 24.

1. LINE SHAFT. The line shaft extends the entire length of the Autotune casting and drives all the Autotune units. Power is applied to the shaft from the motor (47) by means of a chain drive (48).

2. SINGLETURN WORM. The singleturn unit is driven by one worm on the line shaft (1).

3. CAM DRUM DRIVE SPUR GEAR. This gear is fastened directly to the slip clutch worm gear (4) and drives the cam drum spur gear (10) through the idler gear (14).

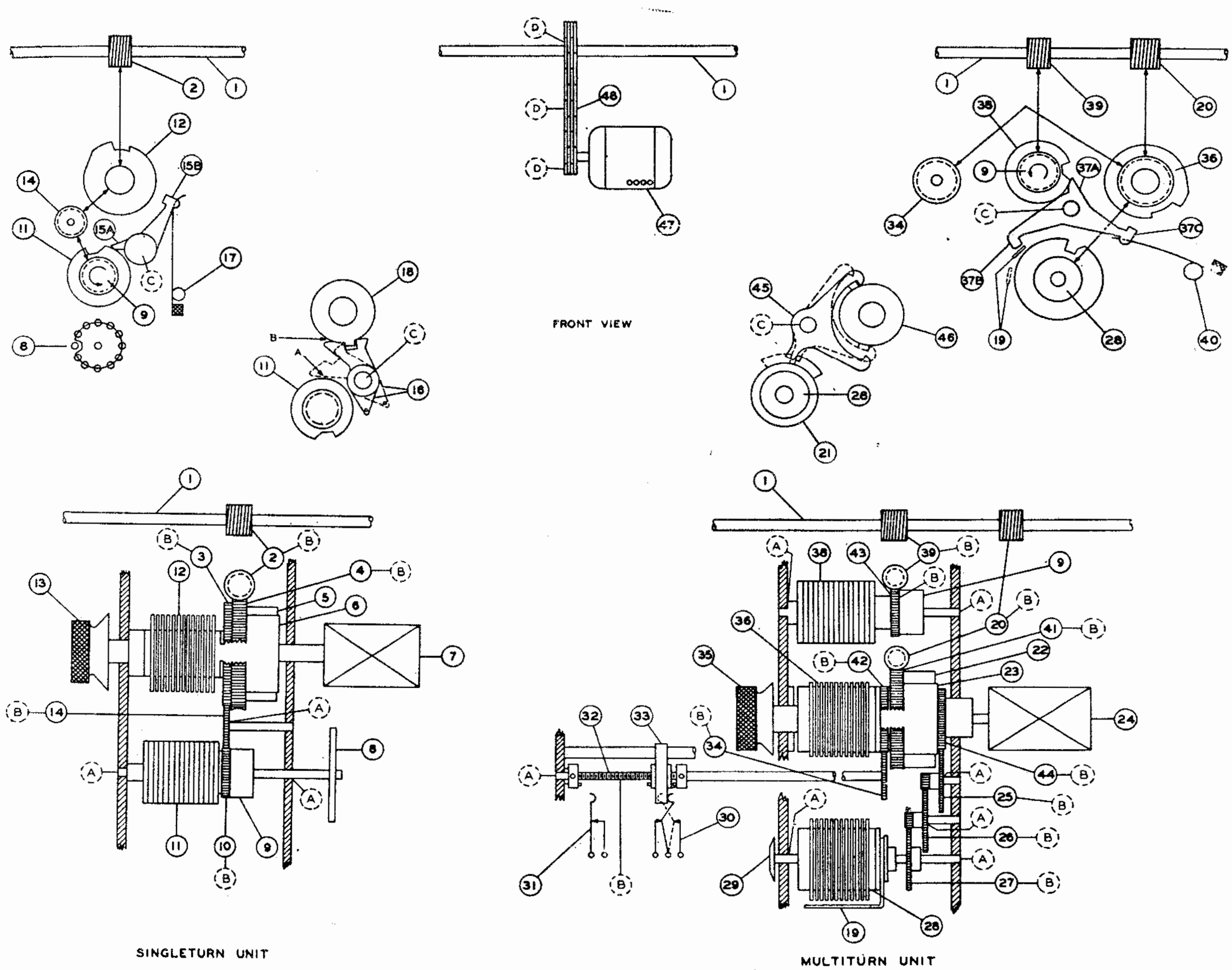
4. SLIP CLUTCH WORM GEAR. This gear is fastened to the cam drum drive spur gear (3) and drives the stop ring drum (12) through the slip clutch (6). This gear is driven by the singleturn worm (2).

5. SLIP CLUTCH BAND. This band is driven directly from the slip clutch worm gear (4) and presses against the slip clutch drum (6).

6. SLIP CLUTCH DRUM. This slip clutch drum, driven by the slip clutch band (5), is fastened to the stop ring drum shaft.

7. TUNED ELEMENT. The tuned element, such as a tap switch, a variable capacitor, or a variometer, is driven directly from the stop ring drum shaft.

8. CIRCUIT SEEKING TAP SWITCH. This switch is driven by the cam drum shaft and is phased so that the contacts are in synchronization with the cams of the cam drums (11) and (38).



LUBRICATING INFORMATION

SYMBOL	RECOMMENDED LUBRICANT
A	TEXACO CAPELLA A OIL (OR EQUAL)
B	SOCONY VACUUM PD535A GREASE (OR EQUAL)
C	CITIES SERVICE NORTH STAR 000 (OR EQUAL)
D	STANO-DRIP # 39 GREASE (OR EQUAL)

NOTE: SEE MAINTENANCE MANUAL FOR LUBRICATION INSTRUCTIONS

KEY TO SYMBOLS

1-LINE SHAFT
2-SINGLETURN WORM
3-CAM DRUM DRIVE SPUR GEAR
4-SLIP CLUTCH WORM GEAR
5-SLIP CLUTCH BAND
6-SLIP CLUTCH DRUM
7-TUNED ELEMENT
8-CIRCUIT SEEKING TAP SWITCH
9-SINGLE TOOTH RACHET
10-CAM DRUM SPUR GEAR
11-CAM DRUM
12-STOP RING DRUM
13-SINGLETURN DIAL
14-IDLER GEAR
15-PAWL (15A-PAWL HEEL)(15B-PAWL TOE)
16-SINGLETURN HOME STOP PAWL
17-PAWL SPRING
18-SINGLETURN HOME STOP RING
19-ANVIL
20-MULTITURN WORM #1
21-MULTITURN HOME STOP CAM
22-SLIP CLUTCH BAND
23-SLIP CLUTCH DRUM
24-TUNED ELEMENT
25-IDLER GEAR #1
26-IDLER GEAR #2
27-COUNTER DRUM SPUR GEAR
28-COUNTER DRUM
29-TURN COUNTER DIAL
30-REAR LIMIT SWITCH SECTION
31-FORWARD LIMIT SWITCH SECTION
32-LIMIT SWITCH DRIVE SHAFT
33-SWITCH OPERATING ARM
34-LIMIT SWITCH DRIVE SHAFT SPUR GEAR
35-MULTITURN DIAL
36-STOP RING DRUM
37-PAWL (37A-PAWL HEEL) (37B-PAWL TAIL) (37C-PAWL TOE)
38-CAM DRUM
39-MULTITURN WORM #2
40-PAWL SPRING
41-STOP RING DRUM WORM GEAR
42-STOP RING DRUM SPUR GEAR
43-CAM DRUM WORM GEAR
44-COUNTER DRUM DRIVE GEAR
45-MULTITURN HOME STOP PAWL
46-MULTITURN HOME STOP RING
47-AUTOTUNE MOTOR
48-CHAIN DRIVE

COLLINS AUTOTUNE SYSTEM MECHANICAL DETAILS

Fig. 24 Collins Autotune System—Mechanical Portion
(Dwg. No. 500 0010 00D)

9. SINGLE TOOTH RATCHET. The single tooth ratchet, when engaged, drives the cam drum. These ratchets keep the cam drums of the various units synchronized.

10. CAM DRUM SPUR GEAR. The cam drum spur gear is driven from the line shaft through gears (2), (3), and (14). The spur gear drives the cam drum (11) through the single tooth ratchet (9).

11. CAM DRUM. The cam drum consists of twelve cams mounted on a shaft with adjacent cam slots staggered 30 degrees. These cams are rigidly fastened to the drum. The single tooth ratchet (9) mounts on the shaft behind the drum and drives the drum.

12. STOP RING DRUM. The stop ring drum assembly consists of twelve stop rings mounted on a shaft with spacers between the rings. The stop rings are free to rotate but the spacers are keyed to the shaft such that as one stop ring is rotated, movement of the ring will not affect the adjacent rings which may have been previously adjusted. A locking bar, on the dial, locks the stop rings when adjustment has been completed. The locking mechanism consists of a bar that drives a screw to apply pressure to the stack of stop rings and spacers, thereby, in effect, locking them.

13. SINGLETURN DIAL. The singleturn dial is fastened to the stop ring drum (12) and enables the operator to adjust the tuned element (7). The locking bar is located on the front of the dial.

14. IDLER GEAR. The idler gear transmits power from the cam drum drive spur gear (3) to the cam drum spur gear (10).

15A. PAWL HEEL. The pawl heel is held against the cam drum (11) by the pawl spring (17).

15B. PAWL TOE. The pawl toe serves to position the tuned element (7) by dropping into the stop ring slot and stopping the stop ring drum (12) after the motor (47) reverses and the pawl heel (15A) is in a cam drum slot.

16. SINGLETURN HOME STOP PAWL. This pawl limits the rotation of the singleturn unit to one revolution. The pawl is located on the same shaft as the pawl (15) and is engaged by the singleturn home stop ring (18). Referring to the mechanical portion of the Autotune, the pawl as shown in solid lines limits the rotation of the stop ring drum (12) in the counterclockwise direction. The pawl cannot pivot further because it bears against the stop ring drum (12) at point "B". The pawl as shown in dotted lines limits the rotation of the cam drum (12) in a clockwise direction. The pawl cannot pivot further in this position because it bears on the cam drum (11) at point "A".

17. PAWL SPRING. The pawl spring presses the pawl heel (15A) against the cam drum (11) and when the pawl heel (15A) drops into the cam drum slot, the pawl spring presses the pawl toe (15B) against the stop ring drum (12).

18. SINGLETURN HOME STOP RING. This ring, mounted with the other stop rings on the stop ring drum (12), is rigidly fastened to the drum. The home stop pawl (16) engages with this ring to limit the rotation of the stop ring drum (12) to one revolution.

19. ANVIL. The anvil prevents the multiturn pawl tails (37B) from becoming engaged in the counter drum (28) ring slots until after the motor (47) reverses.

20. MULTITURN WORM #1. This worm drives the stop ring drum worm gear (41).

21. MULTITURN HOME STOP CAM. This cam is mounted with the other cams on the counter drum (28). This cam actuates the home stop pawl (45) to limit the rotation of the stop ring drum (36) to twenty revolutions.

22. SLIP CLUTCH BAND. This band, driven by the worm gear (41), drives the stop ring drum (36) through the slip clutch drum (23).

23. SLIP CLUTCH. This clutch, similar to (6), is driven by the slip clutch band (22) and is fastened to the stop ring drum shaft.

24. TUNED ELEMENT. This frequency determining element is coupled directly to the stop ring drum (36).

25. IDLER GEAR #1. This gear and gear (26) link the counter drum (28) to the slip clutch spur gear (44) which is fastened to the stop ring drum (36).

26. IDLER GEAR #2. This gear and idler gear #1 (25) link the counter drum (28) to the slip clutch spur gear (44).

27. COUNTER DRUM SPUR GEAR. This gear drives the counter drum (28).

28. COUNTER DRUM. This drum consists of eleven cams with spacers between them. Like the stop ring drums (12) and (36), the spacers are keyed to the shaft so that movement of one cam will not disturb adjacent cams. A spring on the rear of the counter drum loads the stack of cams axially so that the rings will not turn too easily.

29. TURN COUNTER DIAL. This dial, numbered from 0 to 20, indicates the number of turns the Multiturn unit has made.

30. REAR LIMIT SWITCH SECTION. This switch, actuated by the operating arm (33), is operated when the Autotune is in the Home position. During the first part of the Autotune cycle, this switch opens, disabling the keying relay. As the Autotune cycle nears completion, the operating arm (33) recloses the switch, turning off the motor (47) and restoring the coil circuit of the keying relay.

31. FORWARD LIMIT SWITCH SECTION. This switch, normally closed, provides a holding circuit for the motor control relay. When the operating arm (33) opens the switch, the circuit seeking tap switch reverses the motor, thereby returning the Autotune to the home position, completing the cycle.

32. LIMIT SWITCH DRIVE SHAFT. This shaft is driven by the gear (34) from the line shaft (1). The screw thread on the shaft moves the switch operating arm forward or backward between the limit switch sections (30) and (31). On either end of the screw are cams which limit the travel of the switch operating arm (33).

33. SWITCH OPERATING ARM. This arm is driven by the threaded drive shaft (32) and controls limit switches (30) and (31).

34. LIMIT SWITCH DRIVE SHAFT SPUR GEAR. This gear, driven by the stop ring drum spur gear (42) drives the limit switch drive shaft (32).

35. MULTITURN DIAL. This dial with locking bar enables the operator to adjust the stop ring drum (36) to any desired operating frequency within the range of the equipment.

36. STOP RING DRUM. See (12).

37A. PAWL HEEL. The pawl heel is held against the cam drum (38) by the pawl spring (40).

37B. PAWL TAIL. The pawl tail, when allowed to engage the counter drum (28) ring slot by the movement of the anvil (19) selects the revolution in which the tuned element (24) will be positioned.

37C. PAWL TOE. The pawl toe serves to position the tuned element (24) by dropping into the stop ring slot and stopping the stop ring drum (36).

38. CAM DRUM. See (11).

39. MULTITURN WORM #2. This worm drives the cam drum (38) through the single-tooth ratchet (9).

40. PAWL SPRING. This spring is similar to (17).

41. STOP RING DRUM WORM GEAR. This gear, powered from the line shaft (1) by the worm (20), drives the stop ring drum (36) through the slip clutch (23).

42. STOP RING DRUM SPUR GEAR. This gear is fastened to the stop ring drum worm gear (41) and drives the limit switch drive shaft (32) through the gear (34).

43. CAM DRUM WORM GEAR. This gear, powered from the line shaft (1) by the worm (39), drives the cam drum (38) through the single tooth ratchet (9).

44. COUNTER DRUM DRIVE GEAR. This gear, fastened to the slip clutch drum (23) drives the counter drum (28) through the idler gears (25) and (26) and gear (27).

45. MULTITURN HOME STOP PAWL. This pawl, actuated to either position shown by the home stop cam (21), engages the projection on the home stop ring (46) to limit the rotation of the stop ring drum (36) to 20 revolutions. This pawl is mounted on the same shaft as the pawl (37).

46. MULTITURN HOME STOP RING. This ring is engaged by the pawl (45) and is mounted on the stop ring drum (36). The dotted outlines of the home stop ring (46) and pawl (45) show the stop ring drum (36) in the limit of rotation in the counterclockwise direction. The other position shows limit in the clockwise direction.

47. AUTOTUNE MOTOR. The Autotune motor is a d-c shunt wound reversible type and applies power to the line shaft (1) through the chain drive (48).

48. CHAIN DRIVE. The chain drive transmits the power from the Autotune motor (47) to the line shaft (1) and consists of a driving pinion coupled to a driven sprocket by a chain.

2.10.3.2. Electrical Details

Refer to Figure 25.

B101 AUTOTUNE MOTOR. The Autotune motor operates from the 28 volt direct current power source and is controlled by the limit switch S111 and S112, and motor control relay, K101.

K101 MOTOR CONTROL RELAY. K101 is energized through the contacts of the keying relay, K102, the LOCAL-REMOTE switch, S107, the channel selector switch, S108, and the circuit seeking tap switch, S109, to ground. The holding circuit for the relay is through contacts 5 and 6 of motor control relay K101 and the front limit switch section, S112.

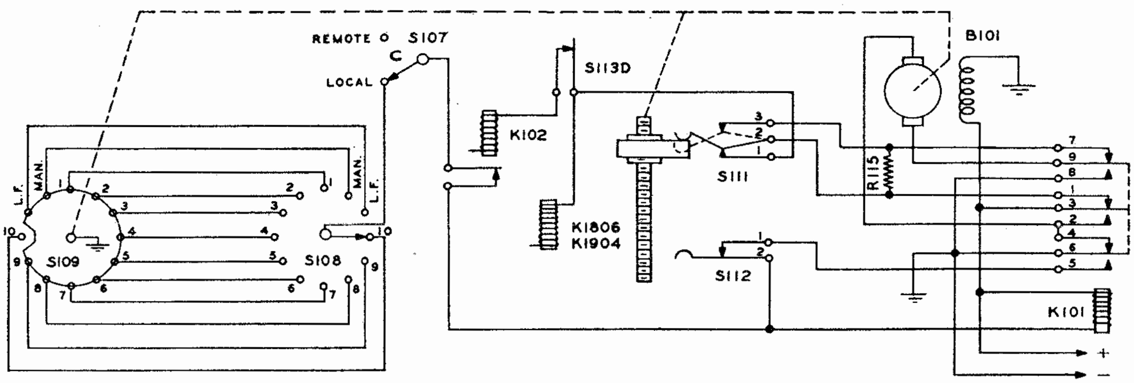
K102 KEYING RELAY. K102, when operated during periods of transmission, prevents false operation of the Autotune system. The energizing circuit is through the emission control circuits, that is, the TEST switch, S104, the Throttle Switch jack, J101, the MICROPHONE jack, J102, or the KEY jack, J103.

S107 LOCAL-REMOTE SWITCH. S107 permits the selection of either the panel channel selecting circuit or the remote channel selecting circuit. The switch is located on the transmitter panel and is designed for manual operation only.

S108 CHANNEL SELECTING SWITCH. S108 permits the selection of any one of ten high-frequency Autotune channels, one low-frequency channel and "MANUAL" tuning of the transmitter. The selection of a new channel energizes motor control relay, K101, by the circuit through CHANNEL selecting switch, S108, and circuit seeking tap switch, S109, to ground.

S109 CIRCUIT SEEKING TAP SWITCH. S109 is driven by the Autotune motor, B101, through a worm and spur gear arrangement. The circuit seeking tap switch, S109, completes the circuit necessary for the operation of the motor control relay, K101. Of the twelve circuits connected to the circuit seeking tap switch, S109, eleven are grounded at all times. The switch seeks the open position and when this position is located, the operating circuit for the motor control relay is broken. Thus the motor control relay, K101, may release upon the operation of the front limit switch section S112.

S111 REAR LIMIT SWITCH SECTION. S111 is normally held in the operated position to complete the circuit necessary for the operation of the keying relay, K102. When released to the normal position by the limit switch operating arm, contacts 2 and 3 of the



B101 - AUTOTUNE MOTOR
K101 - MOTOR CONTROL RELAY
K102 - KEYING RELAY
K1806/K1904 - PLATE POWER RELAY
R115 - MOTOR TORQUE RETAINER RESISTOR
S107 - LOCAL-REMOTE SWITCH
S108 - CHANNEL SELECTOR SWITCH
S109 - CIRCUIT SEEKING TAP SWITCH
S111 - REAR LIMIT SWITCH SECTION
S112 - FORWARD LIMIT SWITCH SECTION
S113D - KEYING INTERLOCK SWITCH

Fig. 25 Collins Autotune System—Electrical Portion
(Dwg. No. 502 3850 003)

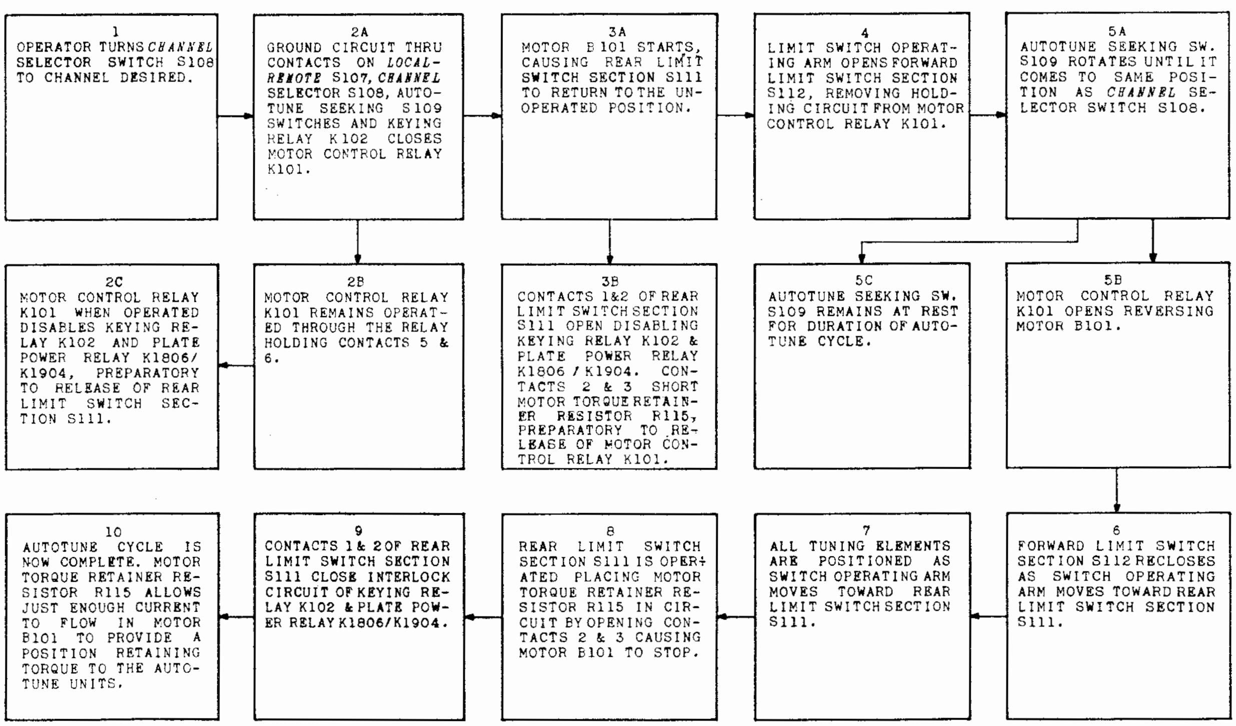


Fig. 26 Autotune Operation Sequence
(Dwg. No. 502 3850 003)

rear limit switch section, S111, complete the circuit from the power source through the contacts of the motor control relay, K101 to the Autotune motor, B101.

S112 FRONT LIMIT SWITCH SECTION. The normally closed contacts of S112 complete the holding circuit for motor control relay K101 through contacts 1 and 2 of K101. When the front limit switch section, S112, is operated by the switch operating arm, motor control relay K101 is released and the direction of rotation of the Autotune motor, B101, is reversed.

S113D KEYING INTERLOCK SWITCH. S113D is operated by the "ANTENNA TUNING—COARSE", Control "C", and prevents the operation of the keying relay K102, when the keying interlock switch S113D is open.

2.10.3.3. **Autotune Operation**

The Autotune system consists of one Multiturn unit and four Singleturn units (refer to Figures 24, 34, 35, 36, and 37) which are driven by a reversible motor through a line shaft. The Multiturn unit may be set up to select any dial setting in a continuous range of 7200 angular degrees (twenty turns or revolutions) of dial rotation. **Note:** One revolution of the dial is equal to 360 angular degrees of rotation. The Singleturn units may be set up to select any dial setting from 0 to 360 degrees of rotation (a single turn or revolution).

The drawings of the electrical and mechanical portions of the Autotune, Figures 24, 25, and 26, should be referred to in connection with the description of the operational sequence. The drawings show the Autotune in the home position.

The following sequence of operations, listed in order, represents the complete Autotune cycle:

1. The operator turns the CHANNEL selector switch, S108, to the channel desired.

2. This places a ground on the motor control relay, K101, through the circuit seeking tap switch, S109, the CHANNEL selector switch, S108, the LOCAL-REMOTE switch, S107, and the contacts of the keying relay, K102. With the keying relay, K102, in the normal or unoperated position, the motor control relay, K101, will operate and energize the Autotune motor, B101. The motor control relay, K101, is then kept energized by the circuit through contacts 5 and 6 and the limit switch section, S112. The operation of motor control relay K101 disables the keying relay, K102.

3. The motor, B101, drives the line shaft (1) in a forward direction causing all the cam drums and stop ring drums to rotate in a counterclockwise direction and the counter drum to rotate in a clockwise direction.

4. The switch operating arm (33) moves out from the rear limit switch section, S111, and moves toward the forward limit switch section, S112. Contacts #1 and #2 of the rear limit switch section, S111, open, keeping the keying relay K102 disabled when the motor control relay K101 opens.

5. The forward limit switch section S112 opens and the motor continues to run until the open segment of the circuit seeking tap switch S109 is positioned opposite the contact upon which the channel selector switch has been set by the operator.

6. As the open segment of the seeking tap switch S109 comes to the contact of the channel selected, all the cam drums are synchronized and are at the position where the pawl heels (15A) (37A) of the channel selected drop into their respective slots at the moment the cam drums are reversed.

7. Since the holding circuit has been removed, the motor control relay, K101, opens, causing the polarity of the voltage on the armature to be reversed. The motor reverses direction of rotation.

8. After the motor reverses, allowing the cam drums to engage their respective pawl

heels, the switch operating arm moves toward the rear, allowing the forward limit switch section, S112, to reclose.

9. As the motor continues to run in a reverse direction, the stop ring drum (12) of the singleturn unit rotates and when the slot on the stop ring of the channel selected is adjacent to pawl toe (15B) the pawl toe drops into the slot. The pawl toe stops the tuned element (7) at the predetermined position and the clutch slips until the Autotune cycle has been completed.

10. The counter drum (28) of the multiturn unit also rotates as the motor reverses, and when the slot of the cam on the counter drum, of the channel selected, is adjacent to the pawl tail (37B), the pawl tail drops into the slot and selects the revolution in which the tuned element (24) will be positioned.

11. As soon as the slot in the proper stop ring in this stop ring drum (36) is adjacent to the pawl toe (37C) the pawl toe drops into the slot. This stops the tuned element (24) at the preselected position and the clutch (23) slips until the Autotune cycle has been completed.

12. As the motor continues in the reverse direction, the switch operating arm moves back against the rear limit switch section, S111, stopping the motor by opening the armature circuit through contacts #2 and #3 of S111.

13. Contacts #2 and #3 of the rear limit switch section upon opening remove the short across the motor torque retainer resistor, R115, allowing just enough current to flow through the armature of motor, B101, to provide a position retaining torque to the Autotune units.

14. The contacts #1 and #2 of the rear limit switch section, S111, close, permitting the carrier to be turned on. The Autotune cycle is now complete. The carrier control circuits and Autotune control circuits are interlocked so that the Autotune will not operate when the carrier is on and the carrier cannot be turned on while the Autotune system is in operation.

2.11. UNIT FUNCTION

2.11.1. The order of the Autotune units from left to right is as follows: E, C, D, A, and B.

2.11.2. Proceeding in the order of unit function: The choice of oscillator, the high frequency oscillator range, the multiplier range and the Autotune seeking switch, S109, are controlled by Autotune unit "A"; the high frequency oscillator tuning by Autotune unit "B"; the coarse selection of inductance and capacity in connection with a given antenna by Autotune unit "C"; the variometer, providing a fine control of inductance, serving as tuning resonator by Autotune unit "D"; and the large variable condenser, providing a fine control of capacitance, serving as a loading control, by Autotune unit "E".

2.11.3. The high frequency oscillator, which is the unit at the extreme right of the transmitter is controlled by Autotune unit "B". At the back of the casting the multiplier coil forms are mounted, the slugs of which are attached to the same shaft as that controlling the oscillator slug. Also in the high frequency oscillator casting is mounted the switch, actuated by a star cam in the adjacent multiplier chassis, which changes the frequency range of the high frequency oscillator.

2.11.4. The multiplier chassis, the operation of which is controlled by Autotune unit "A", contains the star cam mentioned above plus a cam operated multi-contact switch which controls the high and the low frequency oscillators. The wafer switch nearest the Autotune unit controls the range of the first multiplier stage, the wafer switch farthest from the Autotune unit controls the range of the second multiplier stage and the remaining cam operates a switch that closes the cathode circuit of the second multiplier stage at the correct moment. Autotune unit "D" controls the variometer.

2.11.5. The network switch controlled by Autotune unit "C" varies the tap on the loading inductance and the capacity in the circuit. In the first position all of the inductance is in the circuit and in the seventh position this inductance is completely shorted out. Between ranges seven and eight a switch operates to cut in the ceramic padding condensers, various combinations of which are used from ranges eight to thirteen. In addition, a small inductance is connected across the variometer on range thirteen by the operation of one of the switch arms. A star cam on the same network switch shaft operates a switch that incapacitates the R-F portion of the complete transmitter by preventing the operation of the keying relay, K102, between the network switch settings.

2.11.6. Autotune unit "E" controls the setting of the large variable loading capacitor, plus the operation of a switch in the network switch assembly controlled by a cam attached to the variable capacitor rotor. This switch extends the range of the large variable loading capacitor by connecting three ceramic capacitors located in the network switch assembly as padders.

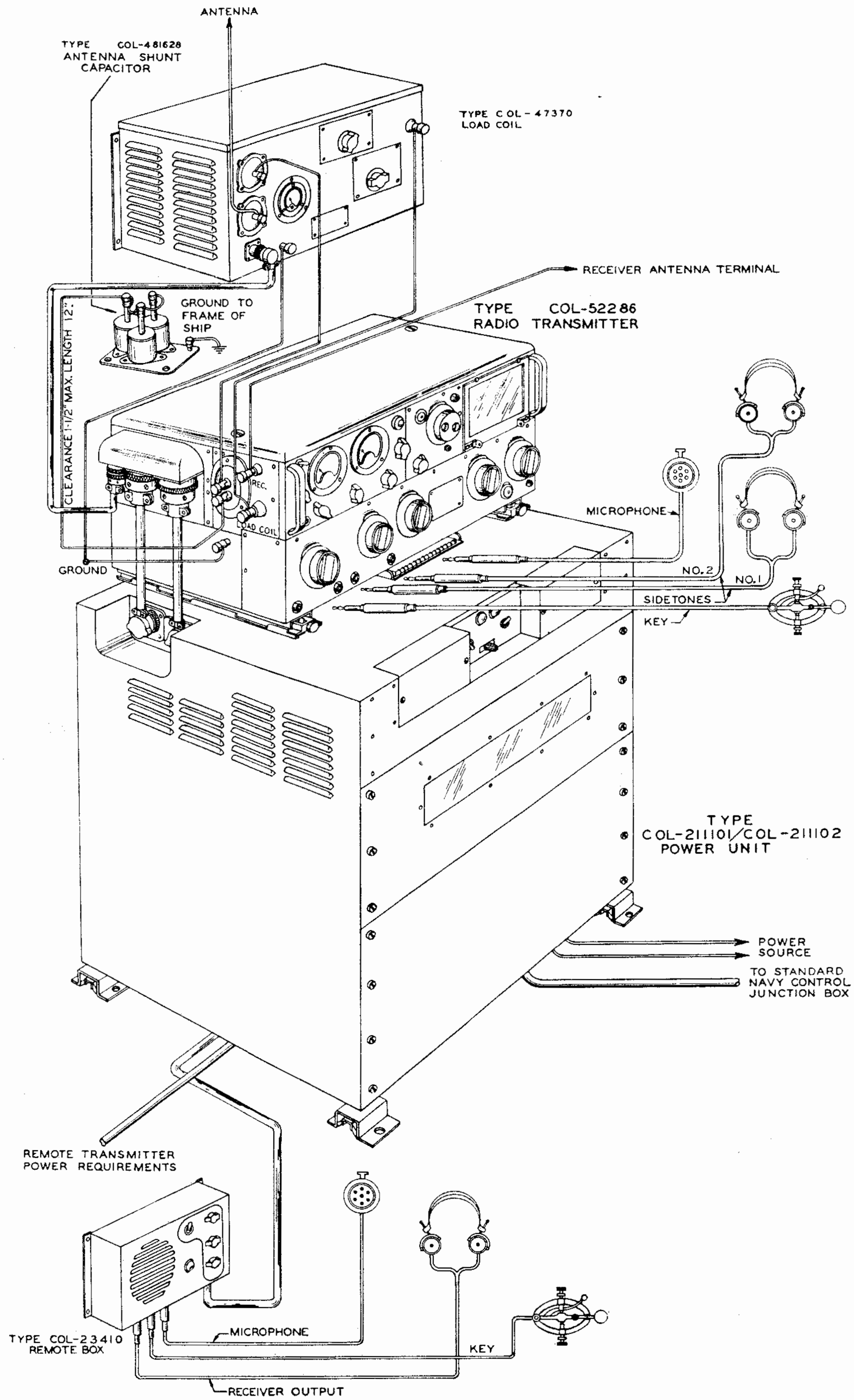


Fig. 27 Complete TCZ Installation Diagram
(Dwg. No. 500 1475 00D)

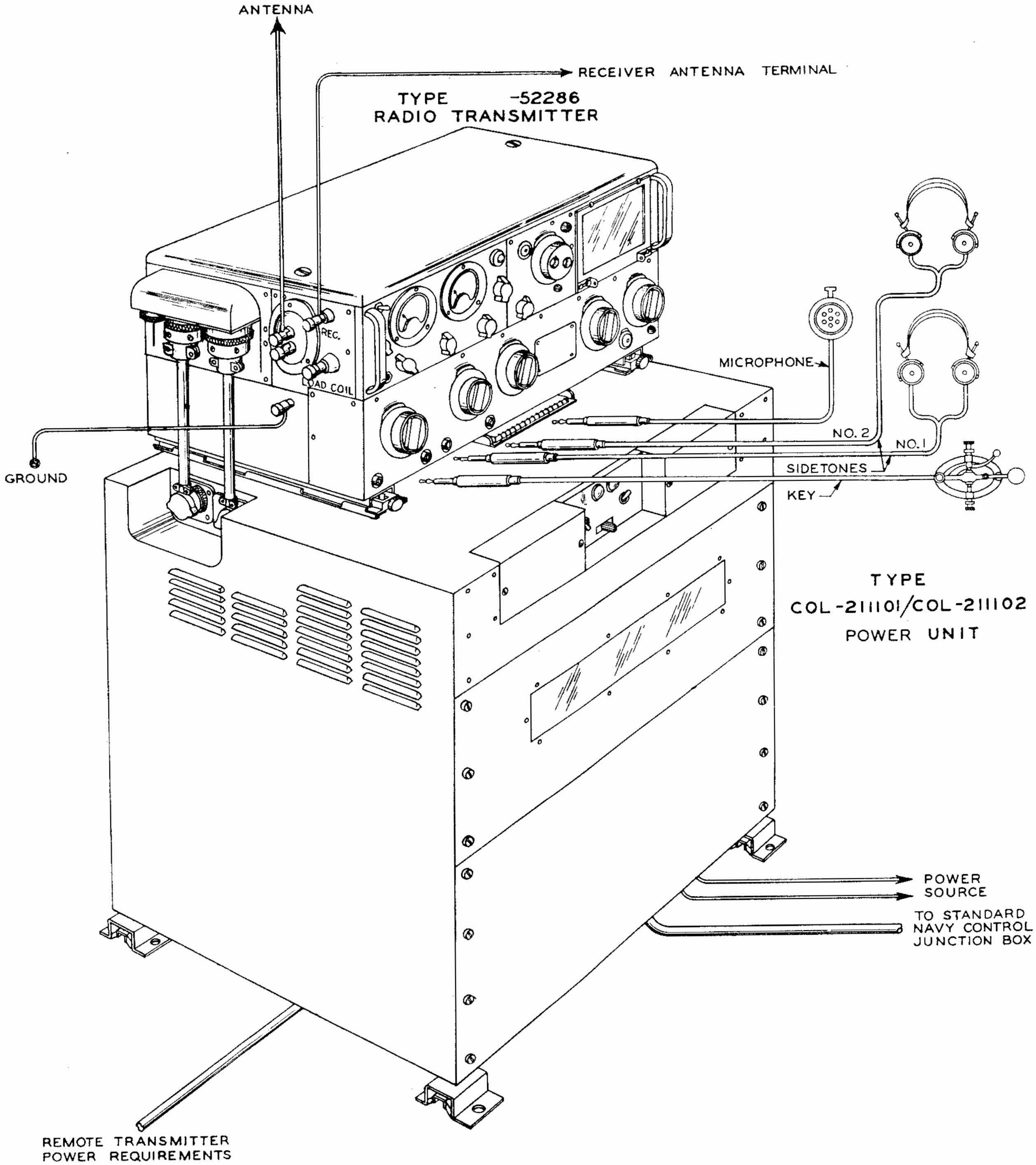


Fig. 28 Simplified TCZ Installation Diagram
(Dwg. No. 500 1474 00D)

3.1. UNCRATING

3.1.1. Open packing crates with care. When crates are marked with arrows to indicate upright position, remove crate covers only and lift units out carefully. Search all packing material for small packages. Inspect cables and wiring and be sure that all terminal connections are tight. Inspect each unit for loose screws and bolts. Be sure that 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 packing material must be preserved.

3.2. GENERAL

3.2.1. Figure 27 shows a complete TCZ installation with all the accessories necessary for transmission on any frequency within the frequency range of the transmitter and with transmitter control from either the transmitter panel or from a remote position. If the fixed antenna has sufficient capacity, the Type -481628 Antenna Shunt Capacitor Unit may be omitted from the installation.

3.2.2. The first step in preparing the transmitter for installation is to check the vacuum tubes and calibration crystal for placement in the proper sockets. The transmitting tubes and the crystal unit can be installed from the top of the transmitter unit. To remove the transmitter cabinet cover, loosen the cover hold-down screws and lift the cover upward. To remove the shield cover from the low-frequency oscillator unit remove the six screws and lift the cover off.

3.2.3. The rectifier tubes used in the A.C. power unit are installed from the front of the power unit.

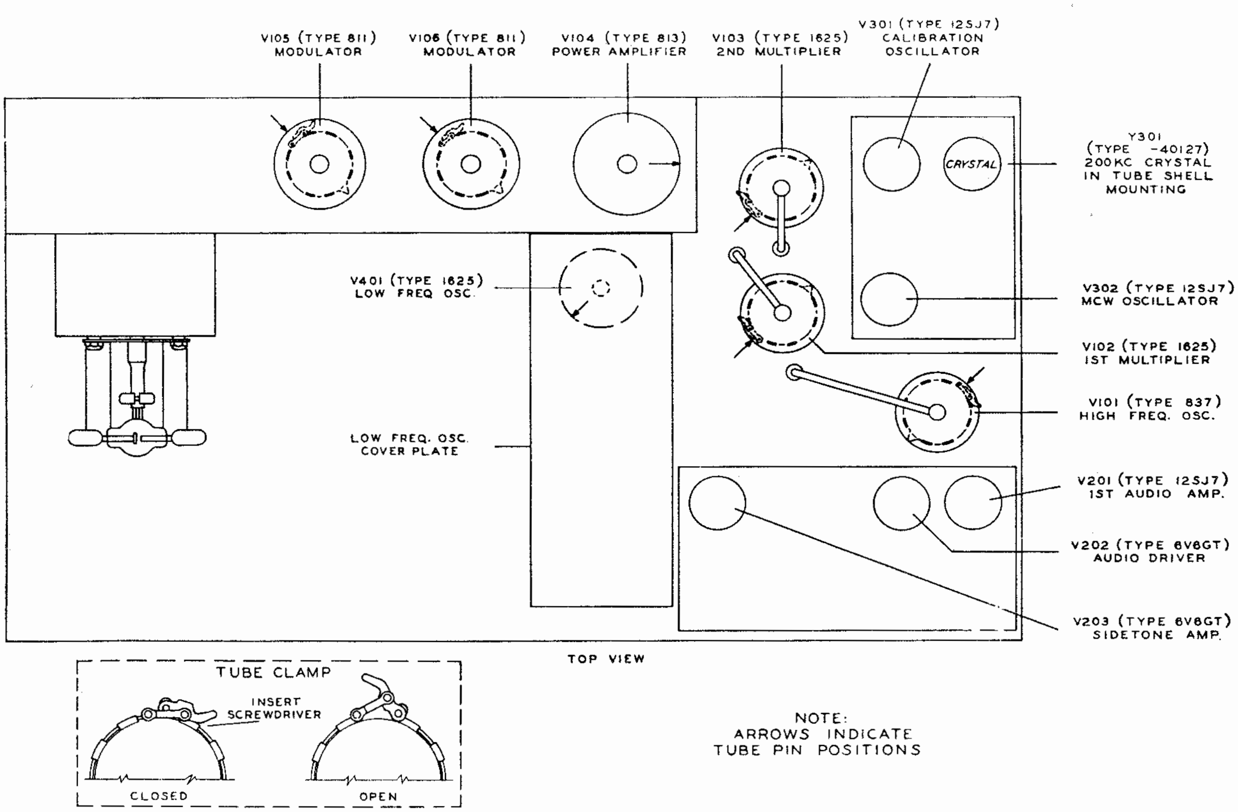


Fig. 29 Tube Placement Diagram (Dwg. No. K1627B)

3.3. TUBES

3.3.1. The tube placement diagram, Figure 29, consists of an outline drawing of the top view of the transmitter unit with cover removed. This drawing shows the proper location of the transmitting tubes and illustrates the operation of the tube clamps. Also refer to Figure 42.

3.3.2. Place all plate lead connectors firmly on the plate caps of 811, 813, 837, and 1625 tubes and lock tube clamps before replacing the oscillator shield.

Fasten the oscillator shield cover securely in position with the securing bolts.

3.4. CRYSTALS

3.4.1. The quartz crystal has been carefully calibrated, checked and sealed in the holder at the factory.

3.4.2. The Type –40127 Crystal Unit is designed to mount in a standard eight terminal octal tube socket.

3.4.3. Plug the crystal unit into the eight prong octal socket in the extreme rear right-hand corner of the transmitter as illustrated in Figure 29.

3.4.4. Replace the cabinet cover and fasten securely in position with the clamping bolts.

3.5. OPERATIONAL CHECK

3.5.1. It is recommended that the complete equipment be given an operational check before installing the units in the ship. Considerable time and labor may be saved if all units are in working order before installation. Where numerous installations are to be made, it is recommended that a test bench be set up so that each equipment may be given a careful electrical check prior to installation for operation.

3.5.2. In addition to the regular units supplied with the TCZ Series Equipment, it will be necessary to have available the correct source of power for the type power unit concerned, a set of test cables with plugs and cabling of the same type as supplied with the equipment, a set of earphones (500 ohm impedance), a single button carbon or dynamic microphone similar to the microphone that is to be used in actual operation of the equipment, a telegraph key and a dummy antenna load consisting of from 3 to 5 ohms of resistance in series with approximately 100 mmf of capacity. (Note: Make certain that the microphone circuit switch, S201, is in the correct position for the type of microphone that is being used.)

3.5.3. Using the above mentioned accessories, carefully check the operation of the transmitter unit, the power unit, and the remote control unit. Check the equipment with all types of emission and both remote and panel control. Refer to Section IV for operating instructions. If any trouble is found, it will be much less difficult on the work bench than after the installation has been completed. When the equipment has been carefully checked, the installation on shipboard may be made.

3.6. MOUNTING OF UNITS

3.6.1. Type –52286 Transmitter Unit

3.6.1.1. The transmitter proper is equipped with detachable sliding mounting tracks. Rubber shock mounts incorporated in the mounting tracks reduce the effect of the vibration and shock encountered in normal service to a minimum.

3.6.1.2. When the power unit is securely bolted in position, the transmitter may be slid into position. The unit may be slid into position from the front of the track slide or may be lowered into the slots and then slid backward approximately two inches. When the unit has been placed, the locking knob on the front edge of the track should be rotated in a clockwise direction to the locked position.

3.6.2. Power Unit

3.6.2.1. The overall dimensions for the power unit with the mounting feet positioned as furnished are: 29⅛″ high, 23⅛″ wide, and 20⅛″ deep. Note that the height is 39⅞″ for the power unit and transmitter combined. The dimensions change slightly if the mounting feet are rotated 90 degrees. Refer to Figure 81 for mounting layout and dimensions. Each mounting foot has 2 holes, which are 13/32″ in diameter, for bolting the unit to the deck. ⅜″ bolts may be used for this purpose.

3.6.2.2. Sufficient space should be left between the sides of the cabinet and surrounding objects to permit free circulation of air around and through the cabinet.

3.6.2.3. The external cable connections are made through the bottom of the power unit, near the front edge, to a terminal board that is made accessible by removing the bottom front panel.

3.6.3. Rotating Machinery

3.6.3.1. The motor-generator of the AC Power Unit is mounted on a removable chassis. All power connections are made to plugs at the rear of the chassis which engage socket terminals as the chassis is inserted into the power unit. The chassis must be inserted left end first with the right end swinging into position as the unit is moved further into the cabinet. After the connectors have been completely engaged, the securing bolt may be inserted into the top of the chassis and the two thumb-nuts inserted into the front of the chassis.

3.6.3.2. The dynamotors of the DC Power Unit are mounted on removable chassis which have plug connectors that engage socket terminals in the power unit. The chassis should be shoved straight into their respective positions with the high voltage dynamotor in the right-hand position, viewed from the front, and the low voltage dynamotor in the left-hand position. The thumb-nut locks should be rotated as far as they will go in the counterclockwise direction and then rotated in the clockwise direction until they secure the units into place.

3.6.4. Panels

3.6.4.1. The removable panels and covers on the power unit are equipped with thumb-nuts that may be secured in position by a locking wire. In installations where severe vibration is encountered, locking wires should be inserted through the thumb-nuts and through the tabs on the panels and the ends of the wires twisted.

3.6.5. Antenna Loading Coil

3.6.5.1. Installation drawing, Figure 83, shows the outline dimensions and the distances between centers of the mounting holes for the Antenna Loading Coil.

3.6.5.2. The loading coil may be mounted using universal mounting brackets on either the bottom or rear of the cabinet. The unit should be mounted within easy reach of the transmitter unit to facilitate the adjustment of the controls on the panel when making tuning adjustments for low-frequency operation.

3.6.5.3. The mounting centers are 18″ x 4.125″/4.125″ on the bottom and rear. All mounting holes are drilled for #10 screws.

3.6.6. Remote Control Unit

3.6.6.1. The Type COL–23410 Control Unit should be mounted in a position convenient to the operator. Figure 82 shows the outline dimensions and mounting details of the unit.

3.6.7. Antenna Capacitor

3.6.7.1. If operation in the frequency range of 2000 kc to 3000 kc is contemplated and the antenna does not have sufficient capacity to permit the tuning of the output circuit within this frequency range, the Type –481628 Antenna Shunt Capacitor should be connected between the COND. terminal, just below the ANT. terminal on the left-hand end of the transmitter, and ground.

3.6.7.2. Figure 84 shows the outline dimensions and mounting details of the Type –481628 Antenna Shunt Capacitor.

3.6.7.3. The capacitor should be mounted as close as possible to the left end of the transmitter cabinet so that the lead between the COND. terminal and the capacitor unit will be as short as possible. **The length of lead must not exceed 12 inches.**

3.7. CABLES

3.7.1. The external cables used with this equipment are furnished completely assembled. The construction of the 65X-7 and 65X-8 cables is shown in Figures 85 and 86 respectively while the construction of the 65X-9 cable which furnishes relay power to the load box is shown in Figure 87. Refer to Figure 88 for details of the 65X-10 remote control cable. The cables should be installed allowing sufficient length for free action of the shock mounts. Bends in the cables should be made with a radius of not less than eight inches.

3.8. CONNECTIONS

After all units have been mounted, the installation may be completed by making the power, inter-unit and antenna connections. Refer to the installation diagrams, Figure 27 and Figure 28.

3.8.1. Power Connections

3.8.1.1. Connections from the power unit to the power source should be made using two heavy cables.

3.8.1.2. Connections to the terminals provided in the base of the power unit should be clean and firm as there is considerable power drawn from the power source.

3.8.2. Inter-Unit Connections

3.8.2.1. Connections from the transmitter to the power unit are made by pre-assembled cables, see Figures 85 and 86. The 65X-7 Cable is a 27 wire cable used to transfer the control circuits from the transmitter to the base terminals of the power unit for use with the remote control box. The 65X-8 cable is a 10 wire cable used to convey the filament and plate power from the power unit to the transmitter. Each of the above cables is approximately 10½″ long including the connectors.

3.8.2.2. The 65X-7 and 65X-8 cable connectors should be inserted in their respective sockets and the locking rings tightened.

3.8.2.3. After the two-conductor cable, Figure 87, is cut to length, the two 3-terminal plugs may be fitted on the ends. The wires should be connected to pins number 2 and 3. Note that the shield is grounded on the transmitter end only. The right-angle connector is then inserted in P1001 on the load box and the straight connector in J107 on the transmitter. Tighten the locking rings on the connectors.

3.8.2.4. The 27 conductor cable should be cut to length and the 27 terminal plug fitted on one end. The other end of the cable is made up to fit the group of 27 terminals on the terminal board in the base of the power unit, these being connected straight through to J1801/J1901 thence to the 65X-7 interconnecting cable and transmitter. The 27 terminal plug should be inserted in P901 in the remote control box and the locking rings tightened.

3.8.2.5. **Note:** Safety wires should be inserted in the locking rings to prevent them from loosening under conditions of vibration.

3.8.3. Antenna Connections

3.8.3.1. Five terminals on the left-hand end of the transmitter cabinet provide terminals for connecting the antenna shunt capacitor, the load coil, the receiver antenna terminal and a ground to the output circuit and the contacts of the keying relay, K102.

3.8.3.2. A connection should be made from J1002 on the load box to the LOADING COIL terminal J117 on the transmitter and a good ground from the frame of the ship should be made to GROUND terminal J1003 on the load box. Connect terminal J1004 on the load box to FIXED ANTENNA terminal J109 on the transmitter. The Antenna is connected to ANTENNA terminal J1005 on the load coil box. Heavy stranded conductors should be used for all connections where possible and the leads should be kept short and direct.

3.8.3.3. The Type –486128 Antenna Shunt Capacitor should be connected between the lower terminal of this pair, J118, engraved COND., and ground. A heavy, stranded conductor should be used to make the connections and the lead between J118 and the capacitor should be formed to clear all metal objects by at least an inch and a half.

3.8.3.4. A good ground connection to the frame of the ship should be made to the terminal designated as GROUND, J113, using heavy bus or a heavy stranded conductor and keeping the lead as short as practicable.

3.8.3.5. To complete the installation connections, connect a jumper between the antenna terminal on the receiver and the RECEIVER terminal, J110, on the transmitter.

3.8.3.6. A connection for individual keying of double sidetone, utilizing auxiliary jack J105 in connection with SIDETONE jack J104, can be made by connecting jumper wires from terminals number 23 to 27 and 25 to 26 of remote jack J106.

3.8.3.7. The connection for single keyed sidetone plus a receiving disabling circuit, utilizing auxiliary jack J105 in connection with SIDETONE jack J104, can be made by connecting a jumper wire between terminal number 26 and terminal number 27 of remote jack J106. Terminal number 23 of remote jack J106 is connected to an arm of keying relay K102, terminal number 24 is connected to a normally closed contact with the arm and terminal number 25 is connected to a normally open contact with the arm. Terminals 23, 24, and 25 can be used for the receiver disabling circuit, connected as desired.

3.8.3.8. Connection for the purposes described can be made in a dummy plug used in remote jack J106 if REMOTE control of the transmitter is not desired. In case REMOTE control of the transmitter is desired it will be necessary to use a junction box with the remote cable, loosen the cable connector plug cover to bring out separate connections from the remote plug, and "jumper" the proper terminals together or splice the cable.

3.9. FUSES

3.9.1. All fuses for the TCZ equipment are located on either side of the power bay control panel. The fuses are protected by covers which may be removed by loosening the four thumb-nuts.

3.9.2. The fuses should be examined and their ratings checked against the table provided. It is good practice to insert each fuse as required during the initial adjustment procedure in order that any faults which may be due to errors in the interconnecting of the bays or unintentional groundings of terminals may be quickly determined and also to check and clear each individual circuit in the proper sequence. The fuses used in this equipment with the Item Number of the fuses and the unit in which these are located are tabulated below:

Item No.	Rating Amps.	Circuit	Unit Type
F1801	30	Power Line	COL–211101
F1802	30	Power Line	COL–211101
F1803	1.0	Primary of Keying Supply	COL–211101
F1804	15	Motor B1801	COL–211101
F1805	15	28 v Output	COL–211101
F1806	3	14 v Output	COL–211101
F1807	3	Low Voltage Primary	COL–211101
F1808	15	High Voltage Primary	COL–211101
F1901	30	Power Line	COL–211102
F1902	30	Power Line	COL–211102
F1903	15	Primary D1901	COL–211102
F1904	15	Primary D1902	COL–211102
F1905	15	28 v Output	COL–211102
F1906	3	14 v Output	COL–211102
F1907	1.0 (1000 v)	Low Voltage Output	COL–211102
F1908	1.0 (2500 v)	High Voltage Output	COL–211102

4.1. OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. (See Page x.)

4.2. GENERAL

4.2.1. The TCZ Equipment may be controlled from either the panel or a remote position. However, all tuning and Autotune adjustment must be made with the LOCAL-REMOTE switch, S107, in the LOCAL or panel control position, the LOCAL-REMOTE switch S1801/S1901 in the LOCAL position, and the LOCAL-POWER switch, S1802/S1902 in the ON position. Manual operation of all dials is possible without disturbing the position of the Autotune stop rings if the CHANNEL selector switch, S108, is operated to the MANUAL position and the Autotune system allowed to operate.

4.2.2. The frequency determining and tuning controls on the transmitter front panel have been assigned letter designations to aid in identifying the various dials. Reading from left to right, these controls are designated as follows: "E", "C", "D", "A", and "B".

4.2.3. The following paragraphs list the control designations together with the function of each:

4.2.4. Control "A"—"HIGH-FREQUENCY TUNING—COARSE"

4.2.4.1. Control "A" operates the high frequency oscillator range change switch, S101, the first multiplier range change switch, S102, the second multiplier range change switch, S103, the oscillator selector switch, S114, and the second multiplier operating switch, S115. Twelve positions of the control have been assigned to the high-frequency range, with the dial calibrated in megacycles. Position 13 transfers frequency control from the high-frequency oscillator tube, V101, to the low-frequency oscillator tube, V401.

4.2.5. Control "B"—"HIGH-FREQUENCY TUNING—FINE"

4.2.5.1. Control "B" determines the position of the core in the variable inductor, L101; the high-frequency oscillator grid tuning inductor. The dial is calibrated from zero to one hundred. The dial may be rotated a maximum of 20 revolutions, to give a total of 2000 dial divisions for each position of Control "A". The revolution counter, the small dial near Control "B", records the whole revolutions and the fraction of a revolution is indicated by the dial calibration. The indicating mark of dial "B" may be moved approximately forty dial divisions providing a ready means of recalibration on the high frequencies.

4.2.6. Control "C"—"ANTENNA TUNING—COARSE"

4.2.6.1. Control "C" operates the switch S113; the multi-circuit output network switch. Thirteen positions of the control are available. The setting of the dial for any frequency is largely dependent upon the antenna being used. In general, the frequency at which the antenna loading network will tune increases as the dial "C" reading is increased. **The setting of this control is critical.** If the dial is not set accurately the carrier control relay cannot be operated. An interlock switch, S113D, operated by Control "C", breaks the coil circuit of keying relay K102 during the operation of network switch S113 to prevent the burning of switch contacts. If control "C" is not set properly, the keying relay K102 will not function and the transmitter will not transmit. The network switch varies the tap on the loading inductance L113 and the capacity in the circuit. In the first position all of the inductance is in the circuit and in the seventh position this inductance is completely shorted out. Between ranges seven and eight a switch operates to cut in the ceramic padding condensers, various combinations of which are used from ranges eight to thirteen. In addition, a small inductance is connected across the variometer on range thirteen by the operation of one of the switch arms.

4.2.7. Control "D"—"ANTENNA TUNING—FINE"

4.2.7.1. Control "D" operates the variometer section of the output network. As in the case of the other controls, increasing the dial reading increases the frequency at which the network will tune, that is the inductance is a maximum at zero and a minimum at 100.

4.2.8. Control "E"—"ANTENNA LOADING"

4.2.8.1. Control "E" operates the large variable loading capacitor C125 and the associated switch S113A. The dial has two scales, one graduated from 0 to 100 and the other from 100 to 200. When the control is in the range 0 to 100 the switch S113A is in the operated position and connects the padding capacitor C124 in parallel with C125. When the dial is in the range 100 to 200, switch S113A is open, removing the padding capacitor from the circuit. A continuous extended range of capacity is obtained by this means. Maximum capacity is at 0, minimum capacity is at 200.

4.2.9. Control "F"—"LOW-FREQUENCY TUNING—COARSE"

4.2.9.1. Control "F" operates S401 to control the capacity introduced into the grid circuit of V401 and controls the position of the grid inductor tap of the low-frequency oscillator tube, V401. Six positions of this control are available.

4.2.10. Control "G"—"LOW-FREQUENCY TUNING—FINE"

4.2.10.1. Control "G" adjusts the position of the slug in the low-frequency oscillator grid inductor. The dial is similar to Control "B". The dial is divided into 100 divisions and may be rotated twenty revolutions, giving a total of 2000 dial divisions for each setting of Control "F". A small dial, the revolution counter, shows the number of whole revolutions that the dial makes. The indicator mark may be moved approximately 40 dial divisions by operating the CORRECTOR knob.

4.2.10.2. Because only one Autotune channel position has been assigned to the frequency range 300 kc to 600 kc, the LOW-FREQUENCY TUNING controls are independent of the Autotune. After the oscillator frequency within the above range has been set, Control "G" should be locked in position.

4.2.10.3. The frequency determining control "G" has been provided with a movable indicating mark to permit the adjustment of the zero setting of the dial to compensate for the slight variation in oscillator circuit components and the consequent difference in calibration.

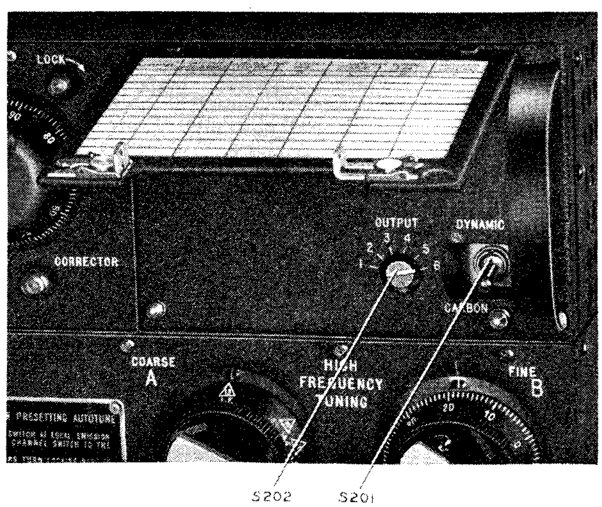


Fig. 30 Microphone Switch and Sidetone Amp. Gain Control

4.2.10.4. The microphone circuit selector switch, S201, is located beneath the tuning chart on the transmitter front panel. Before making any tuning adjustments release the chart holder clips and swing the holder upward to reveal the microphone circuit switch and the sidetone OUTPUT level control. Operate S201 to the CARBON or DYNAMIC position depending on the type of microphone to be used with the equipment.

4.3. AUTOTUNE SYSTEM

4.3.1. Before proceeding with the adjustment of the r-f and audio circuits of the transmitter, Control "A", HIGH-FREQUENCY TUNING—COARSE, should be set to the correct position for each channel. Any combination of channels and frequencies may be set up within the limits of the high frequency bands.

4.3.2. While checking the Autotune operation and setting, the EMISSION selector switch, S110, should be placed in the VOICE position. With S110 in the VOICE position, the Autotune system may be operated without applying primary power to the plate supply primaries. Placing S110 in the VOICE position operates the voice relay, K104.

4.3.3. The following procedure is recommended for the setting of the HIGH FREQUENCY TUNING—COARSE control (Control "A"):

4.3.3.1. Make certain that the MICROPHONE, KEY and throttle Switch jack circuits are open.

4.3.3.2. Rotate the CHANNEL selector switch, S108, to Position 1.

4.3.3.3. Operate the EMISSION selector switch, S110, to the VOICE position.

Note: If the Autotune system begins to run, allow it to complete the cycle of operation before proceeding.

4.3.3.4. Turn the locking bar on Control "A" one-quarter revolution in the counterclockwise direction or until the two red spots appear completely on the dial.

4.3.3.5. Select the lowest frequency of the ten operating frequencies in the range 2.0 mc to 18.1 mc.

4.3.3.6. Rotate Control "A" in a counterclockwise direction 20 to 30 degrees past the contemplated setting. **Note:** To prevent displacement of the Autotune stop rings, and to take out all slack in the mechanism, the controls should be rotated until the desired readings are obtained and the readings noted; then the controls should be rotated 20 or 30 degrees in a counterclockwise direction before being returned to the original settings.

4.3.3.7. Twelve high frequency positions of Control "A" are available. Rotate the dial in a clockwise direction to the frequency range position that includes the frequency that has been selected for Channel 1.

4.3.3.8. Lock the Autotune stop rings in position by holding the dial in the correct position and by turning the locking bar in a clockwise direction until the red spots on the dial are covered. When the dial has been locked, check the switch position by operating Control "A" in a clockwise direction until the stop ring prevents any further rotation of the control. Check the position of the control against the indicator mark on the transmitter panel. **The setting of this control is critical.** The transmitter will not operate if Control "A" is not set properly.

4.3.3.9. Rotate the CHANNEL selector switch, S108, to Position 2.

4.3.3.10. When the Autotune positioning cycle has been completed, repeat Step 4.3.3.4.

4.3.3.11. Repeat Step 4.3.3.6.

4.3.3.12. Advance Control "A" to the frequency range position that includes the frequency that has been selected for Channel 2.

4.3.3.13. Repeat Step 4.3.3.8.

4.3.3.14. Repeat the above procedure for the remaining eight high-frequency channel positions.

4.3.3.15. To complete the adjustment of frequency range switches, place the CHANNEL selector switch, S108, in the "L. FREQ." position.

4.3.3.16. When the Autotune cycle has been completed, repeat Step 4.3.3.4.

4.3.3.17. Repeat Step 4.3.3.6.

4.3.3.18. Rotate Control "A" in a clockwise direction to Position 13.

4.3.3.19. Repeat Step 4.3.3.8.

4.3.3.20. Upon operation of the Autotune system, Control "A" will reposition to channel selected by the CHANNEL selector switch, S108.

4.4. CFI ADJUSTMENT

4.4.1. Operate the power level switch, S106, to the CALIBRATE position. (Apply 1150 volts d.c. to plates of V104, V105 and V106.)

4.4.2. Insert an earphones cord plug into the SIDETONE jack, J104.

4.4.3. Operate the LOCAL-REMOTE switch, S107, to the LOCAL position.

4.4.4. Operate the EMISSION selector switch, S110 to the VOICE position.

4.4.5. While listening to the output of the earphones rotate the calibration oscillator tank, Z301, inductor tuning core until the "hiss" of the oscillator is heard, indicating that CFI oscillator tube V301 is oscillating.

4.4.6. Maximum output at the earphones may be obtained by adjustment of the tank inductor, Z301, tuning core.

4.5. R-F CIRCUIT ADJUSTMENT

4.5.1. After Control "A" has been set for the ten high-frequency channels and the low-frequency channel, the r-f circuits may be adjusted.

Note: Under no circumstances should the transmitter be actually operating (key down or microphone push-button closed) when the EMISSION selector switch, S110, is being operated. Such operation can cause an arc to occur and sustain between the contacts of CW relay K103.

4.5.2. The high-frequency oscillator grid inductor, the 1st multiplier plate inductor and the 2nd multiplier plate inductor tuning screws are "ganged" and are operated by Control "B", the HIGH-FREQUENCY TUNING—FINE control.

4.5.3. Oscillator Calibration

4.5.3.1. The low-frequency and high-frequency oscillators are electron coupled with no provision made for crystal control of the frequency of either oscillator. Therefore, a crystal controlled frequency standard has been incorporated in the equipment to be used for the calibration of the variable frequency oscillators.

4.5.3.2. Detailed Oscillator Calibration Tables (Tables I and II) are included in the DATA Section of this book. Calibrating frequency "check points" have been indicated in the calibration tables by printing them in heavy black type. The check points are frequencies at which audio beat notes between the output of the low-frequency oscillator or the output of the high-frequency oscillator and the harmonics of the 200 kc crystal may be heard. These "beat notes" are used for setting the dial and the movable indicator mark in adjusting for proper calibration of the oscillator. The frequency in the tables is given in kilocycles with the control positions in columns opposite the frequency. To obtain the settings given in the columns under B and G (B and G represent both dial designations and calibration table column headings), operate the control until the revolution counter indicates the proper number of full revolutions and the dial indicates the fraction of a revolution. For example: Opposite 250 kc the reading under "G" in the table is 1738. To obtain this setting of Control "G" rotate the dial until the revolution counter indicates that the control has been rotated 17 full revolutions from the zero setting and to complete the setting, rotate the control until 38 on the dial appears opposite the indicator mark.

4.5.3.3. The Calibration Tables give control settings at 2 kc intervals in the frequency range 200 kc to 500 kc, 5 kc intervals in the frequency range 500 kc to 8000 kc, and 10 kc intervals in the frequency range 8000 kc to 18,100 kc. The transmitter can also be set to frequencies between those given in the table by the following simplified method:

1. Find the difference between the desired frequency and the next lower frequency given in the table.
2. Multiply this difference by the number given in parenthesis at the right of the column of figures containing the next lower frequency.
3. Add the product thus obtained to the dial setting given in the table for the next lower frequency. The result is the dial setting for the desired frequency.
4. Example: It is desired to work on 9653 kilocycles. The next lower frequency given in the table is 9650, and the difference is 3. The number in parenthesis at the right of the column is 0.8. Multiplying 3 by 0.8 gives 2.4. Adding 2.4 to 636, which is the dial setting for the next lower frequency, gives 638.4 as the dial setting for 9653 kilocycles.

4.5.3.4. Oscillator Calibration Curves for all frequency bands in both the low-frequency and the high-frequency ranges are included in the DATA Section of this book.

4.5.4. Low-Frequency Oscillator Calibrations

4.5.4.1. The following procedure is recommended for the calibration of the low-frequency oscillator:

1. Having chosen an operating frequency, refer to TABLE I and locate the check point that is nearest the chosen frequency in the FREQUENCY column.

2. Operate Control "F" to the position that is given in the column under F, opposite the check point that has been chosen.

3. Rotate Control "G" to the position indicated in TABLE I in the column under G.

4. Insert an earphones cord plug into the SIDETONE jack, J104.

5. Operate the LOCAL-REMOTE switch, S107, to the LOCAL position.

6. Select the L. FREQ. Channel with the CHANNEL selector switch, S108.

7. Rotate the EMISSION selector switch, S110, to the VOICE position.

8. When the Autotune positioning cycle has been completed, check the position of Control "A". The control should stop in Position 13.

9. If Control "A" stops in a position other than Position 13, unlock the Autotune stop rings on Control "A" by rotating the locking bar in a counterclockwise direction and operate the control to Position 13.

10. Operate the power level switch, S106, to the CALIBRATE position. (Applies 1150 volts d.c. to plates of V104, V105, and V106.)

11. While listening in the earphones, ro-

tate Control "G" about the point at which it has been set and adjust the control until zero beat is obtained between the two signals, that is, zero beat between the output of the low-frequency oscillator and the output of the calibration oscillator.

12. With Control "G" set to exact zero beat, and referring to TABLE I, adjust the indicator mark by operating the CORRECTOR knob until the dial reading corresponds to the check point reading given in the Column under "G".

13. Turn Control "G" to the dial setting given in the table for the desired frequency. Tighten the dial lock. If the operating frequency desired is between those given in the table, refer to paragraph 4.5.3.3. for instructions to obtain the correct dial setting.

14. After the calibration has been checked as described above, the dial setting for the desired operating frequency may be obtained from the calibration curves in the DATA Section. However, please note: The accuracy of the dial settings obtained from the Tuning Curves is largely dependent upon the operating frequency chosen. The readings obtained at the lower frequencies will be much more accurate than those obtained for the higher frequencies.

Having completed the calibration and adjustment of the oscillator circuit, the r-f circuit adjustment may be completed by following the procedure outlined below.

4.5.5. Low-Frequency Output Tuning

4.5.5.1. When operating in the frequency range 300 kc to 600 kc the output circuit of the low-frequency oscillator is coupled directly to the power amplifier grid. Neither of the frequency multiplier stages is used. The high frequency output network, used as a combination of power amplifier plate tank and antenna coupling circuits, is also inoperative during periods of low-frequency operation. The output circuit selecting relay, K105, operates to disconnect the power amplifier plate from the network, to connect an additional choke, L109, in the power amplifier plate feed lead, to connect the power amplifier plate to the LOAD COIL terminal, J117, on the transmitter, and to connect 28 v. d.c. to the keying relay, K1001, in the L-F Load Coil Unit. Thus the antenna loading coil serves as the power amplifier plate tank and antenna coupling circuit, to replace the combination "L" and "pi" section in the transmitter proper, when output is desired in the frequency range 300 kc to 600 kc.

4.5.5.2. It is important that range 8 on Control "C" be selected when the transmitter is to be operated in the range 300 kc to 600 kc, since this setting provides the least reaction of the transmitter network to operation within these frequencies. It is possible to choose a position that dissipates power in the static drain choke, L110, when certain low frequencies are being used.

1. Frequency Range 300 Kc to 600 Kc

With the antenna connected to the ANTENNA terminal on the Type COL–47370 Antenna Loading Coil and a ground connected to the GROUND terminal, the following adjustment procedure is recommended when output is desired in the frequency range 300 kc to 600 kc:

(a) Set the range switch, S1001, operated by Control "M" on the panel of the Type COL-47370 Antenna Loading Coil Unit, to the position indicated as covering the frequency upon which operation is desired. **Note: In order to prevent doubling of frequency in the output circuit the resonant point lowest in frequency should be found.** The frequency at which the circuit will tune increases as the range control is rotated in a clockwise direction.

(b) Place the metered circuit selector switch, S105, in the P.A. PLATE position.

(c) Place the power level switch, S106, in the TUNE position.

(d) Rotate the CHANNEL selector switch, S108, to the L. FREQ. position and the EMISSION selector switch, S110, to the CW position.

(e) Operate the TEST switch, S104, to the "on" position. (Applies 1150 volts d.c. plate potential.)

(f) Immediately attempt to resonate the power amplifier plate tank circuit by rotating Control "M" for minimum P.A. PLATE meter reading dip as indicated by meter M102 on the transmitter panel. **Note: This meter registers only relative values and not actual values. A percentage scale 0-200 is provided for convenience.**

(g) Try several positions of Control "M", repeating Step (f), until the position is found that gives the maximum P.A. PLATE meter reading, provided the reading obtained is not beyond the CW area on the meter scale with power level switch S106 in the OPERATE position. Resonance is indicated as in Step (f) and the output frequency indicates fundamental tuning of the output circuit.

(h) Release the TEST switch, S104, and place the power level switch, S106, in the OPERATE position.

(i) Place the metered circuit selector switch, S105, in the P.A. GRID position.

(j) Return the TEST switch, S104, to the "on" position and check the P.A. GRID meter reading. (Applies 1150 volts d.c. plate potential.)

The meter, M102, should indicate within the yellow shaded portion of the meter scale under P.A. GRID.

(k) Assuming that normal grid current is flowing, operate the metered circuit selector switch, S105, to the P.A. PLATE position.

(l) Check to make certain that the power amplifier plate tank circuit is tuned to the point that gives the minimum P.A. PLATE current by rotating Control "N" about the original setting.

(m) **Note:** The actual value of P.A. Plate meter reading is of little importance, and will vary considerably with frequency. **Do not detune** any of the dials to make the meter read in the CW area on the meter scale. The transmitter is operated below maximum loading on some low frequencies in order to reduce flashover troubles in the loading coil.

(n) When the proper positions of the controls have been established, lock the variometer, L1002, Control "N" in the position to prevent detuning of the circuit by vibration or shock.

4.5.6. High-Frequency Oscillator Calibration

The following procedure is recommended for the calibration of the high-frequency oscillator:

1. Having chosen an operating frequency, refer to TABLE II in the DATA Section, and obtain the control settings for the check point that is nearest the chosen frequency.

2. Operate Control "A" to the position that is given in the column under "A" opposite the check point.

3. Insert an earphones cord plug into the SIDETONE output jack, J104.

4. Operate the LOCAL-REMOTE switch on the transmitter panel to the LOCAL position.

5. Operate the CHANNEL selector switch to the channel position that has been selected for the particular operating frequency.

6. Rotate the EMISSION selector switch, S110, to the VOICE position.

7. When the Autotune positioning cycle has been completed, check the position of Control "A" to make certain that the control is in the correct position for the operating frequency that has been chosen.

8. Refer to TABLE II and obtain the dial

setting of the nearest check point for Control "B" under the column headed "B".

9. Operate Control "B" to the setting obtained from the table.

10. Rotate the power level switch, S106, to the CALIBRATE position. (Applies 1150 volts d.c. to plates of V104, V105 and V106.)

11. While listening in the earphones, rotate Control "B" about the check point setting. Set the control so that zero beat is obtained between the output of the high frequency oscillator and a harmonic of the crystal calibration oscillator.

12. With Control "B" set as described above, adjust the CORRECTOR knob so that the setting of the control corresponds to the dial setting given in TABLE II for the check point that was chosen.

13. Refer to TABLE II and obtain the correct setting of Control "B" for the desired operating frequency. If the operating frequency desired is between those given in the table, refer to paragraph 4.5.3.3. for instructions to obtain the correct dial setting.

14. Set Control "B" to the reading obtained in 13 above by approaching the setting in a clockwise direction. Lock the Autotune stop rings by rotating the dials 20 or 30 degrees counterclockwise from the correct setting, approach clockwise to the correct setting and operate the locking bar. Now rotate Control "B" in a clockwise direction until the stop ring prevents further rotation. Check the dial reading with the setting previously obtained.

15. The dial setting for the desired operating frequency may also be obtained from the calibration curves in the DATA Section. However, please note; The accuracy of the dial setting obtained from the Tuning Curves is largely dependent upon the operating frequency chosen. The readings obtained at the lower frequencies will be more accurate than those obtained for the higher frequencies.

4.5.7. High-Frequency Output Tuning

The following procedure is recommended for the adjustment of the output network and power amplifier plate tank circuit for operation in the frequency range 2.0 mc to 18.1 mc:

1. Place the power level switch, S106, in the TUNE position.

2. Rotate the CHANNEL selector switch, S108, to Position 1.

3. Rotate the EMISSION selector switch, S110, to the CW position. (Applies 1150 volts d.c. plate potential.)

4. When the Autotune cycle has been completed, loosen the Autotune locking bars on Controls "C", "D", and "E", the ANTENNA TUNING and ANTENNA LOADING controls.

5. From Table III in the DATA Section of this manual find the approximate setting of Control "C" for a given antenna and operating frequency.

Control "C" decreases output network inductance in steps from position 1 to 7 inclusive. In these positions the network is connected as an "L" section.

Control "C" decreases output network capacity in steps from positions 8 to 12 inclusive. In these positions the network is connected as a "pi" section.

6. Place the metered circuit selector switch, S105, in the P.A. PLATE position.

7. Operate the TEST switch, S104, to the "on" position. (Applies 1150 volts d.c. plate potential.)

8. For practical purposes, Control "E", which operates variable capacitor C125, may be considered the fine ANTENNA LOADING control throughout the range of the output network. The approximate setting of Control "E" may be found, on a given setting of Control "C" in the positions 1 to 7 inclusive, by rotating it until a sharp drop in the

reading of P.A. PLATE meter M102 is noted indicating resonance.

9. The approximate setting of Control "E", on a given setting of Control "C" in the positions 8 to 12 inclusive, may be found by rotating "D", the ANTENNA TUNING — FINE control which operates variometer L112, throughout its range on quarter-turn settings of Control "E" until a sharp drop in the reading of P.A. PLATE meter M102 is noted indicating resonance.

10. When resonance has been established, release the TEST switch, S104.

11. Place the metered circuit selector switch, S105, in the P.A. GRID position.

12. Place the power level switch, S106, in the OPERATE position.

13. Operate the TEST switch, S104, to the "on" position.

14. Check the P.A. GRID meter reading as indicated on meter M102.

The meter should indicate within the yellow shaded portion of the meter scale under P.A. GRID.

If the power amplifier grid current is much below the above value, some adjustment of the 1st frequency multiplier plate tank inductor padding condenser or tuning slug will be necessary. The alignment procedure is explained in detail in the MAINTENANCE Section.

15. Assuming that the meter indicates sufficient power amplifier grid drive, return the metered circuit selector switch, S105, to the P.A. PLATE position.

16. Using Control "E", load the power amplifier until the P.A. PLATE meter reading is within the range designated as CW on the scale of meter M102 maintaining resonance of the circuit by rotating tuning Control "D". To increase loading, decrease the reading of Control "E" on ranges 1 to 7 inclusive of Control "C" and increase the reading of Control "E" on ranges 8 to 12 inclusive of Control "C".

It should always be kept in mind that the final result should be the maximum antenna current with rated P.A. PLATE meter reading at resonance.

Note: In order to prevent doubling of frequency in the output circuit the resonant point lowest in frequency should be found.

The frequency at which the circuit will tune increases as Control "C" is rotated to progressively higher dial readings.

17. When the above adjustments have been completed release the TEST switch and lock Controls "C", "D", and "E". **Note:** Care should be exercised when locking Controls "D" and "E" to prevent displacement of the Autotune stop rings. To set the stop rings, rotate Controls "D" and "E" until the desired meter readings are obtained, note the dial readings, release the TEST switch, rotate the controls 20 or 30 degrees in a counterclockwise direction and return the controls to the original settings before tightening the locking bars.

18. Having completed all the circuit adjustments necessary for operation on Channel 1, operate the CHANNEL selector switch, S108, to Position 2.

19. When the Autotune cycle has been completed, release the Autotune stop rings by rotating the locking bars on Controls "C", "D", and "E", one-fourth turn in a counterclockwise direction.

20. Proceed with the adjustment, repeating the procedure outlined under Steps 5 through 17 in the above discussion.

The r-f circuit adjustment should be continued for the remaining eight high-frequency channels, following the procedure as outlined for Channels 1 and 2 and keeping in mind that the final result should be the maximum antenna current with the rated P.A. PLATE meter reading at resonance.

4.6. R-F AMMETER

4.6.1. The r-f ammeter, M101, is calibrated on 2000 kc at the factory using a "dummy" antenna load comprising 10 ohms and 100 micromicrofarads. The calibration will hold approximately throughout the range of the transmitter. However, since the reading of this meter is dependent upon the impedance of the antenna being used and the operating frequency, the reading will be high when the antenna presents a low impedance and low when the antenna presents a high impedance.

4.7. AUDIO ADJUSTMENT

4.7.1. When the adjustment of the r-f circuits has been completed the transmitter is ready for operation with VOICE, CW, or MCW emission. All r-f circuit adjustments should be made with the EMISSION selector switch, S110, in the CW position. With adjustments made to give a P.A. PLATE reading within the CW portion of the meter scale, no further adjustments should be made when using the transmitter for voice or MCW emission. The value of power amplifier plate current may deviate considerably from the original CW condition but will stay well within the rating of the power amplifier tube.

4.7.2. Sidetone Amplifier Adjustment

4.7.2.1. The only adjustment available in the audio system is the adjustment of the power output of the sidetone amplifier. The control, S202, is located beneath the tuning chart on the transmitter front panel. The chart holder is hinged and may be swung upward if the clamps on the lower edge of the holder are released.

4.7.2.2. Six positions of the OUTPUT control, S202, permit the adjustment of the output available at the SIDETONE jack, J104 from 0.5 volt measured across 125 ohms in Position 1, to 9.0 volts measured across 125 ohms in Position 5, or 18.0 volts measured across 2000 ohms in Position 6.

4.7.2.3. The approximate output voltages available with the various positions of the OUTPUT switch, S202, are tabulated below:

Switch Position	Output Voltage	Load Impedance (Test)	Maximum Source Impedance
1	0.5 volt	125 ohms	5 ohms
2	1.0 volt	125 ohms	5 ohms
3	2.0 volts	125 ohms	5 ohms
4	4.0 volts	125 ohms	15 ohms
5	9.0 volts	125 ohms	25 ohms
6	18.0 volts	2000 ohms	100 ohms

4.7.2.4. The following procedure is recommended for the adjustment of the sidetone amplifier output:

1. Insert the earphones cord plug into the SIDETONE jack, J104.

2. Place the sidetone amplifier OUTPUT control (beneath chart holder) in Position 1.

3. Place the LOCAL-REMOTE switch, S107, in the LOCAL position.

4. Rotate the EMISSION selector switch, S110, to the CW position. (Applies 1150 volts d.c. plate potential.)

5. Operate the TEST switch, S104, to the "on" position.

6. While listening to the sidetone in the earphones, advance the OUTPUT control one step at a time until the desired output signal level is obtained.

7. Release the TEST switch, S104.

To further check the operation and adjustment of the sidetone amplifier circuit, proceed as follows:

8. Rotate the EMISSION selector switch, S110, to the VOICE position.

9. Insert a microphone cord plug into the MICROPHONE jack, J102.

10. Place the microphone circuit selector switch, S201, (beneath chart holder) in the position that corresponds to the type of microphone being used.

11. Press the push-to-talk switch on the microphone, (applies 1150 volts d.c. plate potential) and with the earphones in place speak into the microphone at a normal level.

12. The level of the voice signal heard in the earphones should be enough above the level of the normal voice to allow the operator to check the operation of the speech amplifier.

13. If the gain of the amplifier is not high enough to permit the monitoring of the voice signal, the sidetone amplifier OUTPUT control should be advanced one step, or as many steps as are necessary to give satisfactory amplifier output.

14. Release the microphone push-to-talk switch.

4.7.3. MCW Oscillator Adjustment

4.7.3.1. The percentage of modulation of the r-f carrier when using MCW emission is proportional to the voltage that is developed across resistor R310. The percentage of modulation may be regulated by varying the resistance of R310. The rheostat has been carefully adjusted at the factory and should not be tampered with unless it has been proven that adjustment is necessary. Resistor R310 is properly adjusted when the r-f carrier is modulated 70%.

4.7.3.2. All adjustments should be made with full voltage on the plates of the power amplifier and modulator tubes. The following procedure is recommended for the adjustment of the rheostat, R310:

1. Remove the transmitter cabinet cover, the Autotune cover plate and the wrap-around section of the right-hand end of the transmitter cabinet.

2. Remove the snap button from the side of the chassis of the MCW-CFI Unit.

3. Operate the EMISSION selector switch to the MCW position.

4. Operate the LOCAL-REMOTE switch to the LOCAL position.

5. Couple an oscilloscope to the output of the transmitter.

6. Assuming that all r-f adjustments have been completed, operate the TEST switch and adjust resistor R310 with a screwdriver until the picture on the oscilloscope screen indicates 70% modulation.

4.8. ROUTINE OPERATION PROCEDURE

4.8.1. Voice Operation—Panel Control

4.8.1.1. Place LOCAL-REMOTE switch S1801/S1901 in the LOCAL position.

4.8.1.2. Place the EMERGENCY switch S1803/S1903 in the NORMAL position.

4.8.1.3. Place the LOCAL-POWER switch S1802/S1902 in the ON position.

4.8.1.4. Place LOCAL-REMOTE switch, S107, in the LOCAL position.

4.8.1.5. Insert the microphone cord plug into the MICROPHONE jack, J102.

4.8.1.6. Check microphone switch, S201, beneath tuning chart, to make sure that the circuit selected is correct for the type of microphone to be used (carbon or dynamic).

4.8.1.7. Select the Autotune channel, corresponding to the frequency upon which output is desired, with the CHANNEL selector switch, S108.

4.8.1.8. Place the EMISSION selector switch, S110, in the VOICE position.

4.8.1.9. Place the power level switch, S106, in the OPERATE position.

4.8.1.10. Check filament voltage by rotating the metered circuit selector switch, S105, to the BATTERY VOLTAGE position.

4.8.1.11. Normal filament voltage is indicated when the needle of M102 deflects and comes to rest within the solid yellow portion of the scale under BATTERY.

4.8.1.12. Rotate the metered circuit selector switch, S105, to the P.A. PLATE position.

4.8.1.13. Press the push-to-talk button on the microphone. (Applies 1150 volts d.c. plate potential.)

4.8.1.14. Check the P.A. PLATE meter reading.

4.8.1.15. When S105 is in the P.A. PLATE position, the meter indicates the sum of the power amplifier plate and modulator static plate currents. Therefore the zero signal P.A. PLATE meter reading will be slightly higher than when operating with CW emission.

4.8.1.16. If the above readings appear to be normal the transmitter may be operated with voice emission, the carrier being controlled by the push-to-talk button on the microphone.

4.8.2. CW Operation—Panel Control

4.8.2.1. Place the LOCAL-REMOTE switch S1801/S1901 in the LOCAL position.

4.8.2.2. Place the EMERGENCY switch S1803/S1903 in the NORMAL position.

4.8.2.3. Place the LOCAL-POWER switch S1802/S1902 in the ON position.

4.8.2.4. Place the LOCAL-REMOTE switch, S107, in the LOCAL position.

4.8.2.5. Insert the telegraph key cord plug in the KEY jack, J103.

4.8.2.6. Select the Autotune channel corresponding to the frequency upon which transmission is desired, using the CHANNEL selector switch, S108.

4.8.2.7. Place the EMISSION selector switch, S110, in the CW position. (Applies 1150 volts d.c. plate potential.)

4.8.2.8. Check the filament voltage by placing the metered circuit selector switch, S105, in the BATTERY VOLTAGE position.

4.8.2.9. Normal filament voltage is indicated if the meter needle comes to rest within the solid yellow portion of the meter scale under BATTERY.

4.8.2.10. Rotate S105 to the P.A. PLATE position.

4.8.2.11. Close the telegraph key and check the P.A. PLATE meter reading. The meter M102 should indicate within the range of the yellow shaded portion of the scale designated as CW.

4.8.2.12. If the meter indicates normal operating conditions, operation with CW emission may be continued.

4.8.3. MCW Operation—Panel Control

4.8.3.1. Place the LOCAL-REMOTE switch S1801/S1901 in the LOCAL position.

4.8.3.2. Place the EMERGENCY switch S1803/S1903 in the NORMAL position.

4.8.3.3. Place the LOCAL-POWER switch S1802/S1902 in the ON position.

4.8.3.4. Place the LOCAL-REMOTE switch, S107, in the LOCAL position.

4.8.3.5. Insert the telegraph key cord plug into the KEY jack, J103.

4.8.3.6. Using the CHANNEL selector switch, S108, select the Autotune channel corresponding to the frequency upon which transmission is desired.

4.8.3.7. Place the EMISSION selector switch, S110, in the MCW position. (Applies 1150 volts d.c. plate potential.)

4.8.3.8. Check the filament voltage by rotating the metered circuit selector switch, S105, to the BATTERY VOLTAGE position.

4.8.3.9. Normal filament voltage is indicated when the needle of meter, M102, comes to rest within the solid yellow portion of the meter scale under BATTERY.

4.8.3.10. Rotate S105 to the P.A. PLATE position.

4.8.3.11. Close the telegraph key and check the P.A. PLATE meter reading.

4.8.3.12. When operating with MCW emission the meter, M102, indicates both power amplifier and modulator plate current. Therefore the meter reading will be considerably greater than for CW emission. A normal reading is indicated when the meter needle comes to rest within the solid yellow portion of the meter scale designated as MCW.

4.8.3.13. If meter readings appear to be normal, operation may be continued.

4.8.4. Operation—Remote Control Using the Type COL–23410 Control Unit

4.8.4.1. Place LOCAL-REMOTE switch S1801/S1901 in the LOCAL position.

4.8.4.2. Place the EMERGENCY switch S1803/S1903 in the NORMAL position.

4.8.4.3. Place the LOCAL-POWER switch S1802/S1902 in the ON position.

4.8.4.4. Place the LOCAL-REMOTE switch, S107, on the transmitter front panel, in the REMOTE position.

4.8.4.5. If voice operation is contemplated insert the microphone cord plug into the microphone jack, J903, located near the control cable connector plug on the side of the Type COL–23410 Remote Control Unit.

4.8.4.6. Select the Autotune channel corresponding to the frequency upon which transmission is desired, using the CHANNEL selector switch, S902.

4.8.4.7. Select the type of emission desired with the emission selector switch, S903. (If CW or MCW emission is selected, operating S903 will apply 1150 volts d.c. plate potential.)

4.8.4.8. Operate the push-to-talk button on the microphone (applies 1150 volts d.c. plate potential) if voice emission has been selected and the key if CW or MCW emission has been selected.

4.8.5. Operation—Remote Control Using Navy Radiophone Control Circuits

4.8.5.1. Place LOCAL-REMOTE switch S1801/S1901 in the REMOTE position.

4.8.5.2. Place the EMERGENCY switch S1803/S1903 in the NORMAL position.

4.8.5.3. Place the LOCAL-POWER switch S1802/S1902 in the OFF position.

4.8.5.4. Power and emission can now be controlled from remote positions by Navy Radiophone Circuits.

5.1. This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing will be necessary to maintain efficient and dependable operation.

5.2. The following sections have been compiled to aid in the checking and servicing of the equipment.

5.3. OPERATIONAL CHECK

5.3.1. The following operational checks will indicate whether or not the transmitter is operating normally.

5.3.1.1. Rotate the EMISSION selector switch, S110, to the CW position (applies 1150 volts d.c. plate potential) and after allowing the tubes sufficient time to warm up, operate the TEST switch, S104, to the "on" position.

5.3.1.2. Check the P.A. PLATE meter reading.

5.3.1.3. Release the TEST switch and operate S110 to the VOICE position.

5.3.1.4. Insert a microphone cord plug into the MICROPHONE jack, J102, press the push-to-talk switch (applies 1150 volts plate potential) and while speaking into the microphone observe the P.A. PLATE meter needle "kick." Check the position of the microphone switch, S201, to make certain that it corresponds with the type of microphone used.

5.3.1.5. Check the keying on CW and MCW by listening to the output of the sidetone amplifier and to the keyed signal on an adjacent receiver.

5.3.1.6. Check the keying using LOCAL control and an external key. Also check keying with REMOTE control.

5.3.2. If the above checks indicate normal transmitter operation, no further tests will be necessary.

5.3.3. If transmitter operation does not appear to be normal, check the (1) position of the power level switch, S106, (2) position of the EMISSION selector switch, S110, (3) position of the LOCAL-REMOTE switch, S107, (4) position of the metered circuit selector switch, S105, (5) fuses, (6) power bay operation, (7) filament voltage, (8) cable connector plugs, and (9) antenna and ground connections.

5.3.4. If the above checks fail to reveal the cause of erratic operation or transmitter failure, further trouble shooting will be necessary. The trouble shooting procedure together with the symptoms of and cures for some of the more common causes of erratic operation or transmitter failure is outlined in this section of this book under SERVICING.

5.4. ROUTINE CHECK

5.4.1. To assure efficient and dependable service, periodic operational checks should be made. The inspection and check should be made at intervals of approximately one month.

5.4.2. The following routine checks are recommended, others may suggest themselves to the maintenance personnel.

5.4.2.1. Equipment Inspection

1. Check all interconnecting cables and wires. If necessary hand-tighten all cable plug locking rings. Inspect cables for breaks and loose wires at the plugs.

2. Check the connections to the receiver, antenna, ground and loading coil, making certain that the spring connector terminals are making good contact with the wires.

3. Remove the end bells from the motor generators or dynamotors and, using com-

pressed air, blow out all carbon and copper dust from the commutator and surrounding surfaces. Inspect the brushes for wear and replace them if the carbons are shorter than ¼ inch. No lubrication of the dynamotor bearings is necessary. The bearings are sealed for the life of the unit.

4. All relays should be carefully checked at regular intervals. Check the contacts for proper alignment, pitting and corrosion. Use a burnishing tool to clean the contacts — **never use sandpaper or emery cloth.**

5.4.2.2. **Operational Checks**

To check the operation of the Autotune system, proceed as follows:

1. Place the power level switch, S106, in the TUNE position and the EMISSION selector switch, S110, in the VOICE position.

2. Beginning with Channel 1 operate the CHANNEL selector switch, S108, to each of the ten high-frequency channels. As each Autotune cycle is completed, check the position of the controls against their original settings.

3. Having checked the positioning of the ten high-frequency channels, operate CHANNEL selector switch S108 to the L. FREQ. position.

4. When the Autotune cycle has been completed Control "A" should come to rest in Position 13.

5. Assuming that the Autotune positions correctly for the eleven channel positions, operate S108 to the MANUAL position.

6. When the Autotune cycle has been completed, check the operation of all controls. Each control should move freely to permit transmitter tuning without disturbing the positions of the Autotune stop rings.

To check the operation of the power control, r-f and audio circuits, proceed as follows:

7. Operate the LOCAL-REMOTE switch S107 to the LOCAL position and the EMISSION selector switch, S110, to the CW position. (Applies 1150 volts d.c. plate potential.)

8. Rotate the metered circuit selector switch, S105, to the P.A. PLATE position.

9. Operate the TEST switch, S104, to the "on" position.

10. Check the power amplifier plate current on meter M102. The meter should indicate current within the CW portion of the meter scale.

If M102 does not indicate a P.A. PLATE meter reading within the CW portion of the scale some adjustment of the output loading may be necessary. Before attempting to readjust the output circuit for proper loading for the particular channel upon which the transmitter is operating, check the operation on the other Autotune channels by operating the CHANNEL selector switch S108.

11. If all meter readings are off in the same direction, that is, if all readings are too high or if all readings are too low, check the supply voltage.

If the supply voltage is much higher or lower than the voltage was at the time that the tuning adjustments were made and the Autotune stop rings locked, the power amplifier plate meter reading will be somewhat different than the original reading. No adjustment of the output tuning controls should be attempted if the tuning adjustments were originally made with normal supply voltage.

12. Release the TEST switch and insert a key cord plug into the KEY jack, J103. Check the keying by operating the telegraph key and listening to the keyed signal in a receiver. The transmitter should key cleanly and without noticeable chirp at speeds up to thirty words per minute.

13. Release the telegraph key and operate the EMISSION selector switch, S110, to the MCW position. (Applies 1150 volts d.c. plate potential.)

14. Operate the TEST switch, S104, to the "on" position.

15. Check the P.A. PLATE meter reading on meter M102. The meter should indicate current within the MCW portion of the meter scale.

(**Note:** When operating with MCW emission the meter M102 indicates both power amplifier plate and modulator plate currents.)

16. Release the TEST switch and insert the earphones cord plug into the SIDETONE jack, J104.

17. Insert the key cord plug into the KEY jack, J103.

18. With the earphones in position, operate the telegraph key and check the keying by listening first in the earphones and then in an adjacent receiver. The keying should be clean-cut and with little distortion of character at keying speeds up to thirty words per minute.

19. Release the telegraph key and operate the EMISSION selector switch, S110, to the VOICE position.

20. Insert the microphone cord plug into the MICROPHONE jack, J102.

21. Press the push-to-talk button on the microphone (applies 1150 volts d.c. plate potential) and check the P.A. PLATE meter reading.

22. Check the modulation by pressing the push-to-talk button on the microphone (applies 1150 volts d.c. plate potential) and speaking into the microphone at normal voice level and checking the swing of the needle of meter M102. The needle should swing up to the MCW portion of the meter scale, or slightly beyond, on voice peaks.

23. Check the operation of the speech amplifier by listening to the sidetone amplifier output while having someone speak into the microphone.

When operation from the LOCAL position has been checked, the procedure outlined below should be followed to check remote operation:

24. Operate the LOCAL-REMOTE switch, S107, to the REMOTE position.

25. Operate the emission selector switch, S903 in the Remote Control Box, to the VOICE position.

26. Following the procedure outlined for checking the Autotune system from the transmitter panel, check the operation and positioning of the dials when using the CHANNEL selector switch, S902. The position of the controls for a given Autotune channel selected with S902 should correspond to the position of the controls when the Autotune channel is selected with the panel switch S108.

27. Insert a microphone cord plug into MICROPHONE jack J903 and check the transmitter control by operating the push-to-talk button on the microphone (applies 1150 volts d.c. plate potential). Also check the condition of the audio lines from the Control Unit to the transmitter by speaking into the microphone and checking the kick of the needle of meter M102. Voice peak readings should correspond to readings obtained when checking the modulation with panel or LOCAL transmitter control.

28. Operate S903 to the CW position (applies 1150 volts d.c. plate potential) and operate the telegraph key. Check the keying by listening to the signal on a receiver.

29. Operate S903 to the MCW position (applies 1150 volts d.c. plate potential) and check P.A. PLATE by observing M102. Check the keying by listening to the keyed signal on a receiver.

5.5. SERVICING

5.5.1. If the above checks reveal erratic or abnormal operation, the tubes should be carefully checked. Tube failure is probably the most common cause of transmitter failure.

The most dependable method of checking the tubes and finding the defective tube is to replace the tubes one at a time, with tubes known to be in good condition.

5.5.1.1. In order to gain access to the tubes and other components the transmitter cover must be removed. This can be done by inserting a coin or a screwdriver in the hold-down screws, making a half turn counter-clockwise and lifting off the cover.

5.5.2. **Tube Replacement**

5.5.2.1. After having made certain that the KEY, MICROPHONE and Throttle Switch circuits are open remove the transmitter cabinet cover.

The tube clamps used in this equipment are designed to prevent the tube from coming out of the socket under vibration incident to normal service. Refer to the tube placement diagram, Fig. 29, for the exact location of the various tube clamps. The clamp on tube V101 is readily accessible through the side cover plate. The clamps on V105 and V106 are accessible through the rear cover plate. The clamps on V102 and V103 can best be reached from the top of the transmitter.

It is a simple operation to open or close a clamp in removing or replacing tubes. Insert a screwdriver where indicated in the lower left corner illustration of Fig. 29. Gently press the clamp open or closed as required. No undue exertion is necessary in operating this type of clamp. The 813 power amplifier tube, V104, removal is facilitated by inserting a screwdriver through a ventilating hole in the rear cover plate so that the screw-driver may be used as a lever between the tube base and the socket.

The 813 tube should be inserted by orienting the base pin with the slot in the hole above the socket and pressing down firmly until the tube snaps solidly in the socket.

5.5.2.2. Some of the more common symptoms of tube failure together with the tubes that may need replacement are given in the paragraphs that follow:

1. **No R-F Output in the Frequency Range 2.0 Mc to 6.0 Mc**

Three r-f tubes are in use when the transmitter is operating in the frequency range 2.0 mc to 6.0 mc, namely V101, V102, and V104. To find the particular tube that is defective replace each tube with another tube of the same type that is known to be in good condition, that is, replace one tube at a time. After each tube replacement check transmitter operation. If, after having replaced all three tubes the transmitter is still inoperative or low in output, further trouble shooting will be necessary.

2. **No R-F Output in the Frequency Range 6.0 Mc to 18.1 Mc**

When operating in the frequency range 6.0 mc to 18.1 mc a fourth r-f tube, V103, is brought into operation. If after having found satisfactory transmitter operation in the frequency range 2.0 mc to 6.0 mc, the output is discovered to be low or nil in the frequency range 6.0 mc to 18.1 mc, the trouble is likely in the 2nd multiplier stage. Replace the type 1625 tube, V103, with a tube of the same type known to be in good condition and check the operation. If the transmitter is still inoperative or the output low, the trouble is something other than a defective tube.

3. **No R-F Output L. FREQ. Channel (300 Kc to 600 Kc)**

When the transmitter is operating in the low-frequency range only two r-f tubes are used, the L-F Oscillator tube, V401, and the P.A. tube, V104. If output in the frequency range 2.0 mc to 18.1 mc is satisfactory but no output is obtained when the low-frequency channel is selected, the trouble is probably in the low-frequency oscillator stage. Replace V401 with a tube of the same type known to be in good condition and check transmitter operation. If the stage is still inoperative further tests will be necessary.

4. Satisfactory VOICE Operation—No Modulation On MCW

The same audio amplifier and modulator stages are employed for both VOICE and MCW operation, therefore, if no modulation is obtained on MCW, the MCW Oscillator tube, V302, must be inoperative. Replace V302 and while listening to the output of the sidetone amplifier or to the signal in a receiver, operate the TEST key and check the modulation. If the signal is still unmodulated it will be necessary to check the oscillator circuit.

5. Satisfactory R-F Output and Sidetone Amplifier Output — No Modulation on Either VOICE or MCW

The output of the audio driver tube, V202, is coupled to the input of the sidetone amplifier. Therefore, satisfactory output from the sidetone amplifier indicates that the audio amplifier and audio driver stages are operating satisfactorily. The output of the audio driver is also coupled through a transformer to the grids of the modulator tubes, V105 and V106. Replace the modulator tubes with tubes known to be in good condition, one at a time, and check the transmitter output for modulation. If the R-F signal is still unmodulated the trouble is other than defective tubes and further trouble shooting will be necessary.

6. Satisfactory R-F Output—No Modulation VOICE or MCW—No Output from Sidetone Amplifier

There being no output from the sidetone amplifier, it is evident that one or more of the following three stages is inoperative, audio amplifier (V201), audio driver (V202), or the sidetone amplifier (V203). Replace V201, V202, and V203 with a tube of the proper type that is known to be in good condition, one at a time, and while listening to the SIDETONE output, operate the TEST switch after each tube is replaced.

7. Satisfactory R-F Output — Satisfactory VOICE and MCW Operation When Operating in CALIBRATE Position—No Beat Note Obtainable Between R-F Oscillator Output and Calibration Oscillator Output

Satisfactory VOICE and MCW operation indicates that the r-f audio and MCW oscillator stages are operating properly, therefore, the trouble must be in the calibration oscillator circuit. Remove the calibration oscillator tube, V301, and replace with another tube that is known to be in good condition. If it is still impossible to obtain a beat note between the two signals, the trouble is still likely in the calibration oscillator circuit but is something other than a defective tube.

8. Low R-F Output

If the grid meter reading is satisfactory and the transmitter is otherwise apparently operating satisfactorily, note the extent to which the P.A. PLATE meter reading soars off resonance with power level switch S106 in the OPERATE position. Failure of the P.A. PLATE meter reading to soar more than 10% usually indicates low emission of the 813 final amplifier tube, V104. Normal off resonance P.A. PLATE meter reading will be found to be about 200. If it appears that the off resonance reading is considerably more than 200 the 813 tube will usually be found to be "soft" or "gassy."

9. High Distortion on VOICE

Replace the 813 tube if after checking the speech amplifier tubes, the audio unit itself and the modulator tubes, V105 and V106, high distortion exists at full modulation. Since both the screen and the plate of the tube have separate modulation transformer windings it is possible for a condition to exist where the proportion of current drawn by the 813 screen and plate is not normal which can cause a mismatch to occur in the modulation transformer at high audio levels.

5.5.3. Trouble Shooting

If replacing vacuum tubes has failed to remedy the trouble and the transmitter is still inoperative or not operating properly, further trouble shooting will be necessary.

A few tools and an indicating instrument are absolutely essential. In addition to the tools ordinarily available (screwdriver, pliers, soldering iron, etc.) a volt-ohmmeter capable of measuring d-c voltages up to 1500 volts is necessary. Any voltmeter having high internal resistance (1000 ohms per volt) will suffice but a meter of the vacuum tube type is recommended. High voltage circuits should not be checked with a voltmeter unless other means cannot be used. This practice is advocated in the interest of safety.

1. Remote Control Unit

To gain access to the components in the Remote Control Unit, remove the mounting plate by removing the four thumb nuts on the front panel. The contacts on the ganged switch sections may require cleaning or if the unit has been exposed to an extreme shock the switch pies may require replacement.

2. Dynamotors

IN MEASURING VOLTAGES WHEN THE H.V. DYNAMOTOR IS IN OPERATION, EXTREME CARE SHOULD BE EXERCISED TO PREVENT PERSONAL INJURY. WHEN OPERATED UNDER NORMAL CONDITIONS THE POSITIVE OUTPUT CIRCUIT OF THE DYNAMOTOR IS AT A POTENTIAL OF 1150 VOLTS ABOVE GROUND.

There are three sets of brushes in each dynamotor. If a dynamotor fails to start when the primary circuit is closed the 115 volt brushes should be inspected for wear and if the brushes show signs of considerable wear, replacement should be made. If a dynamotor rotates but fails to give the required voltage, remove both end bells from the dynamotor and inspect the output commutator brushes. The brushes may need replacement or copper dust may have accumulated between commutator bars causing short circuiting of some of the segments of the armature. To remove the copper dust use a stream of compressed air. If the brushes are worn down to one-quarter inch or less in length the brushes should be replaced.

The above statements concerning cleaning the commutator, and inspection and replacing the brushes apply also to the motor-generator in the A-C power unit.

3. Power Control Relays

Failure of the power units to operate properly may be traced to inoperative power control relays. The relay coil circuit may not be closing due to defective switch contacts or the relay contacts may be corroded, pitted, or out of adjustment. Failure of the rectifier filaments to light or the filament motor generator to rotate may be traced to K1801/K1901 while plate power failure for all tubes may be traced to K1806/K1904.

To clean the contacts of these relays, always use a burnishing tool—**never use sandpaper or emery cloth.**

4. Antenna Loading Coils

The antenna loading coils should require very little maintenance but components such as switches, capacitors and inductors may require adjustment or replacement if the equipment has been subject to overload or extreme mechanical shock.

To gain access to the components in the Antenna Loading Coil Unit, remove the screws in the top that hold the cover on and remove the cover. The switch contacts may become corroded and require cleaning. The static drain choke or the capacitor may become defective and cause failure or erratic operation when operating in the frequency range 300 kc to 600 kc. The static drain choke may become open circuited or the capacitor may become shorted. All components are exposed when the cover is removed and may be checked with standard test equipment.

5. Transmitter Unit

Three of the sub-units in the Type –52286 Transmitter Unit, the L-F Oscillator Unit, the MCW-CFI Unit and the Audio Amplifier Unit, may be readily removed for checking and the replacement of parts. The three units have been equipped with multi-terminal connector plugs to permit the removal of the sub-units from the transmitter without the use of a soldering iron.

The following procedure is recommended for the removal of the above named units:

(a) L-F Oscillator Unit

(1) Remove the connector wire from the right-hand side of the unit.

(2) Remove the seven screws that hold the low-frequency panel in place.

(3) Loosen all screws along the top edge of the Autotune front cover plate.

(4) Remove the plate lead from the 813 power amplifier tube, V104, and remove the tube from the socket by inserting a screwdriver through a ventilating hole in the back of the transmitter and using it as a lever between a tube base and the socket. Lift the tube out.

(5) Insert a screwdriver through the ventilating holes at the back of the transmitter and remove the screws that hold the back of the unit.

(6) The unit is now free of all retaining screws and wires and may be removed from the transmitter by raising the rear edge of the oscillator unit to free the front panel from the Autotune cover plate and then raising the unit until the connector plug is free.

Note: Some l-f oscillator components are accessible from the top of the unit (cover removed). The **wrap-around** shield may be removed to permit the checking or replacement of the remaining components.

(b) MCW-CFI Unit

(1) Loosen the two large screws that hold the unit to the main transmitter chassis.

(2) Raise the unit until the connector plug is disengaged.

(3) Tip the unit toward the frequency multiplier tubes, V102 and V103, until the transformer clears the cabinet cover clamping bracket.

(4) All circuit components are accessible from the bottom of the unit.

(c) Audio Amplifier Unit

(1) Loosen the two large screws that hold the unit to the main transmitter chassis.

(2) Remove the plate cap from the high-frequency oscillator, V101, and remove the tube from the socket.

(3) Raise the unit until the multi-terminal plug becomes disengaged from the receptacle.

(4) Slide the unit backward until the cabinet studs are cleared and raise the audio amplifier unit upward.

(d) High-Frequency Oscillator

The frequency multiplier plate tank inductors are readily accessible if the cabinet **wrap-around** plate is removed from the right-hand end of the transmitter cabinet. Four screws in the rear and ten screws on the side hold the plate in position. An additional shield covers the section of the casting that houses the high-frequency oscillator circuit components. If this inner shield is removed all oscillator circuit components will be exposed and available for checking and replacement. Do not remove this inner shield or make any adjustments of the h-f oscillator condensers or slug unless the calibration of this oscillator is thoroughly understood.

(e) Frequency Multiplier

Some of the frequency multiplier circuit components are accessible from the bottom of the transmitter if the bottom cover plate is removed. To gain access to the remaining frequency multiplier circuit components, the multiplier unit must be removed from the assembly.

The following procedure is recommended for the removal of the multiplier unit from the transmitter.

(1) Remove the plate caps from the frequency multiplier tubes, V102 and V103, unlock the tube base clamps and remove the tubes from the sockets. Disconnect the Low Frequency Oscillator Plate lead at the Oscillator end.

(2) Remove the transmitter bottom cover plate and the Autotune cover plate.

(3) Remove the Autotune Unit "A" in the following manner: Turn the dial locking bar to the unlocked position and loosen the two #10 bristo set screws in the dial. Turn the dial and locking bar counterclockwise together until the bar comes free. Remove both the dial and the locking bar. Remove the dial back plate, loosen the two long screws on the top end of the unit and the short screw on the bottom end of the unit. Carefully lift the unit out.

Caution: Care must be exercised not to move any of the Autotune mechanisms from the time the unit is loosened until the unit is again securely in place, otherwise the unit may be thrown out of synchronization.

(4) When the Autotune Singleturn Unit has been removed, remove the screws holding the seeking switch, S109, to the Autotune casting and swing the switch out.

(5) Heat and remove the wires leading to the multiplier coils at the rear of the High Frequency Oscillator Unit. Heat and remove the bus wire connected to coupling capacitor C116.

(6) Remove the two screws just behind the second multiplier tube clamp shell and the two screws just in front of the first multiplier tube clamp shell.

(7) The multiplier unit can now be pulled out sufficiently to remove the nut holding the ground wire lug on the side of the unit adjacent to the fire wall assembly. Remove cable connector J115 from P101 in the multiplier unit.

(8) The multiplier unit may now be lifted out of the transmitter.

(9) In reassembling the transmitter it is essential that the shaft of seeking switch S109 be carefully centered with the cam drum shaft that drives it. This may be checked by referring to section 5.7.4., except that the position of the switch and not the driving arm should be adjusted.

(f) Oscillator Casting

The removal of the High-Frequency Oscillator is not recommended unless it is absolutely necessary.

The following procedure is recommended for the removal of the oscillator casting from the transmitter:

(1) Remove the plate cap from the high-frequency oscillator tube, V101, unlock the tube base clamp and remove the tube from the socket.

(2) Remove the MCW-CFI and the Audio Units as outlined in the preceding section.

(3) Remove the two screws that hold J111, the MCW-CFI Unit Connector plug receptacle, to the standoffs and unsolder the single wire that connects the high frequency oscillator tube V101 cathode to terminal 1 on J111.

(4) Remove the Autotune cover plate and wrap-around section of the transmitter cabinet.

(5) Remove the locking bar and dial from Control "A" by turning the dial locking bar to the unlocked position, loosening the two #10 bristo set screws in the dial, and turning both locking bar and dial counterclockwise until free. Remove the dial back plate.

(6) The Autotune Singleturn Unit adjacent to the High-Frequency Oscillator Multiturn Unit must be removed so that the screws that hold the oscillator casting to the Autotune casting may be loosened. To remove this unit loosen the short screw that holds the lower edge of the unit to the Autotune casting and the two long screws that hold the upper edge of the unit to the casting and lift the unit carefully out of position.

Caution: Care must be exercised not to move any of the Autotune mechanisms from the time the unit is loosened until the unit is again securely in place, otherwise the unit may be thrown out of synchronization.

(7) When the Autotune Singleturn Unit has been removed, loosen the screws that hold the castings together in the front and top of the chassis.

(8) To complete disconnecting the h-f oscillator, move the casting slightly to the right and unsolder the connections to the terminal strip on the inner side of the casting and the wires leading to the frequency multiplier plate tank inductors.

(9) The h-f oscillator casting assembly may now be removed from the transmitter.

All components not included in units that may not be removed from the main assembly of the transmitter have been mounted in positions so as to be as accessible as possible in the limited space available. The cabinet cover, bottom plate and Autotune cover plate are all removable from the main assembly. The location of the part to be checked or replaced will determine the section of the cabinet that is to be removed.

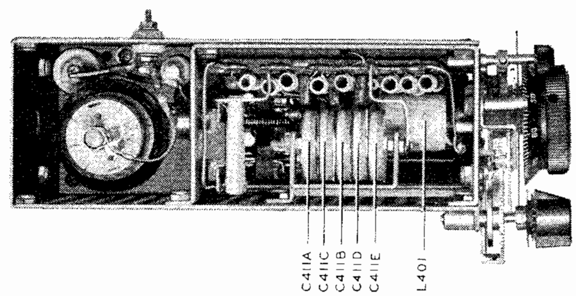


Fig. 31 Low Frequency Oscillator

5.6. RADIO-FREQUENCY CIRCUIT ALIGNMENT

5.6.1. Low-Frequency Oscillator Alignment

5.6.1.1. If low-frequency oscillator circuit components have been damaged or replaced, the grid circuit may require realignment. For realignment of the circuit the following procedure should be followed:

1. Operate Control "F" to Position 6 (1035 kc to 1500 kc).

2. Operate the EMISSION selector switch, S110, to the VOICE position.

3. Rotate the CHANNEL selector switch, S108, to the L. FREQ. position.

4. When the Autotune cycle has been completed check the position of Control "A".

The control should stop in Position 13. If the control stops in any position other than number 13, loosen the locking bar and manually operate Control "A" to Position 13.

5. Refer to TABLE I in the DATA Section of this book and select a dial setting under column G that is near the middle of the tuning range. If there is a dial setting listed on each side of the midpoint of the tuning range, select the dial setting on the high-frequency side.

For example, 1073 in the column under G is very near the midpoint of the tuning range of the control. (The exact midpoint is 1000.)

6. Rotate Control "G" to the dial setting that has been chosen from the calibration table.

7. Operate the power level switch, S106, to the CALIBRATE position. (Applies 1150 volts d.c. to plates of V104, V105, and V106.)

8. Insert an earphones cord plug into the SIDETONE output jack, J104.

9. While listening to the SIDETONE amplifier output, rotate Control "G" about the setting obtained from the calibration table until exact zero beat is obtained between the output of the low-frequency oscillator and the output of the calibration oscillator.

10. Check the dial setting and lock the dial.

11. Loosen the two set screws that hold the knob to the shaft of Control "G" and without detuning the circuit, rotate the knob on the shaft until the dial setting corresponds to the setting given in the calibration table and tighten the set screws.

Rotate Control "G" to home stop position near zero. Loosen the two set screws on the counter dial mechanism collar attached to the main oscillator shaft and holding the mechanism at zero, rotate Control "G" to zero. Tighten the set screws.

12. Operate Control "F" to Position 5.

13. As explained in steps 5 and 6, select a dial setting from TABLE I near the middle of the tuning range.

14. Note the numbered slots on the oscillator shield cover exposing the trimming capacitor, C411.

15. While listening to the SIDETONE output, adjust capacitor section E (5) of C411, with any narrow tool, until zero beat is obtained between the low-frequency oscillator output and the output of the calibration oscillator.

16. Operate Control "F" to Position 4 and repeat steps 13 and 15 adjusting section D (4) of C411 instead of section E.

17. Repeat steps 13 and 15, adjusting capacitor trimmer sections C (3), B (2) and A (1), for Control "F" Positions 3, 2, and 1, respectively.

18. Check the excitation over the entire range of each position of Control "F" by rotating Control "G" through twenty revolutions for each position of Control "F".

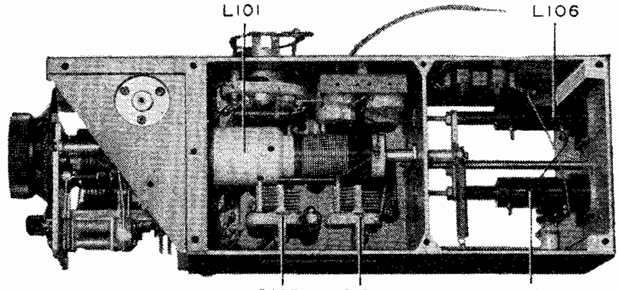


Fig. 32 High Frequency Oscillator

5.6.2. High-Frequency Oscillator Alignment—(Using CFI)

5.6.2.1. If the high-frequency r-f circuits are to be realigned in the field, where no frequency measuring equipment is available, the calibration oscillator may be used to check the band end-point frequencies. However, if coils, transformer cores, capacitors, etc., in the oscillator circuit require replacement, an accurate means of measuring frequency must be used together with a portable wave meter to check the harmonic output of the frequency multiplier.

5.6.2.2. For realignment when a frequency standard is not available, the following procedure should be followed:

1. With the EMISSION selector switch, S110, in the OFF position, remove the cover plate from the right-hand end of the transmitter cabinet. Remove the small plate on the bottom of the oscillator casting. This plate covers the holes provided for the adjustment of trimmer capacitors C134 and C135. The h-f oscillator grid trimmer capacitors, C134 and C135, the h-f oscillator grid inductor, L101, tuning slug adjustment and the frequency multiplier plate inductor, L105 and L106, tuning slug adjustments are thus exposed.

2. Rotate the CHANNEL selector switch, S108, to the MANUAL position.

3. Operate the EMISSION selector switch, S110, to the VOICE position.

4. When the Autotune cycle has been completed, operate Control "A" to Position 2.

5. Set the indicator mark, over Control "B", to mid-scale using the CORRECTOR knob.

6. Refer to TABLE II in the DATA section of this book and obtain the dial setting of Control "B" for output on 2400 kc with Control "A" in Position 2. (Oscillator output on 1200 kc.)

7. Rotate Control "B" to the setting obtained from the table. Approach the setting in a clockwise direction.

8. Loosen the nut on the rear of the lead screw that holds the multiplier tuning slug yoke to the screw.

9. Insert an earphones cord plug into the SIDETONE output jack, J104.

10. Operate the power level switch, S106, to the CALIBRATE position. (Applies 1150 volts d.c. to plates of V104, V105, and V106.)

11. While listening to the SIDETONE output in the earphones, and keeping Control "B" set at the position obtained from the table, adjust the position of the h-f oscillator grid inductor tuning slug by rotating the tuning slug screw with pliers, the jaws of which have been padded to prevent marring the shaft, until zero beat is obtained between the output of the calibration oscillator and the output of the high-frequency oscillator. **Note:** Caution should be exercised in the adjustment of the position of the tuning slug when no frequency standard is available. A fraction of a revolution in one direction or the other should realign the circuit.

12. When zero beat has been obtained, carefully tighten the nut on the end of the slug screw to prevent further displacement of the tuning slug.

13. Refer to TABLE II in the DATA section and obtain the correct position of Control "B" for output on 3000 kc with Control "A" in Position 2. (Oscillator output on 1500 kc.)

14. Rotate Control "B" to the setting obtained from the table. Approach the setting in a clockwise direction.

15. Adjust trimming capacitor C134, until zero beat is obtained between the output of the h-f oscillator and the output of the calibration oscillator.

16. Check several points in the band by obtaining Control "B" settings from TABLE II and listening to the beat note output of the SIDETONE amplifier.

17. If the setting of Control "B" necessary to obtain exact zero beat deviates more than 4 or 5 dial divisions from the setting given in the calibration table, repeat steps 6 through 16 of the above procedure until the dial settings necessary to obtain a given frequency correspond very closely to those given in the calibration table.

18. When alignment adjustments have been completed with Control "A" in Position 2, operate the control to Position 1.

19. Refer to TABLE II opposite 2000 kc (Control "A" in Position 1) and obtain the

dial setting for Control "B". (Oscillator output on 1000 kc.)

20. While listening to the SIDETONE output, adjust trimming capacitor C135, until zero beat between the high-frequency oscillator output and the calibration oscillator output is obtained.

Note: Do not make any further adjustments of trimmer C134.

21. Check several points within the frequency range 2000 kc to 2400 kc by obtaining the dial setting of Control "B" from the table, listening to the SIDETONE output and operating Control "B" about the setting obtained from the Calibration Table. The settings should check with those given in the table within 4 or 5 dial divisions.

Note: No adjustment of the high-frequency oscillator grid inductor slug should be made with Control "A" in Position 1.

22. Return the EMISSION selector switch, S110, to the OFF position.

5.6.3. High-Frequency Oscillator Alignment — (Using External Frequency Standard)

5.6.3.1. If oscillator circuit components have been replaced and an accurate frequency standard is available the following procedure should be followed for the alignment of the high-frequency oscillator circuit:

1. With the EMISSION selector switch, S110, in the OFF position remove the cover plates from the right-hand end and bottom of the transmitter cabinet. The h-f oscillator grid trimmer capacitors, C134 and C135, the h-f oscillator grid inductor, L101, tuning slug adjustment and the frequency multiplier plate inductor, L105 and L106, tuning slug adjustments are exposed.

2. Rotate the CHANNEL selector switch, S108, to the MANUAL position.

3. Operate the EMISSION selector switch, S110, to the VOICE position.

4. When the Autotune cycle has been completed, operate Control "A" to Position 2.

5. Set the indicator mark, over Control "B", to mid-scale using the CORRECTOR knob.

6. Refer to TABLE II and obtain the dial setting for an output frequency of 2400 kc with Control "A" in Position 2. (Oscillator output on 1200 kc.)

7. Rotate Control "B" to the setting obtained from the table.

8. Loosen the nut on the rear of the lead screw that holds the multiplier tuning slug yoke to the screw.

9. Operate the power level switch, S106, to the CALIBRATE position. (Applies 1150 volts d.c. to plates of V104, V105, and V106.)

10. Measure the output frequency of the oscillator and adjust the position of the tuning slug in L101 until the oscillator frequency is exactly 1200 kc.

11. When the correct position of the tuning slug has been found tighten the locking nut to prevent any further displacement of the slug.

12. Refer to TABLE II and obtain the setting of Control "B" necessary to obtain an output frequency of 3000 kc with Control "A" in Position 2. (Oscillator output on 1500 kc.)

13. Rotate Control "B" to the setting obtained from the table.

14. Measure the output frequency of the oscillator and adjust capacitor trimmer C134 until the frequency of the oscillator output is exactly 1500 kc.

15. Check several points within the band by obtaining dial settings from the calibration tables, rotating Control "B" to these settings and measuring the frequencies.

Note: Always keep in mind that with Control "A" in Positions 1 or 2 the frequencies given in the calibration tables are always twice the output frequency of the oscillator.

With the power level switch in the CALIBRATE position only the oscillator is operating, therefore, the output frequency to be measured will always be one-half the frequency that is given in the calibration table.

16. If the dial settings of Control "B" necessary to obtain output on a selected frequency deviates more than 4 or 5 dial divisions from the dial setting given in the calibration tables repeat steps 6 through 15 until the actual dial setting of Control "B" necessary to obtain a given output frequency corresponds very closely to the setting given in the table.

17. When alignment has been completed with Control "A" in Position 2, operate the control to Position 1.

18. Refer to TABLE II and obtain the dial setting of Control "B" to obtain an output frequency of 2000 kc with Control "A" in Position 1. (Oscillator output on 1000 kc.)

19. Adjust trimmer capacitor C135 (Fig. 47) until the oscillator output frequency is exactly 1200 kc.

Note: Do not make any adjustment of C134 or the core in inductor L101 with Control "A" in Position 1.

20. Check several points within the band by comparing the actual dial settings necessary to obtain a given frequency with the dial settings given in the calibration tables for the same frequency. The settings should check within 4 or 5 dial divisions.

21. Return the EMISSION selector switch, S110, to the OFF position.

5.6.4. Frequency Multiplier Alignment

5.6.4.1. Having completed the alignment of the high-frequency oscillator circuit complete the r-f circuit alignment by following the procedure outlined below for the adjustment of the frequency multiplier circuits:

1. With the transmitter tipped up on the rear edge and bottom cover removed, the frequency multiplier plate tank capacitors are exposed.

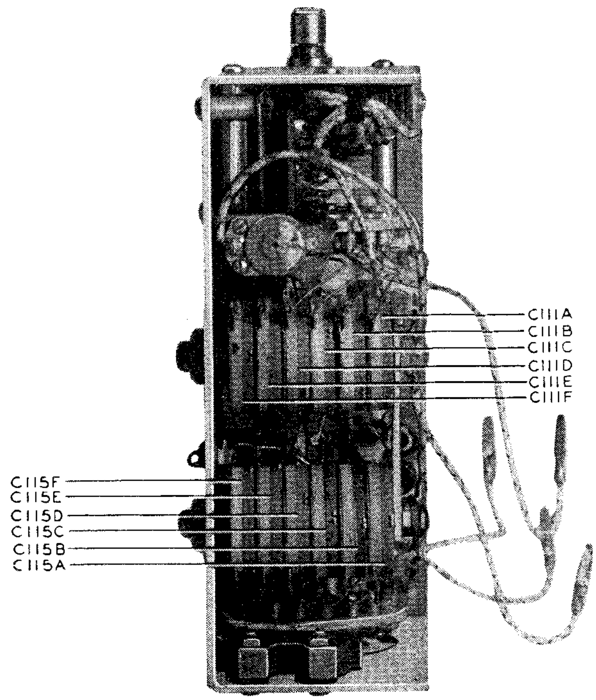


Fig. 33 Frequency Multiplier Bottom View

The multiplier plate tank capacitors are located beneath the multiplier chassis. (Stacks of ceramic capacitor sections.) Capacitor section A of each capacitor, C111 and C115, is located nearest the right-hand side of the transmitter, as the transmitter is viewed from the bottom, with sections B, C, D, E, and F in order in the stack.

2. Operate Control "A" to Position 6.

3. Rotate the metered circuit selector switch, S105, to the P.A. GRID position.

4. Rotate Control "B" until the dial reading is 1100.

5. Operate the power level switch to the TUNE position.

6. Operate the EMISSION selector switch, S110, to the CW position. (Applies 1150 volts d.c. plate potential.)

CAUTION: USE AN INSULATED TOOL

TO ADJUST THE CAPACITORS. WHEN THE KEY IS OPERATED THE CAPACITOR IS AT A POTENTIAL OF 400 VOLTS ABOVE GROUND.

7. Insert a shorted plug in KEY jack J103 and adjust section F (bottom of stack) of first multiplier padding capacitor C111 to the position that will give the maximum P.A. GRID meter reading on M102.

Note: To vary the capacity of sections of C111 or C115 rotate the metal lip that protrudes between capacitor sections.

8. Using a portable wavemeter check the output frequency of the first frequency multiplier stage to be sure that the plate circuit is tuned to the correct harmonic. The output should be on approximately 5400 kc with Control "A" in Position 6 and Control "B" tuned to a dial reading of 1100.

9. When it has been ascertained that the multiplier output is on the correct harmonic rotate Control "B" over the entire range and observe the grid reading on meter M102.

CAUTION: WHEN THE KEY IS OPERATED THE INDUCTORS L105 AND L106 ARE AT A POTENTIAL OF 400 VOLTS ABOVE GROUND.

10. Take out dips in the meter reading by adjusting section F of first multiplier padding capacitor C111 for an average reading of the meter.

CAUTION: WHEN THE KEY IS OPERATED THE INDUCTORS L105 AND L106 ARE AT A POTENTIAL OF 400 VOLTS ABOVE GROUND.

11. A drop at the extreme ends of the range is permissible but if the meter needle still dips sharply at the other point, rotate Control "B" to a dial reading of 1100, loosen the first multiplier inductance L105 tuning slug locking nut and change slightly the position of the tuning slug. Tighten the slug locking nut.

12. Rotate Control "B" over the entire range and check the P.A. GRID current. Meter M102 should indicate a consistent value of grid current over the entire range. If the meter needle dips sharply at any point repeat steps 10 and 11.

13. Having completed the adjustment of the inductor slug and section F of C111, remove the key shorting plug and rotate Control "A" to Position 5.

14. Rotate Control "B" to a dial reading of 1100.

15. Replace the key shorting plug, adjust section E of capacitor C111 to give a maximum P.A. GRID meter reading and check with a wavemeter for the correct harmonic.

Note: Do not make any further adjustments of the position of the tuning slug in L105.

16. Rotate Control "B" through the entire range and check the excitation. If dips occur in the meter reading readjust padding capacitor C111E.

17. Remove the key shorting plug and operate Control "A" to Position 4.

18. Replace the key shorting plug and adjust section D of C111 for maximum P.A. GRID meter reading.

19. Check the excitation over the band by operating Control "B" over the entire range. If dips in the meter reading occur repeat step 10.

20. Repeat Steps 18 and 19, for Positions 4, 3, 2, and 1 of Control "A". Adjust capacitor sections D, C, B, and A, for Control "A" Positions 4, 3, 2, and 1 respectively.

21. Having completed the alignment of the 1st frequency multiplier stage, remove the key shorting plug and operate Control "A" to Position 12.

22. Rotate Control "B" to a dial reading of 1100.

23. Replace the key shorting plug and adjust section F of second multiplier padding capacitor C115 for maximum P.A. GRID meter reading.

24. Using an insulated screwdriver to reduce body capacity adjust trimmer capacitor C136 for maximum P.A. GRID meter reading.

25. Check the output frequency of the second multiplier with a wavemeter. With Control "A" in Position 12 and Control "B" tuned to a dial reading of 1100 the wavemeter should indicate approximately 16,430 kc. A materially different reading indicates that a wrong harmonic has been chosen necessitating a readjustment of padding capacitor C115F and trimmer capacitor C136.

26. Take out drops in the meter reading by adjusting section F of padding capacitor C115.

27. A drop at the extreme ends of the range is permissible but if the meter needle still dips sharply at any other point, rotate Control "B" to a dial reading of 1100, loosen the second multiplier inductance, L106, tuning slug locking nut and change slightly the position of the tuning slug. Tighten the slug locking nut.

28. Again rotate Control "B" over the entire range and check the excitation. If the meter dips sharply at any point repeat Steps 24 through 28.

29. Having completed the adjustment of the inductor slug and section F of C115, remove the key shorting plug and rotate Control "A" to Position 11.

30. Rotate Control "B" to a dial reading of 1100.

31. Replace the key shorting plug, adjust section E of capacitor C115 to the capacity which gives the maximum P.A. GRID meter reading and check with a wavemeter for the correct harmonic.

Note: Do not make any further adjustment of the tuning slug in L106 or trimmer capacitor C136.

32. Rotate Control "B" through the entire range and check the excitation. If dips occur in the meter reading readjust padding capacitor C115E.

33. Repeat Steps 31 and 32 with Control "A" in Positions 10, 9, 8, and 7. Adjust capacitor sections D, C, B, and A for Control "A" Positions 10, 9, 8, and 7 respectively.

The above procedure completes the alignment of the high-frequency r-f circuits of the transmitter.

5.7. MAINTENANCE OF AUTOTUNE MECHANISM

5.7.1. Lubrication

5.7.1.1. The Autotune mechanism will require thorough lubrication at least once every month for proper operation. The four types of lubricants which are required are: (1) Texaco Capella A lubricating oil manufactured by the Texas Company, 135 E. 42nd St., New York City, (2) Socony-Vacuum PD-535A, manufactured by Socony-Vacuum Oil Company, 26 Broadway, New York City, (3) Cities Service North Star 000 oil manufactured by The Cities Service Oil Co., 500 Roberts St., Saint Paul, Minn., and (4) Stano-Drip #39 manufactured by Standard Oil of Indiana, 910 S. Michigan Avenue, Chicago, Illinois. In locations where severe dust is encountered, it may be necessary to thoroughly clean all parts before application of any lubricants. A soft brush and a jet of compressed air will be suitable for cleaning the Autotune mechanism.

5.7.1.2. The Texaco Capella A oil is to be used for all lubrication points except the open gears and pawls. The points to be lubricated with this oil include:

1. All line shaft bearings.
2. Autotune motor bearings.
3. Front and rear cam drum bearings on each of the Autotune units.
4. All idler gear bearings.
5. Counter drum bearings.
6. Limit switch drive shaft bearings.

5.7.1.3. The Socony-Vacuum PD-535A grease should be used on all gears. These gears include:

7. All line shaft worms.
8. Worm gears on all Autotune units.
9. Spur and idler gears on all Autotune units.
10. The screw on the limit switch drive shaft.

5.7.1.4. The Stano-Drip #39 should be used on the motor sprocket and chain assembly.

5.7.1.5. Cities Service North Star 000 oil should be used for lubricating the pawl stacks on each of the Autotune units.

5.7.1.6. The drawing of the Collins Autotune System, Mechanical Portion, Fig. 22, shows the proper points for the application of each type of lubricant. The letters inside the dotted circles denote the type of lubricant to be used at each point. The letters A, B, C and D, are identified with the lubricants they represent at the bottom of Figure 24.

5.7.1.7. Each of the four lubricants may be applied with a camel's hair brush to the various lubrication points. Only very small amounts of oil or grease are required at most points. Be sure to remove any excess oil or grease after lubricating the Autotune system.

5.7.1.8. It will not be necessary to remove the individual Autotune units in order to lubricate the mechanism properly. The transmitter should be turned on the back and the Autotune front panel removed for maximum access to the lubrication points.

5.7.2. Synchronization Check

5.7.2.1. In order for the Autotune system to function properly, the five individual units must be carefully synchronized. If there is any reason to doubt the accuracy of the synchronization, it should be immediately checked. This may be done as follows:

5.7.2.2. Turn the equipment on the back so as to have maximum access to the units and remove the Autotune front panel.

Note: If the counter drum rings in the multi-turn unit "B" have been moved for any reason so that a pawl cannot fall in the slot of a given ring within the range of the counter drum rotation, the ring must be moved manually a quarter turn in either direction.

5.7.2.3. Place the crank (which is included in the spare parts) on the right end of the Autotune line shaft, orient the crank hub in the slot and fasten it with a 4-40 x ½″ screw.

5.7.2.4. Turn the crank counterclockwise until all the cam drums are set in motion.

5.7.2.5. By means of the crank turn the line shaft counterclockwise until all the cam drums are being driven. Continue to turn the crank counterclockwise until the stop ring drum on the Multiturn unit has reached home stop and has ceased to turn.

5.7.2.6. After the stop-ring drum on the Multiturn unit has ceased to turn and only the cam drums are turning, pull the fork of the anvil (Fig. 24) in a counterclockwise direction away from under the tails of the pawls so that they are free to fall to the surface of the counter drum. If at any time the line shaft should be turned clockwise, it will first be necessary to turn the line shaft again in the counterclockwise direction far enough to reach home stop before pulling the anvil out from under the tails of the pawls; otherwise, as soon as the line shaft is turned counterclockwise, the anvil will be rotated up under the tails of the pawls.

5.7.2.7. Continue to rotate the crank slowly until the No. 5 pawl on one of the units, just drops into its cam slot. **Note:** Count from the front of the Autotune unit to the back, omitting the first or manual pawl, to arrive at pawl No. 5.

5.7.2.8. Note the position of the crank arm by marking a line on the casting and then slowly turn the crank, noting the points at which the No. 5 pawls on all of the other units drop into the cam slots. All of the pawls should drop into place with a quarter turn ahead or behind the point where the No. 5 pawl on unit "A" engaged with its cam. All pawls should drop sharply with a "click."

5.7.2.9. Continue to rotate the crank counterclockwise until the No. 6 pawl on one of the units, just drops into its cam slot.

5.7.2.10. Note the position of the crank arm by marking a line on the casting and then slowly turn the crank, noting the points at which the No. 6 pawls on all of the other units drop into the cam slots and repeat the procedure outlined in Step 5.7.2.7.

5.7.2.11. Repeat Steps 5.2.1.9. and 5.2.1.10. checking the operation in turn of pawls No. 7, 8, 9, 10, 11, 12 (L.Freq.), manual, 1, 2, 3, and 4.

5.7.3. Synchronization

5.7.3.1. If the Autotune system is found to be out of synchronization, the following procedure should be used to restore it:

5.7.3.2. Determine which units are not in synchronism with the multiturn unit by use of the foregoing procedure. No adjustment is possible on the multiturn unit, therefore all other units should be synchronized with this unit.

5.7.3.3. Repeat Steps 5.7.2.5. and 5.7.2.6.

5.7.3.4. If it has been found by means of the Synchronization Check that Autotune unit "A" is not synchronized with Autotune unit "B", it may be synchronized as follows:

(a) Turn the line shaft counterclockwise until pawl No. 5 on Unit "B" just drops into its slot in the cam drum. At this point the cam drum on unit "A" should be in a position so that the set screws in the collar below the gear are accessible. In case one of the set screws is inaccessible, tighten the accessible set screw with a No. 6 bristo wrench and continue to turn the line shaft counterclockwise until the inaccessible set screw can be reached and loosened with the No. 6 bristo wrench, after which it will be necessary to continue to turn the line shaft in a counterclockwise direction until pawl No. 5 on unit "B" again just drops into its slot in the cam drum. When this point is reached the remaining set screw in the collar on the cam drum shaft in unit "A" should be loosened. In case the above conditions cannot be met, it will be necessary to choose some other pawl that will allow these conditions.

(b) The cam drum in unit "A" is now free to be turned with the fingers until No. 5 pawl just drops into its slot in the cam drum.

(c) Insert a 0.005 inch feeler gauge between the cam drum washer, which is adjacent to the cam drum and the gear on the cam drum shaft in unit "A". Now insert a No. 6 wrench in the accessible set screw, force the collar tight against the gear and around clockwise so that all play is taken up before tightening the screw. Care must be used not to move the cam drum during this step.

(d) Turn the line shaft counterclockwise noting the sequence in which the pawls on unit "A" fall with respect to the corresponding pawls on unit "B". If all the corresponding pawls on the two units fall within one-quarter turn of the line shaft, the two units are synchronized. The second set screw in the collar on unit "A" cam drum shaft should now be tightened.

5.7.3.5. It is entirely possible, due to slight irregularities in the structure of the cam drums, that one or more corresponding pairs of pawls on the two units will not fall within the prescribed one-quarter turn tolerance or that the synchronizing was not done with sufficient care, causing even No. 5 pawl on unit "A" to drop ahead or behind No. 5 pawl on unit "B" more than one-quarter turn.

(a) If it is found necessary to correct the synchronization, turn the line shaft counterclockwise noting the sequence in which the pawls fall. If some or all of the corresponding pawls fall farther apart from each other than the prescribed tolerance, pick out the pair that drops farthest apart and note which pawl drops first.

(b) If the pawl on unit "A" drops first, note what part of a revolution the line shaft must be turned through before the corresponding pawl on unit "B" falls. Continue to crank the line shaft counterclockwise until the two set screws on the collar below the cam drum on unit "A" are easily accessible. After loosening the set screws, turn the line shaft counterclockwise through the required part of a turn deemed necessary to correct the error and tighten the set screws. Repeat with more care if the pawls upon rechecking do not yet fall within the prescribed limits.

(c) If the pawl on unit "B" drops first, note what part of a revolution the line shaft must be turned through before the corresponding pawl on unit "A" falls. Continue to crank the line shaft counterclockwise until the two set screws on the collar below the cam drum on unit "A" are easily accessible. After loosening the set screws, rest the hand on the frame of the unit "A" and, placing the thumb firmly on the cam drum, rotate the cam drum slightly counterclockwise by the amount judged necessary to correct the error and tighten the set screws. Repeat with more care if the pawls upon rechecking do not yet fall within the prescribed limits.

(d) Check to make sure that both set screws in the collar on unit "A" cam drum shaft are tight.

5.7.3.6. If it has been found by means of the Synchronization Check that Autotune unit "D", "C", or "E" is not synchronized with unit "A", causing corresponding pawls on units "A", "D", "C" and "E" to drop more than one-quarter turn of the line shaft apart, it will be necessary to re-synchronize the unit or units with unit "A" which are not within the one-quarter turn tolerance by the same procedure given for synchronizing unit "A" with unit "B" as outlined in Steps 5.7.3.4. and 5.7.3.5.

5.7.3.7. It should be noted that when the Autotune System has been synchronized correctly corresponding pawls on units "A" and "B" drop within one-quarter turn of each other and the corresponding pawls on units "C", "D" and "E" drop within one-quarter turn of those on unit "A".

5.7.4. Autotune Positioning Mechanism

5.7.4.1. The Autotune positioning control mechanism consists of the Autotune seeking switch, S109, which is of the open segment type, driven by an arm attached to the shaft of the cam drum on the singleturn Autotune unit "A", and the CHANNEL selector switch, S108.

5.7.4.2. The seeking switch driving arm must be so adjusted that when, for instance position No. 5 is selected by the channel selector switch, S108, the No. 5 pawl will drop on all Autotune units and be in this position at the end of the Autotune cycle. In addition, the driving arm pin must engage the driven arm completely, but the pin must not touch the frame of the seeking switch, S109, at any point of the 360 degree rotation. Finally, a "back-up" distance of roughly from $5/64''$ $\pm 1/64''$ must be maintained between the pin of the driving arm and its place of contact on the driven arm after the cam drum, to which the driving arm is attached, is rotated by hand clockwise as far as it will go.

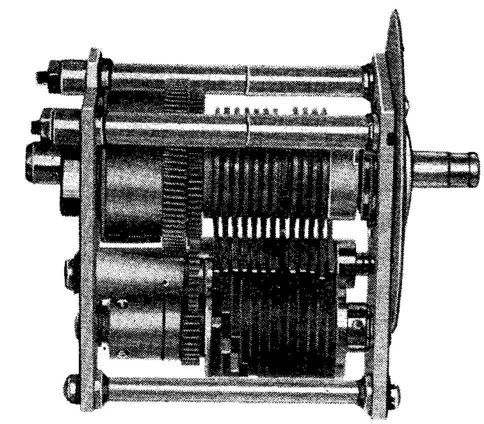


Fig. 34 96J Autotune Singleturn Unit Left Side View

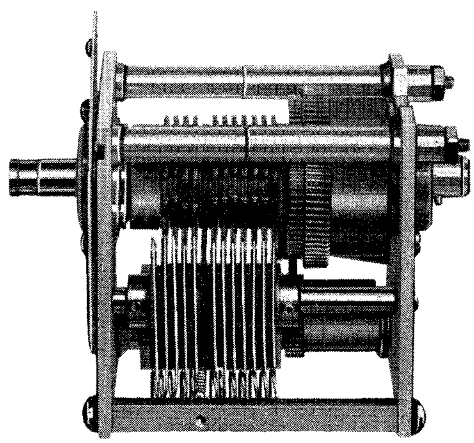


Fig. 35 96J Autotune Singleturn Unit Right Side View

5.7.4.3. If there is reason to believe that the seeking switch driving arm is out of adjustment, the following procedure should be followed to check it:

(a) Turn the CHANNEL selector switch, S108, to any position.

(b) Turn the EMISSION selector switch, S110, to the VOICE position. If the Autotune motor starts running allow it to run until the Autotune cycle is complete and the motor stops. **Note:** If the motor continues to run more than 30 seconds without coming to a stop, observe whether, due to misalignment of the seeking switch driving arm, the seeking switch, S109, is not being driven before turning the EMISSION selector switch, S110, to the OFF position. If the adjustment of the seeking switch driving arm appears to be correct, the trouble is probably misalignment of or foreign matter in the motor control relay, K101 or limit switch, S111 and S112. A short in the seeking switch itself can cause this trouble as can a short in the wiring.

(c) Turn the EMISSION selector switch, S110, to the OFF position.

(d) Connect a continuity check from the number 1 contact of remote cable jack J106 to the GND connector on the transmitter. Operate the LOCAL-REMOTE switch S107 to the REMOTE position.

(e) Repeat Steps 5.7.2.2. to 5.7.2.4. inclusive.

(f) Continue to rotate the crank slowly until the last pawl corresponding to the contact selected has just dropped into its cam slot.

(g) Note the position of the crank arm by marking a line on the casting and then slowly turn the crank until the continuity is broken.

(h) Observe the fraction of a revolution that the crank has turned. It should be within the limits of one-eighth to one full turn of the crank.

(i) If the continuity is not broken within the limits of one-eighth to one full turn of the crank, the seeking switch driving arm must be adjusted.

(j) Repeat Steps f, g, and h for each contact of remote cable jack J106 up to and including number 11.

5.7.4.4. If it is determined in checking the driving arm of the seeking switch, S109, by Step 5.7.4.3., that it is out of adjustment, it may be readjusted as follows:

(a) If the switch shaft is not centered exactly with the cam drum shaft in front of it or if the mounting screws are loose, correct these conditions by recentering the switch shaft and tightening the screws.

(b) Select a position by turning the line shaft crank counterclockwise that will place the set screws in the hub of the seeking switch driving arm in an accessible position.

(c) Loosen the set screws with a No. 6 bristo wrench.

(d) Turn the seeking switch driving arm clockwise if the switch as checked in Step 5.7.4.3. opened early, and counterclockwise if it opened late. The amount to turn the arm must be determined by trial and error, but will be very slight unless it has become loose enough to cause an entirely different pawl number to drop on the Autotune units.

(e) Tighten the set screws, taking care that the pin completely engages the driven arm but does not come so close to the frame of the seeking switch as to permit it to touch at any point of the 360 degree rotation.

(f) Recheck as outlined in Steps 5.7.4.3. f, g, h, and repeat procedure until the Autotune seeking switch, S109, is correctly adjusted.

5.7.5. Autotune Limit Switch

5.7.5.1. The limit switch is composed of a front section, S112, and a rear section, S111, and is located on the right side of the Multiturn or "B" Autotune Unit.

5.7.5.2. The rear limit switch section, S111, should be adjusted so that it snaps between the limits of 3¼ to 9¼ turns of the line shaft crank counting clockwise from the time the switch snaps until the collar pin on the switch operating arm is engaged by the rear lead screw collar.

5.7.5.3. Add or remove shims from the rear end of the front switch section S112, insulator stack until the foregoing conditions (Step 5.7.5.2.) can be met. **Note:** Do not attempt to bend the arms of the rear switch sections as such a procedure may destroy the snap action of the switch.

5.7.5.4. The front limit switch section should be adjusted so that it closes between the limits of 3¼ to 9¼ turns of the line shaft crank counting clockwise from the point arrived at by turning the line shaft counterclockwise, which the collar pin on the switch operation arm is engaged by the front lead screw collar. A continuity checker connected across the switch contacts will facilitate noting the exact moment the switch makes contact.

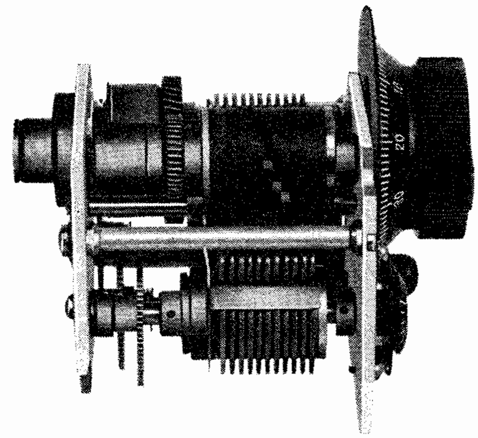


Fig. 36 96K Autotune Multiturn Unit Left Side View

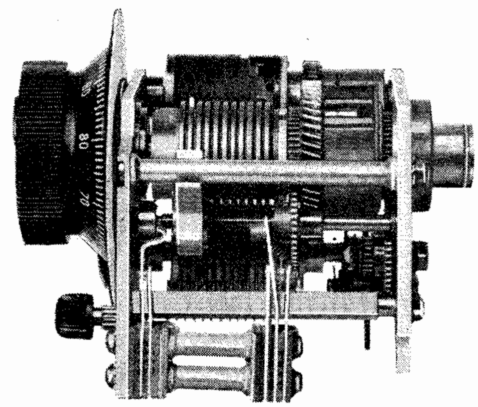


Fig. 37 96K Autotune Multiturn Unit Right Side View

5.7.5.5. The main arm of the front switch section should follow the short arm for slightly less than $\frac{1}{32}$ inch as the short arm is bent back until contact is broken. This assures adequate contact pressure necessary for reliable operation of the switch.

5.7.5.6. Using an ordinary telephone relay spring bender, bend the head of the long switch contact arm and the heel end of the short contact leaf until the foregoing conditions (Steps 5.7.5.4. and 5.7.5.5.) are met.

5.7.5.7. Make sure that the leaves of the front and rear switch sections are in the clear and are not in danger of shorting on any part of the mechanism.

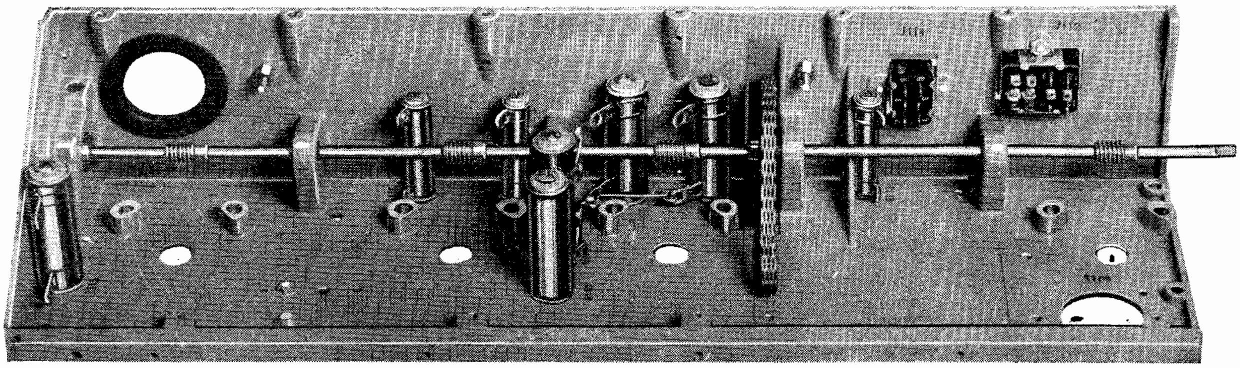


Fig. 38 Autotune Casting

5.8. REPLACEMENT OF PARTS

5.8.1. The following Autotune parts may be replaced in the field if adequate shop facilities are available. Since the Autotune mechanism is necessarily complicated, it is recommended that only skilled and experienced personnel be permitted to repair it.

REPLACEABLE AUTOTUNE PARTS

Item	Quan.	Part Description	Used With Item	Collins Part No.
1	1	Multiturn Autotune Unit "B"		96K-1
2	1	Singleturn Autotune Unit "A"		96J-4
3	1	Singleturn Autotune Unit "C"		96J-2
4	1	Singleturn Autotune Unit "D"		96J-1
5	1	Singleturn Autotune Unit "E"		96J-3
6	1	Dial for Unit A	2	NY-1069B
7	1	Dial for Unit B	1	X-5524
8	1	Dial for Unit C	3	NY-1072B
9	1	Dial for Unit D	4	NX-5586
10	1	Dial for Unit E	5	NX-5796
11	5	Dial Locking Bar	6, 7, 8, 9, 10	NX-5525
12	5	Bar Stop Disc	11	X-5620
13	1	Main Line Shaft	17	NX-5512
14	4	Singleturn Worm	13	NX-5513
15	1	Small Multiturn Worm	17	Same as (14)
16	1	Large Multiturn Worm	17	NX-5519
17	1	Multiturn Line Shaft	13	NX-5517
18	1	Main Line Shaft Thrust Bearing	13	309N132
19	1	Multiturn Line Shaft Thrust Bearing	17	309N136
20	6	Line Shaft Bearing	13, 17	NX-5724
21	1	Line Shaft Crank	17	GA-1149A
22	1	Counter Drum Dial	1	X-5527
23	1	Positioning Switch Drive Arm	2	881A
24	1	Chain Drive	13, 25, 26	NX-5603
25	1	Motor Sprocket	24	NX-5602
26	1	Line Shaft Sprocket	13, 25, 26	NX-5514

5.8.2. **Removing Component Parts**

5.8.2.1. Cover—remove 16 screws and lift off. (Cover must be removed before any other units or parts are removed.)

5.8.2.2. Motor—remove 3 mounting screws and unsolder four wires to motor. Pivot motor as it is lifted out so as to free it from chain drive.

5.8.2.3. Autotune unit "A"—turn dial locking bar to unlocked position and loosen the two #10 bristo set screws in the dial. Turn dial and locking bar counterclockwise together until bar comes free. Remove both dial and locking bar. Remove the dial back plate, loosen the two long screws on the top end of the unit and the short screw on the bottom of the rear plate. Lift the unit out.

5.8.2.4. Autotune unit "C", "D", or "E"—remove 4 screws, one on each of Autotune units "C", "D" and "E" and one on the end of the jack strip. Pull the strip out as far as the wires will permit. Turn locking screw on Autotune unit "C", "D" or "E" to unlock position and loosen the two #10 bristo set screws in the dial. Remove dial, remove dial back plate, loosen the two long screws on the top end of the unit and the short screw on the bottom of the rear plate. Lift the unit out.

5.8.2.5. Autotune unit "B"—remove the right end cover plate and the dial and back plate from unit "A". Next remove the #10 nut on the back end of the main tuning slug leadscrew which is attached to the multiplier slug coupling yoke. Then remove the two mounting screws along the upper edge of the back plate of the multiturn unit; also remove the single screw along the lower edge. Remove the two screws which hold the limit switch and carefully pull the switch away from the assembly. Carefully pull the assembly out of the casting being very careful not to damage the tuning slug on the leadscrew. **Note: If the leadscrew is turned even slightly the high frequency oscillator must be recalibrated and realigned.**

5.8.2.6. Line Shaft — remove all Autotune singleturn units and four screws of the thrust bearing on left end of shaft. Remove taper groove pins on worms for heads A, C, and D and on sprocket. Pull shaft assembly out left end of Autotune casting. **Caution:** Be very careful not to spring the line shaft when driving out the taper groove pins. Support the shaft adjacent to the gears when removing or replacing the taper groove pins. Keep the gears separate and in order so each may be replaced in the same location from which it was removed.

5.8.3. **Servicing the Main Line Shaft Assembly**

5.8.3.1. The following replaceable parts are associated with the main line shaft assembly:

Item	Description
13	Main Line Shaft
14	Singleturn Worm (4)
18	Main Line Shaft Thrust Bearing
20	Line Shaft Bearing (4)
24	Chain Drive
25	Line Shaft Sprocket

5.8.3.2. In order to replace these parts it will be necessary to remove the entire line shaft assembly. Care must be exercised to keep each gear in the proper order when disassembling the line shaft. None of the gears are interchangeable.

5.8.3.3. The following procedure is recommended for removing the line shaft assembly. **CAUTION:** When driving out the taper groove pins be very careful not to spring the line shaft.

(a) Remove all singleturn Autotune heads (heads A, C, D, and E).

(b) Remove the taper groove pin from each of the worms and the sprocket. Before driving out a taper groove pin, be sure that the line shaft is well supported adjacent to the taper groove pin.

(c) Remove the four screws from the thrust bearing retainer plate on the left end of the casting.

(d) Slowly work the shaft off the left end of the casting removing each worm or the sprocket as it nears the end of the shaft. Be sure each gear is properly identified so as to be replaced in its original position. These gears are not interchangeable because each gear is drilled while on the line shaft.

5.8.4. Replacing a Singleturn Worm

5.8.4.1. The replacement singleturn worm is furnished undrilled. The following procedure is recommended for replacing a singleturn worm:

(a) Center-punch the sleeve of the worm in the spot corresponding to the center of the hole on the old worm.

(b) Using a 1/16″ drill, drill through one side of the worm sleeve.

(c) Slide the worm on the shaft with the sleeve end away from the thrust bearing assembly.

(d) Drill through to the other side of the worm sleeve with the 1/16″ drill.

(e) Proceed to reassemble the line shaft in the reverse order of the foregoing disassembling procedure using **new** 1/16″ x 3/8″ taper groove pins on the worms and a **new** 5/64″ x 1/2″ taper groove pin on the sprocket.

5.8.5. Replacing a Line Shaft Sprocket

5.8.5.1. Follow the same procedure as used for replacing the singleturn worm except use a #47 drill.

5.8.6. Replacing the Chain Drive

5.8.6.1. As the line shaft is being pulled out the left end of the casting, slip off the old chain and sprocket. Put the new chain on the sprocket and push the line shaft back into place, slipping the shaft through the sprocket. Slip the singleturn worm on the end of the shaft and then replace with **new** taper groove pins.

5.8.7. Replacing a Line Shaft Bearing

5.8.7.1. The oilite type line shaft bearings are held in place by means of a press fit. A thin steel sleeve fits over these bearings. After removing the line shaft the defective bearing should be driven out gently by using a mallet and a rod or blunt end punch. The new bearing should then be gently driven into place. Be careful not to deform the bearing.

5.8.8. Replacing the Main Line Shaft Thrust Bearing

5.8.8.1. In replacing this bearing, it will not be necessary to remove the entire line shaft assembly. The following procedure is recommended:

(a) Remove the four screws from the bearing retainer plate on the left end of the casting.

(b) Remove the taper groove pin from the line shaft sprocket.

(c) Work the shaft end bearing out about an inch or more from the end of the casting.

(d) Carefully block up the outside bearing collar and drive out the taper groove pin from the inside bearing collar. **Caution:** Be careful not to spring the line shaft when driving the taper groove pin out.

(e) Replace the inside collar on the shaft, slide the new bearing on the shaft and then slide the outside collar through the bearing into the inside collar.

(f) Insert a taper groove pin and gently drive it home. **Caution:** Be sure the outside collar is blocked up properly so the line shaft will not be sprung.

(g) Slide the shaft back to its original position and replace the bearing plate. Use a **new** taper groove pin in the line shaft sprocket.

5.8.9. Replacing the Main Line Shaft

5.8.9.1. The task of installing a new line shaft is difficult and lengthy and should only be attempted by an experienced mechanic who has adequate tools available.

The following procedure is recommended for replacing the main line shaft:

(a) Remove the line shaft as previously prescribed.

(b) Reassemble the gears on the shaft and drive the taper groove pins in lightly.

(c) Carefully measure the distance from the milled end of the shaft to one end of each worm, the sprocket and the thrust bearing.

(d) Completely disassemble the line shaft.

(e) Centerpunch each gear and the sprocket at a point which is at a right angle to the previously used taper groove pin hole and the same distance from the end.

(f) Drill each gear with a $\frac{1}{16}''$ drill and the sprocket with a #47 drill through on one side only.

(g) Put one of the worms on the shaft, in its predetermined position, block the shaft well, and, using a $\frac{1}{16}''$ drill, drill through the new hole in the gear into the line shaft through the other side of the gear.

(h) Suitably mark the new hole on the sleeve of the gear.

(i) Repeat Steps (g) and (h) for the remaining worms and sprocket. Use a #47 drill for the sprocket.

(j) Assemble the bearing and slide it on the end of the shaft.

(k) Clamp the bearing, block the shaft and drill through the two sleeves and the shaft at a point at right angles to the old hole. Use a $\frac{1}{16}''$ drill.

(l) Suitably mark the new hole on both sleeves.

(m) Using a new taper groove pin (five $\frac{1}{16}''$ x $\frac{3}{8}''$ and one $\frac{5}{64}''$ x $\frac{1}{2}''$) assemble the shaft in the casting as previously described. **Note: Be sure to place the gears in their proper order on the shaft.**

5.8.10. Servicing the Multiturn Line Shaft Assembly

5.8.10.1. The following replaceable parts are associated with the Multiturn line shaft assembly:

Item	Description
15	Small Multiturn Worm
16	Large Multiturn Worm
17	Multiturn Line Shaft
19	Multiturn Line Shaft Thrust Bearing
20	Line Shaft Bearing

5.8.10.2. This shaft assembly may be serviced in the same general way as the main line shaft. The multiturn head must be removed before any work may be done on the shaft. The large worm requires a $\frac{5}{64}''$ x $\frac{1}{2}''$ taper groove pin and the small worm and thrust bearing require $\frac{1}{16}''$ x $\frac{3}{8}''$ taper groove pins.

VI DATA

DATA

TABLE I—L-F OSCILLATOR CALIBRATION DATA (200 Kc. to 1500 Kc.)

Freq.	A	F	G	
200	**13**	**1**	**393**	
202	13	1	469	(30 divisions per kc)
204	13	1	540	
206	13	1	609	
208	13	1	676	
210	13	1	739	
212	13	1	801	
214	13	1	861	
216	13	1	919	
218	13	1	976	
220	13	1	1030	
222	13	1	1084	
224	13	1	1136	
226	13	1	1187	(23 divisions per kc)
228	13	1	1237	
230	13	1	1286	
232	13	1	1334	
234	13	1	1381	
236	13	1	1426	
238	13	1	1472	
240	**13**	**1**	**1515**	
242	13	1	1560	
244	13	1	1603	
246	13	1	1646	(20 divisions per kc)
248	13	1	1688	
250	**13**	**1**	**1729**	
252	13	1	1770	
254	13	1	1810	
256	13	1	1851	
258	13	1	1890	
260	13	1	1929	
262	13	1	1968	
262	13	2	175	
264	13	2	242	
266	13	2	305	(28 divisions per kc)
267	**13**	**2**	**325**	
268	13	2	366	
270	13	2	423	
272	13	2	480	
274	13	2	533	
276	13	2	585	
278	13	2	635	
280	13	2	684	
282	13	2	731	
284	13	2	778	(21 divisions per kc)
286	13	2	823	
288	13	2	868	
290	13	2	911	
292	13	2	953	
294	13	2	995	
296	13	2	1035	
298	13	2	1075	
300	**13**	**2**	**1114**	

Freq.	A	F	G	
300	**13**	**2**	**1114**	(18 divisions per kc)
302	13	2	1153	
304	13	2	1192	
306	13	2	1229	
308	13	2	1266	
310	13	2	1302	
312	13	2	1338	
314	13	2	1373	
316	13	2	1407	
318	13	2	1442	
320	13	2	1476	
322	13	2	1508	
324	13	2	1542	(16 divisions per kc)
326	13	2	1574	
328	13	2	1606	
330	13	2	1638	
332	13	2	1670	
333	**13**	**2**	**1691**	
334	13	2	1701	
336	13	2	1732	
338	13	2	1763	
340	13	2	1793	
342	13	2	1823	(17 divisions per kc)
344	13	2	1854	
346	13	2	1883	
348	13	2	1912	
350	**13**	**2**	**1942**	
352	13	2	1971	
354	13	2	2000	
356	13	2	2028	
350	**13**	**3**	**154**	
352	13	3	205	
354	13	3	255	(21 divisions per kc)
356	13	3	302	
358	13	3	347	
360	13	3	392	
362	13	3	434	
364	13	3	476	
366	13	3	515	
368	13	3	555	
370	13	3	593	
372	13	3	631	
374	13	3	668	
376	13	3	704	
378	13	3	739	
380	13	3	774	(16 divisions per kc)
382	13	3	808	
384	13	3	841	
386	13	3	874	
388	13	3	906	
390	13	3	938	
392	13	3	970	
394	13	3	1000	
396	13	3	1030	
398	13	3	1061	
400	**13**	**3**	**1090**	

Freq.	A	F	G	
400	**13**	**3**	**1090**	
402	13	3	1120	
404	13	3	1148	
406	13	3	1177	
408	13	3	1205	
410	13	3	1233	(13 divisions per kc)
412	13	3	1260	
414	13	3	1288	
416	13	3	1314	
418	13	3	1341	
420	13	3	1368	
422	13	3	1394	
424	13	3	1419	
426	13	3	1445	
428	13	3	1470	
430	13	3	1495	
432	13	3	1519	
434	13	3	1544	
436	13	3	1569	
438	13	3	1593	
440	13	3	1616	(11 divisions per kc)
442	13	3	1641	
444	13	3	1665	
446	13	3	1688	
448	13	3	1710	
450	13	3	1734	
452	13	3	1757	
454	13	3	1780	
456	13	3	1802	
458	13	3	1825	
460	13	3	1847	
462	13	3	1870	
464	13	3	1892	(11 divisions per kc)
466	13	3	1913	
467	**13**	**3**	**1921**	
468	13	3	1936	
470	13	3	1958	
472	13	3	1980	
474	13	3	2001	
476	13	3	2022	
467	**13**	**4**	**176**	(11 divisions per kc)
468	13	4	191	
470	13	4	213	
472	13	4	235	
474	13	4	257	
476	13	4	279	
478	13	4	300	
480	13	4	321	
482	13	4	342	
484	13	4	363	(10 divisions per kc)
486	13	4	383	
488	13	4	402	
490	13	4	422	
492	13	4	442	
494	13	4	462	
496	13	4	481	
498	13	4	499	
500	**13**	**4**	**518**	

Freq.	A	F	G	
500	**13**	**4**	**518**	(9 divisions per kc)
505	13	4	565	
510	13	4	609	
515	13	4	654	
520	13	4	697	
525	13	4	739	
530	13	4	781	(8 divisions per kc)
533	**13**	**4**	**808**	
535	13	4	821	
540	13	4	862	
545	13	4	901	
550	13	4	940	
555	13	4	978	
560	13	4	1016	
565	13	4	1053	
570	13	4	1090	
575	13	4	1127	
580	13	4	1163	
585	13	4	1198	(7 divisions per kc)
590	13	4	1234	
595	13	4	1270	
600	**13**	**4**	**1304**	
605	13	4	1340	
610	13	4	1375	
615	13	4	1408	
620	13	4	1444	
625	13	4	1479	
630	13	4	1512	
635	13	4	1548	
640	13	4	1584	
645	13	4	1618	(7 divisions per kc)
650	13	4	1655	
655	13	4	1691	
660	13	4	1728	
665	13	4	1766	
667	**13**	**4**	**1779**	
670	13	4	1804	
675	13	4	1845	
680	13	4	1886	
685	13	4	1928	(9 div.)
690	13	4	1976	
695	13	4	2023	
695	13	5	156	
700	**13**	**5**	**195**	
705	13	5	231	
710	13	5	269	
715	13	5	303	
720	13	5	338	(7 divisions per kc)
725	13	5	373	
730	13	5	406	
733	**13**	**5**	**427**	
735	13	5	438	
740	13	5	471	
745	13	5	502	
750	**13**	**5**	**533**	

Use nearest check point shown in heavy type.

Frequency 750 to 1500 kilocycles

TABLE I—(Cont.)

Freq.	A	F	G	
750	**13**	**5**	**533**	(6 div. per kc)
755	13	5	565	
760	13	5	594	
765	13	5	624	
770	13	5	654	
775	13	5	683	(5.5 div. per kc)
780	13	5	711	
785	13	5	739	
790	13	5	768	
795	13	5	795	
800	**13**	**5**	**821**	
805	13	5	849	
810	13	5	876	
815	13	5	901	
820	13	5	927	
825	13	5	953	
830	13	5	979	
835	13	5	1004	(4.8 divisions per kc)
840	13	5	1029	
845	13	5	1054	
850	13	5	1079	
855	13	5	1103	
860	13	5	1127	
865	13	5	1152	
867	**13**	**5**	**1160**	
870	13	5	1176	
875	13	5	1199	
880	13	5	1223	
885	13	5	1247	(4.6 divisions per kc)
890	13	5	1270	
895	13	5	1294	
900	**13**	**5**	**1317**	
905	13	5	1341	
910	13	5	1364	
915	13	5	1387	
920	13	5	1410	(4.6 divisions per kc)
925	13	5	1433	
930	13	5	1457	
933	**13**	**5**	**1473**	
935	13	5	1480	
940	13	5	1503	
945	13	5	1526	
950	13	5	1550	
955	13	5	1574	
960	13	5	1597	
965	13	5	1621	(4.8 divisions per kc)
970	13	5	1645	
975	13	5	1670	
980	13	5	1694	
985	13	5	1718	
990	13	5	1744	
995	13	5	1770	
1000	**13**	**5**	**1795**	

Freq.	A	F	G	
1000	**13**	**5**	**1795**	(5.3 divisions per kc)
1005	13	5	1822	
1010	13	5	1850	
1015	13	5	1878	
1020	13	5	1905	
1025	13	5	1935	
1030	13	5	1966	
1035	13	5	1998	
1035	13	6	145	(4.9 div. per kc)
1040	13	6	171	
1045	13	6	196	
1050	**13**	**6**	**219**	
1055	13	6	244	
1060	13	6	270	(4.5 div. per kc)
1065	13	6	293	
1067	**13**	**6**	**300**	
1070	13	6	315	
1075	13	6	338	
1080	13	6	363	
1085	13	6	385	(4.3 div. per kc)
1090	13	6	407	
1095	13	6	428	
1100	**13**	**6**	**451**	
1105	13	6	473	
1110	13	6	493	
1115	13	6	514	
1120	13	6	534	(4 div. per kc)
1125	13	6	556	
1130	13	6	576	
1133	**13**	**6**	**589**	
1135	13	6	596	
1140	13	6	615	(3.9 div. per kc)
1145	13	6	635	
1150	**13**	**6**	**656**	
1155	13	6	675	
1160	13	6	694	
1165	13	6	712	
1170	13	6	731	
1175	13	6	751	
1180	13	6	770	(3.5 div. per kc)
1185	13	6	788	
1190	13	6	806	
1195	13	6	823	
1200	**13**	**6**	**842**	
1205	13	6	860	
1210	13	6	878	
1215	13	6	895	
1220	13	6	913	
1225	13	6	930	
1230	13	6	948	
1235	13	6	966	(3.4 div. per kc)
1240	13	6	983	
1245	13	6	999	
1250	13	6	1016	
1267	**13**	**6**	**1073**	

Freq.	A	F	G	
1250	13	6	1016	(3.3 divisions per kc)
1255	13	6	1032	
1260	13	6	1050	
1265	13	6	1067	
1267	**13**	**6**	**1073**	
1270	13	6	1084	
1275	13	6	1100	
1280	13	6	1116	
1285	13	6	1132	(3.2 divisions per kc)
1290	13	6	1149	
1295	13	6	1166	
1300	**13**	**6**	**1182**	
1305	13	6	1198	
1310	13	6	1214	
1315	13	6	1230	
1320	13	6	1246	
1325	13	6	1262	
1330	13	6	1278	
1335	13	6	1294	
1340	13	6	1309	
1345	13	6	1325	
1350	13	6	1341	
1355	13	6	1358	(3.2 divisions per kc)
1360	13	6	1374	
1365	13	6	1389	
1370	13	6	1404	
1375	13	6	1419	
1380	13	6	1436	
1385	13	6	1452	
1390	13	6	1468	
1395	13	6	1484	
1400	**13**	**6**	**1499**	
1405	13	6	1514	
1410	13	6	1530	
1415	13	6	1547	
1420	13	6	1563	
1425	13	6	1580	
1430	13	6	1595	
1435	13	6	1611	(3.4 divisions per kc)
1440	13	6	1627	
1445	13	6	1644	
1450	13	6	1661	
1455	13	6	1678	
1460	13	6	1694	
1465	13	6	1710	
1467	**13**	**6**	**1715**	
1470	13	6	1727	
1475	13	6	1744	
1480	13	6	1763	
1485	13	6	1780	(3.5 div. per kc)
1490	13	6	1797	
1495	13	6	1813	
1500	**13**	**6**	**1832**	

Use nearest check point shown in heavy type.

TABLE II—H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.)

Freq.	A	B	
2000	**1**	**100**	(3.6 divisions per kc)
2005	1	119	
2010	1	138	
2015	1	156	
2020	1	174	
2025	1	193	
2030	1	211	
2035	1	230	
2040	1	248	
2045	1	267	
2050	1	285	
2055	1	303	
2060	1	322	
2065	1	340	
2070	1	359	(3.6 divisions per kc)
2075	1	377	
2080	1	396	
2085	1	415	
2090	1	433	
2095	1	452	
2100	**1**	**470**	
2105	1	489	
2110	1	508	
2115	1	526	
2120	1	545	
2125	1	564	
2130	1	582	
2133	**1**	**595**	(3.6 div. per kc)
2135	1	601	
2140	1	620	
2145	1	638	
2150	1	657	
2155	1	675	
2160	1	693	
2165	1	713	
2170	1	732	
2175	1	750	
2180	1	769	
2185	1	787	
2190	1	806	(3.6 divisions per kc)
2195	1	824	
2200	**1**	**843**	
2205	1	862	
2210	1	880	
2215	1	898	
2220	1	917	
2225	1	935	
2230	1	954	
2235	1	972	
2240	1	991	
2245	1	1009	
2250	1	1027	

Freq.	A	B	
2250	1	1027	
2255	1	1046	(3.6 div. per kc)
2260	1	1064	
2265	1	1083	
2267	**1**	**1089**	
2270	1	1101	
2275	1	1119	
2280	1	1138	
2285	1	1156	
2290	1	1174	
2295	1	1193	
2300	**1**	**1211**	(3.6 divisions per kc)
2305	1	1229	
2310	1	1247	
2315	1	1265	
2320	1	1284	
2325	1	1302	
2330	1	1321	
2335	1	1339	
2340	1	1357	
2345	1	1376	
2350	1	1394	
2355	1	1412	
2360	1	1430	(3.6 div. per kc)
2365	1	1449	
2370	1	1468	
2375	1	1486	
2380	1	1504	
2385	1	1523	
2390	1	1541	
2395	1	1560	
2400	**1**	**1578**	
2400	**2**	**060**	
2405	2	076	
2410	2	091	(3 div. per kc)
2415	2	106	
2420	2	121	
2425	2	137	
2430	2	152	
2435	2	168	
2440	2	183	
2445	2	198	
2450	2	213	
2455	2	228	
2460	2	243	(3 divisions per kc)
2465	2	259	
2470	2	274	
2475	2	290	
2480	2	305	
2485	2	320	
2490	2	335	
2495	2	351	
2500	**2**	**366**	

Freq.	A	B	
2500	**2**	**366**	(3 div. per kc)
2505	2	381	
2510	2	397	
2515	2	412	
2520	2	427	
2525	2	443	
2530	2	458	(3 divisions per kc)
2533	**2**	**469**	
2535	2	474	
2540	2	489	
2545	2	505	
2550	2	520	
2555	2	535	
2560	2	551	
2565	2	567	
2570	2	590	
2575	2	597	
2580	2	613	(3 divisions per kc)
2585	2	628	
2590	2	644	
2595	2	659	
2600	**2**	**674**	
2605	2	690	
2610	2	705	
2615	2	721	
2620	2	736	
2625	2	756	
2630	2	767	
2635	2	782	
2640	2	797	
2645	2	813	(3 divisions per kc)
2650	2	828	
2655	2	844	
2660	2	859	
2665	2	874	
2667	**2**	**879**	
2670	2	890	
2675	2	905	
2680	2	920	
2685	2	935	
2690	2	951	
2695	2	966	
2700	**2**	**981**	(3 divisions per kc)
2705	2	996	
2710	2	1012	
2715	2	1027	
2720	2	1042	
2725	2	1057	
2730	2	1073	
2735	2	1088	
2740	2	1103	
2745	2	1118	
2750	2	1133	

Freq.	A	B	
2750	2	1133	
2755	2	1148	
2760	2	1163	
2765	2	1179	
2770	2	1194	
2775	2	1209	
2780	2	1224	
2785	2	1239	(3 divisions per kc)
2790	2	1254	
2795	2	1270	
2800	**2**	**1285**	
2805	2	1300	
2810	2	1315	
2815	2	1330	
2820	2	1345	
2825	2	1361	
2830	2	1376	
2835	2	1391	
2840	2	1406	
2845	2	1421	
2850	2	1436	
2855	2	1452	
2860	2	1469	
2865	2	1482	
2870	2	1498	(3 divisions per kc)
2875	2	1513	
2880	2	1528	
2885	2	1544	
2890	2	1559	
2895	2	1574	
2900	**2**	**1590**	
2905	2	1605	
2910	2	1621	
2915	2	1636	
2920	2	1653	
2925	2	1668	
2930	2	1683	(3 divisions per kc)
2933	**2**	**1694**	
2935	2	1699	
2940	2	1715	
2945	2	1731	
2950	2	1749	
2955	2	1763	
2960	2	1779	
2965	2	1795	
2970	2	1811	
2975	2	1827	(3 div. per kc)
2980	2	1843	
2985	2	1860	
2990	2	1877	
2995	2	1893	
3000	**2**	**1910**	

Use nearest check point shown in heavy type.

Frequency 3000 to 4000 kilocycles

TABLE II—(Cont.)

Freq.	A	B	
3000	**3**	**100**	
3005	3	113	
3010	3	126	
3015	3	138	
3020	3	150	(2.5 divisions per kc)
3025	3	162	
3030	3	174	
3035	3	186	
3040	3	198	
3045	3	211	
3050	3	223	
3055	3	235	
3060	3	248	
3065	3	260	
3070	3	272	
3075	3	285	
3080	3	297	
3085	3	309	
3090	3	322	
3095	3	334	
3100	3	346	
3105	3	359	
3110	3	371	(2.5 divisions per kc)
3115	3	383	
3120	3	396	
3125	3	408	
3130	3	420	
3135	3	433	
3140	3	445	
3145	3	457	
3150	**3**	**470**	
3155	3	483	
3160	3	496	
3165	3	508	
3170	3	520	
3175	3	532	
3180	3	545	
3185	3	557	
3190	3	569	
3195	3	582	(2.5 divisions per kc)
3200	**3**	**594**	
3205	3	606	
3210	3	620	
3215	3	632	
3220	3	644	
3225	3	657	
3230	3	669	
3235	3	681	
3240	3	693	
3245	3	706	
3250	3	719	

Freq.	A	B	
3250	3	719	
3255	3	731	
3260	3	743	
3265	3	755	
3270	3	769	
3275	3	781	
3280	3	793	
3285	3	806	(2.5 divisions per kc)
3290	3	818	
3295	3	830	
3300	**3**	**843**	
3305	3	855	
3310	3	867	
3315	3	880	
3320	3	892	
3325	3	904	
3330	3	917	
3335	3	929	
3340	3	941	
3345	3	954	
3350	3	966	
3355	3	978	
3360	3	991	
3365	3	1003	
3370	3	1015	
3375	3	1027	(2.5 div. per kc)
3380	3	1039	
3385	3	1051	
3390	3	1064	
3395	3	1076	
3400	**3**	**1088**	
3405	3	1101	
3410	3	1113	
3415	3	1125	
3420	3	1138	
3425	3	1150	
3430	3	1162	
3435	3	1174	
3440	3	1186	
3445	3	1198	
3450	**3**	**1211**	
3455	3	1223	(2.5 div. per kc)
3460	3	1235	
3465	3	1247	
3470	3	1259	
3475	3	1271	
3480	3	1284	
3485	3	1296	
3490	3	1308	
3495	3	1321	
3500	3	1333	

Freq.	A	B	
3500	3	1333	
3505	3	1345	
3510	3	1357	
3515	3	1369	
3520	3	1381	
3525	3	1394	
3530	3	1406	(2.5 divisions per kc)
3535	3	1418	
3540	3	1430	
3545	3	1443	
3550	3	1456	
3555	3	1468	
3560	3	1480	
3565	3	1492	
3570	3	1504	
3575	3	1516	
3580	3	1528	
3585	3	1541	
3590	3	1553	
3595	3	1565	
3600	**3**	**1578**	
3600	**4**	**060**	
3605	4	070	
3610	4	080	
3615	4	091	
3620	4	101	
3625	4	116	
3630	4	121	(2 div. per kc)
3635	4	131	
3640	4	141	
3645	4	152	
3650	4	162	
3655	4	172	
3660	4	183	
3665	4	193	
3670	4	203	
3675	4	213	
3680	4	223	
3685	4	233	
3690	4	243	
3695	4	253	
3700	4	264	(2 divisions per kc)
3705	4	275	
3710	4	285	
3715	4	295	
3720	4	305	
3725	4	315	
3730	4	325	
3735	4	335	
3740	4	345	
3745	4	355	
3750	**4**	**366**	

Freq.	A	B	
3750	**4**	**366**	(2 div. per kc)
3755	4	376	
3760	4	386	
3765	4	397	
3770	4	407	
3775	4	417	
3780	4	427	
3785	4	437	
3790	4	447	
3795	4	458	
3800	**4**	**469**	(2 divisions per kc)
3805	4	479	
3810	4	489	
3815	4	499	
3820	4	509	
3825	4	520	
3830	4	530	
3835	4	540	
3840	4	551	
3845	4	561	
3850	4	571	
3855	4	582	
3860	4	592	
3865	4	602	
3870	4	613	
3875	4	623	
3880	4	633	
3885	4	644	
3890	4	654	(2 divisions per kc)
3895	4	664	
3900	**4**	**674**	
3905	4	684	
3910	4	694	
3915	4	705	
3920	4	715	
3925	4	725	
3930	4	736	
3935	4	746	
3940	4	756	
3945	4	767	
3950	4	777	
3955	4	787	
3960	4	797	
3965	4	807	(2 div. per kc)
3970	4	817	
3975	4	828	
3980	4	838	
3985	4	848	
3990	4	859	
3995	4	869	
4000	**4**	**879**	

Use nearest check point shown in heavy type.

Frequency 4000 to 5000 kilocycles

DATA

TABLE II—(Cont.)

Freq.	A	B	
4000	**5**	**100**	
4005	5	109	
4010	5	119	
4015	5	128	
4020	5	138	
4025	5	147	
4030	5	156	(1.8 divisions per kc)
4035	5	165	
4040	5	174	
4045	5	183	
4050	5	193	
4055	5	202	
4060	5	211	
4065	5	220	
4070	5	230	
4075	5	239	
4080	5	248	
4085	5	257	
4090	5	267	
4095	5	276	
4100	5	285	
4105	5	293	
4110	5	303	
4115	5	312	
4120	5	322	
4125	5	331	
4130	5	340	
4135	5	349	
4140	5	359	
4145	5	368	
4150	5	377	
4155	5	386	
4160	5	396	(1.8 div. per kc)
4165	5	405	
4170	5	415	
4175	5	424	
4180	5	433	
4185	5	442	
4190	5	452	
4195	5	461	
4200	**5**	**470**	
4205	5	479	
4210	5	489	
4215	5	498	
4220	5	508	
4225	5	517	
4230	5	526	
4235	5	535	(1.8 div. per kc)
4240	5	545	
4245	5	554	
4250	5	564	
4267	**5**	**595**	

Freq.	A	B	
4250	5	564	
4255	5	573	
4260	5	582	
4265	5	591	
4267	**5**	**595**	
4270	5	601	(1.8 divisions per kc)
4275	5	610	
4280	5	620	
4285	5	629	
4290	5	638	
4295	5	647	
4300	5	657	
4305	5	666	
4310	5	675	
4315	5	684	
4320	5	693	
4325	5	702	
4330	5	713	
4335	5	722	
4340	5	732	
4345	5	741	
4350	5	750	
4355	5	759	
4360	5	769	
4365	5	778	
4370	5	787	
4375	5	796	
4380	5	806	(1.8 divisions per kc)
4385	5	815	
4390	5	824	
4395	5	833	
4400	**5**	**843**	
4405	5	852	
4410	5	862	
4415	5	871	
4420	5	880	
4425	5	889	
4430	5	898	
4435	5	907	
4440	5	917	
4445	5	926	
4450	5	935	
4455	5	944	
4460	5	954	
4465	5	963	
4470	5	972	(1.8 divisions per kc)
4475	5	981	
4480	5	991	
4485	5	1000	
4490	5	1009	
4495	5	1018	
4500	5	1027	
4533	**5**	**1089**	

Freq.	A	B	
4500	5	1027	
4505	5	1036	
4510	5	1046	
4515	5	1055	(1.8 divisions per kc)
4520	5	1064	
4525	5	1073	
4530	5	1083	
4533	**5**	**1089**	
4535	5	1092	
4540	5	1101	
4545	5	1110	
4550	5	1119	
4555	5	1128	
4560	5	1138	
4565	5	1147	
4570	5	1156	
4575	5	1165	
4580	5	1174	
4585	5	1183	
4590	5	1193	
4595	5	1202	
4600	**5**	**1211**	
4605	5	1220	
4610	5	1229	
4615	5	1238	(1.8 divisions per kc)
4620	5	1247	
4625	5	1256	
4630	5	1266	
4635	5	1275	
4640	5	1284	
4645	5	1293	
4650	5	1302	
4655	5	1311	
4660	5	1321	
4665	5	1330	
4670	5	1339	
4675	5	1348	
4680	5	1357	
4685	5	1366	
4690	5	1376	
4695	5	1385	
4700	5	1394	
4705	5	1403	
4710	5	1412	(1.8 div. per kc)
4715	5	1421	
4720	5	1430	
4725	5	1439	
4730	5	1449	
4735	5	1458	
4740	5	1468	
4745	5	1477	
4750	5	1486	
4800	**5**	**1578**	

Freq.	A	B	
4750	5	1486	
4755	5	1495	(1.8 divisions per kc)
4760	5	1504	
4765	5	1513	
4770	4	1523	
4775	5	1532	
4780	5	1541	
4785	5	1550	
4790	5	1560	
4795	5	1569	
4800	**5**	**1578**	
4800	**6**	**060**	
4805	6	068	
4810	6	076	
4815	6	084	
4820	6	091	
4825	6	099	
4830	6	106	(1.5 divisions per kc)
4835	6	114	
4840	6	121	
4845	6	129	
4850	6	137	
4855	6	145	
4860	6	152	
4865	6	160	
4870	6	168	
4875	6	176	
4880	6	183	
4885	6	191	
4890	6	198	
4895	6	206	
4900	6	213	
4905	6	221	
4910	6	228	
4915	6	236	
4920	6	243	
4925	6	251	
4930	6	259	(1.5 divisions per kc)
4935	6	267	
4940	6	274	
4945	6	282	
4950	6	290	
4955	6	298	
4960	6	305	
4965	6	313	
4970	6	320	
4975	6	328	
4980	6	335	
4985	6	343	
4990	6	351	
4995	6	359	
5000	**6**	**366**	

Use nearest check point shown in heavy type.

Frequency 5000 to 6000 kilocycles

TABLE II—(Cont.)

Freq.	A	B		Freq.	A	B		Freq.	A	B		Freq.	A	B	
5000	**6**	**366**	(1.5 divisions per kc)	5250	6	752		5500	6	1133		5750	6	1513	
5005	6	374		5255	6	760		5505	6	1141		5755	6	1521	
5010	6	381		5260	6	767		5510	6	1148		5760	6	1528	
5015	6	389		5265	6	775		5515	6	1156		5765	6	1536	
5020	6	397		5270	6	782		5520	6	1163		5770	6	1544	(1.5 divisions per kc)
5025	6	405		5275	6	790		5525	6	1171		5775	6	1552	
5030	6	412		5280	6	797		5530	6	1179		5780	6	1559	
				5285	6	805		5535	6	1187		5785	6	1567	
5035	6	420		5290	6	813	(1.5 divisions per kc)	5540	6	1194		5790	6	1574	
5040	6	427		5295	6	821		5545	6	1202		5795	6	1582	
5045	6	435		5300	6	828		5550	6	1209		**5800**	**6**	**1590**	
5050	6	443		5305	6	836		5555	6	1217		5805	6	1598	
5055	6	451		5310	6	844		5560	6	1224		5810	6	1605	
5060	6	458		5315	6	852		5565	6	1232		5815	6	1613	
5065	6	466	(1.5 divisions per kc)	5320	6	859		5570	6	1239		5820	6	1621	
5067	**6**	**469**		5325	6	867		5575	6	1247	(1.5 divisions per kc)	5825	6	1629	
5070	6	474		5330	6	874		5580	6	1254		5830	6	1636	
5075	6	482		**5333**	**6**	**879**		5585	6	1262					
5080	6	489		5335	6	882		5590	6	1270		5835	6	1644	
5085	6	497		5340	6	890		5595	6	1278		5840	6	1653	
5090	6	505		5345	6	898		**5600**	**6**	**1285**		5845	6	1661	
5095	6	513		5350	6	905		5605	6	1293		5850	6	1668	
5100	6	520		5355	6	913		5610	6	1300		5855	6	1676	
5105	6	528		5360	6	920		5615	6	1308		5860	6	1683	
5110	6	535		5365	6	928		5620	6	1315		5865	6	1691	(1.6 divisions per kc)
5115	6	543						5625	6	1323		**5867**	**6**	**1694**	
5120	6	551		5370	6	935		5630	6	1330		5870	6	1699	
5125	6	559		5375	6	943		5635	6	1338		5875	6	1707	
5130	6	567		5380	6	951		5640	6	1345		5880	6	1715	
				5385	6	959		5645	6	1353		5885	6	1723	
5135	6	575		5390	6	966		5650	6	1361		5890	6	1731	
5140	6	582		5395	6	974		5655	6	1369		5895	6	1739	
5145	6	590		**5400**	**6**	**981**		5660	6	1376		5900	6	1747	
5150	6	597		5405	6	989		5665	6	1384		5905	6	1755	
5155	6	605		5410	6	996		5670	6	1391		5910	6	1763	
5160	6	613		5415	6	1004		5675	6	1399		5915	6	1771	
5165	6	621		5420	6	1012	(1.5 divisions per kc)	5680	6	1406		5920	6	1779	
5170	6	628		5425	6	1020		5685	6	1414		5925	6	1787	
5175	6	636		5430	6	1027		5690	6	1421		5930	6	1795	
5180	6	644		5435	6	1035		5695	6	1429					
5185	6	652		5440	6	1042		5700	6	1436		5935	6	1803	
5190	6	659	(1.5 divisions per kc)	5445	6	1050						5940	6	1811	
5195	6	667		5450	6	1057		5705	6	1444		5945	6	1819	
5200	**6**	**674**		5455	6	1065		5710	6	1452		5950	6	1827	
5205	6	682		5460	6	1073		5715	6	1460	(1.5 divisions per kc)	5955	6	1835	(1.6 divisions per kc)
5210	6	690		5465	6	1081		5720	6	1467		5960	6	1844	
5215	6	698		5470	6	1088		5725	6	1475		5965	6	1852	
5220	6	705		5475	6	1096		5730	6	1482		5970	6	1860	
5225	6	713		5480	6	1103		5735	6	1490		5975	6	1868	
5230	6	721		5485	6	1111		5740	6	1498		5980	6	1877	
5235	6	729		5490	6	1118		5745	6	1506		5985	6	1885	
5240	6	736		5495	6	1126		5750	6	1513		5990	6	1893	
5245	6	744		5500	6	1133		**5800**	**6**	**1590**		5995	6	1901	
5250	6	752										**6000**	**6**	**1910**	

Use nearest check point shown in heavy type.

TABLE II—(Cont.)

Freq.	A	B	Freq.	A	B	Freq.	A	B	Freq.	A	B
6000	**7**	**100**	6250	7	408	6500	7	719	6750	7	1027
6005	7	106	6255	7	415	6505	7	725	6755	7	1033
6010	7	112	6260	7	421	6510	7	732	6760	7	1039
6015	7	119	6265	7	427	6515	7	738	6765	7	1046
6020	7	125	6270	7	433	6520	7	744	6770	7	1052
6025	7	131	6275	7	439	6525	7	750	6775	7	1058
6030	7	138	6280	7	445	6530	7	756	6780	7	1064
6035	7	144	6285	7	452	6535	7	762	6785	7	1070
6040	7	150	6290	7	458	6540	7	769	6790	7	1076
6045	7	156	6295	7	464	6545	7	775	6795	7	1083
6050	7	162	**6300**	**7**	**470** (1.2 divisions per kc)	6550	7	781	**6800**	**7**	**1089** (1.2 divisions per kc)
6055	7	168	6305	7	476	6555	7	787	6805	7	1095
6060	7	174 (1.2 divisions per kc)	6310	7	482	6560	7	793	6810	7	1101
6065	7	180	6315	7	489	6565	7	799 (1.2 divisions per kc)	6815	7	1107
6070	7	186	6320	7	495	6570	7	806	6820	7	1113
6075	7	193	6325	7	501	6575	7	812	6825	7	1119
6080	7	199	6330	7	508	6580	7	818	6830	7	1125
6085	7	205	6335	7	514	6585	7	824	6835	7	1131
6090	7	211	6340	7	520	6590	7	830	6840	7	1138
6095	7	217	6345	7	526	6595	7	836	6845	7	1144
6100	7	223	6350	7	532	**6600**	**7**	**843**	6850	7	1150
6105	7	230				6605	7	849			
6110	7	236	6355	7	538	6610	7	855	6855	7	1156
6115	7	242	6360	7	545	6615	7	862	6860	7	1162
6120	7	248	6365	7	551	6620	7	868	6865	7	1168
6125	7	254	6370	7	557	6625	7	874	6870	7	1174
6130	7	260	6375	7	564	6630	7	880	6875	7	1180
6135	7	267	6380	7	570	6635	7	886	6880	7	1186
6140	7	273	6385	7	576	6640	7	892	6885	7	1193
6145	7	279	6390	7	582	6645	7	898	6890	7	1199
6150	7	285	6395	7	588	6650	7	904	6895	7	1205
			6400	**7**	**595**	6655	7	910	**6900**	**7**	**1211**
6155	7	291	6405	7	601	6660	7	917	6905	7	1217
6160	7	297	6410	7	607	6665	7	923	6910	7	1223
6165	7	303	6415	7	613	6670	7	929	6915	7	1229
6170	7	309	6420	7	620	6675	7	935 (1.2 divisions per kc)	6920	7	1235
6175	7	315	6425	7	626	6680	7	941	6925	7	1241 (1.2 divisions per kc)
6180	7	322	6430	7	632 (1.2 divisions per kc)	6685	7	947	6930	7	1247
6185	7	328	6435	7	638	6690	7	954	6935	7	1253
6190	7	334	6440	7	644	6695	7	960	6940	7	1259
6195	7	340	6445	7	650	6700	7	966	6945	7	1266
6200	7	346 (1.2 divisions per kc)	6450	7	657				6950	7	1272
6205	7	352	6455	7	663	6705	7	972	6955	7	1278
6210	7	359	6460	7	669	6710	7	978	6960	7	1284
6215	7	365	6465	7	675	6715	7	984	6965	7	1290
6220	7	371	6470	7	681	6720	7	991	6970	7	1296
6225	7	377	6475	7	687	6725	7	997	6975	7	1302
6230	7	383	6480	7	693	6730	7	1003	6980	7	1308
6235	7	389	6485	7	699	6735	7	1009	6985	7	1314
6240	7	396	6490	7	705	6740	7	1015 (1.2 divisions per kc)	6990	7	1321
6245	7	402	6495	7	713	6745	7	1021	6995	7	1327
6250	7	408	6500	7	719	6750	7	1027	7000	7	1333
6300	**7**	**470**				**6800**	**7**	**1089**			

Use nearest check point shown in heavy type.

Frequency 7000 to 8000 kilocycles

TABLE II—(Cont.)

Freq.	A	B	Note
6900	**7**	**1211**	
7000	7	1333	(1.2 div. per kc)
7005	7	1339	
7010	7	1345	
7015	7	1351	
7020	7	1357	
7025	7	1363	
7030	7	1369	
7035	7	1376	
7040	7	1382	
7045	7	1388	
7050	7	1394	
7055	7	1400	
7060	7	1406	
7065	7	1412	
7070	7	1418	
7075	7	1424	
7080	7	1430	
7085	7	1436	
7090	7	1442	
7095	7	1449	
7100	7	1455	(1.2 divisions per kc)
7105	7	1461	
7110	7	1468	
7115	7	1474	
7120	7	1480	
7125	7	1486	
7130	7	1492	
7135	7	1498	
7140	7	1504	
7145	7	1510	
7150	7	1516	
7155	7	1523	
7160	7	1529	
7165	7	1535	
7170	7	1541	
7175	7	1547	
7180	7	1553	
7185	7	1560	
7190	7	1566	
7195	7	1572	
7200	**7**	**1578**	
7200	**8**	**060**	
7205	8	065	
7210	8	070	(1 div. per kc)
7215	8	076	
7220	8	081	
7225	8	086	
7230	8	091	
7235	8	096	
7240	8	101	
7245	8	106	
7250	8	111	

Freq.	A	B	Note
7200	**8**	**060**	
7250	8	111	
7255	8	116	
7260	8	121	
7265	8	126	
7270	8	131	
7275	8	137	
7280	8	142	
7285	8	147	
7290	8	152	(1 division per kc)
7295	8	157	
7300	8	162	
7305	8	168	
7310	8	173	
7315	8	178	
7320	8	183	
7325	8	188	
7330	8	193	
7335	8	198	
7340	8	203	
7345	8	208	
7350	8	213	
7355	8	218	
7360	8	223	
7365	8	228	
7370	8	233	
7375	8	238	
7380	8	243	
7385	8	248	
7390	8	253	
7395	8	259	
7400	8	264	
7405	8	269	
7410	8	274	(1 division per kc)
7415	8	279	
7420	8	284	
7425	8	290	
7430	8	295	
7435	8	300	
7440	8	305	
7445	8	310	
7450	8	315	
7455	8	320	
7460	8	325	
7465	8	330	
7470	8	335	
7475	8	340	
7480	8	345	
7485	8	351	
7490	8	356	
7495	8	361	
7500	**8**	**366**	

Freq.	A	B	Note
7500	**8**	**366**	
7505	8	371	(1 division per kc)
7510	8	376	
7515	8	381	
7520	8	386	
7525	8	391	
7530	8	397	
7535	8	402	
7540	8	407	
7545	8	412	
7550	8	417	
7555	8	422	
7560	8	427	
7565	8	432	
7570	8	437	
7575	8	443	
7580	8	448	
7585	8	453	
7590	8	458	
7595	8	463	
7600	**8**	**469**	
7605	8	474	(1 division per kc)
7610	8	479	
7615	8	484	
7620	8	489	
7625	8	494	
7630	8	499	
7635	8	505	
7640	8	510	
7645	8	515	
7650	8	520	
7655	8	525	
7660	8	530	
7665	8	535	
7670	8	540	
7675	8	545	
7680	8	551	
7685	8	556	
7690	8	561	
7695	8	567	
7700	8	572	
7705	8	577	
7710	8	582	
7715	8	587	(1 division per kc)
7720	8	592	
7725	8	597	
7730	8	602	
7735	8	607	
7740	8	613	
7745	8	618	
7750	8	623	
7800	**8**	**674**	

Freq.	A	B	Note
7750	8	623	
7755	8	628	
7760	8	633	
7765	8	638	
7770	8	644	
7775	8	649	
7780	8	654	
7785	8	659	
7790	8	664	
7795	8	669	
7800	**8**	**674**	
7805	8	679	(1 division per kc)
7810	8	684	
7815	8	690	
7820	8	695	
7825	8	700	
7830	8	705	
7835	8	710	
7840	8	715	
7845	8	721	
7850	8	726	
7855	8	731	
7860	8	736	
7865	8	741	
7870	8	746	
7875	8	752	
7880	8	757	
7885	8	762	
7890	8	767	
7895	8	772	
7900	8	777	
7905	8	782	
7910	8	787	
7915	8	792	
7920	8	797	
7925	8	802	
7930	8	807	
7935	8	813	
7940	8	818	
7945	8	823	(1 division per kc)
7950	8	828	
7955	8	833	
7960	8	838	
7965	8	844	
7970	8	849	
7975	8	854	
7980	8	859	
7985	8	864	
7990	8	869	
7995	8	874	
8000	**8**	**879**	

Use nearest check point shown in heavy type.

TABLE II—(Cont.)

Freq.	A	B	
8000	**8**	**879**	(1 div. per kc)
8010	8	890	
8020	8	900	
8030	8	910	
8040	8	920	
8050	8	930	
8060	8	940	
8070	8	951	
8080	8	961	
8090	8	971	
8100	**8**	**981**	
8110	8	991	
8120	8	1001	
8130	8	1012	(1 division per kc)
8140	8	1022	
8150	8	1032	
8160	8	1042	
8170	8	1052	
8180	8	1062	
8190	8	1073	
8200	8	1083	
8210	8	1093	
8220	8	1103	
8230	8	1113	
8240	8	1123	
8250	8	1133	
8260	8	1143	
8270	8	1153	
8280	8	1163	
8290	8	1173	
8300	8	1183	
8310	8	1194	
8320	8	1204	
8330	8	1214	
8340	8	1224	
8350	8	1234	(1 division per kc)
8360	8	1244	
8370	8	1254	
8380	8	1264	
8390	8	1274	
8400	**8**	**1285**	
8410	8	1295	
8420	8	1305	
8430	8	1315	
8440	8	1325	
8450	8	1335	
8460	8	1345	
8470	8	1355	
8480	8	1365	
8490	8	1376	
8500	8	1386	

Freq.	A	B	
8400	**8**	**1285**	(1 division per kc)
8500	8	1386	
8510	8	1396	
8520	8	1406	
8530	8	1416	
8540	8	1426	
8550	8	1436	
8560	8	1446	
8570	8	1456	
8580	8	1467	
8590	8	1477	
8600	8	1487	
8610	8	1498	
8620	8	1508	(1 division per kc)
8630	8	1518	
8640	8	1528	
8650	8	1538	
8660	8	1548	
8670	8	1559	
8680	8	1569	
8690	8	1579	
8700	**8**	**1590**	
8710	8	1600	
8720	8	1610	
8730	8	1621	
8740	8	1631	
8750	8	1641	
8760	8	1653	
8770	8	1663	
8780	8	1673	
8790	8	1683	
8800	**8**	**1694**	(1 division per kc)
8810	8	1704	
8820	8	1715	
8830	8	1725	
8840	8	1736	
8850	8	1747	
8860	8	1757	
8870	8	1768	
8880	8	1779	
8890	8	1789	
8900	8	1799	
8910	8	1811	
8920	8	1821	(1 division per kc)
8930	8	1832	
8940	8	1843	
8950	8	1854	
8960	8	1865	
8970	8	1877	
8980	8	1888	
8990	8	1899	
9000	**8**	**1910**	

Freq.	A	B	
9000	**9**	**100**	
9010	9	108	
9020	9	116	
9030	9	124	
9040	9	132	
9050	9	140	
9060	9	148	
9070	9	156	
9080	9	165	(0.8 divisions per kc)
9090	9	174	
9100	9	182	
9110	9	190	
9120	9	198	
9130	9	206	
9140	9	214	
9150	9	222	
9160	9	230	
9170	9	239	
9180	9	248	
9190	9	256	
9200	9	264	
9210	9	272	
9220	9	280	
9230	9	288	
9240	9	296	
9250	9	304	
9260	9	313	
9270	9	322	
9280	9	330	
9290	9	338	
9300	9	346	
9310	9	354	
9320	9	362	
9330	9	370	
9340	9	378	
9350	9	387	
9360	9	396	(0.8 divisions per kc)
9370	9	404	
9380	9	412	
9390	9	420	
9400	9	428	
9410	9	436	
9420	9	444	
9430	9	452	
9440	9	461	
9450	**9**	**470**	
9460	9	478	
9470	9	486	
9480	9	494	
9490	9	502	
9500	9	510	

Freq.	A	B	
9450	**9**	**470**	
9500	9	510	
9510	9	518	
9520	9	527	
9530	9	536	
9540	9	545	
9550	9	553	
9560	9	561	
9570	9	570	(0.8 divisions per kc)
9580	9	578	
9590	9	586	
9600	**9**	**595**	
9610	9	601	
9620	9	610	
9630	9	620	
9640	9	628	
9650	9	636	
9660	9	644	
9670	9	652	
9680	9	660	
9690	9	668	
9700	9	676	
9710	9	684	
9720	9	693	
9730	9	701	
9740	9	709	
9750	9	717	
9760	9	725	
9770	9	733	
9780	9	742	
9790	9	751	
9800	9	760	
9810	9	769	
9820	9	777	
9830	9	785	
9840	9	793	
9850	9	801	(0.8 divisions per kc)
9860	9	809	
9870	9	817	
9880	9	825	
9890	9	834	
9900	**9**	**843**	
9910	9	851	
9920	9	859	
9930	9	867	
9940	9	875	
9950	9	883	
9960	9	891	
9970	9	899	
9980	9	908	
9990	9	917	
10000	9	925	

Use nearest check point shown in heavy type.

Frequency 10000 to 12000 kilocycles

TABLE II—(Cont.)

Freq.	A	B	
9900	**9**	**843**	(0.8 divisions per kc)
10000	9	925	
10010	9	933	
10020	9	941	
10030	9	949	
10040	9	957	
10050	9	965	
10060	9	973	
10070	9	982	
10080	9	991	
10090	9	999	
10100	9	1007	
10110	9	1015	
10120	9	1023	(0.8 divisions per kc)
10130	9	1031	
10140	9	1039	
10150	9	1047	
10160	9	1055	
10170	9	1064	
10180	9	1072	
10190	9	1080	
10200	**9**	**1089**	
10210	9	1097	
10220	9	1105	
10230	9	1113	
10240	9	1121	
10250	9	1129	
10260	9	1138	
10270	9	1146	
10280	9	1154	
10290	9	1162	
10300	9	1170	
10310	9	1178	
10320	9	1186	
10330	9	1194	
10340	9	1202	(0.8 divisions per kc)
10350	**9**	**1211**	
10360	9	1219	
10370	9	1227	
10380	9	1235	
10390	9	1243	
10400	9	1251	
10410	9	1259	
10420	9	1267	
10430	9	1275	
10440	9	1284	
10450	9	1292	
10460	9	1300	
10470	9	1308	
10480	9	1316	
10490	9	1324	
10500	9	1333	

Freq.	A	B	
10350	**9**	**1211**	(0.8 divisions per kc)
10500	9	1333	
10510	9	1341	
10520	9	1349	
10530	9	1357	
10540	9	1365	
10550	9	1373	
10560	9	1381	
10570	9	1389	
10580	9	1397	
10590	9	1405	
10600	9	1413	
10610	9	1421	
10620	9	1430	
10630	9	1438	
10640	9	1446	(0.8 divisions per kc)
10650	9	1454	
10660	9	1462	
10670	9	1470	
10680	9	1478	
10690	9	1486	
10700	9	1494	
10710	9	1504	
10720	9	1512	
10730	9	1520	
10740	9	1528	
10750	9	1536	
10760	9	1544	
10770	9	1552	
10780	9	1560	
10790	9	1569	
10800	**9**	**1578**	
10800	**10**	**060**	
10810	10	066	
10820	10	072	
10830	10	079	
10840	10	086	
10850	10	093	
10860	10	100	(0.68 divisions per kc)
10870	10	107	
10880	10	114	
10890	10	121	
10900	10	127	
10910	10	134	
10920	10	141	
10930	10	148	
10940	10	155	
10950	10	162	
10960	10	169	
10970	10	176	
10980	10	183	
10990	10	189	
11000	10	195	

Freq.	A	B	
11000	10	195	
11010	10	202	
11020	10	209	
11030	10	216	
11040	10	223	
11050	10	230	
11060	10	237	
11070	10	243	
11080	10	249	
11090	10	256	
11100	10	264	
11110	10	270	(0.68 divisions per kc)
11120	10	277	
11130	10	284	
11140	10	291	
11150	10	297	
11160	10	305	
11170	10	311	
11180	10	317	
11190	10	324	
11200	10	331	
11210	10	338	
11220	10	345	
11230	10	352	
11240	10	359	
11250	**10**	**366**	
11260	10	372	
11270	10	378	
11280	10	385	
11290	10	392	
11300	10	399	
11310	10	406	
11320	10	413	
11330	10	420	
11340	10	427	
11350	10	433	
11360	10	440	
11370	10	447	(0.68 divisions per kc)
11380	10	454	
11390	10	462	
11400	**10**	**469**	
11410	10	475	
11420	10	482	
11430	10	489	
11440	10	495	
11450	10	503	
11460	10	510	
11470	10	517	
11480	10	524	
11490	10	531	
11500	10	538	

Freq.	A	B	
11400	**10**	**469**	(0.68 divisions per kc)
11500	10	538	
11510	10	545	
11520	10	551	
11530	10	557	
11540	10	563	
11550	10	570	
11560	10	577	
11570	10	584	
11580	10	591	
11590	10	598	
11600	10	605	
11610	10	613	
11620	10	619	
11630	10	625	
11640	10	632	
11650	10	639	
11660	10	646	
11670	10	653	(0.68 divisions per kc)
11680	10	660	
11690	10	667	
11700	**10**	**674**	
11710	10	680	
11720	10	687	
11730	10	694	
11740	10	701	
11750	10	708	
11760	10	715	
11770	10	722	
11780	10	729	
11790	10	736	
11800	10	742	
11810	10	748	
11820	10	755	
11830	10	762	
11840	10	769	
11850	10	776	
11860	10	783	
11870	10	790	
11880	10	797	
11890	10	803	(0.68 divisions per kc)
11900	10	810	
11910	10	817	
11920	10	824	
11930	10	831	
11940	10	838	
11950	10	845	
11960	10	852	
11970	10	859	
11980	10	866	
11990	10	873	
12000	**10**	**879**	

Use nearest check point shown in heavy type.

TABLE II—(Cont.)

Freq.	A	B	
12000	**11**	**100**	
12010	11	106	
12020	11	112	
12030	11	119	
12040	11	125	
12050	11	131	
12060	11	138	
12070	11	144	
12080	11	150	
12090	11	156	
12100	11	162	
12110	11	168	
12120	11	174	
12130	11	180	(0.6 divisions per kc)
12140	11	187	
12150	11	193	
12160	11	199	
12170	11	205	
12180	11	211	
12190	11	217	
12200	11	223	
12210	11	230	
12220	11	236	
12230	11	242	
12240	11	248	
12250	11	254	
12260	11	260	
12270	11	267	
12280	11	273	
12290	11	279	
12300	11	285	
12310	11	291	
12320	11	297	
12330	11	303	
12340	11	309	
12350	11	315	
12360	11	322	
12370	11	328	(0.6 divisions per kc)
12380	11	334	
12390	11	340	
12400	11	346	
12410	11	352	
12420	11	359	
12430	11	365	
12440	11	371	
12450	11	377	
12460	11	383	
12470	11	389	
12480	11	396	
12490	11	402	
12500	11	408	
12600	**11**	**470**	

Freq.	A	B	
12500	11	408	
12510	11	415	
12520	11	421	
12530	11	427	
12540	11	433	
12550	11	439	
12560	11	445	(0.6 divisions per kc)
12570	11	452	
12580	11	458	
12590	11	464	
12600	**11**	**470**	
12610	11	476	
12620	11	482	
12630	11	489	
12640	11	495	
12650	11	501	
12660	11	508	
12670	11	514	
12680	11	520	
12690	11	526	
12700	11	532	
12710	11	538	
12720	11	545	
12730	11	551	
12740	11	557	
12750	11	564	
12760	11	570	
12770	11	576	
12780	11	582	
12790	11	590	(0.6 divisions per kc)
12800	**11**	**595**	
12810	11	601	
12820	11	607	
12830	11	613	
12840	11	620	
12850	11	626	
12860	11	632	
12870	11	638	
12880	11	644	
12890	11	650	
12900	11	657	
12910	11	663	
12920	11	669	
12930	11	675	
12940	11	681	
12950	11	687	
12960	11	693	
12970	11	699	
12980	11	706	
12990	11	713	
13000	11	719	

Freq.	A	B	
13000	11	719	
13010	11	725	
13020	11	732	
13030	11	738	
13040	11	744	
13050	11	750	
13060	11	756	
13070	11	762	
13080	11	769	
13090	11	775	
13100	11	781	(0.6 divisions per kc)
13110	11	787	
13120	11	793	
13130	11	799	
13140	11	806	
13150	11	812	
13160	11	818	
13170	11	824	
13180	11	830	
13190	11	836	
13200	**11**	**843**	
13210	11	849	
13220	11	855	
13230	11	862	
13240	11	868	
13250	11	874	
13260	11	880	
13270	11	886	
13280	11	892	
13290	11	898	
13300	11	904	
13310	11	910	(0.6 divisions per kc)
13320	11	917	
13330	11	923	
13340	11	929	
13350	11	935	
13360	11	941	
13370	11	947	
13380	11	954	
13390	11	960	
13400	11	966	
13410	11	972	
13420	11	980	
13430	11	986	
13440	11	991	(0.6 divisions per kc)
13450	11	997	
13460	11	1003	
13470	11	1009	
13480	11	1015	
13490	11	1021	
13500	11	1027	
13600	**11**	**1089**	

Freq.	A	B	
13500	11	1027	
13510	11	1033	
13520	11	1039	
13530	11	1046	
13540	11	1052	
13550	11	1058	
13560	11	1064	(0.6 divisions per kc)
13570	11	1070	
13580	11	1076	
13590	11	1083	
13600	**11**	**1089**	
13610	11	1095	
13620	11	1101	
13630	11	1107	
13640	11	1113	
13650	11	1119	
13660	11	1125	
13670	11	1131	
13680	11	1138	
13690	11	1144	
13700	11	1150	
13710	11	1156	
13720	11	1162	
13730	11	1168	
13740	11	1174	(0.6 divisions per kc)
13750	11	1180	
13760	11	1186	
13770	11	1193	
13780	11	1199	
13790	11	1205	
13800	**11**	**1211**	
13810	11	1217	
13820	11	1223	
13830	11	1229	
13840	11	1235	
13850	11	1241	
13860	11	1247	
13870	11	1253	
13880	11	1259	
13890	11	1266	
13900	11	1272	
13910	11	1278	
13920	11	1284	
13930	11	1290	(0.6 div. per kc)
13940	11	1296	
13950	11	1302	
13960	11	1308	
13970	11	1314	
13980	11	1321	
13990	11	1327	
14000	11	1333	

Use nearest check point shown in heavy type.

Frequency 14000 to 16000 kilocycles

TABLE II—(Cont.)

Freq.	A	B	
13800	**11**	**1211**	
14000	11	1333	
14010	11	1339	(0.6 divisions per kc)
14020	11	1345	
14030	11	1351	
14040	11	1357	
14050	11	1363	
14060	11	1369	
14070	11	1376	
14080	11	1382	
14090	11	1388	
14100	11	1394	
14110	11	1400	
14120	11	1406	
14130	11	1412	
14140	11	1418	
14150	11	1424	
14160	11	1430	
14170	11	1436	
14180	11	1442	
14190	11	1449	
14200	11	1455	
14210	11	1461	
14220	11	1468	(0.6 divisions per kc)
14230	11	1474	
14240	11	1480	
14250	11	1486	
14260	11	1492	
14270	11	1498	
14280	11	1504	
14290	11	1510	
14300	11	1516	
14310	11	1523	
14320	11	1529	
14330	11	1535	
14340	11	1541	
14350	11	1547	
14360	11	1553	
14370	11	1560	
14380	11	1566	
14390	11	1572	
14400	**11**	**1578**	
14400	**12**	**060**	
14410	12	065	(0.5 div. per kc)
14420	12	070	
14430	12	076	
14440	12	081	
14450	12	086	
14460	12	091	
14470	12	096	
14480	12	101	
14490	12	106	
14500	12	111	

Freq.	A	B	
14400	**12**	**060**	
14500	12	111	
14510	12	116	
14520	12	121	
14530	12	126	
14540	12	131	
14550	12	137	
14560	12	142	
14570	12	147	
14580	12	152	(0.5 divisions per kc)
14590	12	157	
14600	12	162	
14610	12	168	
14620	12	173	
14630	12	178	
14640	12	183	
14650	12	188	
14660	12	193	
14670	12	198	
14680	12	203	
14690	12	208	
14700	12	213	
14710	12	218	
14720	12	223	
14730	12	228	
14740	12	233	
14750	12	238	
14760	12	243	
14770	12	248	
14780	12	253	
14790	12	259	
14800	12	264	
14810	12	269	
14820	12	274	
14830	12	279	
14840	12	284	
14850	12	290	
14860	12	295	
14870	12	300	(0.5 divisions per kc)
14880	12	305	
14890	12	310	
14900	12	315	
14910	12	320	
14920	12	325	
14930	12	330	
14940	12	335	
14950	12	340	
14960	12	345	
14970	12	351	
14980	12	356	
14990	12	361	
15000	**12**	**366**	

Freq.	A	B	
15000	**12**	**366**	
15010	12	371	(0.5 divisions per kc)
15020	12	376	
15030	12	381	
15040	12	386	
15050	12	391	
15060	12	397	
15070	12	402	
15080	12	407	
15090	12	412	
15100	12	417	
15110	12	422	
15120	12	427	
15130	12	432	
15140	12	437	
15150	12	443	
15160	12	448	
15170	12	453	
15180	12	458	
15190	12	463	
15200	**12**	**469**	(0.5 divisions per kc)
15210	12	474	
15220	12	479	
15230	12	484	
15240	12	489	
15250	12	494	
15260	12	499	
15270	12	505	
15280	12	510	
15290	12	515	
15300	12	520	
15310	12	525	
15320	12	530	
15330	12	535	
15340	12	540	
15350	12	545	
15360	12	551	
15370	12	556	
15380	12	561	
15390	12	567	
15400	12	572	
15410	12	577	
15420	12	582	(0.5 divisions per kc)
15430	12	587	
15440	12	592	
15450	12	597	
15460	12	602	
15470	12	607	
15480	12	613	
15490	12	618	
15500	12	623	
15600	**12**	**674**	

Freq.	A	B	
15500	12	623	
15510	12	628	
15520	12	633	
15530	12	638	
15540	12	644	
15550	12	649	
15560	12	654	
15570	12	659	
15580	12	664	
15590	12	669	
15600	**12**	**674**	(0.5 divisions per kc)
15610	12	679	
15620	12	684	
15630	12	689	
15640	12	694	
15650	12	699	
15660	12	705	
15670	12	710	
15680	12	715	
15690	12	721	
15700	12	726	
15710	12	731	
15720	12	736	
15730	12	741	
15740	12	746	
15750	12	752	
15760	12	757	
15770	12	762	
15780	12	767	
15790	12	772	
15800	12	777	
15810	12	782	
15820	12	787	
15830	12	792	
15840	12	797	
15850	12	802	
15860	12	807	
15870	12	813	
15880	12	818	(0.5 divisions per kc)
15890	12	823	
15900	12	828	
15910	12	833	
15920	12	838	
15930	12	844	
15940	12	849	
15950	12	854	
15960	12	859	
15970	12	864	
15980	12	869	
15990	12	874	
16000	**12**	**879**	

Use nearest check point shown in heavy type.

DATA

TABLE II—(Cont.)

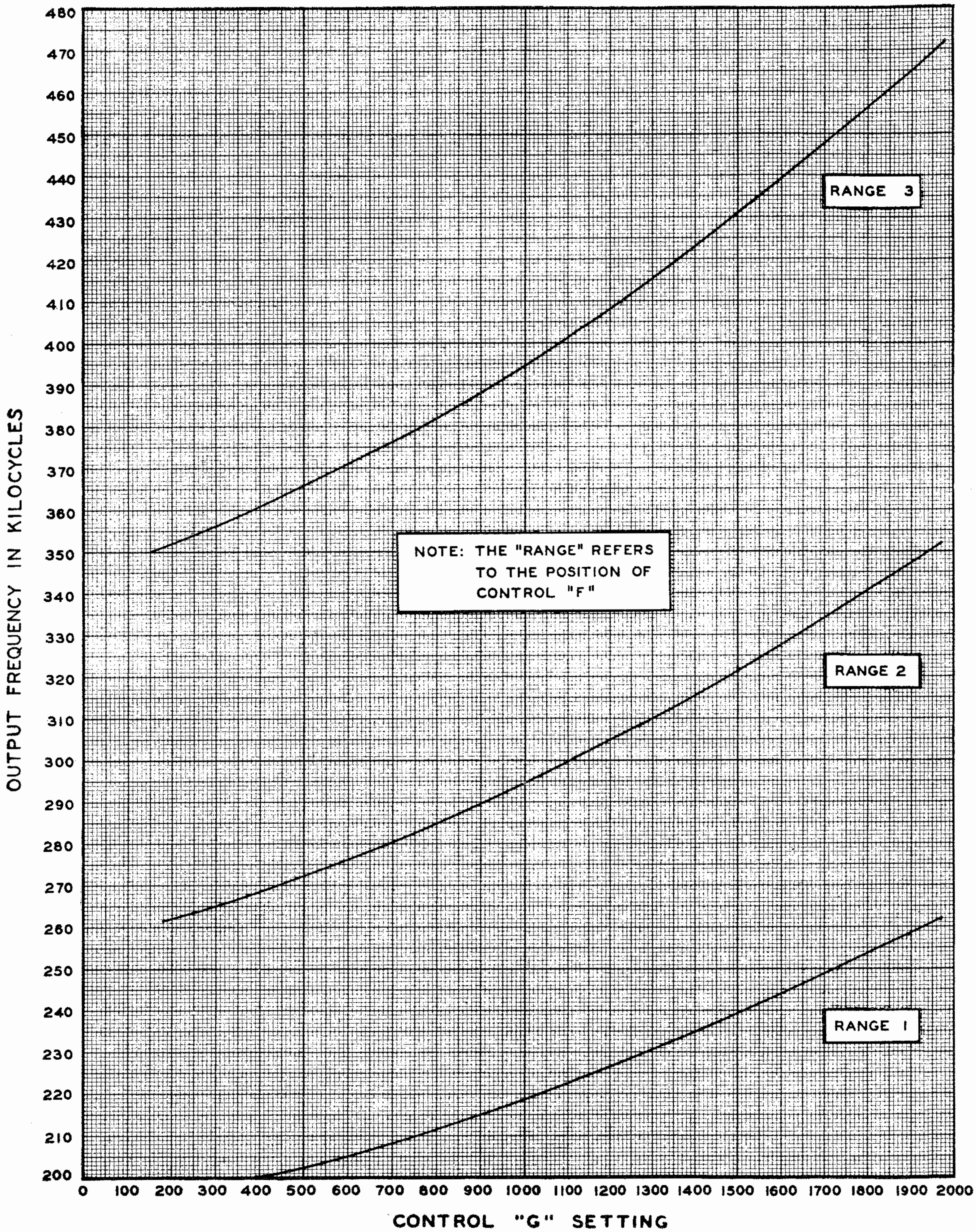
Freq.	A	B	
16000	**12**	**879**	
16010	12	884	(0.5 divisions per kc)
16020	12	890	
16030	12	895	
16040	12	900	
16050	12	905	
16060	12	910	
16070	12	915	
16080	12	920	
16090	12	925	
16100	12	930	
16110	12	935	
16120	12	940	
16130	12	945	
16140	12	951	
16150	12	956	(0.5 divisions per kc)
16160	12	961	
16170	12	966	
16180	12	971	
16190	12	976	
16200	**12**	**981**	
16210	12	986	
16220	12	991	
16230	12	996	
16240	12	1001	
16250	12	1006	
16260	12	1012	
16270	12	1017	
16280	12	1022	
16290	12	1027	
16300	12	1032	
16310	12	1037	
16320	12	1042	
16330	12	1047	
16340	12	1052	(0.5 divisions per kc)
16350	12	1057	
16360	12	1062	
16370	12	1067	
16380	12	1073	
16390	12	1078	
16400	12	1083	
16410	12	1088	
16420	12	1093	
16430	12	1098	
16440	12	1103	
16450	12	1108	
16460	12	1113	
16470	12	1118	
16480	12	1123	
16490	12	1128	
16500	12	1133	

Freq.	A	B	
16500	12	1133	
16510	12	1138	
16520	12	1143	
16530	12	1148	
16540	12	1153	
16550	12	1158	
16560	12	1163	
16570	12	1168	
16580	12	1173	
16590	12	1179	(0.51 divisions per kc)
16600	12	1184	
16610	12	1189	
16620	12	1194	
16630	12	1199	
16640	12	1204	
16650	12	1209	
16660	12	1214	
16670	12	1219	
16680	12	1224	
16690	12	1229	
16700	12	1234	
16710	12	1239	
16720	12	1244	
16730	12	1249	
16740	12	1254	
16750	12	1259	
16760	12	1264	
16770	12	1270	
16780	12	1275	
16790	12	1280	
16800	**12**	**1285**	
16810	12	1290	
16820	12	1295	
16830	12	1300	
16840	12	1305	(0.51 divisions per kc)
16850	12	1310	
16860	12	1315	
16870	12	1320	
16880	12	1325	
16890	12	1330	
16900	12	1335	
16910	12	1340	
16920	12	1345	
16930	12	1350	
16940	12	1355	
16950	12	1361	
16960	12	1366	
16970	12	1371	
16980	12	1376	
16990	12	1381	
17000	12	1386	

Freq.	A	B	
16800	**12**	**1285**	
17000	12	1386	(0.52 divisions per kc)
17010	12	1391	
17020	12	1396	
17030	12	1401	
17040	12	1406	
17050	12	1411	
17060	12	1416	
17070	12	1421	
17080	12	1426	
17090	12	1431	
17100	12	1436	
17110	12	1441	
17120	12	1446	
17130	12	1452	
17140	12	1457	
17150	12	1462	
17160	12	1467	
17170	12	1472	
17180	12	1477	
17190	12	1482	
17200	12	1487	
17210	12	1492	
17220	12	1498	
17230	12	1503	
17240	12	1508	
17250	12	1513	
17260	12	1518	
17270	12	1523	
17280	12	1528	(0.53 divisions per kc)
17290	12	1533	
17300	12	1538	
17310	12	1544	
17320	12	1549	
17330	12	1554	
17340	12	1559	
17350	12	1564	
17360	12	1569	
17370	12	1574	
17380	12	1579	
17390	12	1584	
17400	**12**	**1590**	
17410	12	1595	
17420	12	1600	
17430	12	1605	
17440	12	1610	
17450	12	1615	
17460	12	1621	
17470	12	1626	
17480	12	1631	
17490	12	1636	
17500	12	1641	
17510	12	1647	(0.53 div. per kc)
17520	12	1653	
17530	12	1658	
17540	12	1663	
17550	12	1668	
17600	**12**	**1694**	

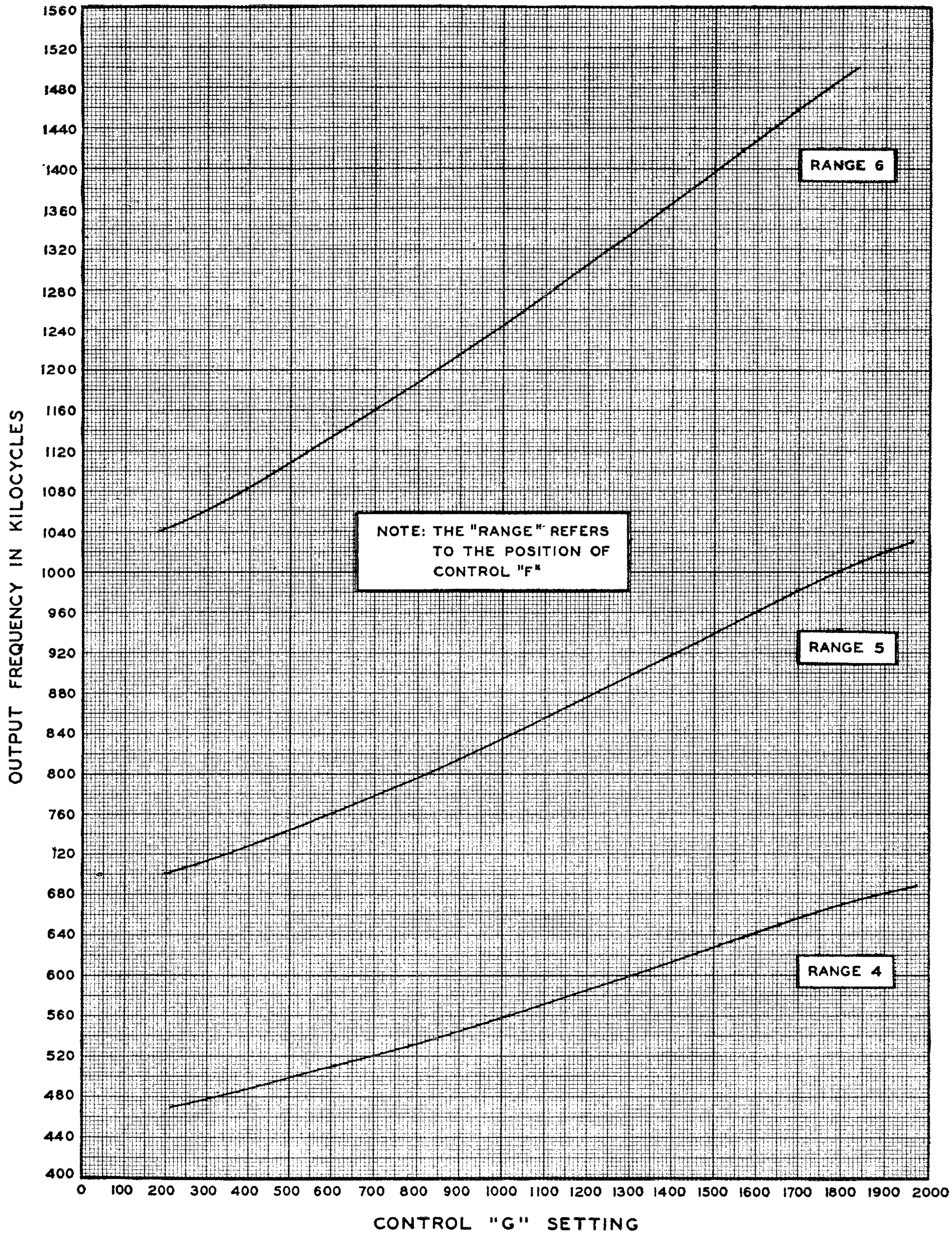
Freq.	A	B	
17550	12	1668	
17560	12	1673	
17570	12	1678	
17580	12	1683	
17590	12	1688	
17600	**12**	**1694**	
17610	12	1699	
17620	12	1704	
17630	12	1709	
17640	12	1715	(0.54 divisions per kc)
17650	12	1720	
17660	12	1725	
17670	12	1731	
17680	12	1736	
17690	12	1742	
17700	12	1747	
17710	12	1752	
17720	12	1757	
17730	12	1763	
17740	12	1768	
17750	12	1773	
17760	12	1779	
17770	12	1784	
17780	12	1789	
17790	12	1795	
17800	12	1800	
17810	12	1805	
17820	12	1811	
17830	12	1816	
17840	12	1821	
17850	12	1827	
17860	12	1832	
17870	12	1837	
17880	12	1843	
17890	12	1848	
17900	12	1854	
17910	12	1860	
17920	12	1865	
17930	12	1871	
17940	12	1877	
17950	12	1882	
17960	12	1888	
17970	12	1893	
17980	12	1898	(0.58 divisions per kc)
17990	12	1904	
18000	**12**	**1910**	
18010	12	1915	
18020	12	1921	
18030	12	1927	
18040	12	1933	
18050	12	1939	
18060	12	1944	
18070	12	1949	
18080	12	1955	
18090	12	1961	
18100	12	1966	

Use nearest check point shown in heavy type.



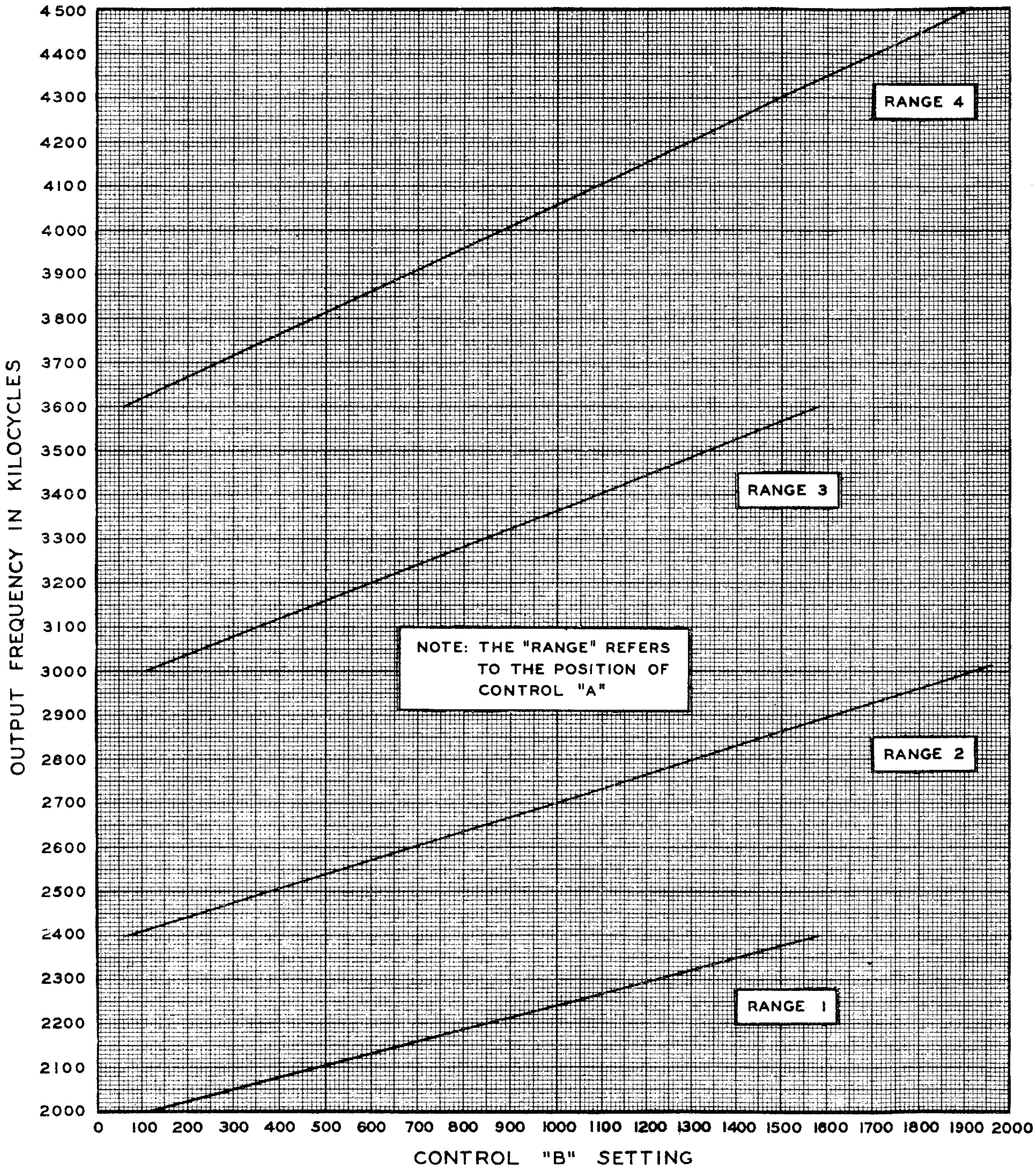
LOW FREQUENCY TUNING CHART

200KC TO 475KC

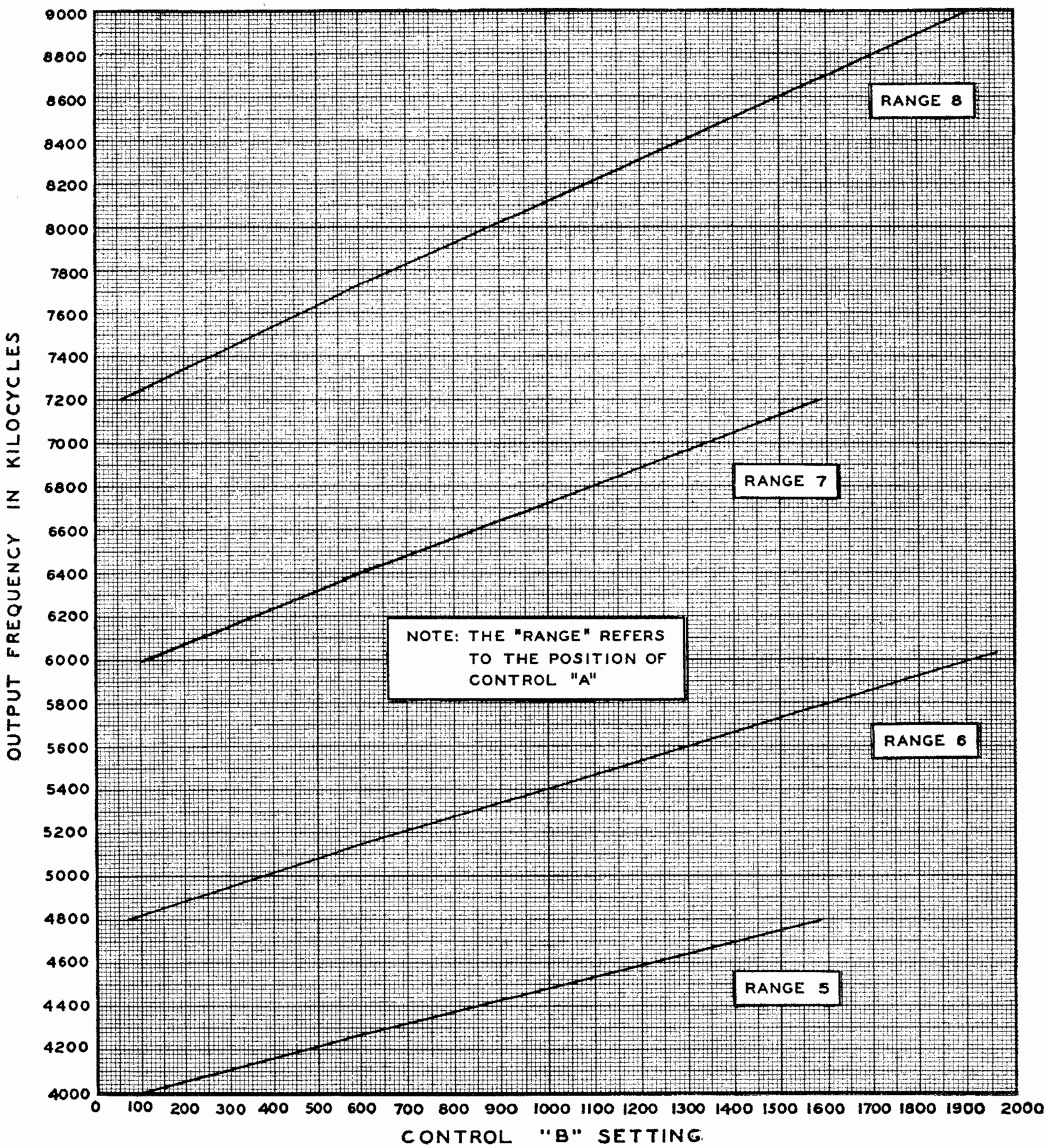


LOW FREQUENCY TUNING CHART

475KC TO 1500KC

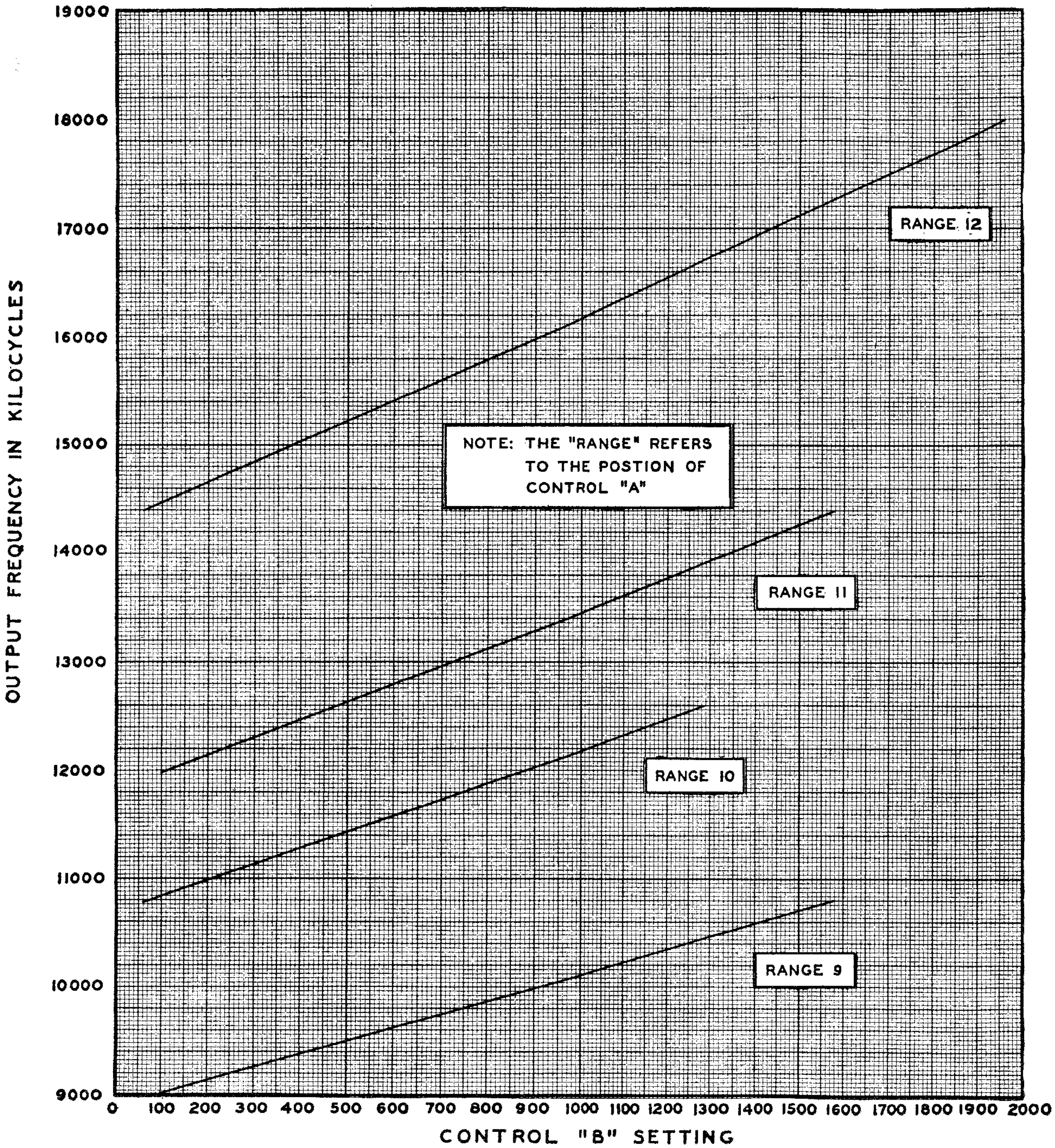


HIGH FREQUENCY TUNING CHART
2000KC TO 4000KC



HIGH FREQUENCY TUNING CHART

4000KC TO 9000KC



HIGH FREQUENCY TUNING CHART
9000 KC TO 18,000 KC

TABLE III—TYPICAL ANTENNA TUNING DATA

20 Ft. Antenna

KC	C	D	E
3000	1-2	...	70
3500	2-3	...	115
4000	3-4	...	130
5000	4-5	70	150
6000	5-6	45	170
8000	6-7	30	185
10000	7	75	190
11000	7	90	200
11300	7	100	200
10500	11	67	200
11000	11	75	200
11500	11	85	200
12000	11	100	200
12000	11	75	30
13000	11	75	140
14000	11	80	164
15000	11	85	170
11500	12	60	10
12000	12	55	60
13000	12	55	155
14000	12	60	180
16000	12	75	190
18000	12	85	200
16000	13	60	150
17000	13	65	170
18000	13	65	180

22.5 Ft. Antenna

KC	C	D	E
2800	1-2	...	70
3000	1-2	...	70
3500	2-3	...	120
4000	3-4	...	130
5000	4-5	90	150
6000	5-6	60	160
8000	6-7	40	185
10000	7	80	200
9500	11	60	200
10000	11	65	200
10500	11	77	200
11000	11	94	200
11000	11	64	66
12000	11	65	150
13000	11	68	165
14000	11	75	180
15000	11	80	180
11500	12	38	145
12000	12	40	170
13000	12	45	190
14000	12	65	200
16000	12	75	200
16000	13	40	170
17000	13	60	175
18000	13	65	185

25 Ft. Antenna

KC	C	D	E
2700	1-2	...	10
3000	2-3	...	60
3500	3-4	...	100
4000	4-5	...	125
5000	5-6	...	150
6000	6	80	160
8000	6-7	70	180
9800	7	100	200
9000	10	75	200
9500	10	85	200
9500	10	65	0
10000	10	65	55
11000	10	65	150
12000	10	70	170
14000	10	85	180
15000	10	95	190
11000	11	53	160
12000	11	55	180
14000	11	70	200
15000	11	80	200
16000	11	95	200
15000	13	0	155
16000	13	0	180
17000	13	35	190
18000	13	55	195

27.5 Ft. Antenna

KC	C	D	E
2600	1	...	0
3000	2	...	75
3500	3-4	...	110
4000	4-5	...	130
5000	6	...	150
6000	6-7	...	165
8000	7	70	190
9100	7	100	200
9000	10	59	10
9500	10	57	80
10000	10	55	110
11000	10	60	175
12000	10	65	185
14000	10	80	195
15500	10	100	195
9000	11	45	40
10000	11	40	140
12000	11	55	195
14000	11	75	200
16500	11	95	200
16000	13	0	180
17000	13	45	190
18000	13	60	195

30 Ft. Antenna

KC	C	D	E
2500	1-2	...	20
3000	3-4	...	70
3500	4	...	95
4000	4-5	...	120
5000	5-6	...	145
6000	6-7	...	165
8000	7	95	180
8500	7	100	200
8200	10	48	0
9000	10	48	130
10000	10	50	170
11000	10	55	200
12000	10	63	200
14000	10	82	200
15000	10	92	200
15600	10	98	200
8000	11	62	110
10000	11	32	180
12000	11	45	200
14000	11	65	200
16000	11	90	200
16600	11	98	200
16000	13	0	184
17000	13	45	188
18000	13	70	188

32.5 Ft. Antenna

KC	C	D	E
2450	1-2	...	26
3000	3	...	65
3500	4-5	...	100
4000	5	...	120
5000	5-6	...	150
6000	6-7	...	165
8000	7	100	200
7600	10	36	0
8000	10	37	90
9000	10	42	160
10000	10	46	185
11000	10	54	200
12000	10	65	200
13000	10	75	200
14000	10	82	200
14600	10	88	200
8000	11	0	113
9000	11	22	168
10000	11	35	188
11000	11	47	200
12000	11	60	200
14000	11	78	200
16000	11	100	188
16200	11	100	200
16000	13	52	165
16500	13	69	160
17000	13	70	170
18000	13	75	180

DO NOT USE ANTENNA CAPACITOR

TYPICAL ANTENNA TUNING DATA

32.5 Ft. Antenna

KC	C	D	E
2450	1-2	...	26
3000	3	...	65
3500	4-5	...	100
4000	5	...	120
5000	5-6	...	150
6000	6-7	...	165
8000	7	100	200
7600	10	36	0
8000	10	37	90
9000	10	42	160
10000	10	46	185
11000	10	54	200
12000	10	65	200
13000	10	75	200
14000	10	82	200
14600	10	88	200
8000	11	0	113
9000	11	22	168
10000	11	35	188
11000	11	47	200
12000	11	60	200
14000	11	78	200
16000	11	100	188
16200	11	100	200
16000	13	52	165
16500	13	69	160
17000	13	70	170
18000	13	75	180

35 Ft. Antenna

KC	C	D	E
2400	1-2	...	0
3000	3-4	...	70
3500	4-5	...	100
4000	5-6	...	120
5000	6-7	...	145
6000	7	...	160
7000	7	...	180
7600	7	100	200
7500	8	70	0
8000	8	75	40
9000	8	85	62
10000	8	100	100
10400	8	100	126
8700	11	0	175
9000	11	8	180
10000	11	28	200
11000	11	52	200
12000	11	62	200
14000	11	77	200
15000	11	86	200
15700	11	100	190
15000	13	0	166
16000	13	66	152
17000	13	84	142
18000	13	100	154

40 Ft. Antenna

KC	C	D	E
2300	1-2	...	3
2500	2-3	...	10
3000	3-4	...	60
3500	4-5	...	95
4000	5-6	...	120
5000	6-7	...	150
6000	7	...	170
6800	7	100	200
6600	8	57	0
7000	8	60	50
8000	8	70	121
9000	8	83	111
10000	8	97	121
10500	8	100	140
8400	10	0	188
9000	10	25	196
10000	10	47	200
11000	10	60	200
12000	10	70	200
14000	10	88	200
14500	10	100	200
14500	12	71	200
15000	12	76	200
16000	12	84	200
17000	12	100	141
18000	12	100	146

45 Ft. Antenna

KC	C	D	E
2200	1-2	...	0
2500	2-3	...	20
3000	4-5	...	62
3500	5-6	...	90
4000	6	...	120
5000	7	...	155
6000	7	100	175
6100	7	100	185
6000	8	49	0
7000	8	59	106
8000	8	69	129
9000	8	85	106
9800	8	100	90
7500	10	0	171
8000	10	0	185
9000	10	38	193
10000	10	53	200
11000	10	64	200
12000	10	73	200
13000	10	83	200
13740	10	100	182
13500	12	66	200
14000	12	70	200
15000	12	82	92
16000	12	85	125
17000	12	87	164
18000	12	86	195

50 Ft. Antenna

KC	C	D	E
2100	1-2	...	0
2500	3-4	...	19
3000	4-5	...	55
3500	5-6	...	95
4000	6-7	...	120
5000	7	...	160
5500	7	100	180
5400	8	32	0
6000	8	38	90
7000	8	48	148
8000	8	65	152
9000	8	85	148
10000	8	92	142
9000	11	29	200
10000	11	40	200
11000	11	53	200
12000	11	72	200
13000	11	82	200
14000	11	100	0
15000	11	98	135
13500	13	37	28
14000	13	45	52
15000	13	52	125
16000	13	69	136
17000	13	71	164
18000	13	68	184

55 Ft. Antenna

KC	C	D	E
2000	1-2	...	0
2500	3-4	...	15
3000	4-5	...	45
3500	5-6	...	100
4000	6-7	...	130
5000	7	100	168
5170	7	100	181
5000	8	15	0
6000	8	35	126
7000	8	51	152
8000	8	64	160
9000	8	81	136
9700	8	100	106
9500	9	62	198
10000	9	68	195
11000	9	87	171
11500	9	100	165
11200	10	73	200
12000	10	90	161
12200	10	100	82
12100	12	60	200
13000	12	62	133
14000	12	63	183
15000	12	68	200
14800	13	0	155
15000	13	0	160
16000	13	45	169
17000	13	62	177
18000	13	72	185

DO NOT USE ANTENNA CAPACITOR

60 Ft. Antenna

KC	C	D	E
2000	1–2	...	0
2500	3–4	...	15
3000	5–6	...	55
3500	6–7	...	90
4000	7	...	125
4800	7	100	178
4750	8	0	0
5000	8	4	60
6000	8	22	155
7000	8	44	170
8000	8	63	164
9000	8	80	150
9700	8	100	120
8000	9	39	200
9000	9	58	200
10000	9	74	186
10880	9	100	123
10500	10	65	200
11000	10	78	181
11350	10	89	0
11290	11	74	200
12000	11	75	190
11600	12	59	30
12000	12	50	141
13000	12	49	197
15000	12	71	200
17000	12	85	200
18000	12	94	200

DO NOT USE ANTENNA CAPACITOR

20 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2100	1	—	0
2500	3–4	—	0
3000	4–5	—	30
3500	5–6	—	52
4000	6	—	65
5000	6–7	—	102
6000	7	50	118
8000	7	72	146
10000	7	90	168
10500	7	100	174
10000	10	75	200
10500	10	85	200
11000	10	94	200
11300	10	100	200
11100	11	76	200
11600	11	95	200
11600	11	75	0
12000	11	75	80
13000	11	80	142
14000	11	86	180
15000	11	92	200
14500	13	0	164
15000	13	0	180
16000	13	66	185
17000	13	84	190
17700	13	100	200

22.5 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2100	1	—	0
2500	2–3	—	20
3000	4–5	—	45
3500	5–6	—	62
4000	6	—	80
5000	6–7	—	108
6000	7	48	120
7000	7	65	132
8000	7	76	149
10000	7	94	184
10400	7	100	200
10000	10	81	200
10450	10	100	200
10450	10	73	0
11000	10	76	75
12000	10	82	160
13000	10	88	178
14000	10	96	195
14100	10	100	200
14000	13	0	140
14500	13	0	175
15000	13	30	200
16000	13	67	200
17000	13	85	200
17600	13	100	200

FOR FREQUENCIES BETWEEN 2000 KCS AND 3000 KCS

25 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2160	1–2	—	0
2500	2–3	—	28
3000	4–5	—	50
3500	5–6	—	65
4000	6–7	—	80
5000	6–7	—	106
6000	7	44	125
7000	7	64	140
9000	7	80	184
9500	7	90	200
9500	10	65	0
10000	10	66	92
11000	10	68	166
12000	10	74	184
13000	10	82	192
14000	10	90	200
14500	10	100	200
14400	13	0	162
14500	13	0	164
15000	13	0	181
16000	13	51	200
17000	13	73	200
18000	13	89	200

27.5 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2130	1–2	—	0
2500	2–3	—	20
3000	4–5	—	44
3500	5–6	—	65
4000	6	—	85
5000	6–7	—	116
6000	7	52	138
7000	7	65	154
8000	7	75	174
8800	7	86	200
8800	10	58	0
9000	10	59	40
10000	10	62	156
11000	10	63	191
12000	10	75	200
13000	10	84	200
14000	10	92	200
14400	10	100	200
13000	11	76	200
14000	11	85	200
15000	11	94	200
15600	11	100	200
14400	13	0	161
15000	13	0	186
16000	13	56	200
17000	13	76	200
18000	13	90	200

FOR FREQUENCIES BETWEEN 2000 KCS AND 2700 KCS

30 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2100	1	—	0
2500	2–3	—	30
3000	4–5	—	48
3500	5–6	—	64
4000	6	—	80
5000	6–7	—	121
6000	7	54	138
7000	7	71	152
8000	7	81	186
8350	7	100	200
8100	10	50	0
8500	10	50	88
9000	10	52	138
10000	10	55	165
11000	10	66	200
12000	10	76	200
13000	10	85	200
13500	10	89	200
14000	10	93	200
13500	11	81	200
14000	11	85	200
14500	11	89	200
15000	11	93	200
14800	13	0	180
15000	13	0	188
15500	13	41	200
16000	13	58	200
17000	13	76	200
18000	13	91	200

FOR FREQUENCIES BETWEEN 2000 KCS AND 2600 KCS

30 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2100	1	—	0
2500	2–3	—	30
3000	4–5	—	48
3500	5–6	—	64
4000	6	—	80
5000	6–7	—	121
6000	7	54	138
7000	7	71	152
8000	7	81	186
8350	7	100	200
8100	10	50	0
8500	10	50	88
9000	10	52	138
10000	10	55	165
11000	10	66	200
12000	10	76	200
13000	10	85	200
13500	10	89	200
14000	10	93	200
13500	11	81	200
14000	11	85	200
14500	11	89	200
15000	11	93	200
14800	13	0	180
15000	13	0	188
15500	13	41	200
16000	13	58	200
17000	13	76	200
18000	13	91	200

FOR FREQUENCIES BETWEEN 2000 KCS AND 2600 KCS

32.5 Ft. Antenna

Use 50 mmfd capacitor (2 sections)

Freq.	C	D	E
2100	1–2	—	0
2500	3–4	—	10
3000	3–4	—	44
3500	5–6	—	70
4000	6–7	—	90
5000	7	—	124
6000	7	55	144
7000	7	70	173
7790	7	90	200
7650	9	60	0
8000	9	64	60
9000	9	69	112
10000	9	74	169
11000	9	81	179
12000	9	90	179
12500	9	100	180
11000	10	69	200
12000	10	78	200
13000	10	86	200
14000	10	95	200
14100	10	100	200
13000	11	79	200
14000	11	86	200
15000	11	94	200
15300	11	100	200
15000	13	5	200
16000	13	60	200
17000	13	86	164
18000	13	100	185

35 Ft. Antenna

Use 50 mmfd capacitor (2 sections)

Freq.	C	D	E
2150	1	—	0
2500	2–3	—	22
3000	4–5	—	60
3500	5–6	—	85
4000	6–7	—	110
5000	7	32	128
6000	7	56	156
7000	7	75	184
7435	7	95	200
7200	9	54	0
7500	9	58	49
8000	9	60	112
9000	9	67	142
10000	9	72	160
11000	9	80	176
12000	9	88	178
13000	9	100	181
10000	10	53	200
11000	10	65	200
12000	10	74	200
13000	10	82	200
14000	10	90	200
14600	10	100	200
14500	13	0	160
15000	13	0	178
16000	13	70	156
17000	13	90	130
17700	13	100	146

40 Ft. Antenna

Use 50 mmfd capacitor (2 sections)

Freq.	C	D	E
2100	1–2	—	0
2500	3–4	—	25
3000	4–5	—	66
3500	5–6	—	100
4000	6–7	—	120
5000	7	38	144
6000	7	60	179
6500	7	71	200
6330	9	40	0
7000	9	47	94
8000	9	56	148
9000	9	66	162
10000	9	72	174
11000	9	80	177
12000	9	91	178
12600	9	100	179
11000	10	68	200
12000	10	76	200
13000	10	85	200
14000	10	100	180
14190	10	100	192
14000	12	71	200
14500	12	75	200
15000	12	80	200
16000	12	88	150
17000	12	94	108
18000	12	100	157

FOR FREQUENCIES BETWEEN 2000 KCS AND 2400 KCS

45 Ft. Antenna

Use 25 mmfd capacitor (1 section)

Freq.	C	D	E
2050	1–2	—	0
2500	3–4	—	33
3000	4–5	—	70
3500	5–6	—	111
4000	6	—	132
5000	7	43	160
5500	7	54	180
5900	7	60	200
5800	9	27	0
6000	9	30	42
7000	9	42	138
8000	9	55	158
9000	9	67	165
10000	9	74	170
11000	9	83	173
12000	9	100	150
12200	9	100	173
12000	11	70	200
13000	11	80	200
14000	11	91	158
14400	11	100	110
14000	12	75	200
15000	12	82	75
16000	12	85	143
17000	12	89	174
18000	12	92	200

50 Ft. Antenna

Use 25 mmfd capacitor (1 section)

FOR FREQUENCIES BETWEEN 2000 KCS AND 2200 KCS

TABLE IV—TYPICAL AUDIO-FREQUENCY DATA

a. Overall Audio-Frequency Response (EITHER CARBON OR DYNAMIC INPUT)

Frequency	50% Mod.	90% Mod.
100 cps	—7.6 db	—7.0 db
200 cps	—3.4 db	—2.8 db
300 cps	—2.2 db	—1.7 db
500 cps	—0.7 db	—0.4 db
1000 cps	0.0 db	0.0 db
2000 cps	—0.2 db	—0.3 db
3000 cps	—0.7 db	—0.9 db
4000 cps	—1.6 db	—1.8 db
5000 cps	—2.7 db	—3.2 db

b. Audio Input

Full Power (1160 v On Plates of P.A. and Mod. Tubes)—
CARBON Input—1.52 v required for 90% Modulation at 1000 cps
DYNAMIC Input—16.0 mv required for 90% Modulation at 1000 cps

c. Audio Distortion

Full Power (1160 v On Plates of P.A. and Mod. Tubes)—
CARBON Input — 4.5% Distortion with 90% Modulation at 1000 cps
DYNAMIC Input — 4.7% Distortion with 90% Modulation at 1000 cps

Distortion measured on output of SIDE-TONE at Pos. 5 — 12% with 90% Modulation at 1000 cps
Full Power (1160 v On Plates of P.A. and Mod. Tubes)—
CARBON Input—8.8% Distortion
DYNAMIC Input—8.9% Distortion

d. Noise Level

Below 100% Modulation with input at 1000 cps—
Full Power (1160 v On Plates of P.A. and Mod. Tubes)—
CARBON Input — —44 db
DYNAMIC Input — —45 db

e. Sidetone Output

Switch Position	Output CW	Output MCW	Load Impedance
1	0.6 volt	0.75 volt	125 ohms
2	1.3 volt	1.6 volt	125 ohms
3	2.5 volts	3.0 volts	125 ohms
4	5.0 volts	6.0 volts	125 ohms
5	8.8 volts	10.5 volts	125 ohms
6	19.5 volts	23.5 volts	2000 ohms

Note: All of the above audio-frequency measurements were made with Control A in Position 2 at an r-f output frequency of 3.0 mc, with 150 ma of P.A. PLATE current and 12.0 ma of P.A. GRID current.

TABLE V—TYPICAL OPERATING VOLTAGES AND CURRENTS

(All readings were taken at full power level)

Set EMISSION selector switch on VOICE position—Key "on"—No modulation

Tube	Filament Vltg.	Pl. Voltage		Pl. Current		Screen Volts		Grid Volts		Grid Current		Cath. Volts	
		3.0 Mc	18.1 Mc	3.0 Mc	18.1 Mc	3.0 Mc	18.1 Mc	3.0 Mc	18.1 Mc	3.0 Mc	18.1 Mc	3.0 Mc	18.1 Mc
V101 (837)	11.5	375	380	30	30	177	177	—3.5	—3.2	0.26	0.27	13.5	13.5
V102 (1625)	11.7	380	375	38	35	220	285	—175	—185	1.70	1.80	34	58
V103 (1625)	12.5	388	388	———	40	365	315	———	—155	———	1.55	———	57
V104 (813)	11.7	CW 1260 VOICE 1220	CW 1260 VOICE 1220	150	150	400	410	—190	—75	12.0	8.0	0	0
V105 (811)	6.2	1220	1220	16.5	16.5	———	———	**	**	———	———	0	0
V106 (811)	6.2	1220	1220	16.5	16.5	———	———	**	**	———	———	0	0
V201 (12SJ7)	12.5	100	100	0.6	0.6	32.0	32.0	0	0	———	———	1.4	1.4
V202 (6V6GT)	6.3	187	187	30	30	197	197	0	0	———	———	8.7	8.7
V203 (6V6GT)	6.3	188	188	30	30	197	197	0	0	———	———	8.7	8.7
V301 (12SJ7)	13.8	Cal. 4.2	———	Cal. 0.8	———	Cal. 98		Cal. 3.8	———	———	———	Cal. 0	———
V302 (12SJ7)	13.0	14	14			14	14	0	0	———	———	0	0
V401 (1625)*	13.5	410	———	50	———	210	———	—8.0	———	———	———	19.3	

*These readings taken on L-F operation at 1000 Kc.

**Since modulator grid bias is obtained by utilizing the average voltage drop through the filaments of the Mod. tubes, it is impractical to measure this value directly. However, the effective value may be considered to be equal to half the filament voltage.

TABLE VI

VOLTAGE TO GROUND FROM VACUUM TUBE TERMINALS

USE 20,000 ohm/voltmeter on voltages less than 250 volts.
USE 1,000 ohm/voltmeter on voltages above 250 volts.
Set EMISSION selector switch on MCW position—key "on".

Tube Base Term. No.	V101 (837)	V102 (1625)	V103 (1625)	V104 (813)	V105 (811)	V106 (811)	V201 (12SJ7)	V202 (6V6GT)	V203 (6V6GT)	V301* (12SJ7)	V302 (12SJ7)	V401** (1625)
1	13.0	12.0	0	10.0	10.0	23	0	0	NC	0	0	0
2	0	0	0	375	NC	NC	0	20	26	0	32.0	0
3	190	310	310	375	16	10	0	182	180	-0.5	15.2	210
4	-5.4	-132	-21.0	-24	16	16	0*	192	189	-0.5	0	-8.0
5	0	-145NC	-21.0NC	0	—	—	1.35	0	0	0	0	19.3NC
6	15.2	36	63.0	0	—	—	32.3	NC	NC	108	13.3	19.3
7	26.0	26.0	12.0	0	—	—	14.2	14	22.5	13.0	13.5	13.5
8	NC	NC	NC	NC	—	—	97	9	10.1	4.5	13.3	—
Top Cap	390	375	375	1220	1220	1220	—	—	—	—	—	410

Adjust for MCW Operation. Adjust transmitter for operation in range 6000 to 7200 Kc. for all readings except as below:

*Place switch S106 in the calibrate position for these readings.

**Adjust transmitter for 1000 kc L-F operation with final amplifier fully loaded.

TABLE VII

VOLTAGE TO GROUND FROM CABLE CONNECTOR TERMINALS

USE 20,000 ohm/voltmeter on voltages less than 250.
USE 1,000 ohm/voltmeter on voltages above 250.

Term. No.	H. F. Osc.	J106 P901		* J107	J108	J111 P301		J112 P201	J114 P401	J115 P101	J116 P102
		Loc.	Rem.			Cal.	MCW				
1	195	0	0	NC	405	16.5	15.5	11.5	0	315	0
2	28	0	0	0	#	0	0	11.9	13.2	400	30.5
3	13.5	0	0	29.5	29.7	415	0	18.7	403	NC	0
4	14	0	0		29.7	0	0	18.5	200	29.5	0
5		0	0	0	0	415	400	0	47	42	410
6		0	0		29.7	0	0	192	0	14	0
7		0	0		NC	0	0	27.3		0	0
8		0	0		.05	27.2	27.2	26.8		0	0
9		0	0		#			0		28	0
10		0	0		1240			0		NC	0
11		0	0							400	0
12		0	0							305	0
13		0	0								405
14		27	27								0
15		0	0								30.0
16		27	27								
17		0	12.5								
18		Key	Open								
		27	27								
19		0	0								
20		25	25								
21		0	0								
22		0	0								
23		NC									
24		NC									
25		NC									
26		**NC									
27		18 a. c.									

Adjust transmitter for MCW in range 6000 to 7200 Kc, Key down. (All stages operating)
*Adjust transmitter for L-F operation for these readings.
**If Receiver disabling circuit is used #26 and #27 are equal.
0 for AC Power Unit—+400 v for DC Power Unit.

TABLE VIII—RESISTANCE TO GROUND FROM VACUUM TUBE TERMINALS

Adjust transmitter for MCW operation in range 6000 to 7200 kc for all readings except as below:

Readings taken with all tubes in place and all power turned off.

Tube Base Term. No.	V101 (837)	V102 (1625)	V103 (1625)	V104 (813)	V105 (811)	V106 (811)	V201 (12SJ7)	V202 (6V6GT)	V203 (6V6GT)	V301* (12SJ7)	V302 (12SJ7)	V401** (1625)
1	*3.8	*4.4	0	0.3	0.2	0.4	0	0	0	0	0	0
2	0	inf	inf	175	inf	inf	0	4.2	2.6	0	2.6	inf
3	1250	20,000	20,000	175	74	67	0	1550	1530	120,000	520,000	1250
4	22,000	100,000	100,000	20,000	0.3	0.3	4000	1300	1280	225,000	47	15,000
5	0	100,000	100,000	0	—	—	2200	470,000	100,000	0	0	inf
6	inf	1000	1000	0	—	—	1 Meg	inf	—	570,000	520,000	inf
7	3	*3	*4.4	0	—	—	5	5	4.3	8.5	8.0	3.4
8	—	—	—	—	—	—	160,000	250	250	500,000	520,000	—
Top Cap	50	80	46	260	280	270	—	—	—	—	—	105

* Place switch S106 in the calibrate position for these readings.

** Adjust transmitter for L-F operation for these readings.

TABLE IX—RESISTANCE TO GROUND FROM CABLE CONNECTOR TERMINALS

All readings made with units removed from the transmitter or plugs and receptacles disconnected, but with tubes in place. The EMISSION selector switch in the MCW position. Control "A" on Position 1. Autotune positioned on 1. LOCAL-REMOTE switch in the LOCAL position.

Term. No.	H-F Osc.	J106		J107		J108	J111			J112	J114	J115	J116	P101	P102	P201	P301	P401
		Loc.	Rem.	HF	LF		C	T	O*									
1	inf	180	inf	0	0	6750	inf	inf	inf	inf	0	24,000	inf	inf	inf	inf	inf	0
2	inf	0.1	0.1	inf	inf	inf	inf	inf	inf	0.4	5.5	6750	inf	inf	inf	inf	inf	11
3	inf	0.1	0.1	inf	110	3.1	42	inf	inf	0.3	6750	inf	0	—	inf	inf	190,000	inf
4	inf	0.1	0.1	—	—	3.1	6.5	inf	inf	inf	5000	17	0	inf	inf	inf	inf	inf
5	—	0.1	0.1	—	—	0	inf	inf	inf	inf	inf	inf	inf	inf	inf	2 to 16	inf	inf
6	—	0.1	0.1	—	—	1.5	0	0	0	5000	inf	inf	inf	inf	inf	inf	0	inf
7	—	0.1	0.1	—	—	0.2	inf	3.8	6.7	3.2	—	125	inf	inf	inf	24	1 to 13	—
8	—	0.1	0.1	—	—	0.1	2.9	2.9	2.9	0	—	45	inf	inf	inf	0	30	—
9	—	0.1	0.1	—	—	inf	—	—	—	0	—	inf	inf	inf	inf	0	—	—
10	—	0.1	0.1	—	—	inf	—	—	—	inf	—	0	inf	—	inf	325**	—	—
11	—	0.1	0.1	—	—	—	—	—	—	0	—	3.7	inf	inf	inf	0	—	—
12	—	inf	180	—	—	—	—	—	—	6	—	18,000	inf	inf	inf	6.5	—	—
13	—	inf	0	—	—	—	—	—	—	—	—	—	6750	—	inf	—	—	—
14	—	150	150	—	—	—	—	—	—	—	—	—	0.2	—	—	—	—	—
15	—	inf	inf	—	—	—	—	—	—	—	—	—	3.5	—		—	—	—
16	—	120	120	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	—	inf	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	—	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	—	0	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	—	inf	inf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	—	0.1	inf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	—	inf	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	—	inf	inf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	—	inf	inf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	—	inf	inf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	—	inf	inf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	inf	inf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Loc—Local. Rem—Remote. Inf—Infinite Resistance. *C—Calibrate. *T—Tune. *O—Operate. **Microphone circuit selecting switch S202 in the CARBON position.

TABLE X—RESISTANCE MEASUREMENTS ON AUTOTUNE MOTOR

All resistance readings were made with all brushes removed from the machine.

AUTOTUNE MOTOR:

Collins Part No. NY-818C d.c. shunt wound motor 3.1 amps, 28 volts d.c., 1/20 H.P., 3900 rpm.

Resistance between commutator segment diametrically opposed = 1.26 ohms

Average resistance between adjacent commutator segments = 0.3 ohms

Field resistance, F1 to F2—17.8 ohms

Notes:

1. A short or low resistance to ground from either of terminal A1 or A2, with brushes removed and external wires disconnected, indicates a defective capacitor or brush holder.
2. A variation in resistance between adjacent commutator segments, with brushes removed indicates a defective armature.
3. A low resistance or short to ground from the commutator, indicates a defective armature.
4. A large discrepancy in field resistance or a short from F2 to ground indicates a defective field winding.

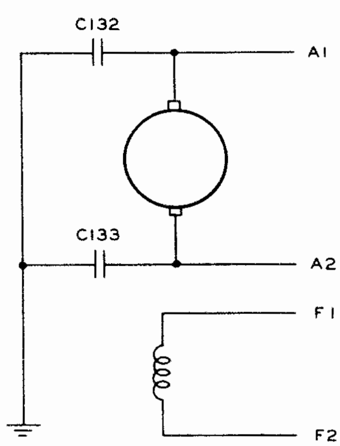


Fig. 39 NY818C-A Autotune Motor Schematic (Dwg. No. 500 0243 00A)

TABLE XI—GENERAL SPECIFICATIONS OF EQUIPMENT

1. **Frequency Range:** 300 Kc to 600 Kc.
&
2000 Kc to 18,100 Kc.

2. **Frequency Bands:**

The frequency range 300 Kc to 600 Kc is covered in three bands. The six positions of Control F together with the frequency range covered by each band are listed below:

Position of Control F	Frequency Range
1	200 kc to 262 kc
2	262 kc to 355 kc
3	355 kc to 475 kc
4	475 kc to 695 kc
5	695 kc to 1035 kc
6	1035 kc to 1500 kc

Note that with the Type COL–47370 Loading Coil, operation of the output circuits is limited to the 300 to 600 kc range.

3. **Frequency Stability:**

(a) Frequency Variation With Temperature Change:

Temp. Change	2.0 mc	% Frequency Deviation 2.4 mc	3.0 mc	6.0 mc
—10° C to 0° C	0.0006	0.0027	0.0011	0.0116
0° C to 10° C	0.0014	0.0027	0.0004	0.0147
10° C to 20° C	0.0009	0.0044	0.0008	0.0123
20° C to 30° C	0.0030	0.0018	0.0027	0.0124
30° C to 40° C	0.0000	0.0042	0.0015	0.0109
40° C to 50° C	0.0042	0.0040	0.0015	0.0126

(b) Frequency Variation With Change in Humidity:

Humidity Change	2.0 mc	% Frequency Deviation 2.4 mc	3.0 mc	6.0 mc
30% to 95%	0.0073	0.0058	0.0097	0.0153
95% to 30%	0.0046	0.0000	0.0050	0.0133

4. Antenna Requirements:

Frequency	Antenna Reactance	Antenna Resistance
300 kc	—4500 ohms	20 ohms
400	—3400	16
500	—2600	14
600	—2100	12
2.0 mc	—500	2.1
3.0	—200	3.1
4.0	0	6.1
5.5	+380	25.0
7.0	0	3500.0
9.0	—350	50.0
11.5	0	50.0
13.5	+350	100.0
15.5	0	1500.0
18.1	—350	200.0

5. Power Output:

Frequency	Power Output	Frequency	Power Output
0.2 mc	5.5 watts	2.0 mc	31.0 watts
0.3	14.0	3.0	60.0
0.4	18.0	4.0	80.0
0.5	24.0	5.5	90.0
0.6	24.0	7.0	90.0
0.7	27.0	9.0	90.0
0.8	45.0	11.5	90.0
1.0	75.0	13.5	90.0
1.3	80.0	15.5	75.0
1.5	65.0	18.1	65.0

6. Input Impedance

The audio input circuit of the equipment is designed to match the output of either a carbon or dynamic microphone. A switch selects the proper input circuit to correspond to the type of microphone that is to be used. When the microphone circuit selector switch is in the CARBON position the input circuit will match a carbon microphone of approximately 40 ohms internal resistance. When the circuit selector switch is in the DYNAMIC position the input circuit will match a dynamic microphone of approximately 200 ohms internal resistance.

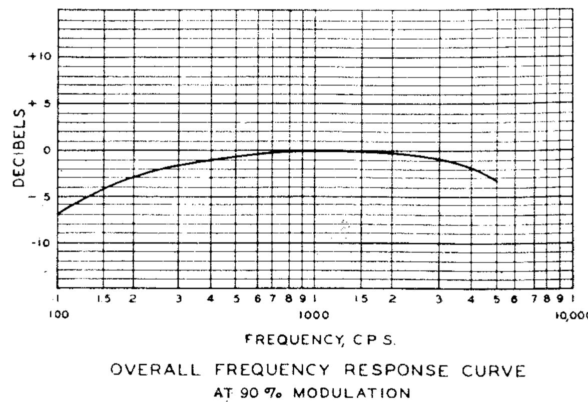


Fig. 40 Overall Frequency Response Curve (Dwg. No. 500 0230 00A)

7. Power Source

Equipments supplied with the Type COL–211101 power units are designed to operate from a 115 volt 50/60 cps power source capable of supplying 4500 watts of power with good voltage regulation. In normal operation the equipment draws approximately 13.1 amps. at an 80% Power Factor.

Equipments supplied with the Type COL–211102 power units are designed to operate from a 115 volt d.c. power source.

8. Modulation

Class B modulation is employed in the equipment. The push-pull modulators are capable of modulating the full-power r-f carrier at least 90% with VOICE emission.

TABLE XII—EQUIPMENT SUPPLIED ON CONTRACT

Navy Type No.	Collins Part Number	Qty.	Description
COL–52286	17H-2	1	Radio Transmitter
COL–211101	413D-1	*	Motor Generator-Rectifier Power Unit
COL–211102	413D-2	*	Dynamotor Assembly Power Unit
COL–23410	314N-2	1	Remote Control Unit
COL–47370	180H-3	1	Antenna Loading Coil Unit
	65X-7	1	Control Cable (Transmitter to Power Unit)
	65X-8	1	Power Cable (Transmitter to Power Unit)
	65X-9	1	Load Coil Cable (Transmitter to Load Coil)
	65X-10	1	Remote Control Cable (Remote Unit to Power Unit)
COL–40127		1	200 Kc Quartz Crystal
COL–481628	195D-1	1	Antenna Shunt Capacitor

* One power unit only is supplied.

TABLE XIII—EQUIPMENT REQUIRED FOR OPERATION BUT NOT SUPPLIED ON CONTRACT

1. Microphone—Carbon of 40 ohms Internal Resistance or Dynamic of 200 ohms Internal Resistance for RED coded circuit per Navy Specifications RE8944A.
   (a) Cord—3 Conductor, Shielded.
   (b) Cord Plug—3 Circuit, Tip 3/16″ dia. and 1 3/16″ long.

2. Telegraph Key—Any Type.
   (a) Key Cord—2 Conductor.
   (b) Cord Plug—2 Circuit, Tip 3/16″ dia. and 1 3/16″ long.

3. Headphones—500 ohm Impedance.
   (a) Cord Plug—2 Circuit, Tip 1/4″ dia. and 1 5/32″ long.

TABLE XIV—INTERCHANGEABILITY OF UNITS

Unit Description	Navy Type Designation	Collins Type No.	Model TCZ
Radio Transmitter	–52286	17H-2	X
Remote Control Unit	COL–23410	314N-2	X
Antenna Loading Coal (300 Kc to 600 Kc)	COL–47370	180H-3	X
Antenna Shunt Capacitor	–481628	195D-1	X
Quartz Crystal Assembly (200 Kc)	–40127		X
A.C. Power Unit	COL–211101	413D-1	X
D.C. Power Unit	COL–211102	413D-2	X
27 Conductor Cable		65X-7	X
10 Conductor Cable		65X-8	X
2 Conductor Cable		65X-9	X
27 Conductor Cable		65X-10	X

VII APPENDIX

APPENDIX

TABLE XV—LIST OF MAJOR UNITS FOR MODEL TCZ RADIO TRANSMITTING EQUIPMENT

Quan.	Symbol Group	Navy Type Designation	Collins Type No.	Name of Major Unit	Assembly Dwg. No.
1	101 to 199	COL–52286	17H-3	Transmitter	K351E
1	201 to 299			Audio Amplifier	
1	301 to 399			MCW-CFI	
1	401 to 499			L-F Oscillator	
1	901 to 999	COL–23410	314N-2	Remote Control Box	K1104C
1	1001 to 1099	COL–47370	180H-3	Loading Coil	K1107C
1	1101 to 1199	COL–481628	195D-1	Antenna Capacitor	1370B
1	1501 to 1599		65X-7	Control Cable	500 1496 00D
1	1601 to 1699		65X-8	Power Cable	500 1497 00D
1	1701 to 1799		65X-9	Load Coil Cable	500 1498 00C
1	1801 to 1899	COL–211101	413D-1	A-C Power Unit	K1082C
1	1901 to 1999	COL–211102	413D-2	D-C Power Unit	K1084C
1	2301 to 2399		65X-10	Remote Control Cable	500 4474 00D

APPENDIX

TABLE XVI—LIST OF MANUFACTURERS

01W Waage Electric Company
125 Church Street
New York, N. Y.

02S Sangamo Electric Company
1935 Funk Street
Springfield, Illinois

05H Hammarlund Mfg. Co., Inc.
460 West 34th Street
New York, N. Y.

05M P. R. Mallory and Co., Inc.
3029 East Washington St.
Indianapolis 6, Indiana

05N National Company, Inc.
61 Sherman Street
Malden, Massachusetts

05P Oak Manufacturing Company
1260 Clybourn Avenue
Chicago 10, Illinois

06A Aerovox Corporation
740 Belleville Avenue
New Bedford, Mass.

10C Cannon Electric Development Co.
3209 Humboldt Street
Los Angeles, California

13M Marathon Electric Co.
4543 Ravenswood Avenue
Chicago, Illinois

16A Alladin Radio Industries, Inc.
501 W. 35th Street
Chicago, Illinois

21N National Fabricated Products Co.
2650 West Belden Avenue
Chicago, Illinois

22A Allen-Bradley Company
136 West Greenfield Avenue
Milwaukee 4, Wisconsin

24B Belden Manufacturing ompany
P. O. Box 5070A
Chicago, Illinois

25C Centralab
900 E. Keefe Avenue
Milwaukee 1, Wisconsin

25P Ohmite Manufacturing Company
4835 West Flournoy Street
Chicago, Illinois

28J International Resistance Co.
401 North Broad Street
Philadelphia, Pennsylvania

34S F. W. Sickles Company
Box 920
Springfield 2, Massachusetts

35J International Telephone Devel.
137 Varick Street
New York, N. Y.

35M Meissner Mfg. Company
Mt. Carmel, Illinois

35W Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pennsylvania

36E Hugh H. Eby, Inc.
18 W. Chelten Avenue
Philadelphia, Pa.

40G General Electric Co.
840 S. Canal Street
Chicago, Illinois

42J Isolantite Incorporated
Belleville, New Jersey

45W Weston Elec. Instrument Corp.
Newark, New Jersey

50X X-L Radio Laboratories
420 W. Chicago Avenue
Chicago, Illinois

55C Chicago Transformer Corp.
3501 Addison Street
Chicago 18, Illinois

60A American Phenolic Corporation
1830 South 54th Avenue
Chicago, Illinois

60D Drake Manufacturing Company
1713 West Hubbard Street
Chicago, Illinois

62S Soreng Manegold Company
1901 Clybourn Avenue
Chicago, Illinois

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LIST OF MANUFACTURERS

64C Collins Radio Company
855 35th Street N.E.
Cedar Rapids, Iowa

64S Solar Manufacturing Corp.
Bayonne, New Jersey

65G G. M. Laboratories, Inc.
4314-26 North Knox Ave.
Chicago, Illinois

65S Speer Resistor Corp.
St. Mary's, Pennsylvania

66R Raytheon Production Corp.
55 Chapel Street
Newton, Massachusetts

66S Sprague Specialties Company
North Adams, Massachusetts

68S S. W. Inductor Company
1056-58 North Wood Street
Chicago, Illinois

69S Spencer Thermostat Company
34 Forrest Street
Attleboro, Massachusetts

70J Jensen Radio Manufacturing Co.
6601 S. Laramie Avenue
Chicago 38, Illinois

75C Cornell-Dubilier Corporation
333 Hamilton Blvd.
South Plainfield, New Jersey

77J E. F. Johnson Company
Waseca, Minnesota

78L Littlefuse Incorporated
4757 North Ravenswood Ave.
Chicago 40, Illinois

82C Coto-Coil Company, Inc.
73 Willard Avenue
Providence, Rhode Island

84A Hart and Hegeman Division
Arrow Hart and Hegeman Elec. Co.
103 Hawthorne Street
Hartford, Connecticut

84C Cramer, The R. W. Co., Inc.
Miller Street
Centerbrook, Connecticut

85G Guardian Electric Mfg. Co.
1430 West Washington Blvd.
Chicago 7, Illinois

88F Fractional Motors
1501 North Halsted
Chicago, Illinois

89W Wirt Company
5221-27 Green Street
Germantown, Philadelphia, Pa.

90B Bryant Elect. Company
Barnum Station
Bridgeport, Connecticut

90L Lord Manufacturing Company
Erie, Pennsylvania

91J Howard B. Jones
2300 Wabansia Avenue
Chicago, Illinois

96C Cutler-Hammer, Inc.
315 N. 12th St.
Milwaukee, Wisconsin

96R Russell Electric Company
340 West Huron Street
Chicago, Illinois

97E Electronic Laboratories, Inc.
122 West New York Street
Indianapolis, Indiana

98E Emerson Electric Co.
324 4th Street
Davenport, Iowa

APPENDIX

PARTS LIST

Refer to Tables XVII and XVIII.

Component parts of the equipment are identified by means of symbol designations. Wherever it is required to reference a component, the same symbol designation is used. Thus, a part appearing on a simplified schematic, a complete circuit diagram, a wiring diagram, photograph or layout drawing, will always be identified by means of the same symbol designation. In addition, each component part is stamped with its corresponding symbol designation. These symbol designations identify the various component parts which appear in the following parts lists. No symbol designation is used to identify more than one part.

The alphabetical portion of symbol designations have been selected from the following list in accordance with the classification of the component parts concerned.

(A) Structural parts, panels, frames, castings, etc.

(B) Motors and other prime movers, self-synchronous motors, etc.

(C) Capacitors of all types.

(CR) Dry Disc Rectifiers.

(D) Dynamotors.

(E) Miscellaneous electrical parts: Insulators, knobs, brushes, etc.

(F) Fuses.

(G) Generators, exciters, etc.

(H) Hardware, screws, bolts, studs, pins, snapslides, etc.

(I) Indicating devices (except meters and thermometers), pilot lamps, etc.

(J) Jacks and receptacles (stationary).

(K) Contactors, relays, circuit breakers, etc.

(L) Inductors, R.F., and A.F.

(M) Meters of all types, gauges, thermometers, etc.

(N) Nameplates, dials, charts, etc.

(O) Mechanical parts, bearings, shafts, couplings, gears, ferrules, flexible shafts, housings, etc.

(P) Plugs.

(Q) Diaphragms, (microphone, telephone, projectors, etc.).

(R) Resistors, fixed and variable, potentiometers, etc.

(S) Switches, interlocks, thermostats.

(T) Transformers, R.F., and A.F., and power.

(U) Hydraulic parts.

(V) Vacuum and gaseous discharge tubes.

(W) Wires, interconnecting cables, without plugs.

(X) Sockets.

(Y) Mechanical oscillators, crystals, magnetestriction tubes, etc.

(Z) Impedance such as traps (wave), etc.

The numerical portion of the Symbol Designation has been assigned to identify the component part with a particular major unit assembly. The numerical portion of symbol designations begin with 101 for the first component part in each class (i.e., component part in each alphabetical class as described above) and run consecutively for the remaining component parts in a particular class. A different numerical series of numbers is used for each major unit of the equipment. The series 101 to 199 is reserved for the first major unit. The series 201 to 299 is reserved for the second major unit. The series 301 to 399 is reserved for the third major unit. In this manner, each major unit of the entire equipment is identified with a series of numerals to be used for the designation of component parts.

The list of Major Units, Table XV, gives a complete list of symbol designation numbers in correlation with the major units.

APPENDIX

PARTS LIST

Only one Symbol Designation is assigned to cover component parts with multiple electrical or mechanical characteristics. However, since at times it is desirable to identify certain electrical or mechanical sections of these component parts, suffix letters are added when necessary. Thus, C121A, C121B, and C121C identify each section of triple capacitor C121 and K101A, K101B, K101C and K101D identify the relay coil and various contacts of relay K101.

The Spare Parts List Table XVIII is divided into two separate lists, one list for equipments employing the Navy Type COL-211101 Motor Generator-Rectifier Power Unit and one for equipments employing the Navy Type COL-211102 Dynamotor Assembly Power Unit.

TABLE XVII—PARTS LIST BY SYMBOL DESIGNATION

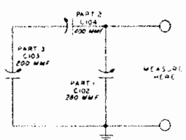
For Navy Model TCZ Radio Transmitting Equipment

RADIO TRANSMITTER NAVY TYPE –52286

MOTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
B101		Autotune Motor	1/20 hp 28 v d-c Nominal 20 v Min. 32 v Max.	98E 88F	NY-818C-A NY-818C-C	818C 818C

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
C101	-481677-1	Cap., H-F Osc. Grid Padding	.000185 mf ±1% 1000 TV	64C	841-001	GA-1433C
C102 C103 C104	-481678-1	Refer to C102, C103, C104 below 	Set of three matched ceramic capacitors packaged as a set. To be connected in the equipment in accordance with the circuit at the left to provide 413 mmf ±1% 1000 TV, Temperature Coefficient minus 48 Parts per Million per degree C ± 5%	64C	Type 841	GA-1433C
C102	Part 1 of -481678-1	Cap., H-F Osc. Grid Coupling	280 mmf ±10% 1000 TV			
C103	Part 3 of -481678-1	Cap., H-F Osc. Grid Coupling	200 mmf ±10% 1000 TV			
C104	Part 2 of -481678-1	Cap., H-F Osc. Grid Feedback	400 mmf ±10% 1000 TV			
C105		Cap., H-F Osc. Cathode Bypass	.005 mf ±5% 2500 TV	75C 02S	4LST HLST	925N250K-J
C106		Cap., H-F Osc. Filament Bypass	.006 mf ±20% 1000 TV	75C 02S	4LS HLS-10	910N260C-M
C107		Cap., H-F Osc. Screen Bypass	.002 mf ±20% 1000 TV	75C 02S	4LS HLS-40	910N220C-M
C108		Cap., 1st Mult. Grid	.0005 mf ±10% 1500 TV	02S	BE-15	915N350E-K
C109		Cap., 1st Mult. Cathode Bypass	.002 mf ±20% 1500 TV	02S	BE-15	915N220E-M
C110		Cap., 1st Mult. Scr. Sup. Fil.	Same as C109			
C111	-481679	Cap., 1st Mult. Pl. Tuning	6 Sect. Variable Ceramic Cap.	25C	828-003	917N6A3
C112		Cap., 2nd Mult. Grid Coupling	.00025 mf ±10% 1500 TV	02S	BE-15	915N325E-K

PARTS LIST BY SYMBOL DESIGNATION

CAPACITORS (Cont.)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
C113		Cap., 2nd Mult. Cathode Bypass	Same as C109			
C114		Cap., 2nd Mult. Screen Sup. Fil.	Same as C109			
C115		Cap., 2nd Mult. Pl. Tuning	Same as C111			
C116		Cap., Power Amp. Grid Coupling	Same as C108			
C117		Cap., Power Amp. Fil. Bypass	Same as C106			
C118		Cap., Power Amp. Pl. Blocking	.002 mf ±20% 7500 TV	02S	A2LS	975N220A-M
C119		Cap., Power Amp. Scr. Sup. Fil.	.002 mf ±20% 2500 TV	75C	4LS	925N220C-M
				02S	HLS-25	
C120A		Cap., Power Amp. Pl. Sup. Fil.	.002 mf ±20% 5000 TV	75C	4LS	950N220C-M
				02S	HLS-50	
C120B		Cap., Power Amp., Pl. Sup. Fil.	Same as C120A			
C121		C121A, C121B, & C121C	3 -0.1 mf ±20% 600 WV	75C	DYRT-6111	956NT01WX1-M
				64S	3XDMRTW6-.1	
C121A		Cap., Transient Suppressing	Section of C121			
C121B		Cap., Transient Suppressing	Section of C121			
C121C		Cap., Transient Suppressing	Section of C121			
C122		C122A & C122B				
C122A	-481690-10	Cap., Power Amp. Pl. Tank Padding	.00005 mf ±10% Ceramic	25C	850-002	913N450C-K
C122B		Cap., Power Amp. Pl. Tank Padding	Same as C122A			
C124A	-481691-5	Cap., P.A. Pl. Tank Padding	.000067 mf ±5% Ceramic	25C	850-003	913N467C-J
C124B		Cap., P.A. Pl. Tank Padding	Same as C124A			
C124C		Cap., P.A. Tank Pl. Padding	Same as C124A			
C125		Cap. Variable, P.A. Pl. Tuning	Rotor Assembly—	64C	GA-1342B	1342B
			Stator Assembly—	64C	GA-1308A	1308A
C126		Cap., Low Voltage Supply Filter	Cat: 2.0 mf ±20% 600 WV	75C	KG-3020	930N78B-M
C127	-481411-B-20	Cap., 2nd Mult. Pl. Supply Fil.	.006 mf ±20% 1500 TV	02S	BE-15	915N260E-M
C128		Cap., P.A. Pl. Supply Fil.	Same as C118			
C129		Cap., P.A. Pl. Tank Padding	Same as C122A			
C130	-481689-10	Cap., P.A. Tank Pl. Padding	.000025 mf ±10% Ceramic	25C	850-011	913N425C-K
C131		Cap., 1st Mult. Pl. Sup. Fil.	.0008 mf ±5% 1000 TV	02S	BE-10	910N380E-J
C132		Cap., Autotune Motor Spark Sup.	.004 mf ±20% 600 TV	75C	3WS	909N240F-M
				02S	JS	
C133		Cap., Autotune Motor Spark Sup.	Same as C132			

PARTS LIST BY SYMBOL DESIGNATION

CAPACITORS (Cont.)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
C134		Cap., H-F Osc. Grid Trimming	Midget Variable	05P		922N51
C135		Cap., H-F Osc. Grid Trimming	Same as C134			
C136	-481681	Cap., P.A. Grid Trimming	13 mmf Variable Ceramic	25C	822-009	917N101
C137		Cap., H-F Noise Filter	.0015 mf ±10% 900 TV	64S		909N215F-K

MISCELLANEOUS ELECTRICAL PARTS
(See Figure 118)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
E101A		Brushes for Autotune Motor B101	+ & — Brush for NY-818C-A (Two required)	98E		234N130
E101C			+ & — Brush for NY-818-C (Two required)	88F	F-811	234N130B
E102		Receptacle for I101	Mtg. Bracket for Bayonet Base Lamp, Type 80	60D	80	262N127
E103A		Insulating Feedthru Recept.	3/8″ x 5/8″ Ceramic Bushing Recpt.	42J		190NBI19
E103B		Insulating Feedthru Plug	3/8″ x 5/8″ Ceramic Bushing Plug	42J		190NBI25
E104		Insulating Standoff	3/4″ Conical Standoff	42J	GS-10	190NSN7
E105		Insulating Standoff	1/2″ x 1″ Cyl. Standoff	42J	397-L1	190NSL3
E106A		LOAD COIL Term. Feedthru	1/2″ x 7/8″ Ceramic Bushing Recpt.	42J		190NBI21
E106B			1/2″ x 7/8″ Ceramic Bushing Plug			190NBI26
E107		Insulating Feedthru	3/16″ x 5/8″ Bushing Insert	42J		190NBI7
E108		Antenna Feedthru Bowl	2-1/2″ x 3-1/8″ Bow	42J	YA-1685B	1685B
E109B		Insulating Feedthru Plug	3/8″ x 5/8″ Ceramic Bushing Plug	42J		190NBI20

INDICATORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
I101		Transmitter Power Pilot Lamp	28 v Clear Bulb Miniature Bayonet Base	40G	T3-1/4	262N327

PARTS LIST BY SYMBOL DESIGNATION

JACKS AND RECEPTACLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
J101		THROTTLE SWITCH Cord Plug Recept.	1 Cir. Jack for plugs with ¼″ barrel	05M 21N	SC1A	358N104
J102		MICROPHONE Cord Plug Recept.	3 Circuit Jack	05M 21N	SCA2B	358N105
J103		KEY Cord Plug Recept.	Same as J101			
J104		Sidetone #1 Receiver Cord Plug Recpt.	Same as J101			
J105		Sidetone #2 Recvr. Cord Plug Recpt.	Same as J101			
J106		Control Box Cable Conn. Plug Recept.	27 Term. Wall Mtg. Recept. Female Conn.	10C	RNK-27-31SL	371N403R
J107		Relay Supply Conn. Plug Recpt.	3 Term. Wall Mtg. Recpt. Female Conn.	10C	RWK-C3-31SL	371N105R
J108		Dynamotor Conn. Plug Recept.	10 Term. Wall Mtg. Recept. Male Conn.	10C	FK-10-32S	371N513
J109		ANTENNA Connector	⅝″ Push Type Binding Post	36E		372N22A
J110		RECEIVER Connector	⅝″ Push Type Binding Post	36E		372N24A
J111		8Q-1 Unit Conn. Plug Recept.	8 Term. Conn. Socket	91J	300	366N208
J112		26S-1 Unit Conn. Plug Recpt.	12 Term. Socket Chassis Mtg.	91J	300	366N212
J113		GROUND Connecter	⅝″ Push Type	36E		372N14A
J114		Low Freq. Osc. Conn. Plug Recept.	6 Term. Socket Chassis Mtg.	91J	300	366N206
J115		Multiplier Unit Conn. Plug Recept.	12 Term. Octal Style Cable Plug Conn.	60A	70-12	369-N17
J116		K102 & S116 Conn Strip	15 Term. Chassis Mtg. Conn.	91J	300	366N215
J117		LOADING COIL Conn.	½″ Push Type	36E		373N21A
J118		ANT. CONDENSER Conn.	Same as J109			

RELAYS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
K101		Relay, Autotune Motor Control	3 Pole Double Throw Circuit Control Relay	85G	G-33177	405 0009 00 405NB201A
K102		Relay, Keying	DT Mult. Contact SPDT	85G	G-32877	410N19A
K103		Relay, CW Emission	2 PDT 1 PST Circuit Control Relay	85G	G-32811	410N17
K104		Relay, VOICE Emission	2 PDT Circuit Control Relay	85G	G-32734	410N16
K105		Relay, Output Circuit Selecting	1 PDT & 1 PNC with Mycalex Insul. 1 PNO with Fiber Insul. 18-32 v d-c	85G	G-33304	410N18

PARTS LIST BY SYMBOL DESIGNATION

INDUCTORS
(See Figure 119)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
L101		H-F Osc. Tuning Ind.	Special precision wound Ind.	64C	GA-671D	671D
L102		H-F Osc. Cathode R-F Choke	Mult. Sect. 2.5 mh 0.125 amp 50 ohm	05N 35M	R100-U	240N53
L103		H-F Osc. Screen R-F Choke	Same as L102			
L104		H-F Osc. Pl. Feed Choke	2 Sect. 208 $\mu h \pm 1\%$ 2 ohms duo-lateral wound	68S		240N60
L105		1st Mult. Pl. Tuning Ind.	Special precision wound Ind.	64C	GA-1687B	1687B
L106		2nd Mult. Pl. Tuning Ind.	Special precision wound Ind.	64C	GA-1686B	1686B
L107		P. A. Grid Feed Choke	Mult. Sect. duo-lateral wound 2.5 mh 0.125 amp 35 to 50 ohm	05N	R100	240N2A
L108		P. A. Pl. Feed Choke	175 turns, close wound, single layer	64C	GA-1404C	1404C
L109		P. A. Pl. Feed Choke	Mult. Sect. 6 mh 21 ohms	82C		240N59
L110		Output Network Static Drain Choke	Close Wound, Single Layer Type	64C	GA-1395C	1395C
L112		P. A. Pl. Tank. Ind.	Variometer	64C	GA-479D	479D
L113		Antenna Loading Ind.	43 turns, close wound, #14 tinned	64C	GA-1258C	1258C
L114		P. A. Pl. Tank Padding Ind.	16 turns, space wound, #16 tinned	64C	GA-1114A	1114A
L115		1st Mult. Pl. Feed Choke	Same as L102			
L116		H. F. Noise Filter	Mult. Sect. duo-lateral wound 1.0 mh 0.3 amp 10 ohm	05N	R-300U	240N58

METERS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
M101		Antenna Current Ammeter	0-0.25 amp R. F. Meter	40G 35W	DW44 NT-33	451ND0.25SN
M102		Voltage-Current Indicating Meter	0-1 ma DC Meter 2% Accy.	40G 35W	DW41 NX-33	450ND1SN

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
P101		Multiplier Unit Conn. Plug Mtg.	12 Term. Octal Style Female Conn. Chassis	60A	MIP	369N16
P102		K102 and S116 Conn. Plug	Part of K102			

PARTS LIST BY SYMBOL DESIGNATION

RESISTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
R101		Resistor, H-F Osc. Grid	22,000 ohm ±10% 1 w	28J	BT1-Navy	729NG22M-K
R102		Resistor, 1st Mult. Grid	100,000 ohm ±10% 1 w	28J	BT1-Navy	729NG100M-K
R103	-RC30BF470M	Resistor, 1st Mult. Grid Parasitic Suppressor	47 ohm ±20% 1 w	65S		729NG47-M
R104		Resistor, 1st Mult. Screen Parasitic Suppressor	Same as R103			
R105		Resistor, 1st Mult. Screen	20,000 ohm ±10% 25 w	25P	0218	710NC20MA-K
R106		Res., 2nd Mult. Grid Par. Suppr.	Same as R103			
R107		Res., 2nd Mult. Grid	Same as R102			
R108		Res., 2nd Mult. Scr. Par. Suppr.	Same as R103			
R109		Res., 2nd Mult. Screen	Same as R105			
R110		Res., P. A. Grid	Same as R105			
R111		Res., P. A. Grid Metering	235 ohm ±2% 200 v	28J	WW3	721NL235-G
R112		Res., P. A. Scr. Par. Suppr.	Same as R103			
R113		Res., Trans. Suppr.	150 ohm ±20% 10 w	25P	BD	710NA150B-M
R114		Res., Trans. Suppr.	Same as R113			
R115		Res., Motor Relay Spark Suppr.	100 ohm ±10% 25 w	25P		710NC100A-K
R116		Res., Fil. Voltage Dropping	1 ohm ±10% 10 w	25P	BD	710NA1A-K
R117		Res., L. V. Supply Bleeder	5000 ohm ±10% 25 w	25P	0212	710NC5MA-K
R118		Res., L. V. Supply Bleeder	Same as R117			
R119		Res., L. V. Supply Bleeder	Same as R117			
R120		Res., L. V. Supply Bleeder	Same as R117			
R121		Res., Filament Voltage Dropping	0.8 ohm ±10% 50 w	25P		710ND0.8A-K
R123		Res., Fil. Voltage Dropping	12.6 ohm ±10% 25 w	25P		710NC12.6A-K
R124		Res., TUNE-P.A. Scr. Voltage Dropping	25,000 ohm ±10% 25 w	25P	0219	710NC25MA-K
R128		Res., M102 Meter Mult.	4000 ohm ±2% 200 v	28J	WW3	721NL4M-G
R129		Res., 2nd Mult. Cathode	1000 ohm ±10% 10 w	26P	BD	710NA1MA-K
R130		Res., 1st Mult. Cathode	Same as R129			
R131		Res., Osc. Cathode	350 ohm ±10% 10 w	25P	BD	710NA350A-K
R132		Res., M102 Meter Mult.	50,000 ohm ±2% 200 v	28J	WW3	721NL50M-G
R133		Res., Fil. Voltage Dropping	50 ohm ±10% 10 w	25P		710NA50A-K
R134		Res., Audio Amp. Input Term.	75 ohm ±10% ½ w	28J	BW½	707N75N-K
R135		Res., MCW Osc. Cathode	10 ohm ±10% ½ w	28J	BW½	707N10N-K
R136		Res., I101 Voltage Dropping	Same as R113			

PARTS LIST BY SYMBOL DESIGNATION

SWITCHES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
S101		Switch, H-F Osc. Grid Tank Padding Cap. Conn.	Moving Switch Arm	64C	GA-1445A	1445A
			Stationary Switch Arm	64C	GA-2002A	2002A
S102		Switch, 1st Mult. Pl. Tank Cap. Select.	18 Cont. single pi	64C		500 0085 00
S103		Switch, 2nd Mult. Pl. Tank Cap. Select.	7 cont. single pi	64C		500 0206 00
S104		Switch, TEST	Single pole NO 20 amp 24 v d-c	96C	8817	260N110
S105		Switch, Metered Circuit Select.	2 circuit 3 pos. non-shorting	05P		259N139A
S106		Switch, Power Level Select.	5 circuit 3 pos. shorting	05P		259N138A
S107		Switch, LOCAL-REMOTE	4 circuit 2 pos. shorting	05P		259N141A
S108		Switch, Autotune CHANNEL Select.	1 circuit 12 pos. non-shorting	05P		259N140A
S109		Switch, Autotune Circuit Seeking	1 circuit 12 pos. shorting	05P	25851-DH-1	259N137
S110		Switch, EMISSION Select.	3 circuit 4 pos. shorting	05P		259N136B
S111		Switch, Rear Limit	Double Pole 1 NC 1 NO cont. leaf	64C	GA-1557B	1557B
S112		Switch, Forward Limit	Single Pole 1 NC Contact leaf	64C	Y-983A	983A
S113		S113A, S113B, S113C, S113D, S113E, S113F, S113G, S113H	Mult. Section Sw. Assembly	64C	186P-1	885C
S113A		Switch, P.A. Tank Padding Cap. Conn.	Single Cont. Sw. Arm Assembly	64C	GA-1105A	1105A
S113B		Switch, P. A. Tuning Cap. Conn.		64C	GA-1083A	1083A
S113C		Switch, P. A. Tank Ind. Tap	Single Cont. Sw. Arm Assembly	64C	GA-1109A	1109A
S113D		Switch, Keying Interlock	Single Pole, 1 NO Contact Leaf	64C	Y-1048A	1048A
S113E		Switch, Padding Ind. Conn.	Single Cont. Sw. Arm Assembly	64C	GA-1082A	1082A
S113F		Switch, Padding Cap. Conn.	Single Contact Arm Assembly	64C	GA-1079A	1079A
S113G		Switch, Padding Cap. Conn.	Same as S113F			
S113H		Switch, Padding Cap. Conn.	Same as S113F			
S114		Switch, Osc. Circuit Selecting	DPST 2 NO 2 NC Cont. Leaf	64C	Y-1136B	1136B
S115		Switch, 2nd Mult. Cath. Grndg.	Single Pole NO Contact Leaf	64C	Y-981A	981A
S116	24163	Switch, Antenna Changeover	8 amp 250 v a.c. SPDT Vacuum Cont.	40G	GL34	260N601

PARTS LIST BY SYMBOL DESIGNATION

TRANSFORMERS
(See Figure 120)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
T101		Transformer, Modulation	Pri: 15,000 ohm CT 150 MA Sec #1: 7300 ohm 4000 TV Sec #2: 970 ohm 2500 TV 300-4000 cps ± 2 db	55C	7950	677N252
T102		Transformer, Antenna Ammeter Coupling	Variable R-F Coupling Transf.	64C	GA-1716B	1716B

TUBES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
V101	837	High Freq. Osc. Tube	Type 837, Beam Pentode	* *	837	
V102	1625	1st Freq. Mult. Tube	Type 1625 Beam Pentode	* *	1625	
V103	1625	2nd Freq. Mult. Tube	Same as V102			
V104	813	Power Amp. Tube	Type 813, Beam Pentode	* *	813	
V105	811	Modulator Tube	Transmitting Tube, Type 811	* *	811	
V106	811	Modulator Tube	Same as V105			

SOCKETS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
X101	-49366	Socket for V101	7 term. base Iso.	77J	227	220N573
X102		Socket for V102	Same as X101			
X103		Socket for V103	Same as X101			
X104		Socket for V104	7 term. "Jumbo" Wafer Socket	77J	237	220N571A
X105		Socket for V105	4 prong low loss Ceramic	77J	224	220N545
X106		Socket for V106	Same as X105			

PARTS LIST BY SYMBOL DESIGNATION

AUDIO AMPLIFIER UNIT

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
C201		Cap., Microphone Supply Fil.	20 mf +100% —10% 100 v	75C	RVL-10051-1	183N33A
				05M	SPO-38482	
C202		Cap., Audio Amp. Cathode Bypass	Same as C201			
C203		Cap., Audio Amp. Scr. Bypass	0.05 mf ±20% 600 WV	75C	TVC	930N66A-M
C204		Cap., Audio Driver Grid Coupl.	.006 mf ±10% 1500 TV	02S	BE-15	915N260E-K
C205		Cap., Audio Amp. Pl. Decoupl.	.001 mf ±10% 1500 TV	02S	BE-15	915N210E-K
C206		Cap., Audio Driver Output Coupl.	.003 mf ±10% 1500 TV	02S	BE-15	915N230E-K
C207		Cap., Audio Dr. Cath. Bypass	Same as C201			
C208		Cap., Sidetone Amp. Cath. Coupl.	Same as C201			
C209		Cap., Parasitic Suppressor	.01 +60% —20% 400 WV		CN35A103	934 0003 00
C210		Cap., Parasitic Suppressor	Same as C209			

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
P201		Audio Amp. Unit Conn. Plug	12 term. conn. chassis mtg.	91J	P-312-AB	365N212

RESISTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
R201		Res., Microphone Current Lim.	220 ohm ±5% 1 w	22A		703NA220-J
R202		Res., Microphone Current Lim.	100 ohm ±5% 1 w	22A		703NA100-J
R203		Res., Microphone Output Coupl.	15,000 ohm ±5% ½ w	28J	BT½-Navy	729NE15M-J
R204		Res., T201 Pri. Terminating	Same as R201			
R205		Res., Audio Amp. Grid	470,000 ohm ±10% ½ w	28J	BT½-Navy	729NE470M-K
R206		Res., Audio Amp. Fil. Current Dividing	42 ohm ±10% 10 w	25P	BD	710NA42B-K
R207		Res., Audio Amp. Cathode	2200 ohm ±10% 1 w	28J	BW1-Navy	708N2200NA-K
R208		Res., Audio Amp. Scr. Decoupl.	1 Meg. ±10% ½ w	28J	BT½-Navy	729NE1Meg-K
R209		Res., Audio Amp. Pl. Decoupl.	220,000 ohm ±10% ½ w	28J	BT½-Navy	729NE220M-K
R210		Res., Audio Driver Grid	Same as R205			

PARTS LIST BY SYMBOL DESIGNATION

RESISTORS (Cont.)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
R211		Res., Sidetone Amp. Grid	100,000 ohm ±5% ½ w	28J	BT½-Navy	729NE100M-J
R212		Res., Sidetone Amp. Grid Coupl.	470,000 ohm ±5% ½ w	28J	BT½-Navy	728NE470M-J
R213		Res., Audio Driver Pl. Decoupl.	750,000 ohm ±5% ½ w	28J	BT½-Navy	729NE750M-J
R214		Res., Audio Driver Cathode	250 ohm ±10% 1 w	28J	BW1-Navy	708N250NA-K
R215		Res., Sidetone Amp. Cathode	Same as R214			
R216		Res., T201 Primary Term.	220 ohm ±10% ½ w	28J	BW½	707N220N-K

SWITCHES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
S201		Microphone Circuit Selector Sw.	DPDT Toggle 1 amp 250 v d-c or 3 amp 125 v d-c	84A	24003	266N103A
S202		Sidetone Amp. Output Control Switch	1 P 6 Pos. 1 Sect. Shorting	05M		259N149

TRANSFORMERS
(See Figure 120)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
T201		Transformer, Audio Amp. Input Coupling	Pri: 75 ohm Sec: 125,000 ohm 100-5000 cps 1000 TV	55C	7823	677N259
T202		Transformer, Audio Dr. Output Coupling	Pri: 5000 ohm 30 ma 300-4000 cps Sec: 2000 ohm 1500 TV	55C	7821	677N253
T203		Transformer, Sidetone Amp. Output Coupling	Pri: 4000 ohm 30 ma 1500 TV 300-4000 cps Sec: Tapped 200 ohm 50 ohm 12.5 ohm 3.12 ohm 0.78 ohm 0.195 ohm 1500 TV	55C	10082	677N254

PARTS LIST BY SYMBOL DESIGNATION

TUBES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
V201	12SJ7	Audio Preamplifier Tube	12SJ7, Triple-Grid Amp.	* *	12SJ7	
V202	6V6GT	Audio Driver Tube	6V6GT, Beam Pentode	* *	6V6GT	
V203	6V6GT	Sidetone Amplifier	Same as V202			

SOCKETS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
X201		Socket for V201	8 term. octal tube socket	60A	88-8	220N185
X202		Socket for V202	Same as X201			
X203		Socket for V203	Same as X201			

PARTS LIST BY SYMBOL DESIGNATION

MCW-CFI UNIT

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
C301		Cap., Calib. Osc. Suppr. Coupling	.00001 mf ±10% 1000 TV	75C	5WS	909N410GN-K
				02S	Type KS	
				64S	Type MO	
C302		Cap., Calib. Osc. Suppr. Coupling	Same as C301			
C303		Cap., Calib. Osc. H.V. Sup. Fil.	.5 mf ±20% 600 WV	75C	DYR-6050	956NS08YX1-M
C304		Cap., Calib. Osc. Scr. Supply Fil.	Same as C203	64S	XDMR6-.5	
C305		Cap., Calib. Osc. Pl. Coupling	Same as C303			
C308		Cap., Calib. Osc. Grid Coupl.	.001 mf ±20% 1000 TV	75C	1RS	912N210AN-M
C309		C309A, C309B	2-0.1 mf ±20% 600 WV	75C	DYRT-6011	956ND01WX1-M
C309A		Cap., MCW Osc. Feedback Coupl.	Section of C309			
C309B		Cap., MCW Osc. Grid Tank	Section of C309			
C310		Cap., Calib. Osc. Pl. Decoupl.	.0025 mf ±20% 1000 TV	75C	1RS	912N225AN-M
C311		Cap., Calib. Osc. Scr. Coupl.	Same as C203			

INDUCTORS
(See Figure 119)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
L302		MCW Osc. Grid Tank Inductor	0.25 mh 1000 cps 0.1 mf Cap.	55C	7822	678N247

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
P301		MCW-CFI Unit Conn. Plug	8 term. Plug Chassis Mtg.	91J	300	365N208

PARTS LIST BY SYMBOL DESIGNATION

RESISTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
R301		Res., Calib. Osc. Suppr.	100,000 ohm ±10% ½ w	28J	BT½-Navy	729NE100M-K
R302		Res., Calib. Osc. H.V. Dropping	10,000 ohm ±10% ½ w	28J	BT½-Navy	729NE10M-K
R303		Res., Calib. Osc. Pl. Decoupl.	Same as R205			
R304		Res., Calib. Osc. Screen	82,000 ohm ±10% ½ w	28J	BT½-Navy	729NE82M-K
R305		Res., Calib. Osc. Screen	8200 ohm ±10% ½ w	28J	BT½-Navy	729NE8200-K
R307		Res., Calib. Osc. Grid	Same as R209			
R308		Res., MCW Osc. Pl. Decoupling	Same as R209			
R309		Res., MCW Osc. Cathode	1500 ohm ±5% ½ w	28J	BT½-Navy	729NE1500-J
R310		Res., MCW Osc. Cathode	2 to 15 ohm Rheostat	89W		381N901
R311		Res., Calib. Osc. Scr. Volt. Dividing	Same as R301			

TUBES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
V301	12SJ7	Calibration Osc. Tube	12SJ7 Triple-Grid Amp.		12SJ7	
V302	12SJ7	MCW Oscillator Tube	12SJ7 Same as V301		12SJ7	

SOCKETS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
X301		Socket for V301	Same as X201			
X302		Socket for V302	Same as X201			
X303		Socket for Y301	Same as X201			

QUARTZ CRYSTALS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
Y301	-40127	Calib. Osc. Quartz Crystal	Quartz Crystal Mtd. in "Plug-in" Holder	64C	146A-2	520 1021 00

MISCELLANEOUS INDUCTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
Z301		Calib. Osc. Grid Tank Circuit	200 kc Osc. Coil Assembly	16A		278N39

PARTS LIST BY SYMBOL DESIGNATION

L-F OSCILLATOR UNIT

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
C401		Cap., L-F Osc. Scr. Bypass	Same as C109			
C402		Cap., L-F Osc. Cathode Coupling	.00005 mf ±20% 900 TV	02S 75C	Type C 1WL	909N450C-M
C403	481685-2	Cap., L-F Osc. Feedback Coupl.	.0003 mf ±2% 1000 TV	25C	816-035	913N330-G
C404	-481688-½	Cap., L-F Osc. Feedback Coupl.	Set of three matched ceramic capacitors packaged as a set. To be connected in parallel to provide 0.00083 mf ±½% TC neg., 150 parts per million per degree C +15 —87 PPM/°C 500 WV	25C	816-044	913NA1
C405A		Cap., L-F Osc. Cathode Bypass	.002 mf ±1% 500 TV	34S		912N220H-F
C405B		Cap., L-F Osc. Cathode Bypass	Same as C405A			
C405C		Cap., L-F Osc. Cathode Bypass	.001 mf ±1% 500 TV	34S		912N210H-F
C406A	-481684-2	Cap., L-F Osc. Cathode Coupl.	.000125 mf ±2% 1000 TV	25C	814-106	913 0001 00
C407	-481687-1	Cap., L-F Osc. Grid Padding	Set of three matched ceramic capacitors packaged as a set. To be connected in parallel to provide 0.00088 mf ±1% TC neg., 32 parts per million per degree C +15 —61 PPM/°C 500 WV	25C	816-043	913NA2
C408A		Cap., L-F Osc. Grid Padding	.0015 mf ±1% 500 TV	34S		912N215H-F
C408B	-481682-2	Cap., L-F Osc. Grid Padding	.00015 mf ±2% 1000 TV	25C	810-250	913N315N6.6-G
C408C	-481685-2	Cap., L-F Osc. Grid Padding	Same as C403			
C409A		Cap., L-F Osc. Grid Padding	Same as C405A			
C409B		Cap., L-F Osc. Grid Padding	.0004 mf ±1% 500 TV	34S		912N340H-F
C409C	-481686-2	Cap., L-F Osc. Grid Padding	.00035 mf ±2% 1000 TV	25C	816-041	913N335N3.3-G
C410A	-481683-2	Cap., L-F Osc. Grid Padding	.00025 mf ±2% 1000 TV	25C	810-290	913N325N7-G
C410B		Cap., L-F Osc. Grid Padding	Same as C405A			
C410C		Cap., L-F Osc. Grid Padding	Same as C405A			
C410D		Cap., L-F Osc. Grid Padding	Same as C408A			
C411	-481680	C411A, C411B, C411C, C411D, C411E	5 Sect. Variable Ceramic Cond.	25C	826-003	917N5A1

PARTS LIST BY SYMBOL DESIGNATION

CAPACITORS (Cont.)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
C411A		Cap., C410 Trimmer	Section of C411			
C411B		Cap., C406 Trimmer	Section of C411			
C411C		Cap., C409 Trimmer	Section of C411			
C411D		Cap., C408 Trimmer	Section of C411			
C411E		Cap., C407 Trimmer	Section of C411			
C412	-481685-2	Cap., L-F Osc. Grid Coupling	Same as C403			

MISCELLANEOUS ELECTRICAL PARTS
(See Figure 118)

E401		L-F Oscillator H. V. Feedthru	3/16″ x 5/8″ Bushing Insert	42J	Type BI	190NBI7
E402		L-F Oscillator Pl. Lead Standoff	3/8″ x 1/2″ Cyl Standoff	42J	395-L-1/2	190NSL5

INDUCTORS
(See Figure 119)

L401		L-F Osc. Grid Tuning Inductor	45 turns close wound 48-38 litz wire	64C	GA-1259C	1259C
L402		L-F Osc. Pl. Feed Choke	8 mh 0.125 amp 70 ohm	05H 35M	CH-8	240N4A
L403		L-F Osc. Cathode Choke	Same as L102			

PLUGS

P401		Low Freq. Osc. Conn. Plug	6 Term. Conn. Chassis Mtg.	91J	Type 300	365N206

PARTS LIST BY SYMBOL DESIGNATION

RESISTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
R401		Resistor, L-F Osc. Grid	15,000 ohm ±10% 1 w	28J	BT1-Navy	729NG15M-K

SWITCHES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
S401		L-F Osc. Freq. Range Sw.	Rotor Assembly	64C	GA-1021A	1021A
			Stator Assembly	64C	GA-1544B	1544B

TUBES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
V401		Low Freq. Osc.	Same as V102			

SOCKETS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
X401		Socket for V401	Same as X101			

DUMMY LFO UNIT

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
P402		Dummy Low Freq. Osc. Conn. Plug	Same as P401			
R402		Filament Substitute Resistor	27 ohm ±5% 20 w	28J	DG	710 0001 00

PARTS LIST BY SYMBOL DESIGNATION

NAVY TYPE COL–23410 REMOTE CONTROL UNIT

MISCELLANEOUS ELECTRICAL PARTS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
E901		Pilot Light Mounting	Miniature Bayonet	60D	CAT. 80	262N127

PILOT LAMPS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
I901		Bulb	28 v 0.17 amp bayonet base clear bulb	40G	T3-¼	262N327

JACKS AND RECEPTACLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
J901		Headphone Jack	Single circuit jack for ¼″ plug	05M 21N	SC1A	358N104
J902		Audio Input Terminal	2 conn. term. strip	64C		GA-2031A
J903		Microphone Jack	3 circuit jack for plug with 3/16″ barrel	05M 21N	SCA2B	358N105
J904		Key Jack	Same as J901			

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
P901		Cable connector	27 term. wall mounting recept. 10 amp contacts	10C	K	371N405

PARTS LIST BY SYMBOL DESIGNATION

RESISTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
R901	-RC31BF182K	Headphone Series Resistor	1800 ohm ±20% 1 w Metallized	28J	BT1-Navy	729NG1800-M
R902	-631874-2 only with two RC21BE511M resistor.	Volume Control	"T" Pad Attenuator 500 ohm	28J	CSMPD	380N201

SWITCHES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
S901	-24003	Phones-Speaker Switch	DPDT Toggle Switch black nickel plated 1 amp 250 v d.c.	84A	20905-GH	266N103
S902		Channel-Selector Switch	1 circuit, non-shorting 11 pos. 1 deck with stops at Pos 1 and 11 with detent	05P		259N142A
S903		Emission Selector Switch	3 circuit, shorting, 4 pos. 2 deck with stops at Pos. 4 and 12 with detent	05P		259N136A

TRANSFORMERS
(See Figure 120)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
T901		Speaker Transformer	500 ohm to 6 ohm matching Transf.	70J		667S705A

LOUD SPEAKERS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
LS901		Speaker	5″ permanent magnet 6 ohm voice coil	70J	PM5C	271N220

PARTS LIST BY SYMBOL DESIGNATION

NAVY TYPE COL–47370 LOADING COIL

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
C1001		Ammeter Series Cond.	.0007 mf ±5% 5000 v dc Mica Cond.	75C 02S	6LS F2	906N370A-J
C1002		Relay Bypass	.01 mf ±20% 500 1000 tv	75C 02S	4L H-10	910N110G-M
C1003		Relay Bypass	Same as C1002			

MISCELLANEOUS ELECTRICAL PARTS
(See Figure 118)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
E1001		Ceramic Bushing on Feedthru Bowl	3/8" x 5/8" Bushing recept. Ceramic	25C		190NBI24
E1002		Ceramic Bushing on Feedthru Bowl	Same as E1001			
E1003		Input Termiual Feedthru Bushing	1/2" x 7/8" Bushing Receptacle Ceramic	42J		190NBI21
E1004		Input Terminal Feedthru Bushing	7/8" x 7/8" Bushing Plug Ceramic	42J		190NBI22
E1005		Meter Shock Mount	Rubber Meter Mount for 2.2" meter body	90L	J-1665-1	200N535
E1006		Antenna Feedthru Bowl	Ceramic bowl			NX-5747
E1007			Same as E1006			

JACKS AND RECEPTACLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
J1001		Relay Power Connector	3 term. wall mtg. recept. male	10C	WK-C3-32S	371N104
J1002		Input Binding Post	Push type binding post	50X	BI Special	372N21
J1003		Ground Connection	Push type binding post top engraved with "GND"	50X	BI Special	372N13X-1
J1004		Transmitter Conn. Binding Post	Push Type binding post	50X	BI Special	372N25
J1005		Antenna Binding Post	Same as J1004			

PARTS LIST BY SYMBOL DESIGNATION

RELAYS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
K1001		Antenna Changeover Relay	SPDT Vacuum Relay 28 v d.c. 60 ohm	85G	G32881	410N21

INDUCTORS AND REACTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
L1001		Static Drain Choke	Radio Frequency Choke 6 mh 21 ohm d.c. resistance	82C		240N59
L1002		Loading Variometer	Special variable inductance	64C		Dwg. 1118C

METERS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
M1001	-22438	R. F. Ammeter	Thermo-ammeter 3 amp scale 2-½″ round case	45W	507	457N114

MECHANICAL PARTS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
O1001		Brake Plate Assembly		64C		Dwg. 1255B

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
P1001		Relay Power Connector Plug	2 term. chassis mount socket	91J	S-302-AB	366N202

SWITCHES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
S1001		Inductance Switch	4 pos. non-shorting type	64C		Dwg. 1108C
S1002		K1001 Contacts	SPST Vacuum Contacts	40G	GL34	260N601

PARTS LIST BY SYMBOL DESIGNATION

ANTENNA SHUNT CAPACITOR NAVY TYPE -481628

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
C1101		Cap., Antenna Shunt	25 mmf ±10% 10,000 v Eff	06A	1860-201	914N1X6-K
C1102		Cap., Antenna Shunt	Same as C1101			
C1103		Cap., Antenna Shunt	Same as C1101			

PARTS LIST BY SYMBOL DESIGNATION

65X-7 EXTERNAL CONTROL CABLE

(Transmitter to Power Unit)

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
P1501		Female Plug	27 term. 90 degree angle plug connector. Female 10 amp cont.	10C	NK-27-23C 11/16	371N406
P1502		Male Plug	27 term. straight plug male connector. 10 amp contacts	10C	RNK-27-22C 11/16	371N404R

CABLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
W1501		Connecting Cable	27 conductor control cable flameproof, 10½″ long	24B		424N271

PARTS LIST BY SYMBOL DESIGNATION

65X-8 EXTERNAL POWER CABLE

(Transmitter to Power Unit)

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
P1601		Female Connector Plug	10 term. straight plug conn. 2-15 amp cont. and 8-10 amp cont.	10C	FK 10-21C 9/16	371N514
P1602		Male Connector Plug	10 term. 90 degree angle plug connector. male 2-15 amp cont. and 8-10 amp contacts	10C	RFK 10-24C 9/16	371N512R

CABLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
W1601		Connecting Cable	10 Cond. power cable flameproof 2 #14, 1 #18 and 7 #22 cond., 10½'' long	24B		424N101

PARTS LIST BY SYMBOL DESIGNATION

65X-9 EXTERNAL RELAY POWER CABLE

(Load Coil to Transmitter)

MISCELLANEOUS ELECTRICAL PARTS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
E1701		P1701 Reducer Bushing	Split rubber bushing	10C	P	371N111
E1702		P1702 Reducer Bushing	Same as E1701			

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
P1701		Load Box Connector Plug	90 degree angle plug 3 terminal female	10C	WK-C3-23C 7/16	371N109
P1702		Transmitter Connector Plug	3 terminal straight plug conn. Male	10C	RWK-C3-22C 7/16	371N110R

CABLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
W1701		Connecting Cable	10 ft. length of 2 conductor shielded cable	24B	#8422	425N025

PARTS LIST BY SYMBOL DESIGNATION

NAVY TYPE COL–211101 POWER UNIT

MOTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
B1801		Generator Driving Motor	115 v 50/60 cycle motor ½ h. p. 3450 rpm	13M		230N18

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
C1801		Audio Coupling Cond.	2 mf ±20% 400 v dc foil-paper liquid impregnant cond.	75C		954NS4U-M
C1802		Keying Supply Filter Cond.	8 mf ±20% 800 v dc foil-paper liquid impregnant cond.	75C	KG-4080	930N19-M
C1803		400 volt Supply Filter Cond.	Same as C1802			
C1804		400 volt Supply Filter Cond.	Same as C1802			
C1805		High Voltage Supply Filter Cond.	4 mf ±20% 2000 v dc foil-paper oil-filled cond.	75C	TJU-20040	930N40-M
C1806		High Voltage Supply Filter Cond.	Same as C1805			
C1807		Generator Noise Filter Cond.	.01 mf ±20% 1000 v dc Mica Cond.	75C 02S	4L H-10	910N110G-M
C1808		C1808A, C1808B				
C1808A		Ripple Filter Cond.	20 mf 100 WV Electrolytic	75C		183N33-A
C1808B		Ripple Filter Cond.	Same as C1808A			
C1809		Generator Noise Filter Cond.	Same as C1807			
C1810		Ripple Filter Cond.	Same as C1801			
C1811		Generator Noise Filter	Same as C1807			
C1812		Generator Noise Filter	Same as C1807			
C1813		Generator Noise Filter	Same as C1807			
C1814		Capacitor, Motor Start	Replacement Cap. for Motor	13M	107-129-MFD-4207	234 0041 00

DRY DISC RECTIFIERS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
CR1801		Dry Disc Rectifier	Selenium dry disc rectifier 110 v d.c. 0.3 amp output	35J	3B8C1	353N25

PARTS LIST BY SYMBOL DESIGNATION

MISCELLANEOUS ELECTRICAL PARTS

(See Figure 118)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
E1801		H. V. Output Conn.	Ceramic Bushing ⅜" x ⅝"	42J	979A	190NBI19
E1802		H. V. Output Conn.	Ceramic Bushing Plug ⅝" x ⅝"	42J		190NBI20
E1803		Rectifier Plate Feedthru	Ceramic Bushing ½" x ⅞"	42J		190NBI21
E1804		Rectifier Plate Feedthru	Same as E1803			
E1805		Rectifier Plate Feedthru	Same as E1803			
E1806		Rectifier Plate Feedthru	Same as E1803			
E1807		Rectifier Plate Feedthru	Ceramic Bushing Plug ½"x⅞"	42J		190NBI22
E1808		Rectifier Plate Feedthru	Same as E1807			
E1809		Rectifier Plate Feedthru	Same as E1807			
E1810		Rectifier Plate Feedthru	Same as E1807			
E1811		Bracket for Filament Power Pilot Light	Pilot Light Mounting for miniature bayonet base bulb	60D	30	262N123
E1812		Bracket for Remote Carrier Cont. Pilot Light	Same as E1811			
E1813		Jewel for E1811	Red Jewel	60D		262 2160 00
E1814		Jewel for E1812	Green Jewel	60D		262 2180 00

FUSES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
F1801		Main Power Fuse	30 amp 250 v Ferrule type renewable element			264N230A
F1802		Main Power Fuse	Same as F1801			
F1803		Keying Supply Fuse	1 amp 250 v 11/32 dia. 1-½" long			AA199A
F1804		Motor Fuse	15 amp 250 v 11/32 dia. 1-½" long			AA199K
F1805		28 Volt Supply Fuse	15 amp 250 v 11/32 dia. 1-½" long			AA199K
F1806		14 Volt Supply Fuse	3 amp 250 v Cartridge 11/32" dia. 1-½" long			AA199C
F1807		400 Volt Supply Fuse	Same as F1806			
F1808		H.V. Supply Fuse	Same as F1804			

PARTS LIST BY SYMBOL DESIGNATION

GENERATORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
G1801		Low Voltage Generator	28 and 14 v dual voltage d.c. generator	88F	G-100	231N604

PILOT LAMPS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
I1801		Pilot Light Bulb	Miniature Bayonet Base 12-16 v 0.10 amp bulb	40G 66R	T-3¼	262N326
I1802		Pilot Light Bulb	Same as I1801			

JACKS AND RECEPTACLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
J1801		27 Contact Cable Connector	27 contact wall mtg. plug 10 amp contacts	10C	NK-27-32S	371N401
J1802		10 Contact Cable Connector	10 contact wall mtg. female recept. 2-15 amp & 8-10 amp	10C	RFK-10-31SL	371N511R
J1803		Remote Control and Remote Transmitter Connector	27 Terminal Connector	64C		YA-1545B
J1804		Part of J1803	10 Terminal Connector	64C		YA-1545B
J1805		RADIOPHONE Bay Connector	21 Terminal Connector	64C		YA-1546B
J1806		Motor Connector Socket	4 prong connector socket	64C	GA-1726A	GA-1726A
J1807		Generator Connector Socket	Same as J1806			

RELAYS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
K1801		Fil. Control Relay	3 pole NO 115 v a.c. 60 cps	85G		405NB204A
K1802		Carrier Control Relay	2PNO 7.2 to 14 v d.c.	85G	G33402	405NB205A
K1803		Keying Relay	DPDT 115 v d.c. Relay 2275 ohm resistance	65G	JD115RR	405NB208
K1804		Time Delay Relay	SPST 1 NO Contact 110 v 60 cps	84C	TD 2/30S	402N18
K1805		Power Control Delay Relay	2 PNO 115 v a.c. 60 cps	65G	JA115AA	405NB207
K1806		Plate Power Control Relay	2 PNO 28 v d.c.	65G	JD28AA	405NB206

PARTS LIST BY SYMBOL DESIGNATION

INDUCTORS AND REACTORS

(See Figure 119)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
L1801		400 Volt Supply Filter Reactor	6 hy 0.3 amp reactor 40 ohm d.c. Res.	55C		678N239
L1802		400 Volt Supply Filter Reactor	Same as L1801			
L1803		H.V. Supply Filter Reactor	6 hy 0.4 amp 48.4 ohm d.c.	55C		678N151
L1804		H.V. Supply Filter Reactor	Same as L1803			
L1805		R. F. Choke	Air Core R.F. Choke .012 mh	97E		240N54
				05M	RF-583	
L1806		R. F. Choke	Same as L1805			
L1807		14 Volt Supply Filter Reactor	0.15 hy 1 amp Reactor 1 ohm d.c. Res.	55C		678N260
L1808		R. F. Choke	Same as L1805			
L1809		R. F. Choke	Same as L1805			

MECHANICAL COUPLERS

O1801		Coupler, Motor-Generator	½″ ID 2-⅛″ long	90L	J-1211-3	15N306

PLUGS

P1801		Motor Connector Plug	4 prong connector plug	91J	P-4-AB1/16	363N204
P1802		Generator Connector Plug	Same as P1801			

PARTS LIST BY SYMBOL DESIGNATION

RESISTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
R1801		Relay Current Limiting Res.	63 ohm ±5% 200 w Ferrule Type Res.	66S		733NXA63-J
R1802		Keying Supply Bleeder	2500 ohm ±5% 15 w Ferrule Type Res.	66S		733NXF2500-J
R1803		Meter Shunt	13.3 ohm ±2% 1 w wire wound	28J	WW3	721NL13.3-G
R1804		H.V. Supply Bleeder	31,500 ohm ±10% 200 w Ferrule Type Res.	66S		733 0331 00
R1805		400 Volt Supply Bleeder	20,000 ohm ±5% 70 w Ferrule Type	66S		733NXC20M-J
R1806		Pilot Light Dropping Resistor	1000 ohm ±5% 25 w Ferrule Type	66S		733NXE1M-J
R1807		Rectifier Heater	660 w 110 v	01W	#40	711 0003 00
R1808		Rectifier Heater	Same as R1807			

SWITCHES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
S1801		Local-Remote Switch	7 NO and 1 NC Key Switch			AC102H
S1802		Local Power On-Off Switch	SPST Toggle Black Nickel Plate 3 amp 125 v	84A	20994-ET	266N101
S1803		Emergency On-Off Switch	Same as S1802			
S1804	-24003	Control Wire Selector Switch	DPDT 3 amp 125 v black nickel	84A	20905-GH	266N103
S1805	-24015	Panel Interlock Switch	Push Toggle NO Contacts	84A	3592-N	266N105
S1806		Heater Thermoswitch adj. to +15° to +20°C	10 amp 115 v 0-400° F.	40F	731RC	292N24

TRANSFORMERS
(See Figure 120)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
T1801		Audio Transformer	200, 400, 600 ohm to 42, 60, 82, 106 ohms matching trans.	55C		677N261
T1802		Rectifier Filament Transformer	2.5 v 10 amp output 115 v 50/60 cps tapped primary	55C		672N264
T1803		Rectifier Filament Transformer	2.5 v 10 amp output 115 v 50/60 cps tapped primary	55C		672N266

PARTS LIST BY SYMBOL DESIGNATION

TRANSFORMERS (Cont.)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
T1804		Low Voltage Plate Transformer	1000 v CT 0.212 amp Sec. 115 v 50/60 cps Pri.	55C		672N265
T1805		High Voltage Plate Transformer	2800 v CT 0.247 amp Sec. 115 v 50/60 cps tapped primary	55C		672N263
T1806		Key Power-Supply Transformer	135 v 0.3 amp Sec. 115 v 50/60 cps tapped Primary	55C		674N262

VACUUM TUBES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
V1801		Low Voltage Rect.	Mercury Vapor Rectifier			866/866A
V1802		Low Voltage Rect.	Same as V1801			
V1803		High Voltage Rect.	Same as V1801			
V1804		High Voltage Rect.	Same as V1801			

SOCKETS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
X1805		Rectifier Tube Socket	4 prong ceramic	77J	224	220N545
X1806		Rectifier Tube Socket	Same as X1805			
X1807		Rectifier Tube Socket	Same as X1805			
X1808		Rectifier Tube Socket	Same as X1805			
X1809		Heater Socket	Ceramic Receptacle	90B	4063	265N101
X1810		Heater Socket	Same as X1809			

PARTS LIST BY SYMBOL DESIGNATION

NAVY TYPE COL–211102 115 V. D.C. POWER UNIT

CAPACITORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
C1901		Audio Coupling Capacitor	2 mf ±20% 400 v d.c. foil paper liquid impregnant	75C		954NS4U-M
C1902		Spark Suppressor Capacitor	Same as C1901			
C1903		400 Volt Supply Filter Cap.	8 mf ±20% 800 v d.c. foil paper liquid impregnant	75C	KG4080	930N19-M
C1904		400 Volt Supply Filter Cap.	Same as C1903			
C1905		High Voltage Supply Filter Cap.	4 mf ±20% 2000 v d.c. foil paper oil-filled	75C	TJU-20040	930N40-M
C1906		High Voltage Supply Filter Cap.	Same as C1905			
C1907	-48312-B-20	400 Volt Noise Filter	Dual 0.1 mf ±20% 600 WV	75C		956ND01W-M
C1908		High Voltage Noise Filter	Same as C1907			
C1909		Spark Suppressor Capacitor	Same as C1901			
C1910		Motor Noise Filter Cap.	.01 mf ±20% 1000 v d.c. Mica	75C 02S	4L H-10	910N110G-M
C1911		400 Volt Filter	0.1 mf ±20% 600 WV	75C		956NS01Y-M
C1912		High Voltage Noise Filter	0.1 mf ±20% 1500 WV	75C		930 0012 00
C1913		Motor Noise Filter Capacitor	Same as C1910			
C1914		Noise Filter Capacitor	Same as C1910			
C1915		Ripple Filter Capacitor	Same as C1901			
C1916		High Voltage Noise Filter	Same as C1912			
C1917		28 Volt Noise Filter	4.0 mf ±20% 50 WV	75C		930 0013 00
C1918		Noise Filter Capacitor	Same as C1910			
C1919		C1919A and C1919B				
C1919A		Ripple Filter Capacitor	20 mf 100 WV Electrolytic −10% +100%	75C		183N33-A
C1919B		Ripple Filter Capacitor	Same as C1919A			
C1920		Line Filter	2 mf ±10% 600 WV			930N78B-K
C1921		Line Filter	Same as C1920			
C1922		C1922A, C1922B	Same as C1907			
C1922A		Line Filter	Part of C1922			
C1922B		Line Filter	Part of C1922			

PARTS LIST BY SYMBOL DESIGNATION

DYNAMOTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
D1901		Low Voltage Dynamotor	115 v d.c. input 28 v d.c. 10 amp 14 v d.c. at 1.2 amp output	88F	D-102	231N48
D1902		High Voltage Dynamotor	115 v d.c. input 400 v d.c. .700 amp 1150 v d.c. .350 amp output	88F	D-101	231N49

MISCELLANEOUS ELECTRICAL PARTS
(See Figure 118)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
E1901		H. V. Output Connector	Ceramic Bushing 3/8″ x 5/8″	42J	979A	190NBI19
E1902		H. V. Output Connector	Ceramic Bushing Plug 5/8″ x 5/8″	42J		190NBI20
E1903		H. V. Feedthru	Same as E1901			
E1904		H. V. Feedthru	Same as E1902			
E1905		400 Volt Feedthru	Same as E1901			
E1906		400 Volt Feedthru	Same as E1902			
E1907		Pilot Light Bracket	Bracket for Miniature Bayonet Base Bulb	60D	30	262N123
E1908		Pilot Light Bracket	Same as E1907			

FUSES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
F1901		Power Line Fuse	30 amp 250 v Ferrule Type Renewable Element			264N230A
F1902		Power Line Fuse	Same as F1901			
F1903		D1901 Dynamotor Primary Fuse	15 amp 250 v 11/32″ dia. 1-½″ long			AA199K
F1904		D1902 Dynamotor Primary Fuse	Same as F1903			
F1905		28 Volt Supply Fuse	Same as F1903			
F1906		14 Volt Supply Fuse	3 amp 250 v 11/32″ dia.1-½″ long			AA199C
F1907		400 Volt Supply Fuse	High Voltage Aircraft Type 1 amp 1000 V	78L	2104	264N704
F1908		1150 Volt Supply Fuse	High Voltage Aircraft Type 1 amp 2500 V	78L	2109	264N709

PARTS LIST BY SYMBOL DESIGNATION

PILOT LAMPS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
I1901		Pilot Light Bulb	Miniature Bayonet Base 12-16 V. 0.10 amp	40G 66R	T3-¼	262N326
I1902		Pilot Light Bulb	Same as I1901			

JACKS AND RECEPTACLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
J1901		27 Contact Cable Connector	27 Cont. Wall Mtg. Plug 10 amp Cont.	10C	NK-27-32S	371N401
J1902		10 Contact Cable Connector	10 Cont. Wall Mtg. Female Recept. 2-15 amp 8-10 amp contacts	10C	RFK-10-31SL	371N511R
J1903		Remote Control and Remote Transmitter Connector	27 Term. Connector	64C		GA-1545B
J1904		Part of J1903	10 Term. Connector	64C		GA-1545B
J1905		RADIOPHONE Box Connector	21 Term. Connector	64C		GA-1546B
J1906		H. V. Dynamotor Connector Socket	6 Contact Socket	64C		500 2072 00A
J1907		L. V. Dynamotor Connector Socket	Same as J1906			

RELAYS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
K1901		Fil. Control Relay	3 Pole NO 115 V d.c.	85G		405NB203A
K1902		Carrier Relay	2 PNO 7.2 to 14 V d.c.	85G	G33402	405NB205A
K1903		Keying Relay	DPDT 115 V d.c. relay 2275 ohm Res.	65G	JD115RR	405NB208
K1904		Plate Power Control Relay	2 PNO 28 V d.c.	65G	JD28AA	405NB206

PARTS LIST BY SYMBOL DESIGNATION

INDUCTORS AND REACTORS

(See Figure 119)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
L1901		14 Volt Supply Filter Reactor	0.15 hy 1 amp reactor 1 ohm d.c. Res.	55C		678N260
L1902		400 Volt Supply Filter Reactor	6 hy 0.3 amp reactor 40 ohm d.c. Res.	55C		678N239
L1903		High Voltage Supply Filter Reactor	6 hy 0.4 amp 48.4 d.c. Res.	55C		678N151
L1904		Radio Frequency Choke	Air Core R. F. Choke 22 microh.	97E		240N54
				05M	RF583	
L1905		Radio Frequency Choke	Same as L1904			
L1906		Radio Frequency Choke	Same as L1904			
L1907		Radio Frequency Choke	Same as L1904			
L1908		Radio Frequency Choke	Same as L1904			
L1909		Radio Frequency Choke	Same as L1904			
L1910		Radio Frequency Choke	Same as L1904			
L1911		Radio Frequency Choke	Same as L1904			
L1912		400 V Noise Filter Choke	1 mh 0.300 amp 10 ohm	05N	R300U	240N58
L1913		400 V Noise Filter Choke	Same as L1912			
L1914		400 V Noise Filter Choke	Same as L1912			
L1915		H. V. Noise Filter Choke	Same as L1912			
L1916		H. V. Noise Filter Choke	Same as L1912			
L1917		H. V. Noise Filter Choke	Same as L1912			
L1918		H. V. Noise Filter Choke	Same as L1912			
L1919		Line Filter Choke	Same as L1904			
L1920		Line Filter Choke	Same as L1904			

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Designation	Contractor's Drawing or Part Number
P1901		H. V. Dynamotor Connector Plug	6 Prong Plug	91J	SS-6-AB 1/16	363N206
P1902		L. V. Dynamotor Connector Plug	Same as P1901			

PARTS LIST BY SYMBOL DESIGNATION

RESISTORS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
R1901		Relay Current Limiting Res.	63 ohm ±5% 200 w Ferrule Type	66S		733NXA63-J
R1902		Arc Suppressor Resistor	200 ohm ±20% 2 w wire wound res.	28J		709N200N-M
R1903		Meter Shunt	13.3 ohm ±2% 1 w wire wound res.	28J	WW3	721NL13.3-G
R1904		Arc Suppressor Resistor	Same as R1902			
R1905		Pilot Light Dropping Resistor	1000 ohm ±5% 25 w Ferrule Type	66S		733NXE1M-J

SWITCHES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
S1901		Local-Remote Switch	7 NO & 1 NC Key Switch			AC102H
S1902		Local Power Switch	SPST Toggle 3 amp 125 v Black Nickel Plate	84A	20994-ET	266N101
S1903		Emergency Switch	Same as S1902			
S1904		Control Wire Selector	Same as S1902			
S1905		Panel Interlock Switch	Push Toggle NO Contacts	84A	3592-N	266N105

TRANSFORMERS
(See Figure 120)

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
T1901		Audio Coupling Transformer	200, 400, 600 ohms to 42, 60, 82, 106 ohms Matching Transformer	55C		677N261

65X-10 REMOTE CABLE
(Remote Control Unit to Power Unit)

PLUGS

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
P2301		Cable Connector	27 terminal straight connector	10C	NK-27-21C 11/16	371N402

CABLES

Symbol Desig.	Navy or JAN Type Number	Function	Description	Mfr's. Code	Mfr's. Desig-nation	Contractor's Drawing or Part Number
W2301		Multi-Conductor Wire	27 conductor wire 10′ long	24B		424N271

TABLE XVIII—TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

MOTORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
160	1		B101	1/20 hp 28 v d-c		98E	NY-818C-A		818C
79	2		B1801	1 set B1801 Motor Bearings		13M	ND8706		234 0039 00

CAPACITORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
167	1	481677-1 481678-1	C101 C102, C103, C104	.000185 mf ±1% 1000 TV Set of 3 matched Ceramic Capacitors Total 413 mmf ±1% 1000 TV		64C			GA-1433C
73	1		C105	.005 mf ±5% 2500 TV		75C 02S	4LST HLST		925N250K-J
72	1		C106, C117	.006 mf ±20% 1000 TV		75C 02S	4LS HLS-10		910N260C-M
72	1		C107	.002 mf ±20% 1000 TV		75C 02S	4LS HLS-10		910N220C-M
73	1		C108, C116	.0005 mf ±10% 1500 TV		02S	BE-15		915N350E-K
72	3	-482111-B-20	C109, C110, C113, C114, C401	.002 mf ±20% 1500 TV		02S	BE-15		915N220E-M
66	1		C111, C115	6 Section Variable Ceramic Cap.		25C	828-003		917N6A3
73	1		C112	.00025 ±10% 1500 TV		02S	BE-15		915N325E-K
24	1		C118	.002 mf ±20% 7500 TV		02S	A2LS		975N220A-M
73	1		C119	.002 mf ±20% 2500 TV		75C 02S	4LS HLS-25		925N220C-M
74	1		C120A, C120B	.002 mf ±20% 5000 TV		75C 02S	4LS HLS-50		950N220C-M
23	1		C121A, C121B, C121C	3-0.1 mf ±20% 600 WV		75C 64S	DYRT-6111 3XDMR TW6-.1		956NT01WX1-M
140	2		C122A, C122B, C129	.00005 mf ±10% Ceramic		25C	850-002		913N450C-K

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

CAPACITORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
140	2		C124A, C124B, C124C	.000067 mf ±5% Ceramic		25C	850-003		913N467C-J
31	1		C126	2.0 mf ±20% 600 WV		75C	KG-3020		930N78B-M
73	1		C127	.006 mf ±20% 1500 TV		02S	BE-15		915N260E-M
140	1	481689-10	C130	.000025 mf ±10% Ceramic		25C	850-001		913N425C-K
72	1		C131	.0008 mf ±5% 1000 TV		02S	BE-10		910N380E-J
70	1		C132, C133	.004 mf ±20% 600 TV		75C	3WS		909N240F-M
						02S	JS		
173	1		C134, C135	Midget Variable		05P			922N51
140	1	481681	C136	13 mmf Variable Ceramic		25C	822-009		917N101
70	1		C137	.0015 mf ±10% 900TV		64S			909N215F-K
						02S			
12, 13, 14	3		C201, C202, C207, C208, C1808A, C1808B	20 mf +100% —10% 100 v		75C	RVL-10051-1		183N33A
						05M	SPO 38482		
30	2		C203, C304, C311	.05 mf ±20% 600 WV		75C	TVC		930N66A-M
73	1		C204	.006 mf ±10% 1500 TV		02S	BE-15		915N260E-K
72	1		C205	.001 mf ±10% 1500 TV		02S	BE-15		915N210E-K
73	1		C206	.003 mf ±10% 1500 TV		02S	BE-15		915N230E-K
70	1		C301, C302	.00001 mf ±10% 1000 TV		75C	5WS		909N410GN-K
						02S	KS		
22	1		C303, C305	.5 mf ±20% 600 WV		75C	DYR-6050		956NS08YX1-M
						64S	X-DMR6-.5		
70	1		C308	.001 mf ±20% 1000 TV		75C	1RS		912N210AN-M
21	1		C309A, C309B	2-0.1 mf ±20% 600 WV		75C	DYRT6011		956ND01WX1-M
70	1		C310	.0025 mf ±20% 1000 TV		75C	1RS		912N225AN-M
70	1		C402	.00005 mf ±20% 900 TV		02S	Type "C"		909N450C-M
						75C	1WL		
71	2	481685-2	C403, C408C, C412	.0003 mf ±2% 1000 TV		25C	816-035		913N330-G
102	1	481688-½	C404	Set of 3 matched Ceramic Capacitors Total 0.00083 mf ±½% 500 WV		25C	816-044		913NA1
71	3		C405A, C405B, C409A, C410B, C410C	.002 mf ±1% 500 TV		34S			912N220H-F

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

CAPACITORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
70	1		C405C	.001 mf ±1% 500 TV		34S			912N210H-F
70	1	481684-2	C406A	.000125 mf ±2% 1000 TV		25C	814-106		913 0001 00
102	1	481687-1	C407	Set of 3 matched Ceramic Capacitors Total .00088 mf ±1% 500 WV		25C	816-043		913NA2
70	1		C408A, C410D	.0015 mf ±1% 500 TV		34S			912N215H-F
71	1		C408B	.00015 mf ±2% 1000 TV		25C	810-250		913N315N6.6-G
70	1		C409B	.0004 mf ±1% 500 TV		34S			912N340H-F
71	1	481686-2	C409C	.00035 mf ±2% 1000 TV		25C	816-041		913N335N3.3-G
71	1	481683-2	C410A	.00025 mf ±2% 1000 TV		25C	810-290		913N325N7-G
172	1	481680	C411	5 Section Variable Ceramic Cap.		25C	826-003		917N5A1
41	1		C1001	.0007 mf ±5% 5000 WV		75C 02S	6LS F2		906N370A-J
74	4		C1002, C1003, C1807, C1809, C1811, C1812, C1813	.01 mf ±20% 1000 TV		75C 02S	4L H-10		910N110G-M
158, 159	2		C1101, C1102, C1103	25 mmf ±10% 10,000 v eff.		06A	1860-201		914N1X6-K
42	1		C1801, C1810	2 mf ±20% 400 WV		75C			954NS4U-M
165, 166	2		C1802, C1803, C1804	8 mf ±20% 800 WV		75C	KG-4080		930N19-M
164	1		C1805, C1806	4 mf ±20% 2000 WV		75C	TJU-20040		930N40-M
168	1		C1814	Motor Capacitor		13M	107-129 MFD-4207		234 0041 00

MISCELLANEOUS ELECTRICAL PARTS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
123	20		E101A	+ and — Brush for NY-818C-A Autotune Motor		98E			234M130
25	4		E1701, E1702	Split rubber bushing		10C	P		371N111

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

FUSES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
81	10		F1801, F1802	30 amp fuse link					264N230B
97	10		F1803	1 amp 250 v 11/32″ dia. 1½″ long					AA199A
100	10		F1804, F1805, F1808	15 amp 250 v 11/32″ dia. 1½″ long					AA199K
98	10		F1806, F1807	3 amp 250 v 11/32″ dia. 1½″ long					AA199C

GENERATORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
77	2		G1801	Brush Holder		88F	B-104		234 0006 00
77	2		G1801	Brush Holder		88F	BLT105		234 0042 00
78	2		G1801	Brush Holder Cap		88F	BHC-101		234 0008 00
78	2		G1801	Brush Holder Cap		88F	BHC-103		234 0009 00
79	2		G1801	Bearing for G1801		88F	CWC88013		234 0010 00
121	10		G1801	Positive 14 v brush for G1801		88F	BR106+		234 0021 00
121	10		G1801	Negative 14 v brush for G1801		88F	BR106—		234 0022 00
122	10		G1801	Positive 28 v brush for G1801		88F	BR105+		234 0027 00
122	10		G1801	Negative 28 v brush for G1801		88F	BR105—		234 0028 00
161	1		G1801	Armature for G1801		88F	ARM-106		234 0035 00
162	2		G1801	Field Coil for G1801		88F	FCA-106		234 0038 00

PILOT LIGHTS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
80	2		I101, I901	28 v Clear Bulb, miniature bayonet base		40G	T3-¼		262N327
80	2		I1801, I1802	12-16 v miniature bayonet base		40G	T-3-¼		262N326

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

JACKS AND RECEPTACLES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
169	4		J101, J103, J104, J105, J901, J904	1 circuit jack for plugs with ¼″ barrel		05M 21N	SC1A		358N104
170	4		J102, J903	3 circuit jack		05M 21N	SCA2B		358N105
130	4		J106	27 term. female connector		10C	RNK-27-31SL		371N403R
106	4		J107	3 term. female conn. wall mtg.		10C	RWK-C3-31SL		371N105R
113	4		J108	10 term. male conn. wall mtg.		10C	FK-10-32S		371N513
103	4		J111	8 term. conn. socket		91J	300		366N208
104	4		J112	12 term. socket chassis mtg.		91J	300		366N212
83	4		J114	6 term. chassis mtg. socket		91J	300		366N206
105	4		J115	12 term. octal style cable plug conn.		60A	70-12		369N17
109	4		J116	15 term chassis mtg. conn.		91J	300		366N215
40	4		J1001	3 term. wall mtg. recept. male		10C	WK-C3-32S		371N104
111	4		J1801	27 term. wall mtg. conn.		10C	NK-27-32S		371N401
133	4		J1802	10 term. wall mtg. conn.		10C	RFK-10-31SL		371N511R
119	4		J1806, J1807	4 term. conn. socket		64C	GA1726A		GA-1726A

RELAYS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
114	4		K101	3 pole double throw relay		85G	G-33177		405NB201A
26	4		K102, K1001A	Coil 28 v 30 ohm (2 required for each relay)		85G			409N37
84	4		K102	Stationary Contact (long) ⅛″ dia. fine silver		85G			409N38
85	4		K102	Stationary Contact (short) ⅛″ dia. fine silver		85G			409N39

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

RELAYS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
86	4		K102	Movable Contact NO 1/8" dia. fine silver		85G			409N40
87	4		K102	Movable Contact NC 1/8" dia. fine silver		85G			409N41
88	4		K102	Movable Contact NO-NC 1/8" fine silver		85G			409N42
89	4		K103	Movable Contact and spring 3/16" dia. fine silver		85G			409N44
90	4		K103	Movable Auxiliary Contact 1/8" dia.		85G			409N45
91	4		K103	Stationary Contact NO 3/16" dia. fine silver		85G			409N46
92	4		K103	Stationary Contact NC 3/16" dia. fine silver		85G			409N47
93	4		K103	Stationary Auxiliary Contact 1/8" diameter		85G			409N48
19	1		K103	Relay Coil 28 v d-c 125 ohm		85G	SP-222-W		409N51
18	1		K104	Relay Coil 28 v d-c 150 ohm		85G	SP-220-W		409N43
94	4		K104	Movable Contact 3/16" dia. fine silver		85G			409N49
95	4		K104	Stationary Relay Contact Bracket and Insulation Board Assy.		85G	BBA-61		409N50
137	1		K105	28 v d-c 1 PDT, 1 PNC, and 1 PNO Contacts		85G	G33304		410N18
115	1		K1801	115 v a.c. 60 cps 3 PNO Cont.		85G	G33396		405NB204A
116	1		K1802	12 v d-c coil 2 PNO Cont.		85G	G333402		405NB205A
65	1		K1803	115 v d-c coil 2 PDT		65G	12706		405NB208
136	1		K1804	Time delay relay 115 v 60 cps coil 1 NO Contact		84C	TD2/30S		402N18

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

RELAYS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
64	1		K1805	115 v 60 cps coil 2 PNO cont.		65G	12709		405NB207
63	1		K1806	28 v d-c coil 2 PNO cont.		65G	12708		405NB206

INDUCTORS AND REACTORS
(See Figure 119)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
108	2		L102, L103, L115, L403	Mult. Sect. 2.5 mh 0.125 amp		05N 35M	R100-U		240N53
16	1		L104	2 sect. 208 mh ±1% 2 ohm duo-lateral wound		68S			240N60
108	1		L107	Mult. Sect. duo-lateral wound 2.5 mh 0.125 amp 35 to 50 ohm		05N	R100		240N2A
8	1		L108	175 turns close wound single layer		64C	GA-1404C		GA-1404C
30	1		L109, L1001	Mult. Sect. 6 mh 21 ohm		82C			240N59
5	1		L110	Close wound single layer		64C	GA-1395C		GA-1395C
108	1		L116	3 sect. 1 mh duo-lateral wound		35M	R-300U		240N58
15	1		L402	8 mh 0.125 amp 70 ohm		05H	CH-8		240N4A
27, 28	2		L1805, L1806, L1808, L1809	.012 mh choke		97E 05M	 RF-583		240N54

METERS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
176	1		M101	0-0.25 amp r.f. meter		40G 35W	DW44 NT-33		451ND0.25SN
175	1		M102	0-1 ma d-c meter 2% accuracy		40G 35W	DW41 NX-33		450ND1SN
177	1	-22438	M1001	3 amp Thermo-ammeter		45W	507		457N114

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

PLUGS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
110	4		P101	12 term. octal style female conn. chassis mtg.		60A	M1P		369N16
127	4		P201	12 term. conn. chassis mtg.		91J	P-312-AB		365N212
126	4		P301	8 term. plug chassis mtg.		91J	300		365N208
125	4		P401	6 term. conn. chassis mtg.		91J	300		365N206
112	4		P901	27 term. wall mtg. recpt.		10C	K		371N405
82	4		P1001	2 term. chassis mtg. socket		91J	S-302-AB		366N202
132	4		P1501	27 term. 90 degree plug conn. female		10C	NK-27-23-11/16		371N406
131	4		P1502	27 term. straight plug conn. male		10C	RNK-27-22C11/16		371N404R
135	4		P1601	10 term. straight plug conn.		10C	FK10-21-9/16		371N514
134	4		P1602	10 term. 90 degree angle plug connector		10C	RFK10-24C 9/16		371N512R
128	4		P1701	3 term. 90 degree angle female plug connector		10C	WK-C3-23C 7/16		371N109
129	4		P1702	3 term. straight plug conn.		10C	RWK-C3-22C 7/16		371N110R
124	4		P1801, P1802	4 prong connector plug		91J	P-4-AB1/16		363N204

RESISTORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
69	1		R101	22,000 ohm ±10% 1 w		28J	BT1-Navy		729NG22M-K
69	1		R102, R107	100,000 ohm ±10% 1 w		28J	BT1-Navy		729NG100M-K
69	3	-RC30BF470M	R103, R104, R106, R108, R112	47 ohm ±20% 1 w		65S			729NG47-M
139	2		R105, R109, R110	20,000 ohm ±10% 25 w		25P	0218		710NC20MA-K
101	1		R111	235 ohm ±2% 200 v		28J	WW3		721NL235-G
138	2		R113, R114, R136	150 ohm ±20% 10 w		25P	BD		710NA150B-M
139	1		R115	100 ohm ±10% 25 w		25P			710NC100A-K
138	1		R116	1 ohm ±10% 10 w		25P	BD		710NA1A-K

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

RESISTORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
139	2		R117, R118, R119, R120	5000 ohm ±10% 25 w		25P	0212		710NC5MA-K
4	1		R121	0.8 ohm ±10% 50 w		25P			710ND0.8A-K
139	1		R123	12.6 ohm ±10% 25 w		25P			710NC12.6A-K
139	1		R124	25,000 ohm ±10% 25 w		25P	0219		710NC25MA-K
101	1		R128	4000 ohm ±2% 200 v		28J	WW3		721NL4M-G
138	1		R129, R130	1000 ohm ±10% 10 w		25P	BD		710NA1MA-K
138	1		R131	350 ohm ±10% 10 w		25P	BD		710NA350-K
101	1		R132	50,000 ohm ±2% 200 v		28J	WW3		721NL50M-G
138	1		R133	50 ohm ±10% 10 w		25P			710NA50A-K
67	1		R134	75 ohm ±10% ½ w		28J	BW½		707N75N-K
67	1		R135	10 ohm ±10% ½ w		28J	BW½		707N10N-K
67	1		R201, R204	220 ohm ±5% 1 w		22A			703NA220-J
67	1		R202	100 ohm ±5% 1 w		22A			703NA100-J
68	1		R203	15,000 ohm ±5% ½ w		28J	BT½-Navy		729NE15M-J
68	2		R205, R210, R303	470,000 ohm ±10% ½ w		28J	BT½-Navy		729NE470M-K
138	1		R206	42 ohm ±10% 10 w		25P	BD		710NA42B-K
67	1		R207	2200 ohm ±10% 1 w		28J	BW1-Navy		708N2200NA-K
69	1		R208	1 Meg ±10% ½ w		28J	BW1-Navy		729NE1MEG-K
68	2		R209, R307, R308	220,000 ohm ±10% ½ w		28J	BT½-Navy		729NE220M-K
68	1		R211	100,000 ohm ±5% ½ w		28J	BT½-Navy		729NE100M-J
68	1		R212	470,000 ohm ±5% ½ w		28J	BT½-Navy		729NE470M-J
68	1		R213	750,000 ohm ±5% ½ w		28J	BT½-Navy		729NE750M-J
67	1		R214, R215	250 ohm ±10% 1 w		28J	BW1-Navy		708N250NA-K
67	1		R216	220 ohm ±10% ½ w		28J	BW½		707N220N-K
68	1		R301, R311	100,000 ohm ±10% ½ w		28J	BT½-Navy		729NE100M-K
67	1		R302	10,000 ohm ±10% ½ w		28J	BT½-Navy		729NE10M-K
68	1		R304	82,000 ohm ±10% ½ w		28J	BT½-Navy		729NE82M-K
67	1		R305	8200 ohm ±10% ½ w		28J	BT½-Navy		729NE8200-K
67	1		R309	1500 ohm ±5% ½ w		28J	BT½-Navy		729NE1500-J
17	1		R310	2-15 ohm Rheostat		89W			381N901
69	1		R401	15,000 ohm ±10% 1 w		28J	BT1-Navy		729NG15M-K
69	1	-RC31BF182K	R901	1800 ohm 1 w ±20%		28J	BT1-Navy		729NG1800-M

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

RESISTORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
171	1	-631874-2	R902	500 ohm "T" pad attenuator		28J	CSMPD		380N201
10	1		R1801	63 ohm ±5% 200 w Ferrule Type		66S			733NXA63-J
2	1		R1802	2500 ohm ±5% 15 w Ferrule Type		66S			733NXF2500-J
101	1		R1803	13.3 ohm ±2% 1 w		28J	WW3		721NL13.3-G
11	1		R1804	31,500 ohm ±10% 200 w		66S			733 0331 00
3	1		R1805	20,000 ohm ±5% 70 w		66S			733NXC20M-J
1	1		R1806	1000 ohm ±5% 25 w		66S			733NXE1M-J

SWITCHES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
75	1		S101	Moving Switch Arm		64C	GA-1445A		GA-1445A
				Stationary Switch Arm		64C	GA-2002A		GA-2002A
33	1		S102	18 contact single pi		64C			500 0085 00B
34	1		S103	7 contact single pi		64C			500 0206 00B
45	1		S104	Single pole NO 20 amp 24 v d-c		96C	8817		260N110
58	1		S105	2 circuit 3 pos. non-shorting		05P			259N139A
57	1		S106	5 circuit 3 pos. shorting		05P			259N138A
60	1		S107	4 circuit 2 pos. shorting		05P			259N141A
59	1		S108	1 circuit 12 pos. non-shorting		05P			259N140A
56	1		S109	1 circuit 12 pos. shorting		05P	25851-DH-1		259N137A
55	1		S110	3 circuit 4 pos. shorting		05P			259N136B
53	1		S111	Double pole 1 NC 1 NO Contact Leaf		64C	GA-1557B		GA-1557B
50	1		S112	Single pole 1 NC contact leaf		64C	Y-983A		Y-983A
43	1		S113C	Single contact Sw. arm Assy.		64C	GA-1074A		GA-1074A
51	1		S113D	Single pole 1 NO contact leaf		64C	Y-1048A		Y-1048A
52	1		S114	DPST 2 NO 2 NC contact leaf		64C	Y-1136B		Y-1136B

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

SWITCHES (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
49	1		S115	Single pole NO contact leaf		64C	Y-981A		Y-981A
36, 37, 38, 39	4		S116, S1002	8 amp 250 v a-c SPDT Vacuum contact		40G	GL34		260N601
48	1		S201	DPDT Toggle 1 amp 250 v d-c or 3 amp 125 v d-c		84A	24003		266N103A
62	1		S202	1 P. 6 pcs. 1 sect. shorting		05M			259N149
35	1		S401	Rotor Assembly		64C	GA-1021A		GA-1021A
				Stator Assembly		64C	GA-1544B		GA-1544B
47	1	-24003	S901, S1804	DPDT Toggle 1 amp 250 v d-c		84A	20905-GH		266N103
61	1		S902	11 pos. 1 circuit single pi non-shorting		05P			259N142A
54	1		S903	4 pos. 3 circuit 2 pi shorting		05P			259N136A
178	1		S1001	4 pos. non-shorting		64C			GA-1108C
174	1		S1801	7 NO 1 NC Key Switch					AC102H
46	1		S1802, S1803	SPST Toggle 3 amp 125 v		84A	20994-ET		266N101

TUBES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
150	1		V101	Type 837, Beam pentode		* *	837		256.837
151, 152, 153	3		V102, V103, V401	Type 1625, Beam Pentode		* *	1625		256.1625
149	1		V104	Type 813, Beam pentode		* *	813		256.813
147, 148	2		V105, V106	Type 811, Triode		* *	811		256.811
141, 142, 143	3		V201, V301, V302	12SJ7, Triple Grid Amp.		* *	12SJ7		255.12SJ7
145, 146	2		V202, V203	6V6GT Beam Pentode		* *	6V6GT		255.6V6GT
154, 155, 156, 157	4		V1801, V1802, V1803, V1804	Mercury Vapor Rectifier		* *	866A		256.866A

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

SOCKETS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
107	4	-49366	X101, X102, X103, X401	7 terminal base, Iso.		77J	227		220N573
120	4		X104	7 term. "Jumbo" wafer socket		77J	237		220N571A
32	4		X105, X106, X1805, X1806, X1807, X1808	4 prong low loss ceramic		77J	224		220N545
29	4		X201, X202, X203, X301, X302, X303	8 term. octal tube socket		60A	88-8		220N185

CRYSTALS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
144	1	-40127	Y301	Quartz Crystal Mtg. in "plug-in" holder		64C	146A-2		520 1021 00

MISCELLANEOUS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
44	1			Crank Arm Assembly		64C	GA-1149A		GA-1149A
117	1			Load Coil Lead Assembly		64C	GA-1174A		GA-1174A
117	1			Final Plate Lead Assembly		64C	GA-1175A		GA-1175A
6	1			Plate Lead Assembly		64C	GA-2021A		GA-2021A
7	1			Mod. Plate Lead Assembly		64C	GA-2030A		GA-2030A
117	1			Meter Lead Assembly		64C	GA-2083A		GA-2083A
9	1			Flexible Lead Assembly		64C	GA-2096A		GA-2096A
117	1			Plate Lead Assembly		64C	GA-2130A		GA-2130A
117	1			Gnd. Strip Assembly		64C	GA-2170A		GA-2170A
76	1			Antenna Lead Assembly		64C	GA-2523A		GA-2523A
118	1			Multiplier Coil Lead Assembly		64C	GA-2583A		GA-2583A
118	1			Multiplier Coil Lead Assembly		64C	GA-2584A		GA-2584A
118	1			L. F. Osc. Lead Assembly		64C	GA-2587A		GA-2587A

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR A-C EQUIPMENT

MISCELLANEOUS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
118	1			Multiplier Coil Lead Assembly		64C	GA-2588A		GA-2588A
118	1			Multiplier Coil Lead Assembly		64C	GA-2589A		GA-2589A
118	1			Grid Clip Assembly		64C	GA-2623A		GA-2623A
118	1			Mod. Plate Lead Assembly		64C	GA-2639A		GA-2639A
6	1			Plate Lead Assembly		64C	GB-2021A		GB-2021A
117	1			Meter Lead Assembly		64C	GB-2083A		GB-2083A
9	1			Flexible Lead Assembly		64C	GB-2096A		GB-2096A
96	2 ft.			Tinned Copper Braid		24B			425 0001 00

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

MOTORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Desig- nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
160	1		B101	1/20 hp 28 v d-c		98E	NY-818C-A		818C

CAPACITORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Desig- nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
167	1	(481677-1 (481678-1	C101 C102, C103, C104	.000185 mf ±1% 1000 TV Set of 3 matched Ceramic Capacitors Total 413 mmf ±1% 1000 TV		64C			GA-1433C
73	1		C105	.005 mf ±5% 2500 TV		75C 02S	4LST HLST		925N250K-J
72	1		C106, C117	.006 mf ±20% 1000 TV		75C 02S	4LS HLS-10		910N260C-M
72	1		C107	.002 mf ±20% 1000 TV		75C 02S	4LS HLS-10		910N220C-M
73	1		C108, C116	.0005 mf ±10% 1500 TV		02S	BE-15		915N350E-K
72	3	-482111-B-20	C109, C110, C113, C114, C401	.002 mf ±20% 1500 TV		02S	BE-15		915N220E-M
66	1		C111, C115	6 sect. variable ceramic cap.		25C	828-003		917N6A3
73	1		C112	.00025 mf ±10% 1500 TV		02S	BE-15		915N325E-K
24	1		C118	.002 mf ±20% 7500 TV		02S	A2LS		975N220A-M
73	1		C119	.002 mf ±20% 2500 TV		75C 02S	4LS HLS-25		925N220C-M
74	1		C120A, C120B	.002 mf ±20% 5000 TV		75C 02S	4LS HLS-50		950N220C-M
23	1		C121A, C121B, C121C	3-0.1 mf ±20% 600 WV		75C 64S	DYRT-6111 3XDMR TW6-.1		956NT01WX1-M
140	2		C122A, C122B, C129	.00005 mf ±10% Ceramic		25C	850-002		913N450C-K
140	2		C124A, C124B, C124C	.000067 mf ±5% Ceramic		25C	850-003		913N467C-J
31, 181, 182	1		C126	2.0 mf ±20% 600 WV		75C	KG-3020		930N78B-M

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

CAPACITORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
73	1		C127	.006 mf ±20% 1500 TV		02S	BE-15		915N260E-M
140	1	481689-10	C130	.000025 mf ±10% Ceramic		25C	850-001		913N425C-K
72	1		C131	.0008 mf ±5% 1000 TV		02S	BE-10		910N380E-J
70	1		C132, C133	.004 mf ±20% 600 TV		75C	3WS		909N240F-M
						02S	JS		
173	1		C134, C135	Midget Variable		05P			922N51
140	1	481681	C136	13 mmf Variable Ceramic		25C	822-009		917N101
70	1		C137	.0015 mf ±10% 900 TV		64S			909N215F-K
						02S			
12, 13, 14	3		C201, C202, C207, C208, C1919A, C1919B	20 mf +100% —10% 100 V		75C	RVL-10051-1		183N33A
						05M	SPO 38482		
20	2		C203, C304, C311	.05 mf ±20% 600 WV		75C	TVC		930N66A-M
73	1		C204	.006 mf ±10% 1500 TV		02S	BE-15		915N260E-K
72	1		C205	.001 mf ±10% 1500 TV		02S	BE-15		915N210E-K
73	1		C206	.003 mf ±10% 1500 TV		02S	BE-15		915N230E-K
70	1		C301, C302	.00001 mf ±10% 1000 TV		75C	5WS		909N410GN-K
						02S	KS		
22	1		C303, C305	.5 mf ±20% 600 WV		75C	DYR-6050		956NS08YX1-M
						64S	X-DMR6-.5		
70	1		C308	.001 mf ±20% 1000 TV		75C	1RS		912N210AN-M
21	1		C309A, C309B	2-0.1 mf ±20% 600 WV		75C	DYRT6011		956ND01WX1-M
70	1		C310	.0025 mf ±20% 1000 TV		75C	1RS		912N225AN-M
70	1		C402	.00005 mf ±20% 900 TV		02S	Type "C"		909N450C-M
						75C	1WL		
71	2	481685-2	C403, C408, C412	.0003 mf ±2% 1000 TV		25C	816-035		913N330-G
102	1	481688-½	C404	Set of 3 matched ceramic capacitors total 0.00083 mf ±½% 500 WV		25C	816-044		913NA1
71	3		C405A, C405B, C409A, C410B, C410C	.002 mf ±1% 500 TV		34S			912N220H-F
70	1		C405C	.001 mf ±1% 500 TV		34S			912N210H-F
70	1	481684-2	C406A	.000125 mf ±2% 1000 TV		25C	814-106		913 0001 00

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

CAPACITORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
102	1	481687-1	C407	Set of 3 matched ceramic capacitors total .00088 mf ±1% 500 WV		25C	816-043		913NA2
70	1		C408A, C410D	.0015 mf ±1% 500 TV		34S			912N215H-F
71	1		C408B	.00015 mf ±2% 1000 TV		25C	810-250		913N315N6.6-G
70	1		C409B	.0004 mf ±1% 500 TV		34S			912N340H-F
71	1	481686-2	C409C	.00035 mf ±2% 1000 TV		25C	816-041		913N335N3.3-G
71	1	481683-2	C410A	.00025 mf ±2% 1000 TV		25C	810-290		913N325N7-G
172	1	481680	C411	5 sect. variable ceramic cap.		25C	826-003		917N5A1
41	1		C1001	.0007 mf ±5% 5000 WV		75C 02S	6LS F2		906N370A-J
74	3		C1002, C1003, C1910, C1913, C1914, C1918	.01 mf ±20% 1000 TV		75C 02S	4L H-10		910N110G-M
158, 159	2		C1101, C1102, C1103	25 mmf ±10% 10,000 v eff.		06A	1860-201		914N1X6-K
42, 64	2		C1901, C1902, C1909, C1915	2 mf ±20% 400 WV		75C			954NS4U-M
165	1		C1903, C1904	8 mf ±20% 800 WV		75C	KG-4080		930N19-M
164	1		C1905, C1906	4 mf ±20% 2000 WV		75C	TJU-20040		930N40-M
74	2	-48312-B-20	C1907, C1908, C1922	Dual 0.1 mf ±20% 600 WV		75C			956ND01W-M
11	1		C1911	0.1 mf ±20% 600 WV		75C			956NS01Y-M
179	1		C1912, C1916	0.1 mf ±20% 1500 WV		75C			930 0012 00
180	1		C1917	4.0 mf ±20% 50 WV		75C			930 0013 00
	1		C1920, C1921	2.0 mf ±10% 600 WV		75C			930N78B-K

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

DYNAMOTORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
121	20		D1901, D1902	+115 v d-c brush for D1901, D1902		88F	BR-104		234 0003 00
122	10		D1902	+400 volt brush		88F	BR-102		234 0005 00
77	2		D1901, D1902	115 v and 28 v brush holder		88F	B-104		234 0006 00
77	2		D1902	400 v brush holder		88F	B101		234 0007 00
78	2		D1901, D1902	Brush holder cap for 115 v and 28 v brush holder		88F	BHC-101		234 0008 00
78	2		D1901, D1902	Brush holder cap for 14 v 400 v and 750 v brush holders		88F	BHC-103		234 0009 00
79	4		D1901, D1902	Bearing for D1901, D1902		88F	CWC 88013		234 0010 00
154	20		D1901, D1902	—115 v d-c brush		88F	BR-104		234 0012 00
122	10		D1902	—400 v brush		88F	BR-102		234 0014 00
155	10		D1901	+14 v brush		88F	BR-106		234 0021 00
155	10		D1901	—14 v brush		88F	BR-106		234 0022 00
156	10		D1901	+28 v brush		88F	BR-101		234 0023 00
156	10		D1901	—28 v brush		88F	BR-101		234 0024 00
157	10		D1902	+750 v brush		88F	BR-103		234 0025 00
157	10		D1902	—750 v brush		88F	BR-103		234 0026 00
97	2		D1901	28 v brush holder		88F	B-103		234 0029 00
97	2		D1902	+750 v brush holder		88F	B-102R		234 0030 00
98	2		D1902	—750 v brush holder		88F	B-102L		234 0031 00
98	2		D1901	28 v brush holder cap		88F	BHC-102		234 0032 00
77	2		D1901	14 v brush holder		88F	DLT-105		234 0042 00
161	1		D1901	D1901 Armature		88F	ARM-104		234 0033 00
166	1		D1902	D1902 Armature		88F	ARM-105		234 0034 00
162	2		D1901	D1901 Field Coil		88F	FCA-104		234 0036 00
163	2		D1902	D1902 Field Coil		88F	FCA-105		234 0037 00

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

MISCELLANEOUS ELECTRICAL PARTS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
123	20		E101A	+ and — Brush for NY-818C-A Autotune Motor		98E			234N130
25	4		E1701, E1702	Split rubber bushing		10C	P		371N111

FUSES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
31	10		F1901, F1902	30 amp fuse link					264N230B
100	10		F1903, F1904, F1905	15 amp 250 v 11/32″ dia. 1½″ long					AA199K
99	10		F1906	3 amp 250 v 11/32″ dia. 1½″ long					AA199C
136	10		F1907	1 amp 1000 v		78L	2104		264N704
168	10		F1908	1 amp 2500 v		78L	2109		264N709

PILOT LIGHTS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
80	2		I101, I901	28 v clear bulb, miniature bayonet base		40G	T3-¼		262N327
80	2		I1901, I1902	12-16 volt miniature bayonet base		40G	T3-¼		262N326

JACKS AND RECEPTACLES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
169	4		J101, J103, J104, J105, J901, J904	1 circuit jack for plugs with ¼″ barrel		05M 21N	SC1A		358N104
170	4		J102, J903	3 circuit jack		05M 21N	SCA2B		358N105

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

JACKS AND RECEPTACLES (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
130	4		J106	27 term. female conn.		10C	RNK-27-31SL		371N403R
106	4		J107	3 term. female conn. wall mtg.		10C	RWK-C3-31SL		371N105R
113	4		J108	10 term. male conn. wall mtg.		10C	FK-10-32S		371N513
103	4		J111	8 term. conn. socket		91J	300		366N208
104	4		J112	12 term. socket chassis mtg.		91J	300		366N212
83	4		J114	6 term. chassis mtg. socket		91J	300		366N206
105	4		J115	12 term. octal style cable plug conn.		60A	70-12		369N17
109	4		J116	15 term. chassis mtg. conn.		91J	300		366N215
40	4		J1001	3 term. wall mtg. recept. male		10C	WK-C3-32S		371N104
111	4		J1901	27 term. wall mtg. conn.		10C	NK-27-32S		371N401
133	4		J1902	10 term. wall mtg. conn.		10C	RFK-10-31SL		371N511R
119	4		J1906, J1907	6 term. conn. socket		64C			500 2072 00A

RELAYS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
114	1		K101	3 pole double throw relay		85G	G-33177		405NB201A
26	1		K102, K1001A	Coil 28 v 30 ohm (2 required for each relay)		85G			409N37
84	4		K102	Stationary Contact (long) 1/8" dia. fine silver		85G			409N38
85	4		K102	Stationary Contact (short) 1/8" dia. fine silver		85G			409N39
86	4		K102	Movable Contact NO 1/8" dia. fine silver		85G			409N40
87	4		K102	Movable Contact NC 1/8" dia. fine silver		85G			409N41
88	4		K102	Movable Contact NO-NC 1/8" dia. fine silver		85G			409N42

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

RELAYS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
89	4		K103	Movable Contact and spring 3/16″ dia. fine silver		85G			409N44
90	4		K103	Movable Auxiliary Contact ⅛″ dia.		85G			409N45
91	4		K103	Stationary Contact NO 3/16″ dia. fine silver		85G			409N46
92	4		K103	Stationary Contact NC 3/16″ dia. fine silver		85G			409N47
33	4		K103	Stat. Auxiliary Cont. ⅛″ dia.		85G			409N48
19	1		K103	Relay Coil 28 v d-c 125 ohm		85G	SP-222-W		409N51
18	1		K104	Relay Coil 28 v d-c 150 ohm		85G	SP-220-W		409N43
94	4		K104	Movable Cont. 3/16″ dia. fine silver		85G			409N49
95	4		K104	Stat. relay cont. bracket and Insulation Board Assy.		85G	BBA-61		409N50
137	1		K105	28 v d-c 1 PDT, 1 PNC, and 1 PNO Contacts		85G	G33304		410N18
116	1		K1902	12 v d-c coil 2 PNO Contacts		85G	G333402		405NB205A
65	1		K1903	115 v d-c coil 2 PDT		65G	12706		405NB208
115	1		K1901	115 v d-c coil 3 PNO Contacts		85G	G33549		405NB203A
63	1		K1904	28 v d-c coil 2 PNO Contacts		65G	12708		405NB206

INDUCTORS AND REACTORS
(See Figure 119)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
108	2		L102, L103, L115, L403	Mult. Sect. 2.5 mh 0.125 amp		05N 35M	R100-U		240N53
16	1		L104	2 sect. 208 mh ±1% 2 ohm duo-lateral wound		68S			240N60

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

INDUCTORS AND REACTORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
108	1		L107	Mult. Sect. duo-lateral wound 2.5 mh 0.125 amp 35-50 ohm		05N	R100		240N2A
8	1		L108	175 turns close wound single layer		64C	GA-1404C		GA-1404C
30	1		L109, L1001	Mult. Sect. 6 mh 21 ohm		82C			240N59
5	1		L110	Close wound single layer		64C	GA-1395C		GA-1395C
108	4		L116, L1912, L1913, L1914, L1915, L1916, L1917, L1918	3 sect. 1 mh duo-lateral wound		35M	R-300U		240N58
15	1		L402	8 mh 0.125 amp 70 ohm		05H	CH-8		240N4A
2, 3, 27, 28, 183	5		L1904, L1905, L1906, L1907, L1908, L1909, L1910, L1911, L1919, L1920	.012 mh choke		97E 05M	 RF-583		240N54

METERS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
176	1		M101	0-0.25 amp r-f meter		40G 35W	DW44 NT-33		451ND0.25 SN
175	1		M102	0-1 ma d-c meter 2% accy.		40G 35W	DW41 NX-33		450ND1SN
177	1	-22438	M1001	3 amp Thermo-ammeter		45W	507		457N114

PLUGS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
110	4		P101	12 term. octal style female conn. chassis mounting		60A	M1P		369N16
127	4		P201	12 term. conn. chassis mtg.		91J	P-312-AB		365N212
126	4		P301	8 term. plug chassis mtg.		91J	300		365N208

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

PLUGS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
125	4		P401	6 term. conn. chassis mtg.		91J	300		365N206
112	4		P901	27 term. wall mtg. recept.		10C	K		371N405
82	4		P1001	2 term. chassis mtg. socket		91J	S-302-AB		366N202
132	4		P1501	27 term. 90 degree plug conn. Female		10C	NK-27-23-11/16		371N406
131	4		P1502	27 term. straight plug conn. Male		10C	RNK-27-22C11/16		371N404R
135	4		P1601	10 term. straight plug conn.		10C	FK10-21-9/16		371N514
134	4		P1602	10 term. 90 degree angle plug conn.		10C	RFK10-24C9/16		371N512R
128	4		P1701	3 term. 90 degree angle female plug conn.		10C	WK-C3-23C7/16		371N109
129	4		P1702	3 term. straight plug conn.		10C	RWK-C3-22C7/16		371N110R
124	4		P1901, P1902	6 prong connector plug		91J	SS-6-AB 1/16		363N206

RESISTORS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
69	1		R101	22,000 ohm ±10% 1 w		28J	BT1-Navy		729NG22M-K
69	1		R102, R107	100,000 ohm ±10% 1 w		28J	BT1-Navy		729NG100M-K
69	3	-RC30BF470M	R103, R104, R106, R108, R112	47 ohm ±20% 1 w		65S			729NG47-M
139	2		R105, R109, R110	20,000 ohm ±10% 25 w		25P	0218		710NC20MA-K
101	1		R111	235 ohm ±2% 200 v		28J	WW3		721NL235-G
138	2		R113, R114, R136	150 ohm ±20% 10 w		25P	BD		710NA150B-M
139	1		R115	100 ohm ±10% 25 w		25P			710NC100A-K
138	1		R116	1 ohm ±10% 10 w		25P	BD		710NA1A-K
139	2		R117, R118, R119, R120	5000 ohm ±10% 25 w		25P	0212		710NC5MA-K
4	1		R121	0.8 ohm ±10% 50 w		25P			710ND0.8A-K
139	1		R123	12.6 ohm ±10% 25 w		25P			710NC12.6A-K
139	1		R124	25,000 ohm ±10% 25 w		25P	0219		710NC25MA-K

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

RESISTORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
101	1		R128	4000 ohm ±2% 200 v		28J	WW3		721NL4M-G
138	1		R129, R130	1000 ohm ±10% 10 w		25P	BD		710NA1MA-K
138	1		R131	350 ohm ±10% 10 w		25P	BD		710NA350-K
101	1		R132	50,000 ohm ±2% 200 v		28J	WW3		721NL50M-G
138	1		R133	50 ohm ±10% 10 w		25P			710NA50A-K
67	1		R134	75 ohm ±10% ½ w		28J	BW½		707N75N-K
67	1		R135	10 ohm ±10% ½ w		28J	BW½		707N10N-K
67	1		R201, R204	220 ohm ±5% 1 w		22A			703NA220-J
67	1		R202	100 ohm ±5% 1 w		22A			703NA100-J
68	1		R203	15,000 ohm ±5% ½ w		28J	BT½-Navy		729NE15M-J
68	2		R205, R210, R303	470,000 ohm ±10% ½ w		28J	BT½-Navy		729NE470M-K
138	1		R206	42 ohm ±10% 10 w		25P	BD		710NA42B-K
67	1		R207	2200 ohm ±10% 1 w		28J	BW1-Navy		708N2200NA-K
69	1		R208	1 Meg ±10% ½ w		28J	BW1-Navy		729NE1MEG-K
68	2		R209, R307, R308	220,000 ohm ±10% ½ w		28J	BT½-Navy		729NE220M-K
68	1		R211	100,000 ohm ±5% ½ w		28J	BT½-Navy		729NE100M-J
68	1		R212	470,000 ohm ±5% ½ w		28J	BT½-Navy		729NE470M-J
68	1		R213	750,000 ohm ±5% ½ w		28J	BT½-Navy		729NE750M-J
67	1		R214, R215	250 ohm ±10% 1 w		28J	BW1-Navy		708N250NA-K
67	1		R216	220 ohm ±10% ½ w		28J	BW½		707N220N-K
68	1		R301, R311	100,000 ohm ±10% ½ w		28J	BT½-Navy		729NE100M-K
67	1		R302	10,000 ohm ±10% ½ w		28J	BT½-Navy		729NE10M-K
68	1		R304	82,000 ohm ±10% ½ w		28J	BT½-Navy		729NE82M-K
67	1		R305	8200 ohm ±10% ½ w		28J	BT½-Navy		729NE8200-K
67	1		R309	1500 ohm ±5% ½ w		28J	BT½-Navy		729NE1500-J
17	1		R310	2-15 ohm Rheostat		89W			381N901
69	1		R401	15,000 ohm ±10% 1 w		28J	BT1-Navy		729NG15M-K
69	1	-RC31BF182K	R901	1800 ohm 1 w ±20%		28J	BT1-Navy		729NG1800-M
171	1	-631874-2	R902	500 ohm "T" pad attenuator		28J	CSMPD		380N201
10	1		R1901	63 ohm ±5% 200 w Ferrule Type		66S			733NXA63-J

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

RESISTORS (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
69	1		R1902, R1904	200 ohm ±20% 2 w		28J	133-0200-7		709N200N-M
101	1		R1903	13.3 ohm 2% 1 w		28J	WW3		721NL13.3-G
1	1		R1905	1000 ohm ±5% 25 w		66S			733NXE1M-J

SWITCHES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
75	1		S101	Moving Switch Arm		64C	GA-1445A		GA-1445A
75	1		S101	Stationary Switch Arm		64C	GA-2003A		GA-2003A
33	1		S102	18 contact single pi		64C			500 0085 00B
34	1		S103	7 contact single pi		64C			500 0206 00B
45	1		S104	Single pole NO 20 amp 24 v d-c		96C	8817		260N110
58	1		S105	2 circuit 3 pos. non-shorting		05P			259N139A
57	1		S106	5 circuit 3 pos. shorting		05P			259N138A
60	1		S107	4 circuit 2 pos. shorting		05P			259N141A
59	1		S108	1 circuit 12 pos. non-shorting		05P			259N140A
56	1		S109	1 circuit 12 pos. shorting		05P	25851-DH-1		259N137A
55	1		S110	3 circuit 4 pos. shorting		05P			259N136B
53	1		S111	Double Pole 1 NC 1 NO Cont. Leaf		64C	GA-1557B		GA-1557B
50	1		S112	Single Pole 1 NC Cont. Leaf		64C	Y-983A		Y-983A
43	1		S113C	Single Cont. Sw. Arm Assy.		64C	GA-1074A		GA-1074A
51	1		S113D	Single Pole 1 NO Cont. Leaf		64C	Y-1048A		Y-1048A
52	1		S114	DPST 2 NO 2 NC Cont. Leaf		64C	Y-1136B		Y-1136B
49	1		S115	Single Pole NO Cont. Leaf		64C	Y-981A		Y-981A
36, 37, 38, 39	4		S116, S1002	8 amp 250 v a-c SPDT Vacuum Contact		40G	GL34		260N601
48	1		S201	DPDT Toggle 1 amp 250 v d-c or 3 amp 125 v d-c		84A	24003		266N103A
62	1		S202	2 P 6 pos. 1 sect. non-shorting		05M			259N149

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

SWITCHES (Cont.)

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
35	1		S401	Rotor Assembly		64C	GA-1021A		GA-1021A
35	1		S401	Stator Assembly		64C	GA-1544B		GA-1544B
47	1	-24003	S901	DPDT Toggle 1 amp 250 v d-c		84A	20905-GH		266N103
61	1		S902	11 pos. 1 circuit single pi non-shorting		05P			259N142A
54	1		S903	4 pos. 3 circuit 2 pi shorting		05P			259N136A
178	1		S1001	4 pos. non-shorting		64C			GA-1108C
174	1		S1901	7 NO 1 NC Key Switch					AC102H
46	1		S1902, S1903, S1904	SPST Toggle 3 amp 125 v		84A	20994-ET		266N101
184	1		S1905	Push Toggle NO Cont. 3 amp 250 v.		84A	3592N		266N105

TUBES

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
150	1		V101	Type 837, Beam Pentode		* *	837		256.837
151, 152, 153	3		V102, V103, V401	Type 1625, Beam Pentode		* *	1625		256.1625
149	1		V104	Type 813, Beam Pentode		* *	813		256.813
147, 148	2		V105, V106	Type 811, Triode		* *	811		256.811
141, 142, 143	3		V201, V301, V302	12SJ7, Triple Grid Amp.		* *	12SJ7		255.12SJ7
145, 146	2		V202, V203	6V6GT Beam Pentode		* *	6V6GT		255.6V6GT

SOCKETS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
107	4	-49366	X101, X102, X103, X401	7 terminal base, Iso.		77J	227		220N573
120	4		X104	7 terminal "Jumbo" wafer socket		77J	237		220N571A
32	4		X105, X106	4 prong low loss ceramic		77J	224		220N545
29	4		X201, X202, X203, X301, X302, X303	8 terminal octal tube socket		60A	88-8		220N185

TCZ SPARE PARTS LIST BY SYMBOL DESIGNATION

FOR D-C EQUIPMENT

CRYSTALS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
144	1	-40127	Y301	Quartz Crystal Mtd. in "Plug-in" holder		64C	146A-3		500 4374 00A

MISCELLANEOUS

Carton Number	Quan.	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's. Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
44	1			Crank Arm Assembly		64C	GA-1149A		GA-1149A
117	1			Load Coil Lead Assembly		64C	GA-1174A		GA-1174A
117	1			Final Plate Lead Assembly		64C	GA-1175A		GA-1175A
6	1			Plate Lead Assembly		64C	GA-2021A		GA-2021A
7	1			Mod. Plate Lead Assembly		64C	GA-2030A		GA-2030A
117	1			Meter Lead Assembly		64C	GA-2083A		GA-2083A
9	1			Flexible Lead Assembly		64C	GA-2096A		GA-2096A
117	1			Gnd. Strip Assembly		64C	GA-2170A		GA-2170A
76	1			Antenna Lead Assembly		64C	GA-2523A		GA-2523A
118	1			Multiplier Coil Lead Assembly		64C	GA-2583A		GA-2583A
118	1			Multiplier Coil Lead Assembly		64C	GA-2584A		GA-2584A
118	1			L. F. Osc. Lead Assembly		64C	GA-2587A		GA-2587A
118	1			Multiplier Coil Lead Assembly		64C	GA-2588A		GA-2588A
118	1			Multiplier Coil Lead Assembly		64C	GA-2589A		GA-2589A
118	1			Grid Clip Assembly		64C	GA-2623A		GA-2623A
118	1			Mod. Plate Lead Assembly		64C	GA-2639A		GA-2639A
6	1			Plate Lead Assembly		64C	GB-2021A		GB-2021A
117	1			Meter Lead Assembly		64C	GB-2083A		GB-2083A
9	1			Flexible Lead Assembly		64C	GB-2096A		GB-2096A
96	2 ft.			Tinned Copper Braid					425 0001 00
	1			Spare Parts Box					500 2599 00D
	1			Tray for Spare Parts Box					500 2029 00C

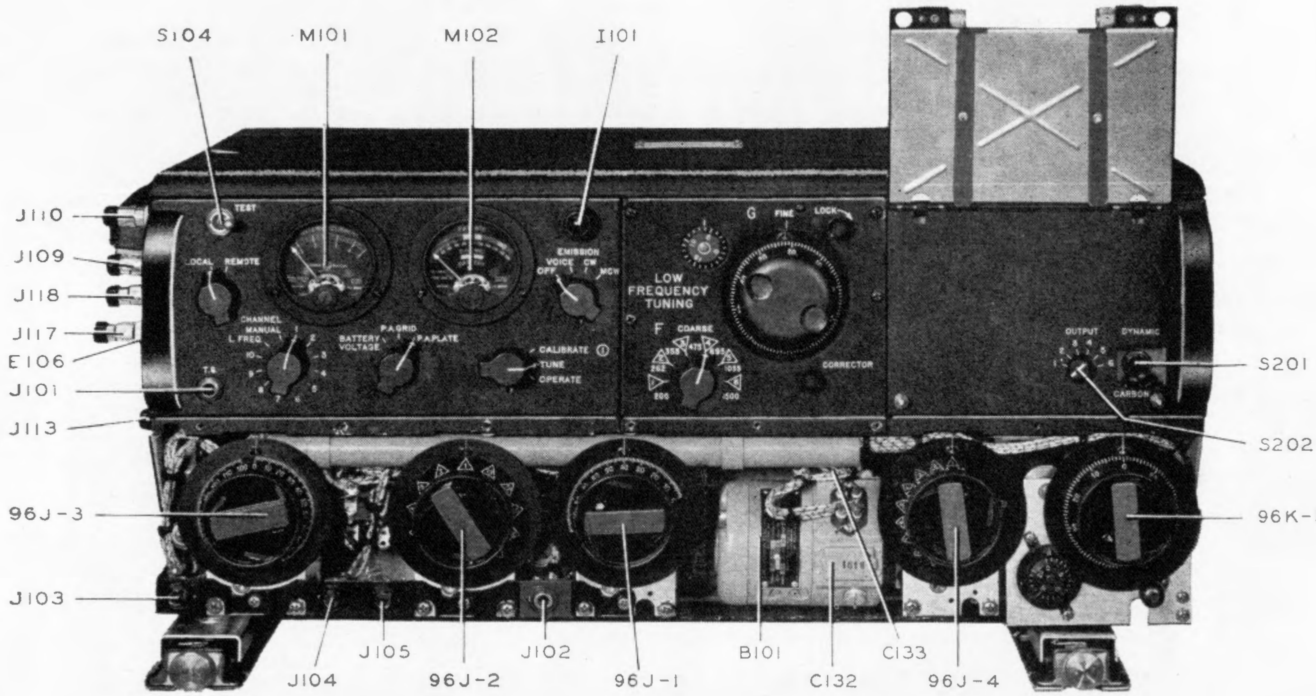


Fig. 41 Type COL–52286 Transmitter Unit—Front Open View

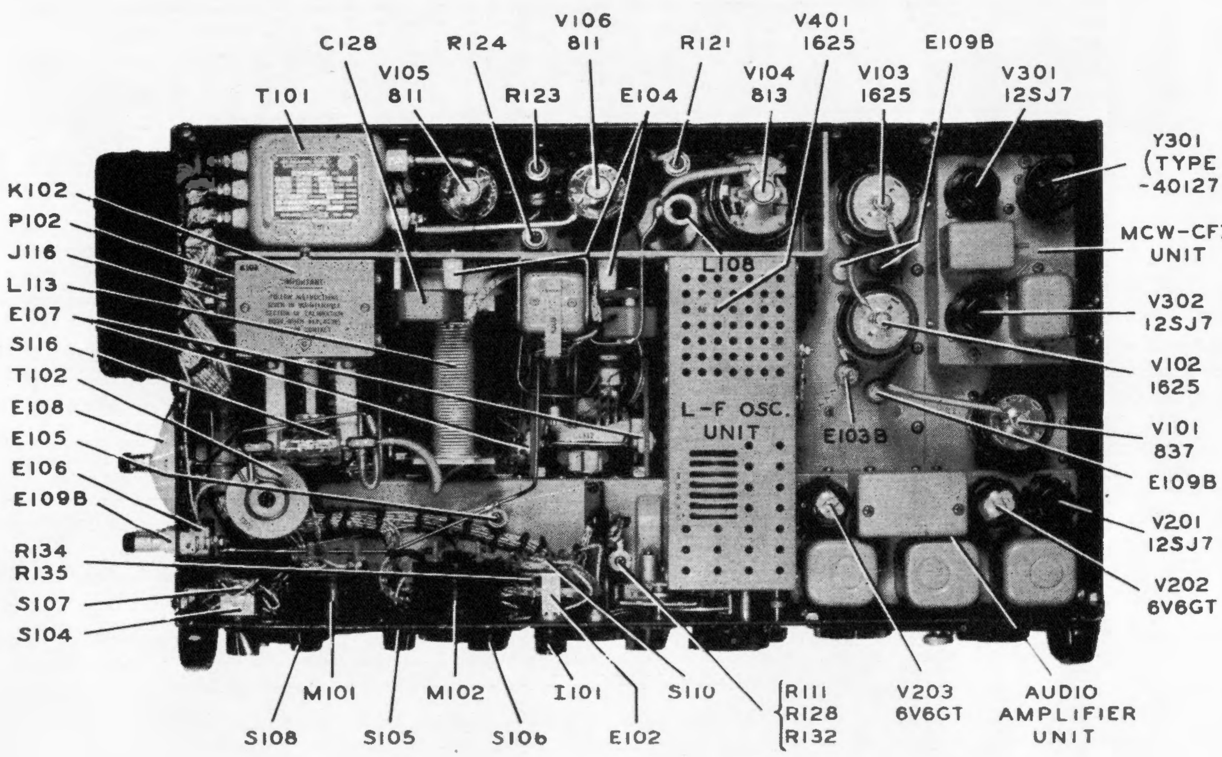


Fig. 42 Type COL–52286 Transmitter Unit—Top Open View

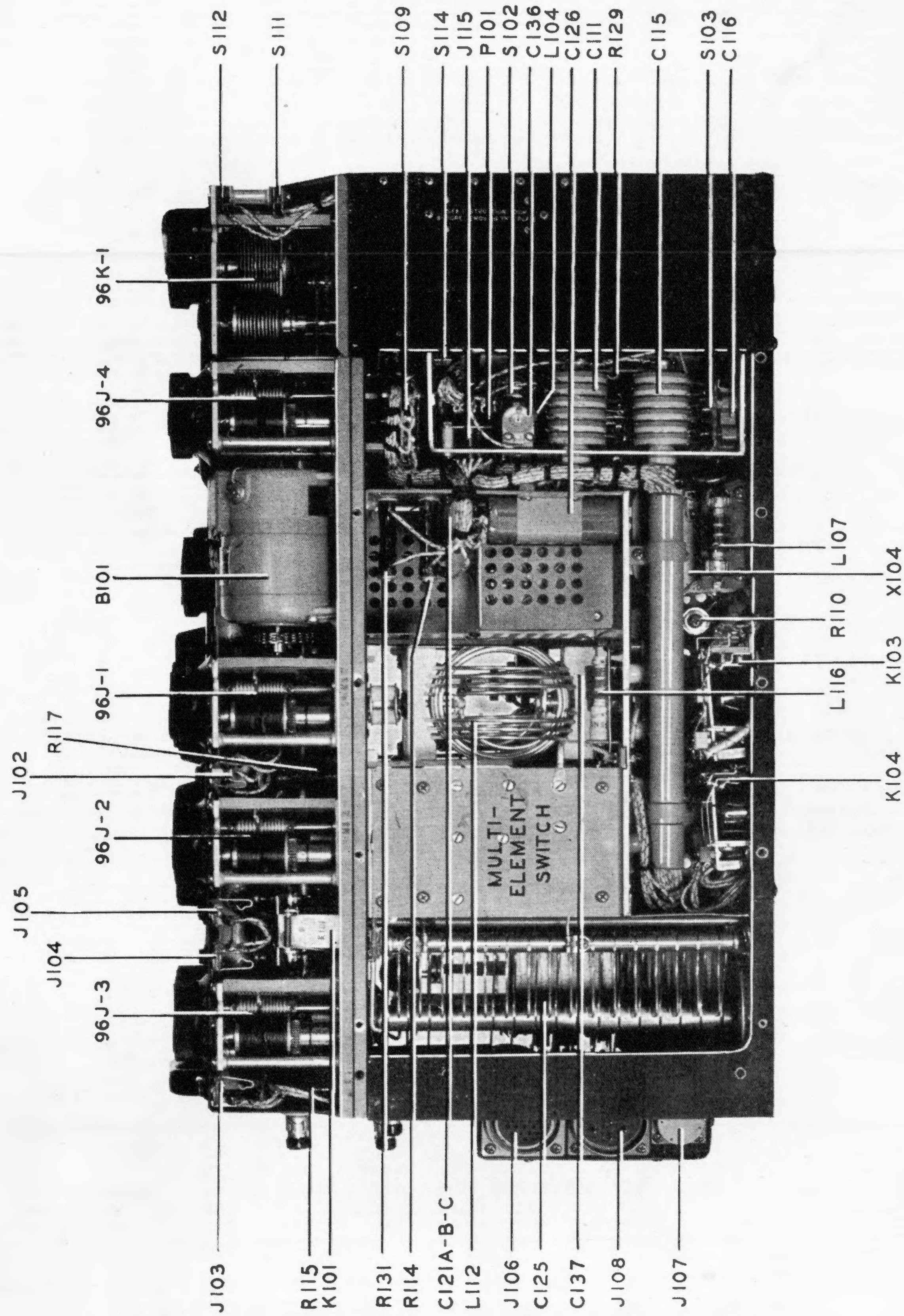


Fig. 43 Type COL–52286 Transmitter Unit—Bottom View

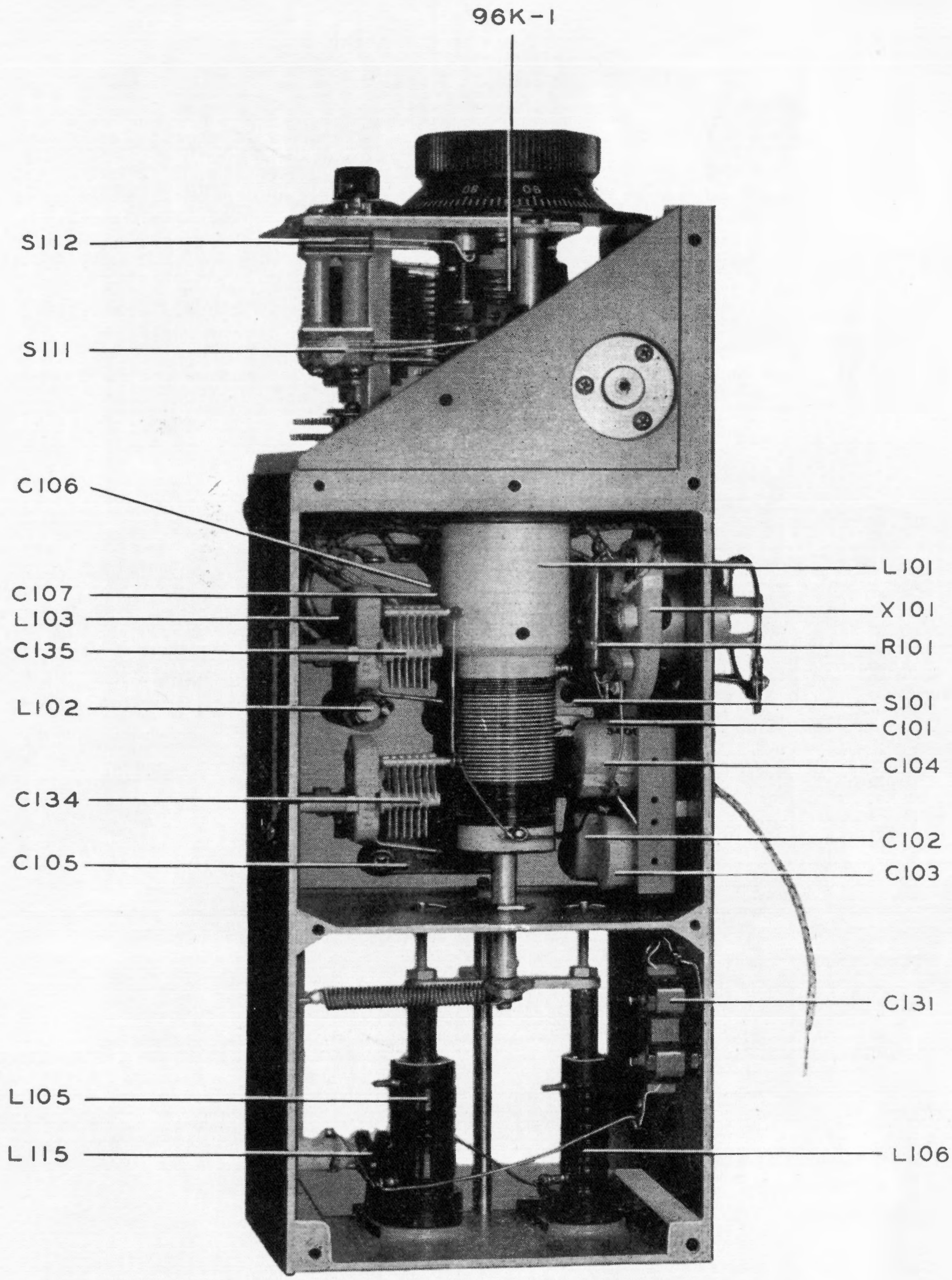


Fig. 44 High-Frequency Oscillator—Side Open View

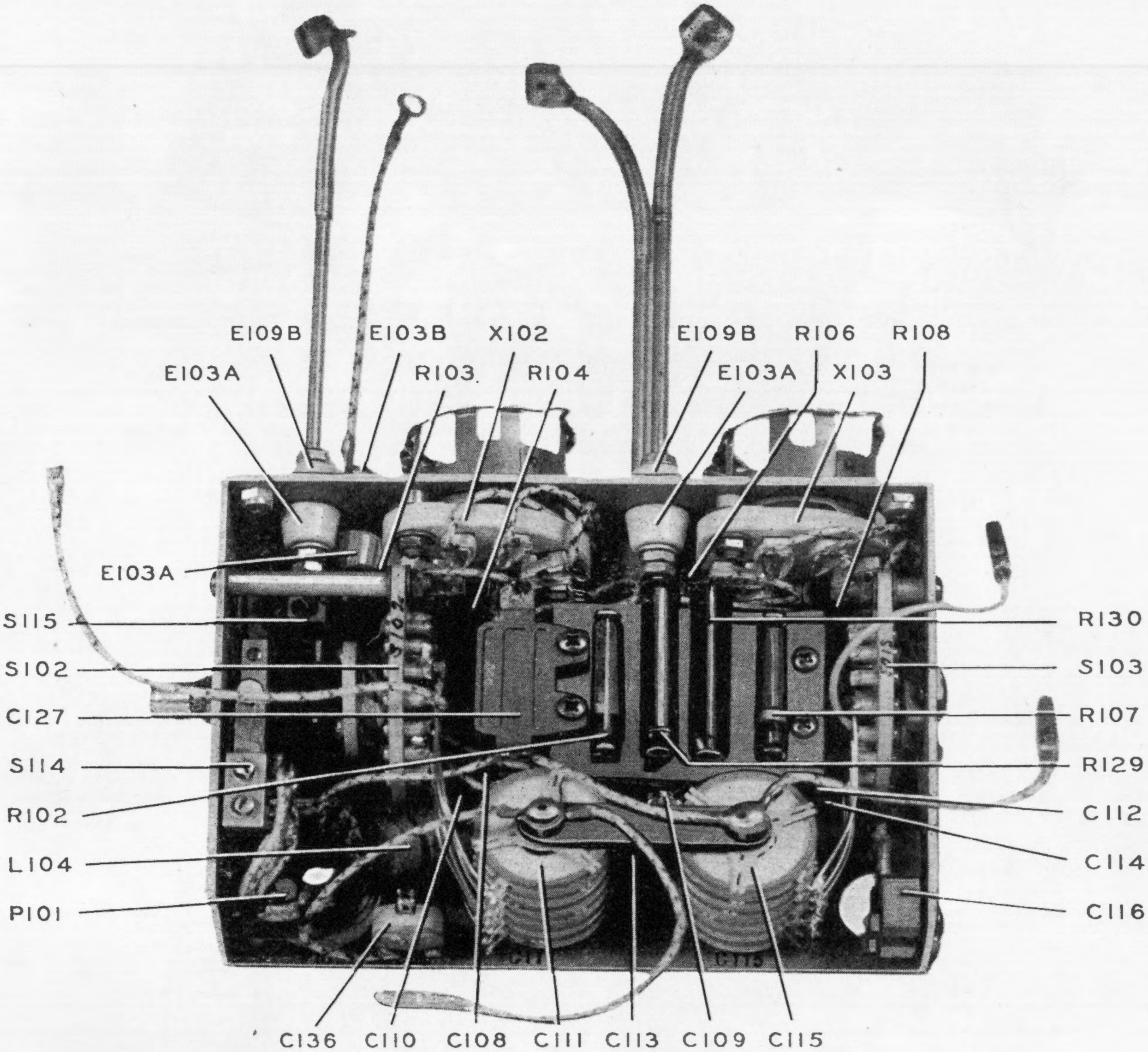


Fig. 45 Frequency Multiplier—Side Open View

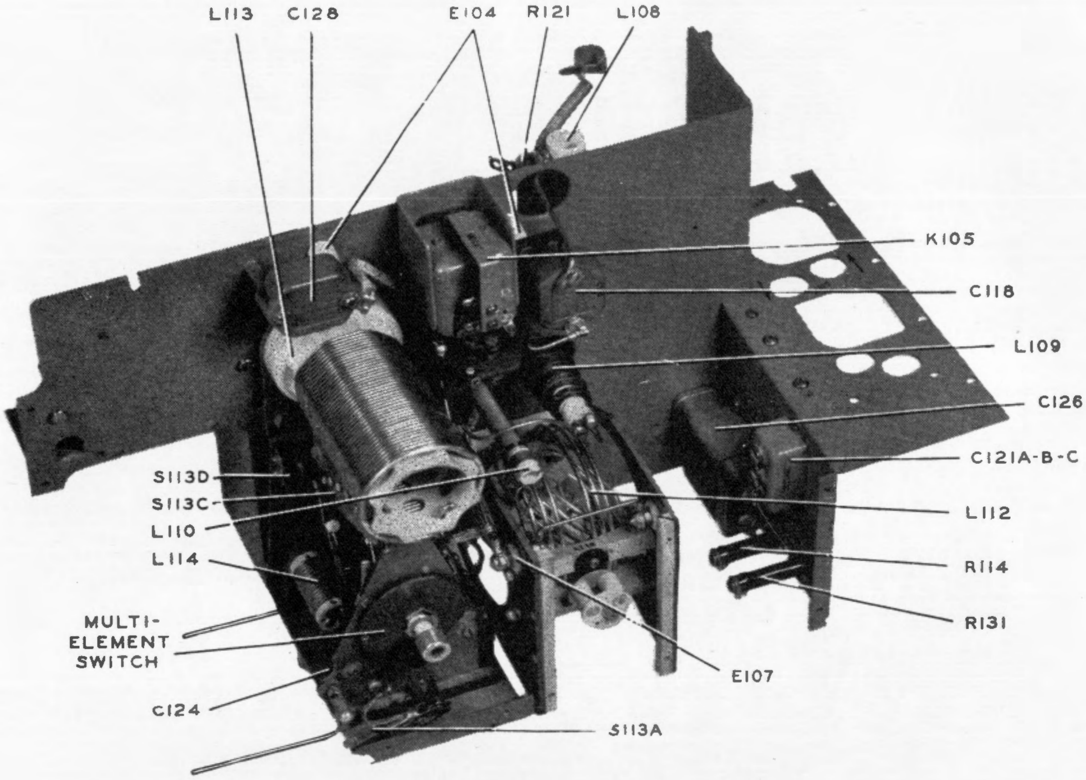


Fig. 46 Fire Wall Assembly—Top View

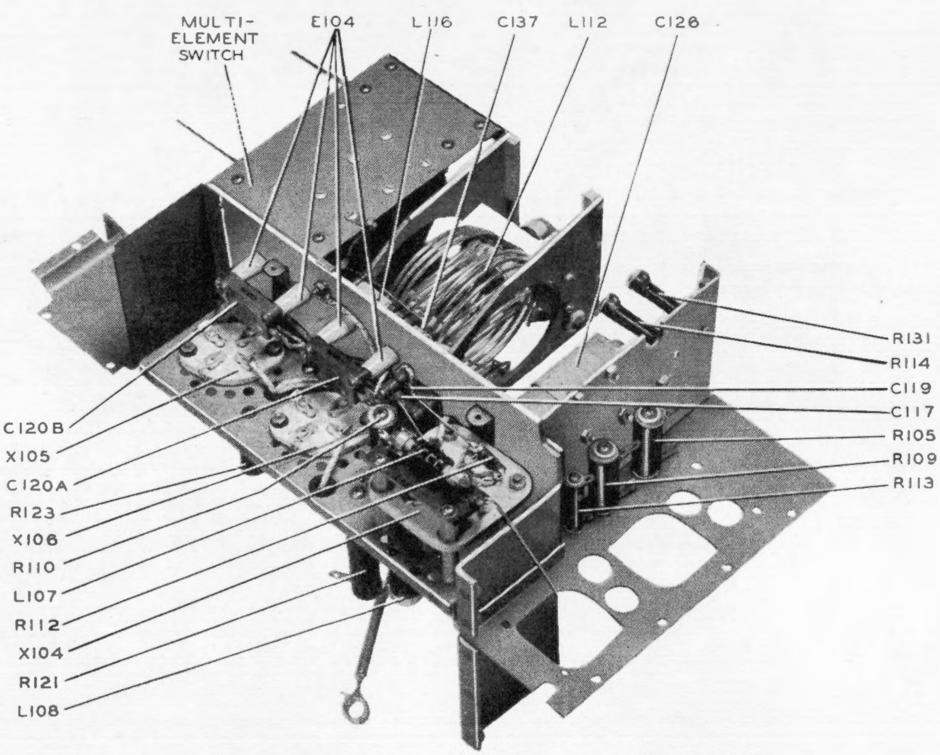


Fig. 47 Fire Wall Assembly—Bottom View

Fig. 48 Low-Frequency Oscillator Unit—Front View

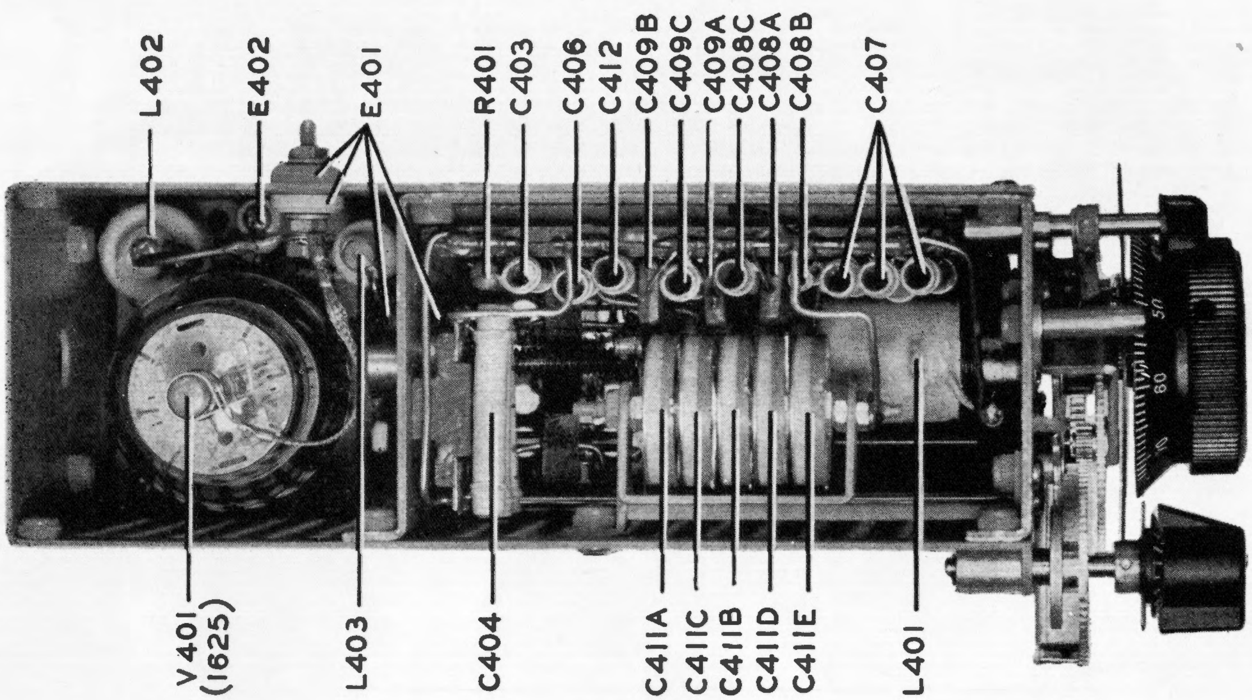


Fig. 49 Low-Frequency Oscillator Unit—Top Open View

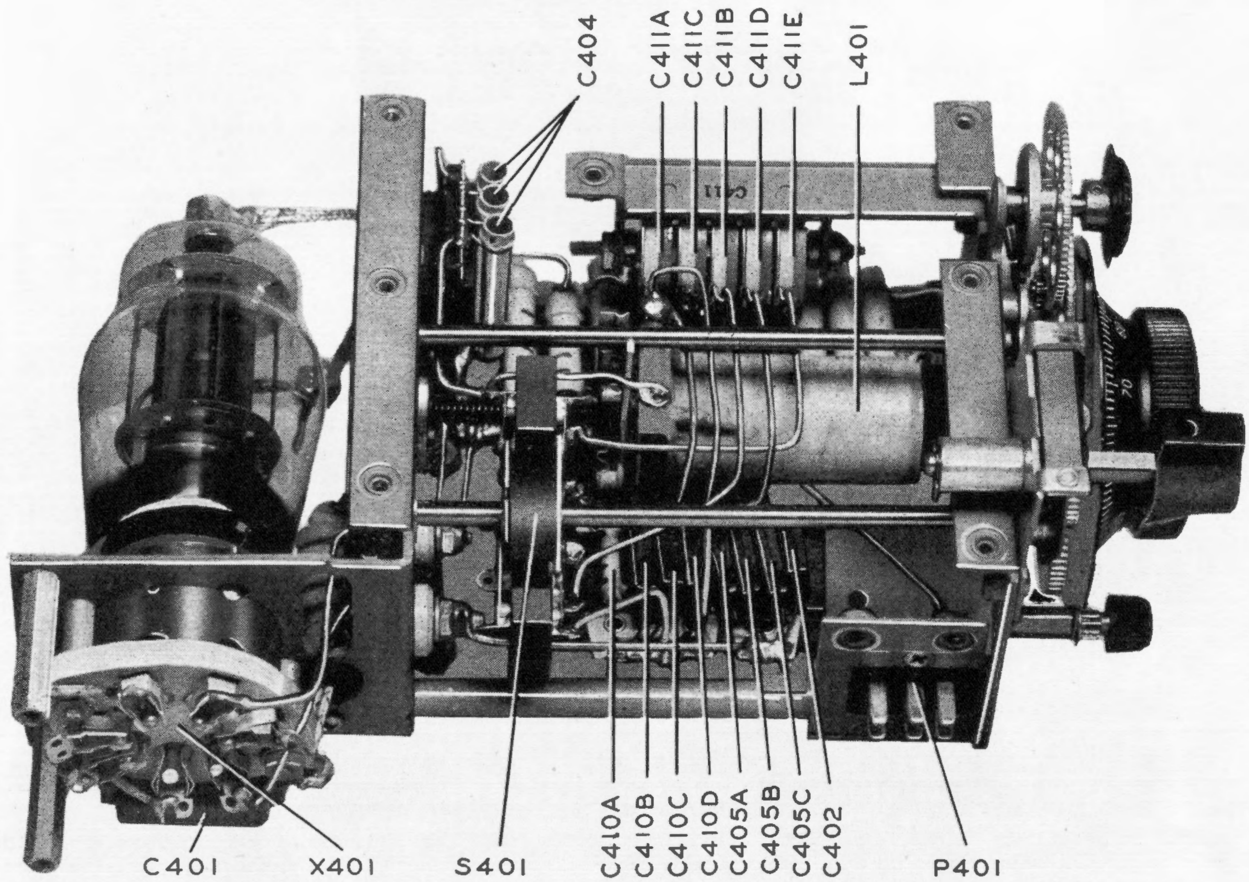


Fig. 50 Low-Frequency Oscillator Unit—Bottom Open View

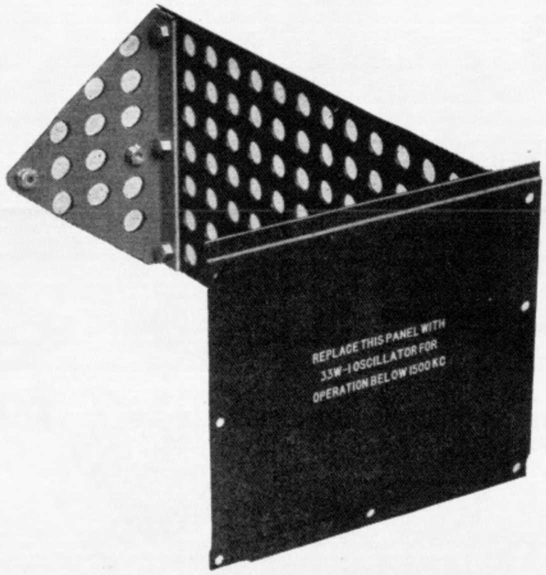


Fig. 51 Dummy Low-Frequency Oscillator Unit—Front View

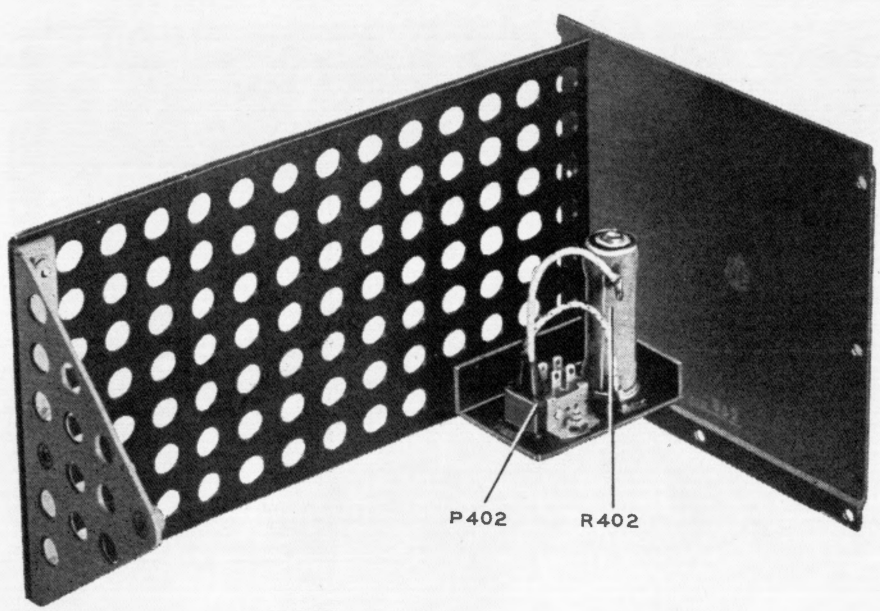


Fig. 52 Dummy Low-Frequency Oscillator Unit—Side View

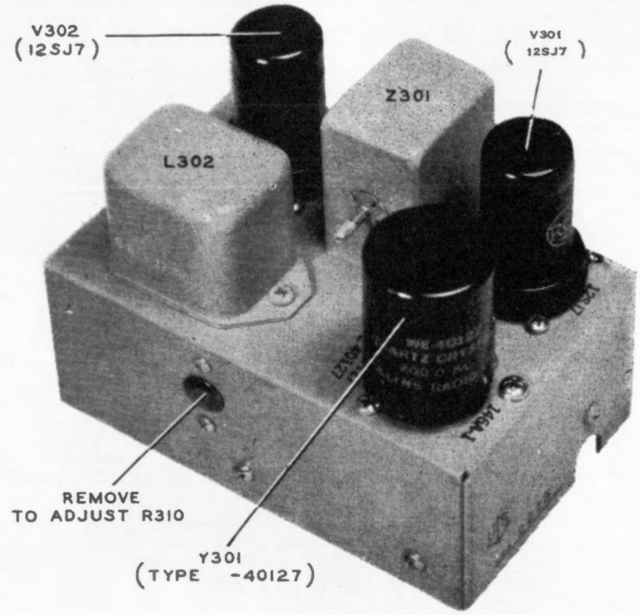


Fig. 53 MCW-CFI Unit—Top View

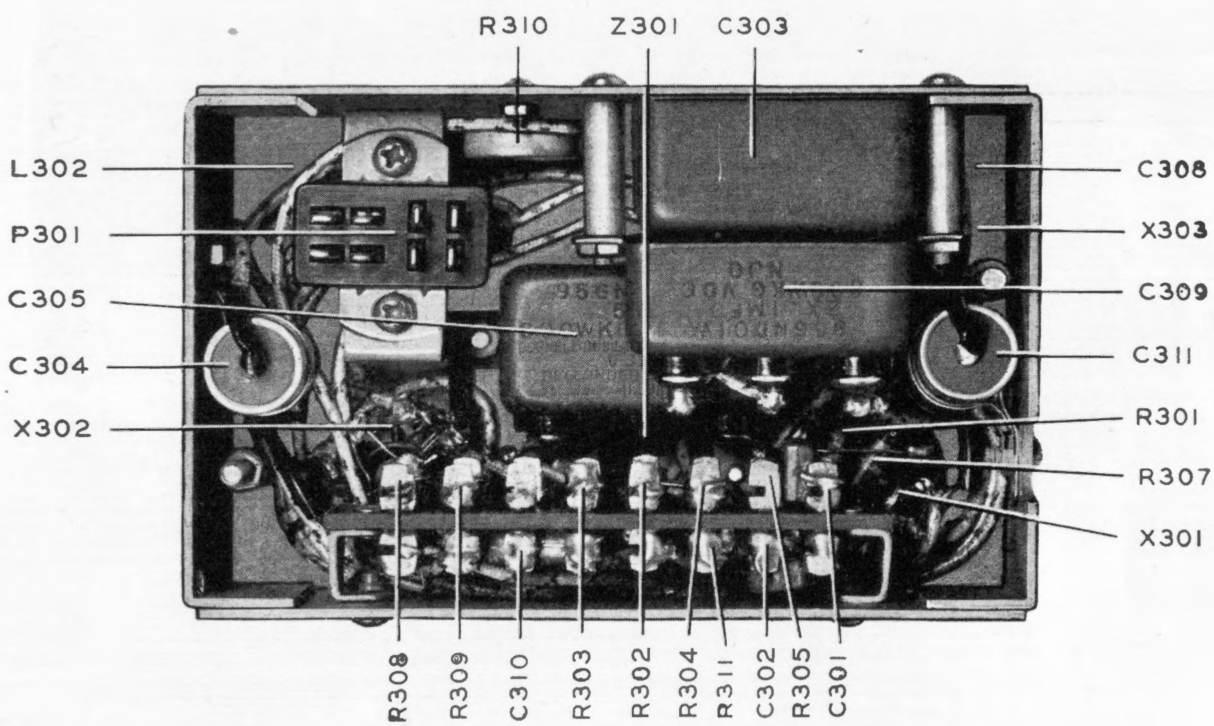


Fig. 54 MCW-CFI Unit—Bottom View

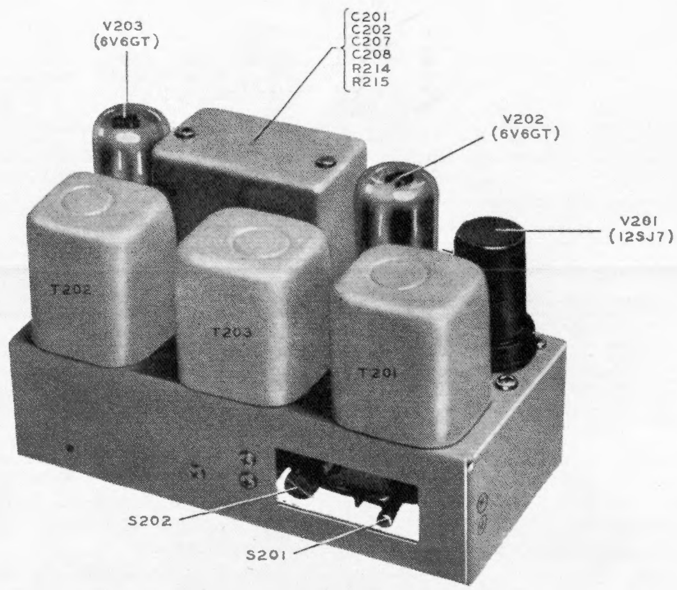


Fig. 55 Audio Amplifier Unit—Top View

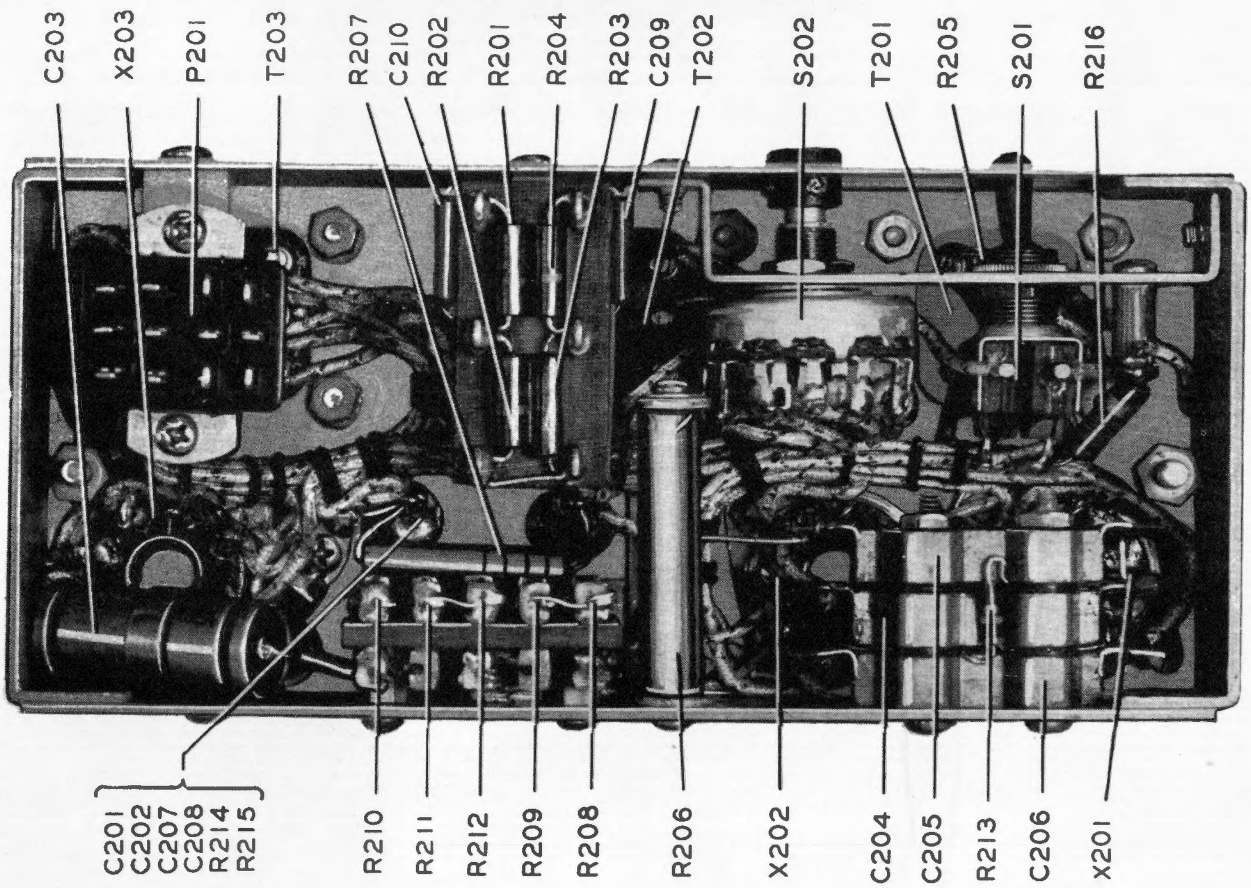


Fig. 56 Audio Amplifier Unit—Bottom View

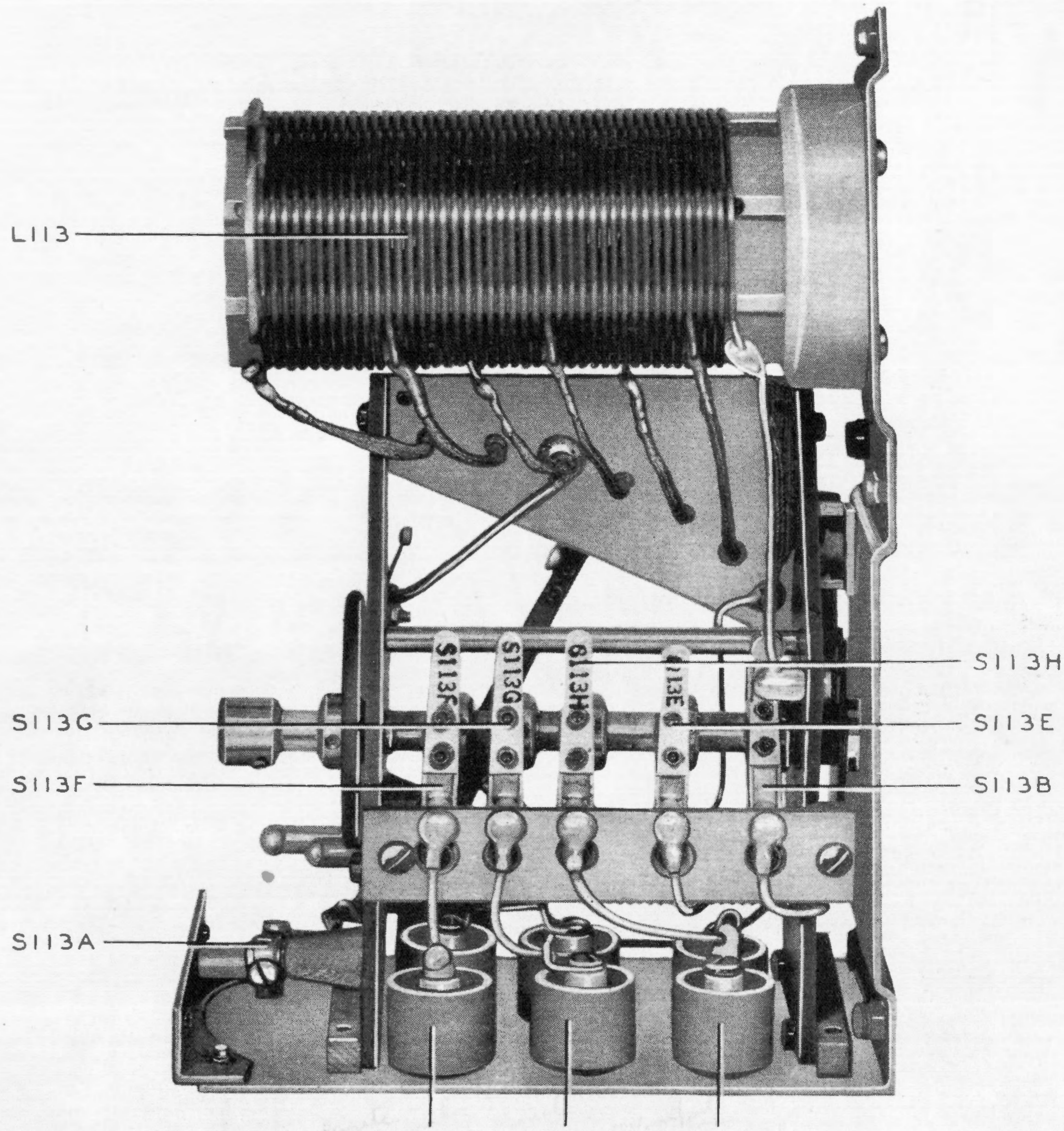


Fig. 57 Multi-Element Switch—Right Side View

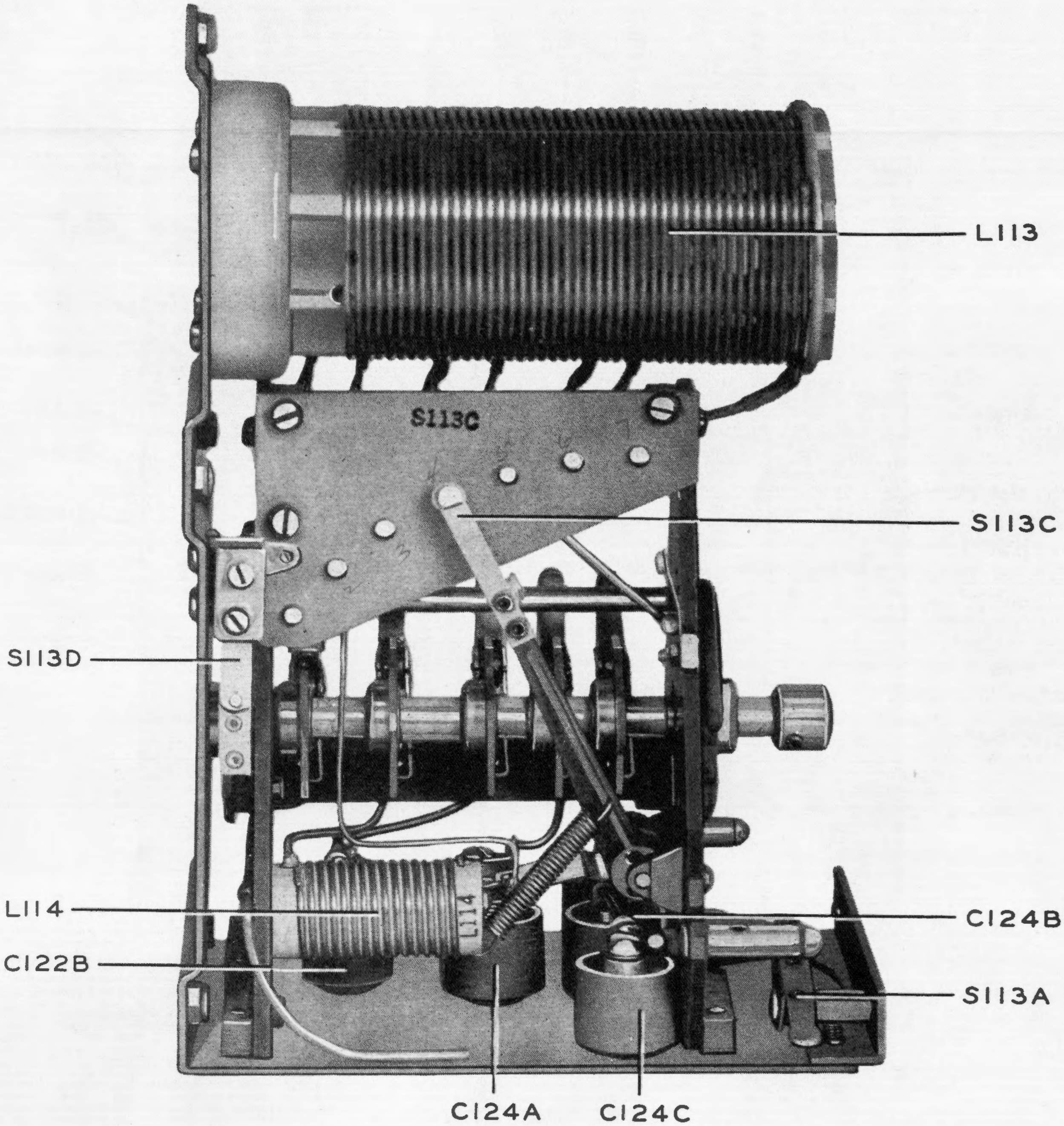


Fig. 58 Multi-Element Switch—Left Side View

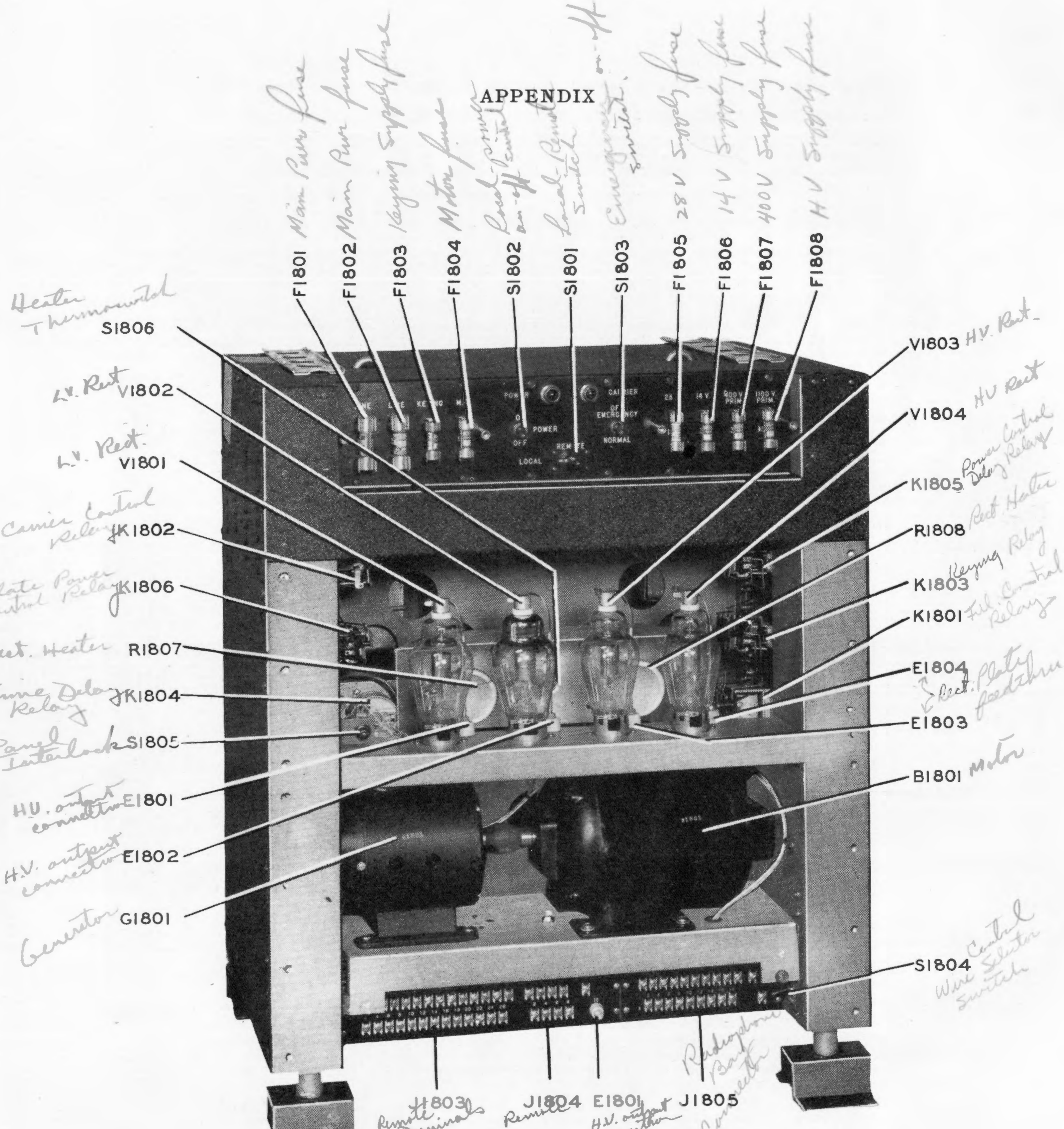


Fig. 59 Type COL–211101 Motor-Generator-Rectifier Power Unit
Front View Open

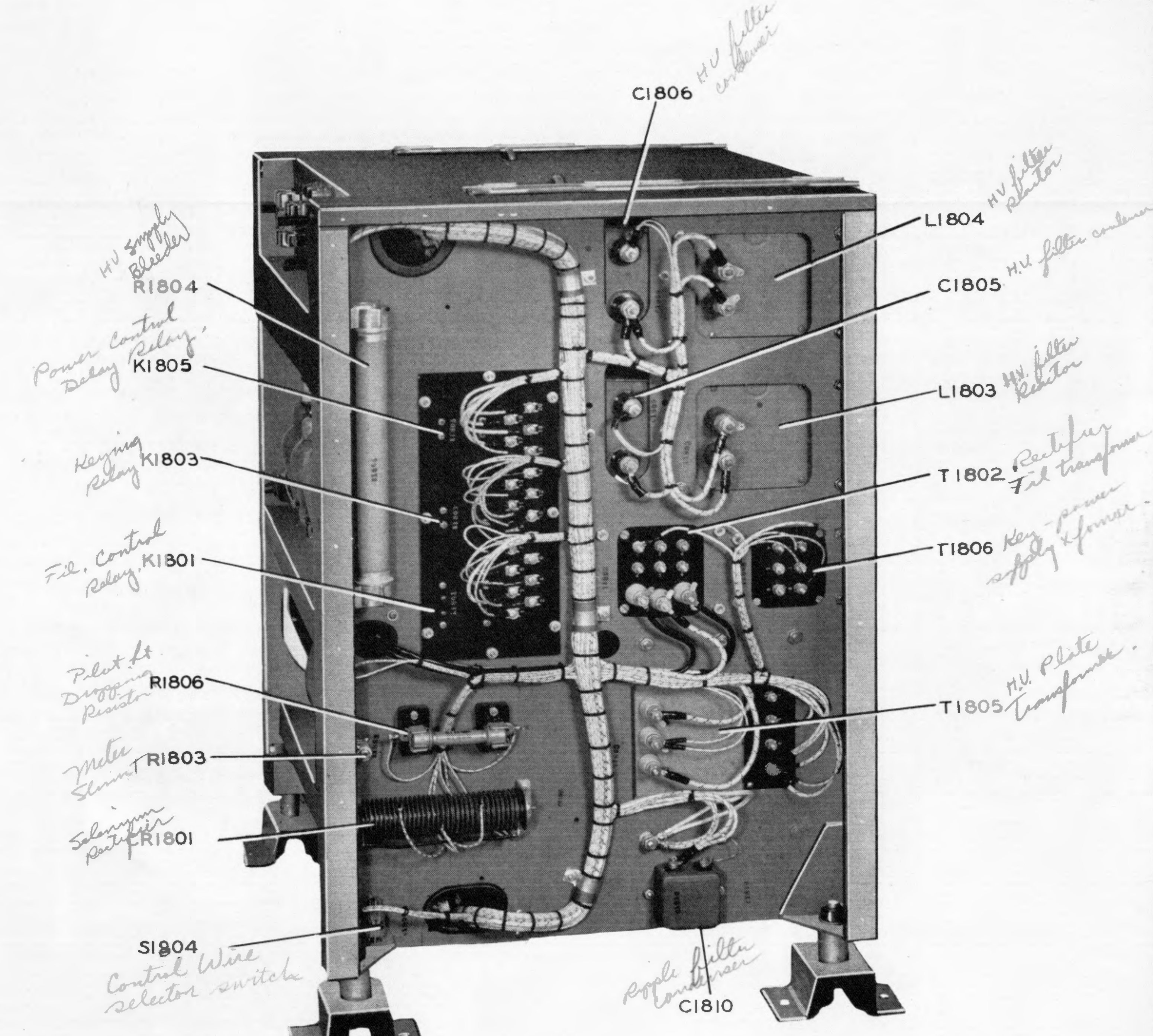


Fig. 60 Type COL–211101 Motor-Generator-Rectifier Power Unit
Right Side Open View

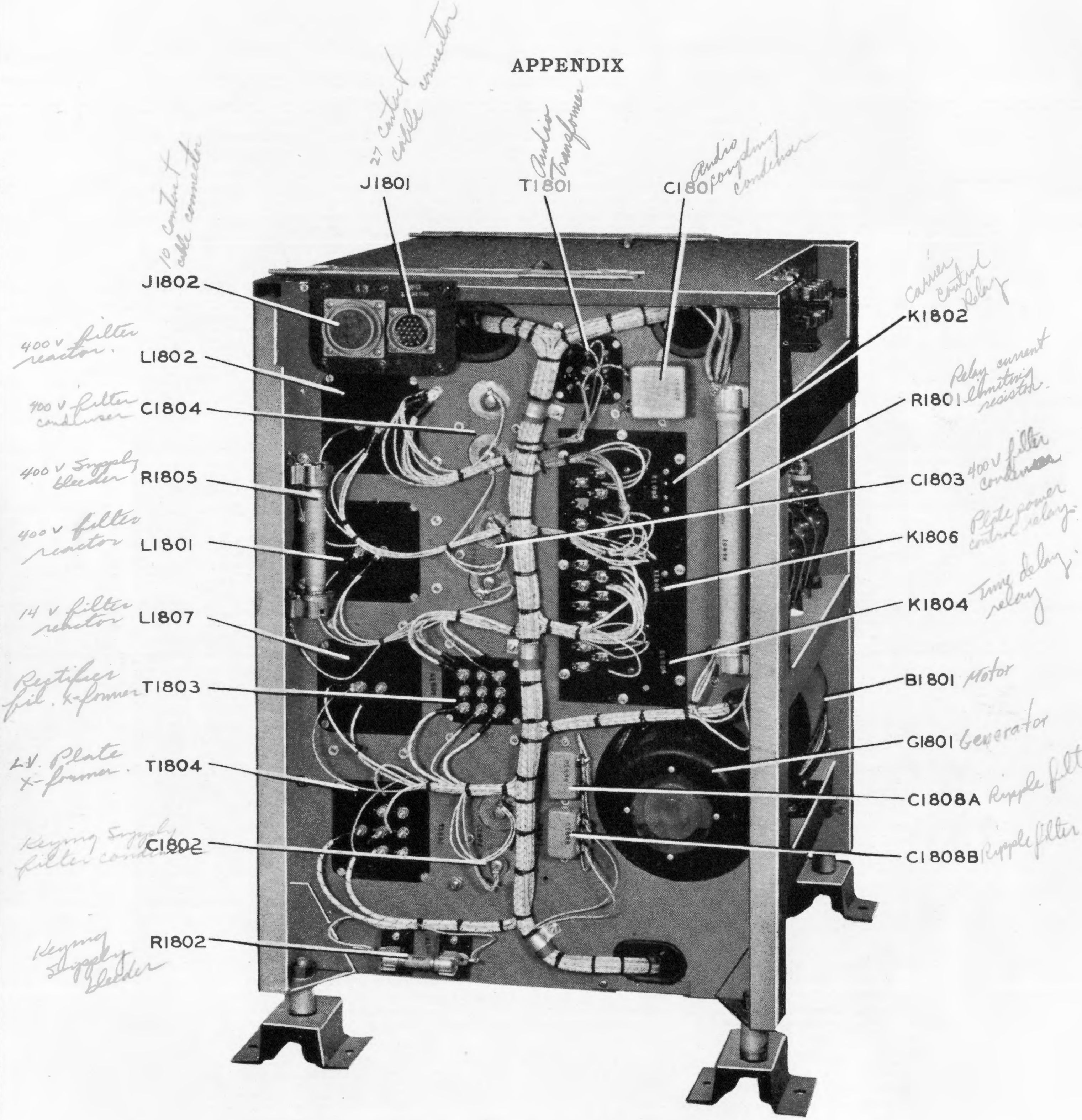


Fig. 61 Type COL–211101 Motor-Generator-Rectifier Power Unit
Left Side Open View

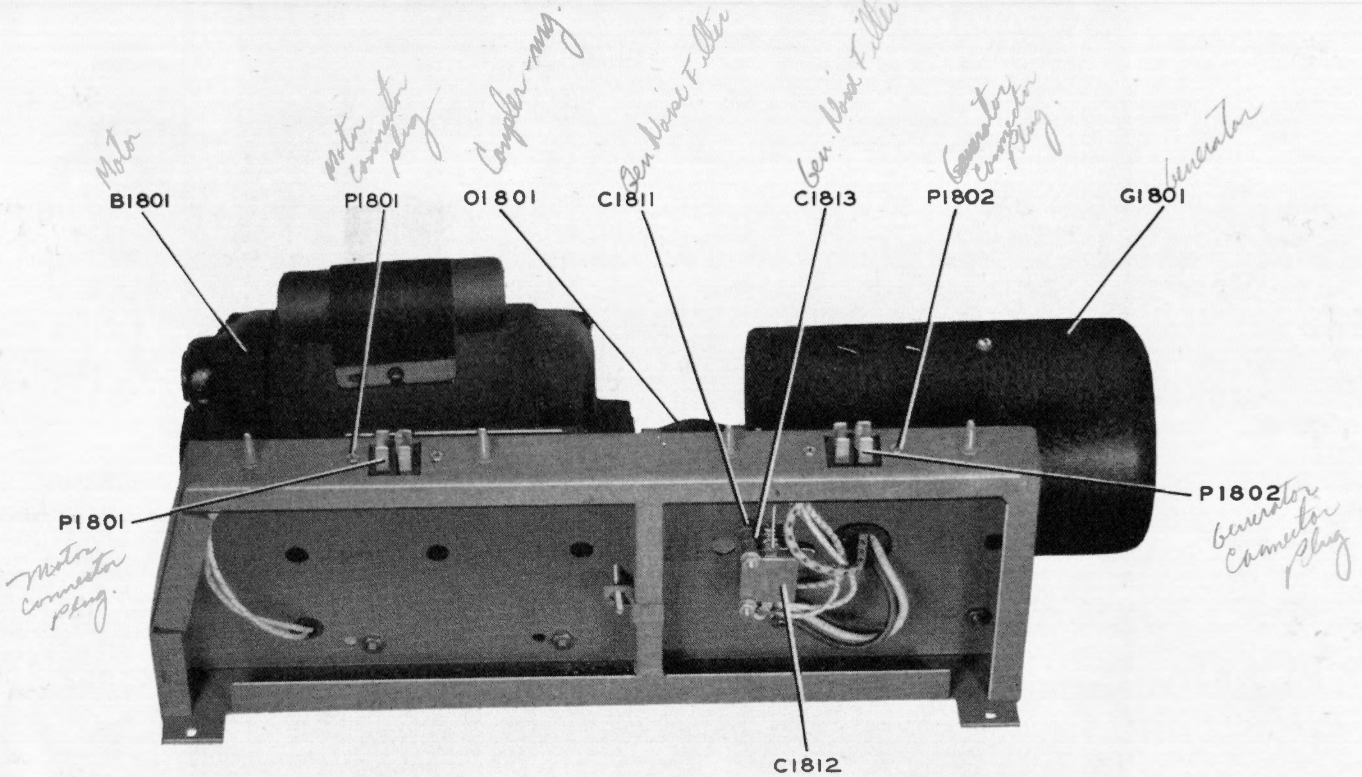


Fig. 62 Motor-Generator—Bottom View

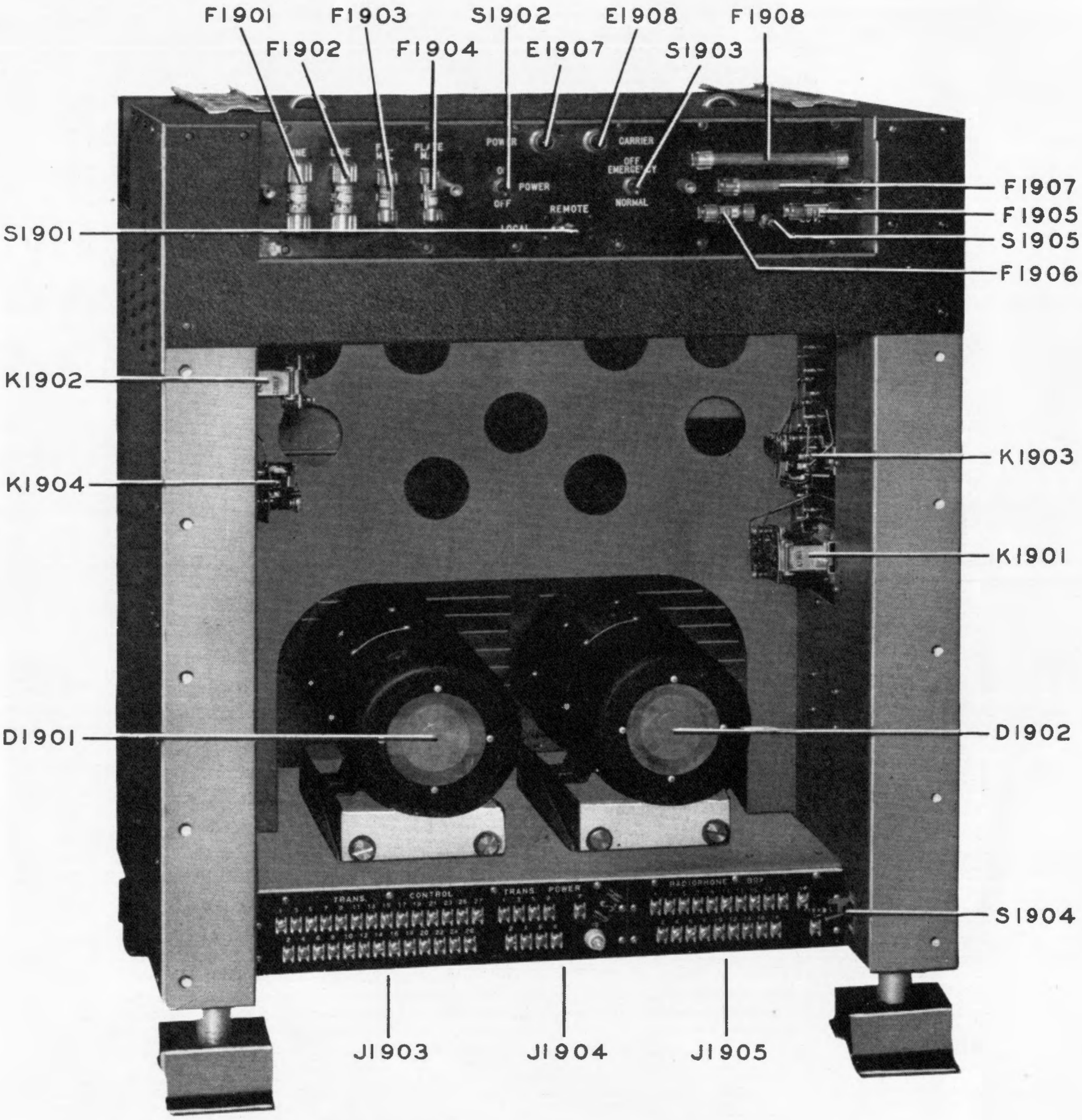


Fig. 63 Type COL–211102 Dynamotor Assembly

Front Open View

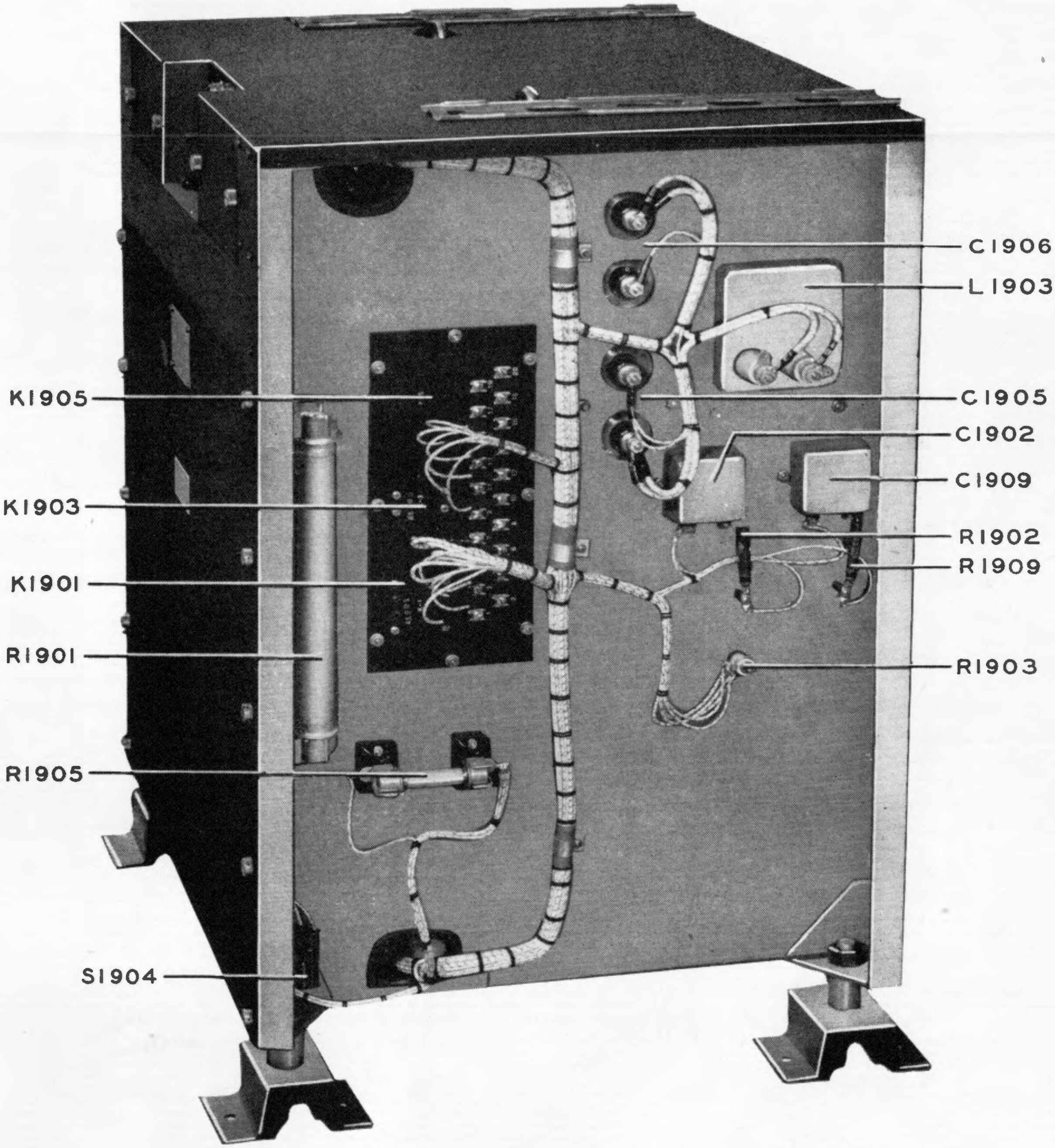


Fig. 64 Type COL–211102 Dynamotor Assembly
Right Side Open View

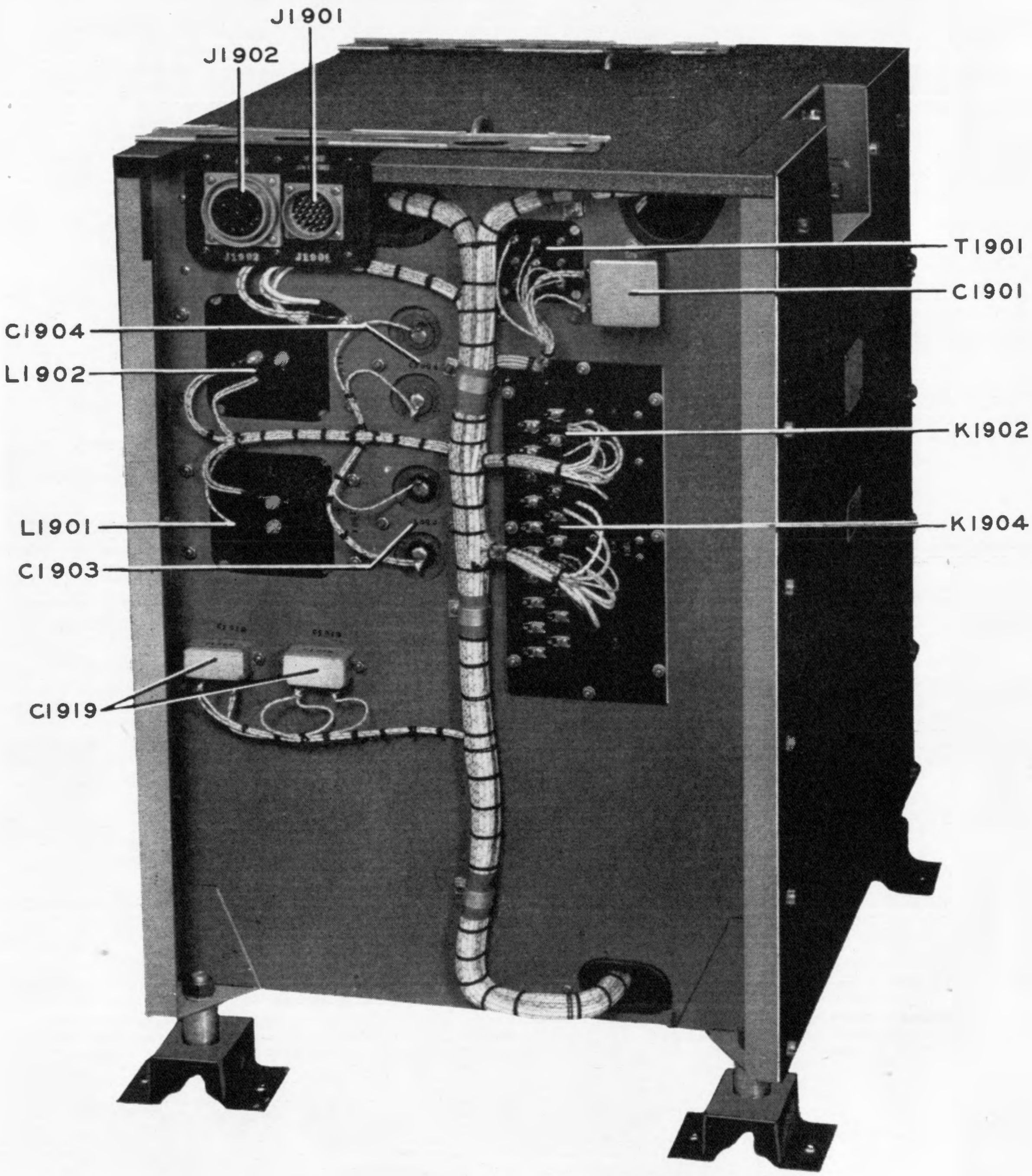


Fig. 65 Type COL–211102 Dynamotor Assembly
Left Side Open View

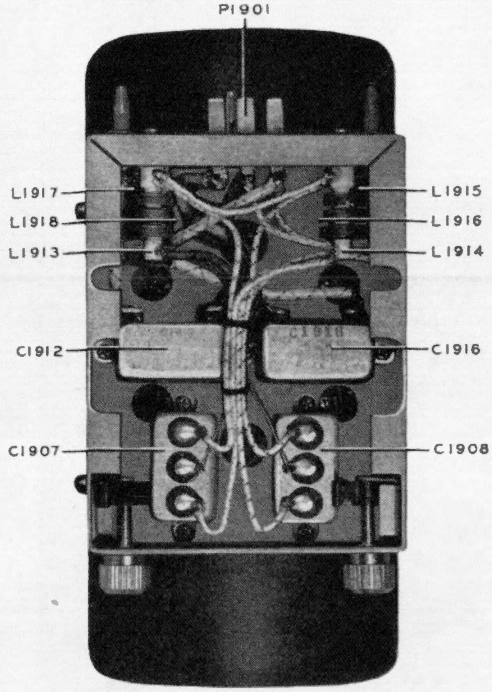


Fig. 66 High Voltage Dynamotor—Bottom View

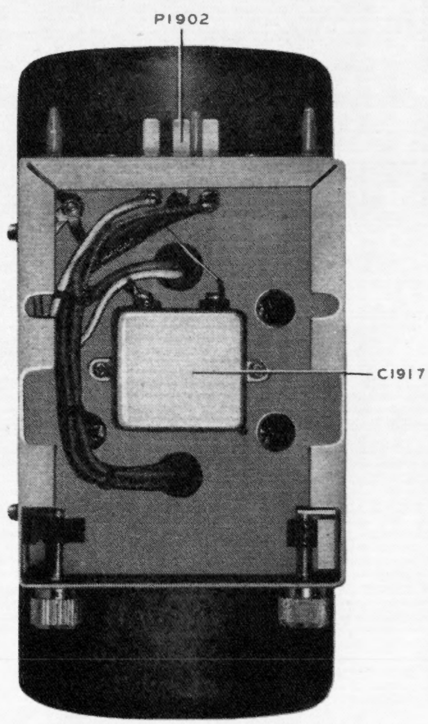


Fig. 67 Low Voltage Dynamotor—Bottom View

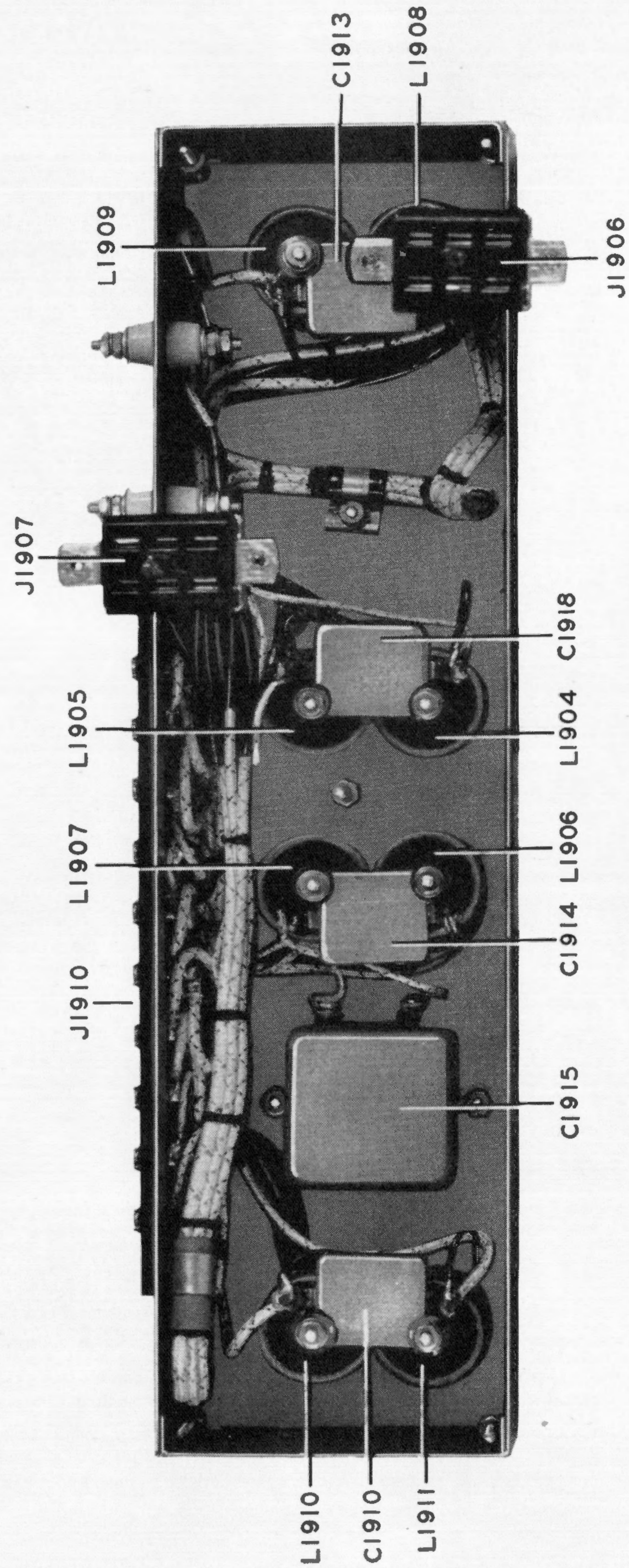


Fig. 68 Dynamotor Assembly Noise Filter Box—Bottom View

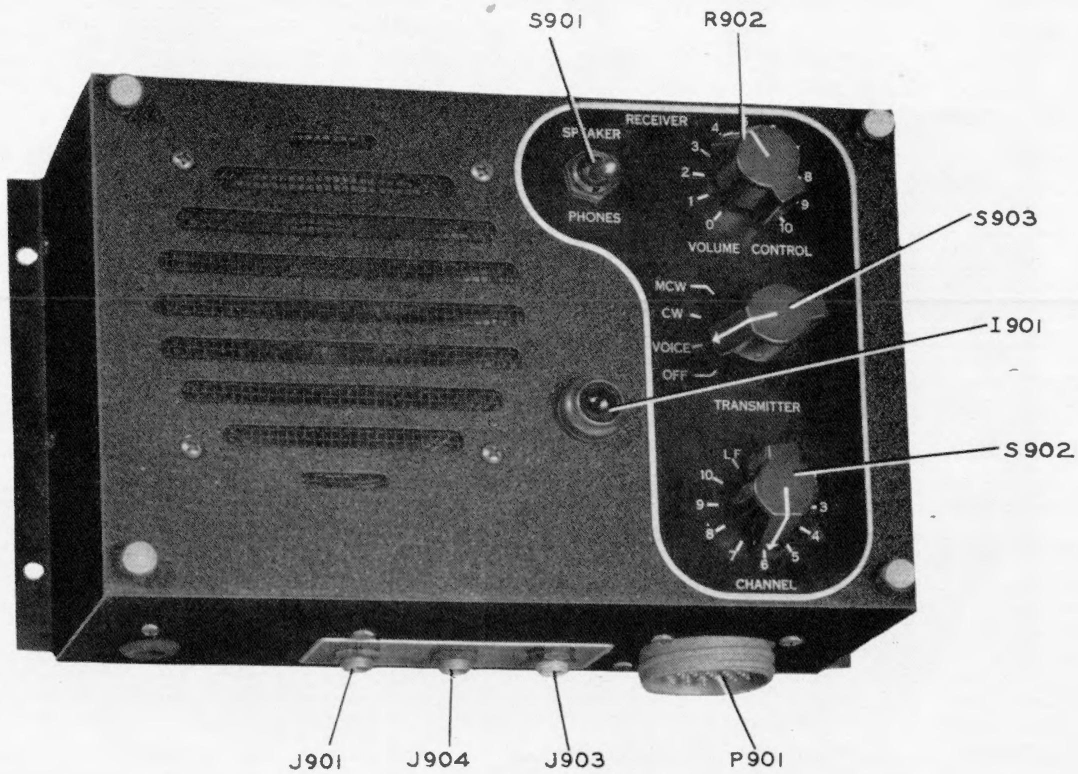


Fig. 69 Type COL–23410 Remote Control Unit—Top View

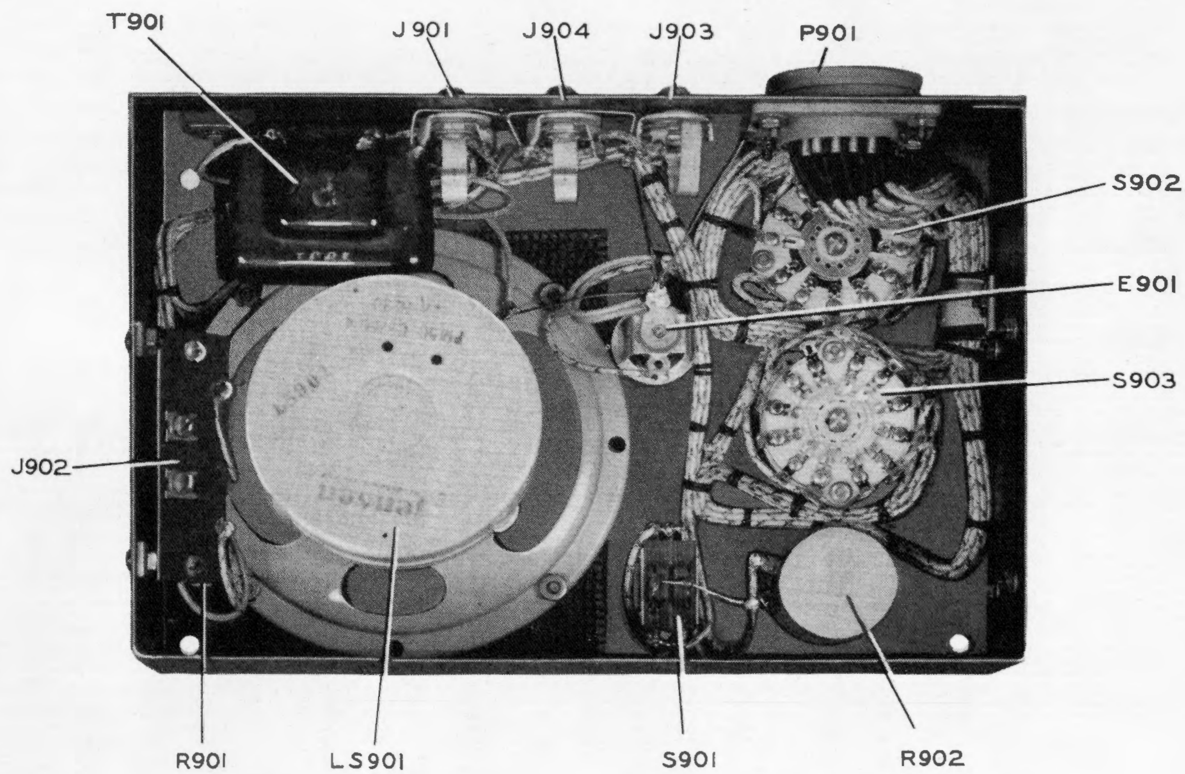


Fig. 70 Type COL–23410 Remote Control Unit—Bottom Open View

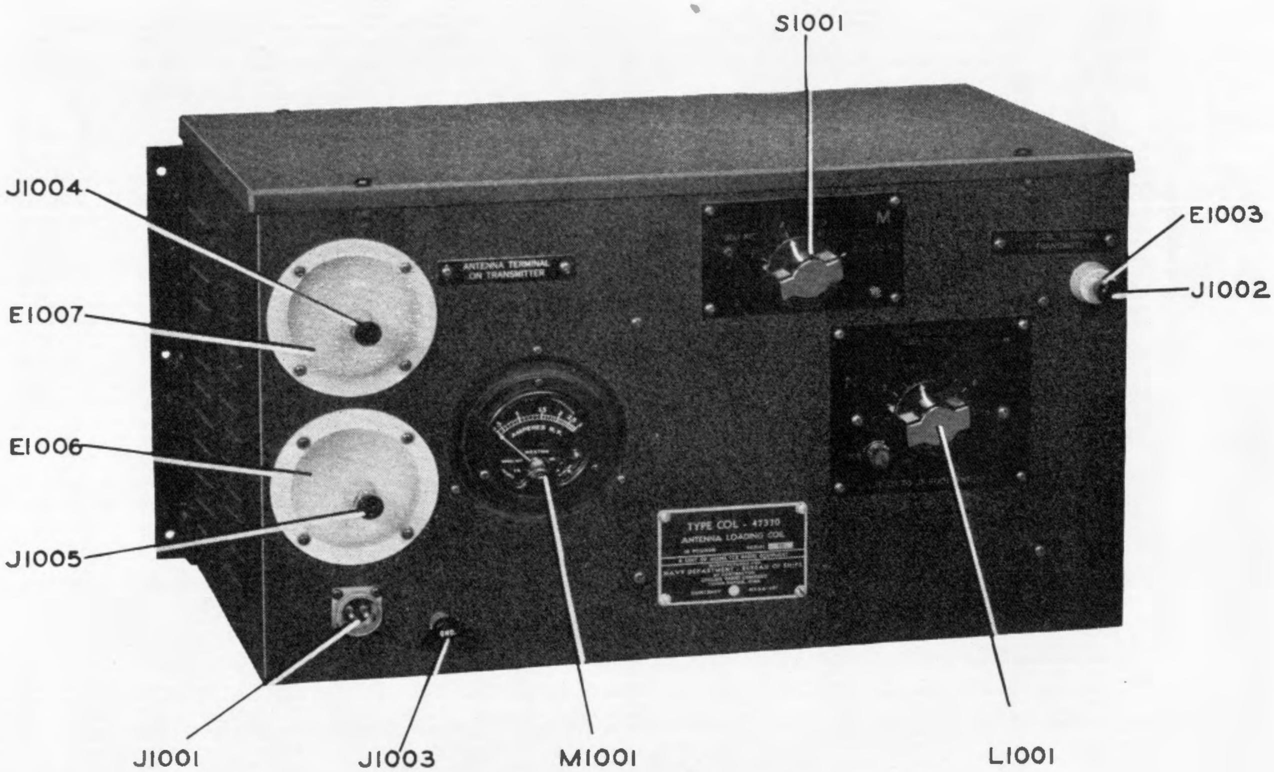


Fig. 71 Type COL–47370 Antenna Loading Coil—Front View

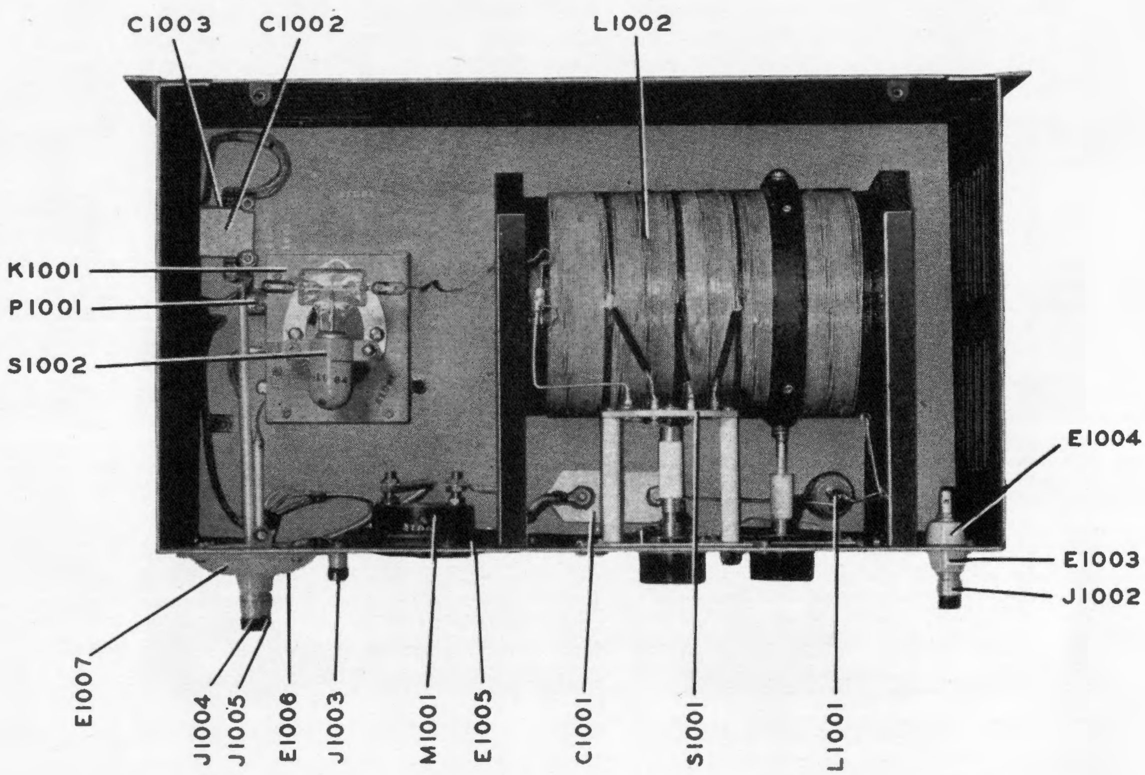


Fig. 72 Type COL–47370 Antenna Loading Coil—Top Open View

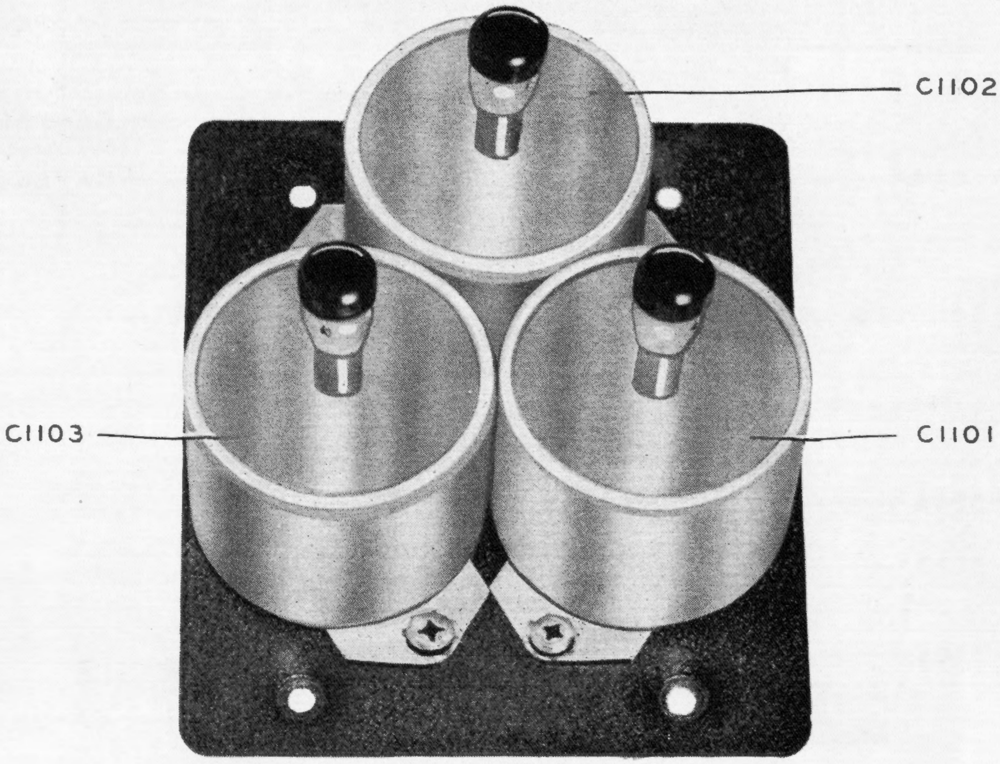


Fig. 73 Type COL-481628 Antenna Shunt Capacitor—Top View

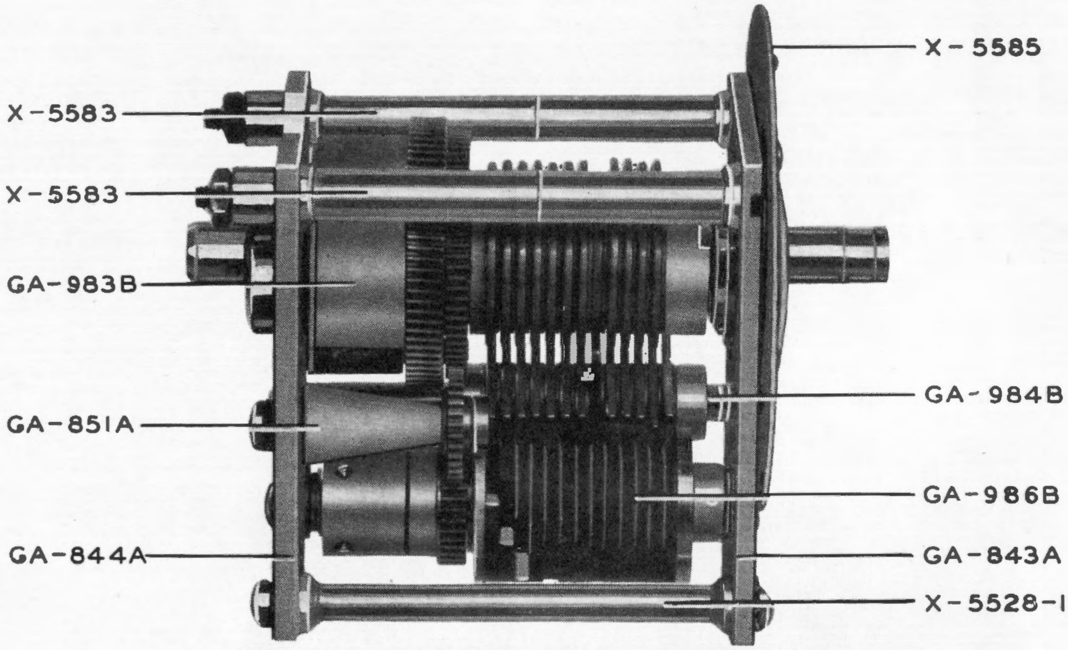


Fig. 74 96J Autotune Singleturn Unit—Left Side View

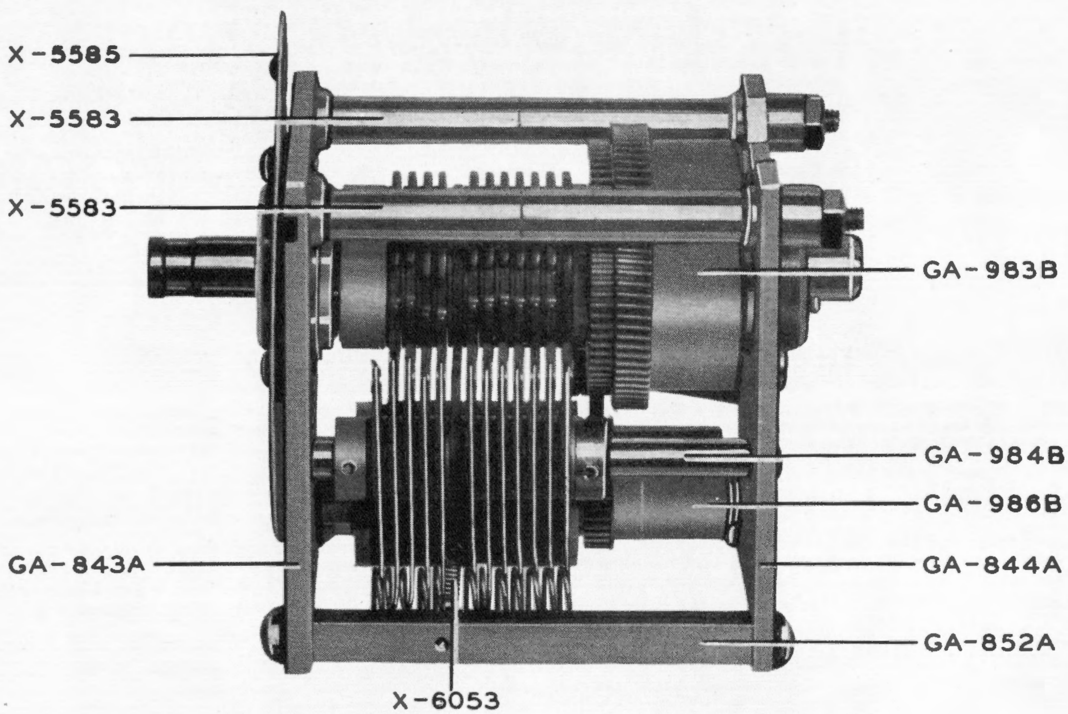


Fig. 75 96J Autotune Singleturn Unit—Right Side View

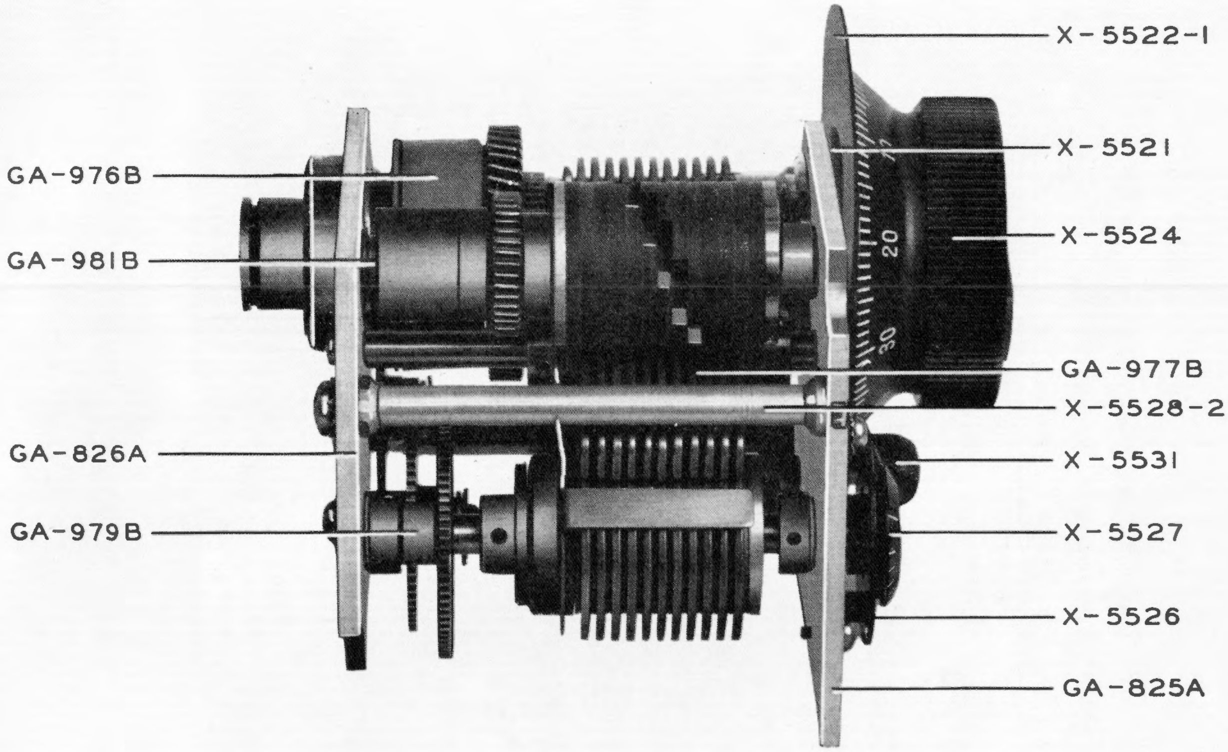


Fig. 76 96K Autotune Multiturn Unit—Left Side View

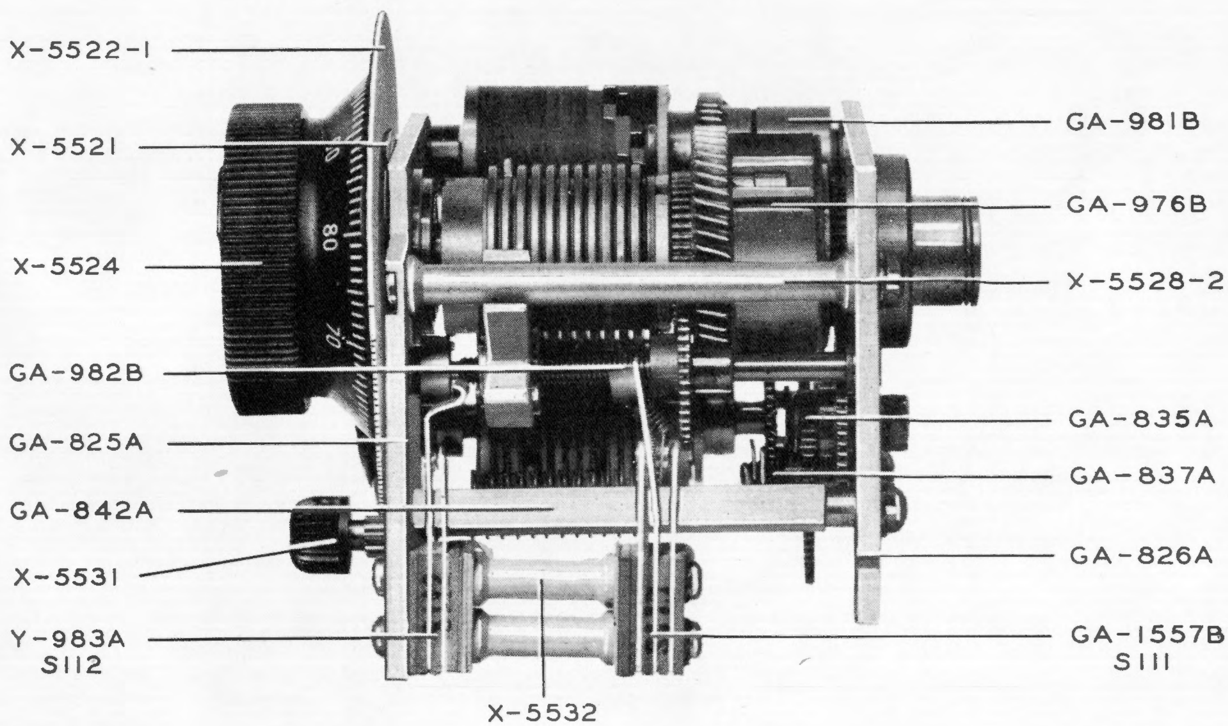


Fig. 77 96K Autotune Multiturn Unit—Right Side View

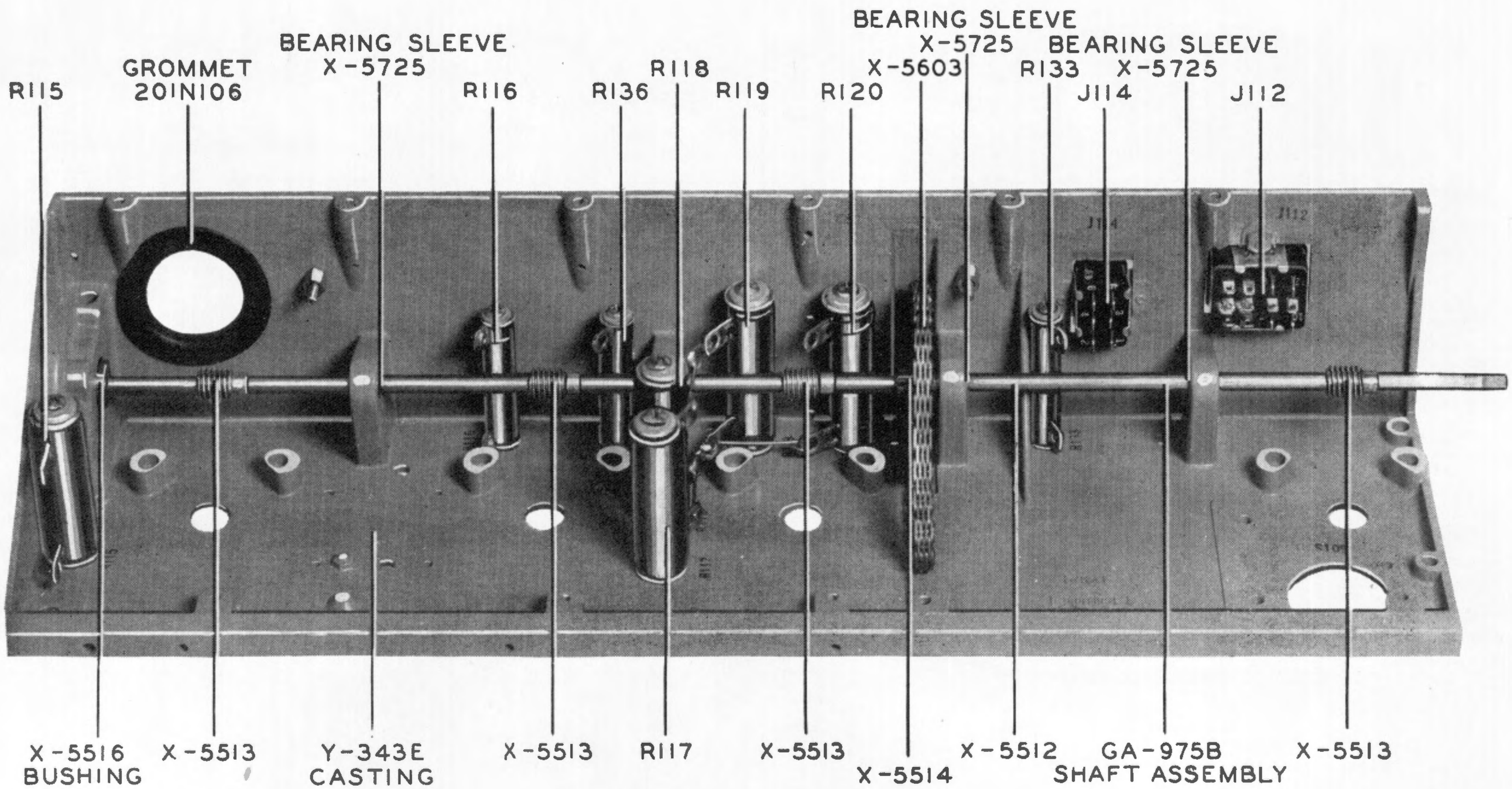


Fig. 78 Autotune Casting

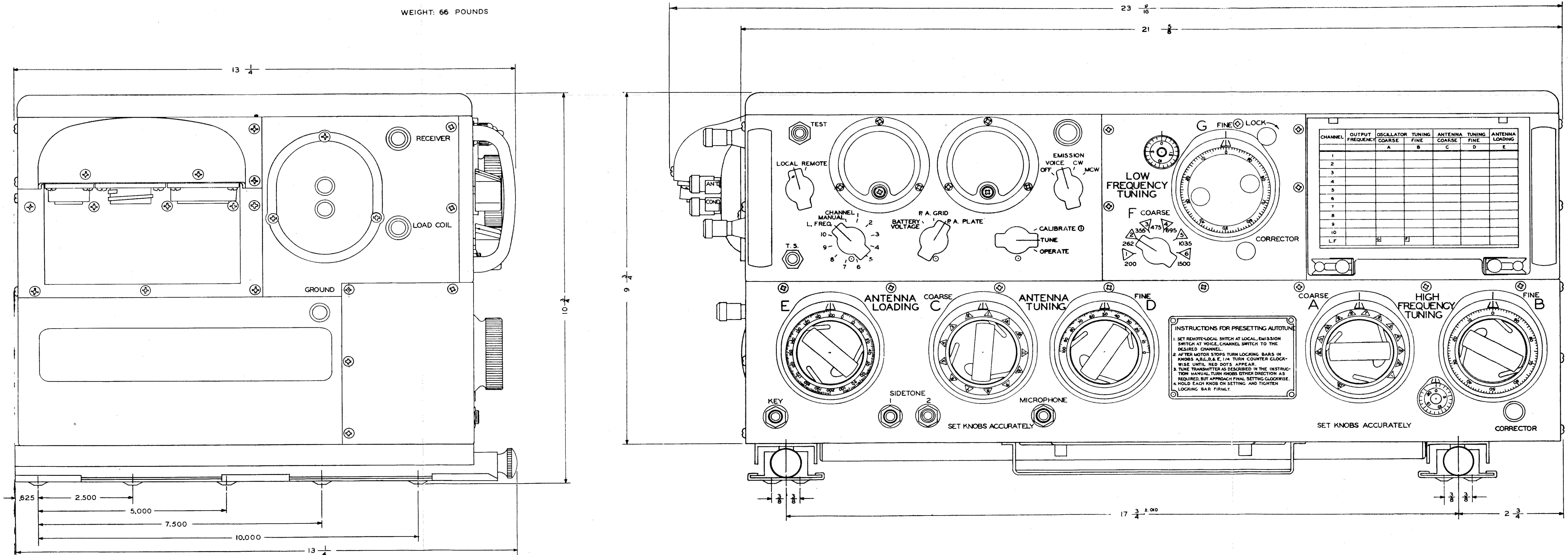


Fig. 79 Type COL–52286 Radio Transmitter Installation Diagram (Dwg. No. K351E)

Fig. 79 Type COL–52286 Radio Transmitter Installation Diagram (Dwg. No. K351E)

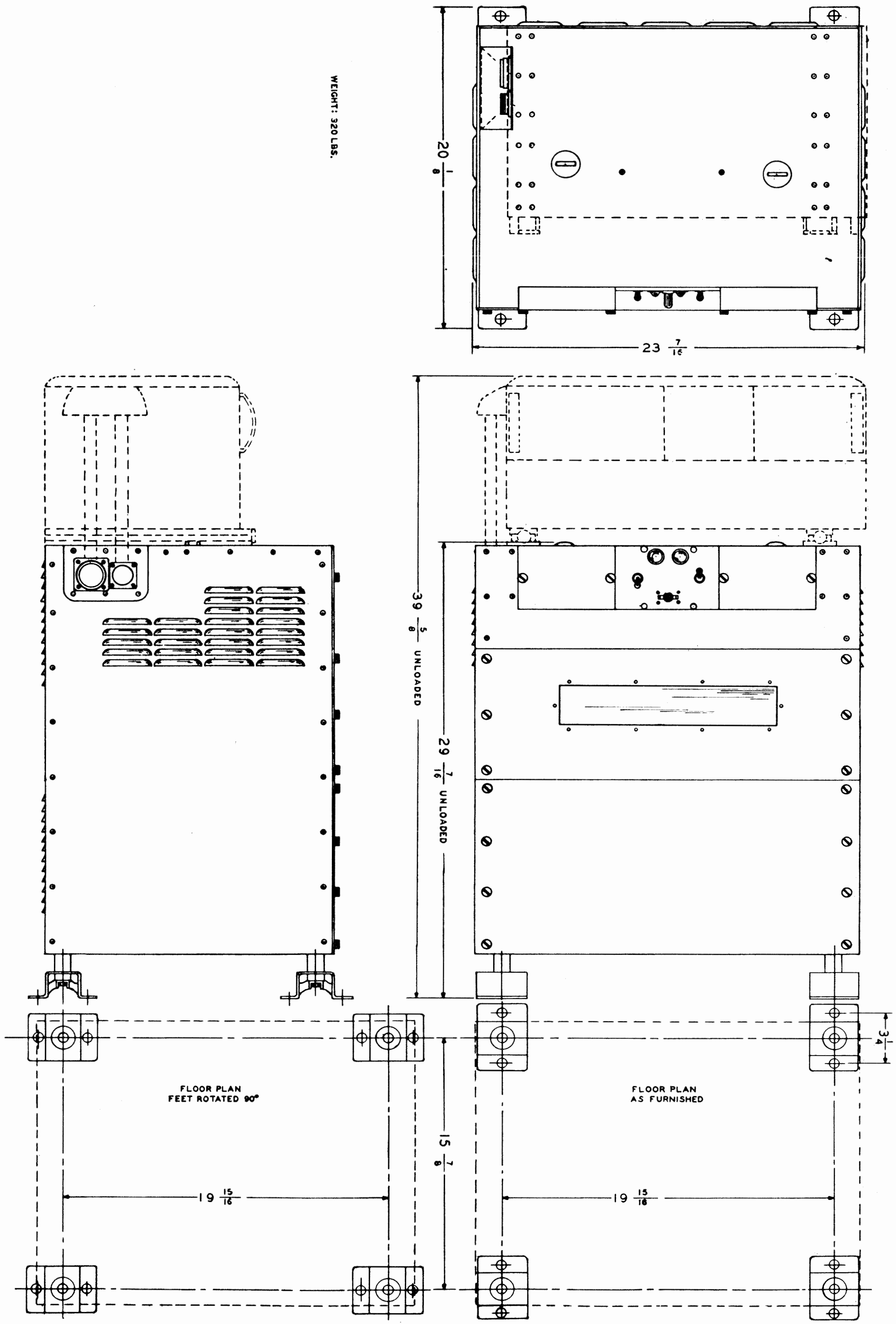


Fig. 80 Type COL–211101 Motor-Generator-Rectifier Power Unit Installation Diagram (Dwg. No. K1082C)

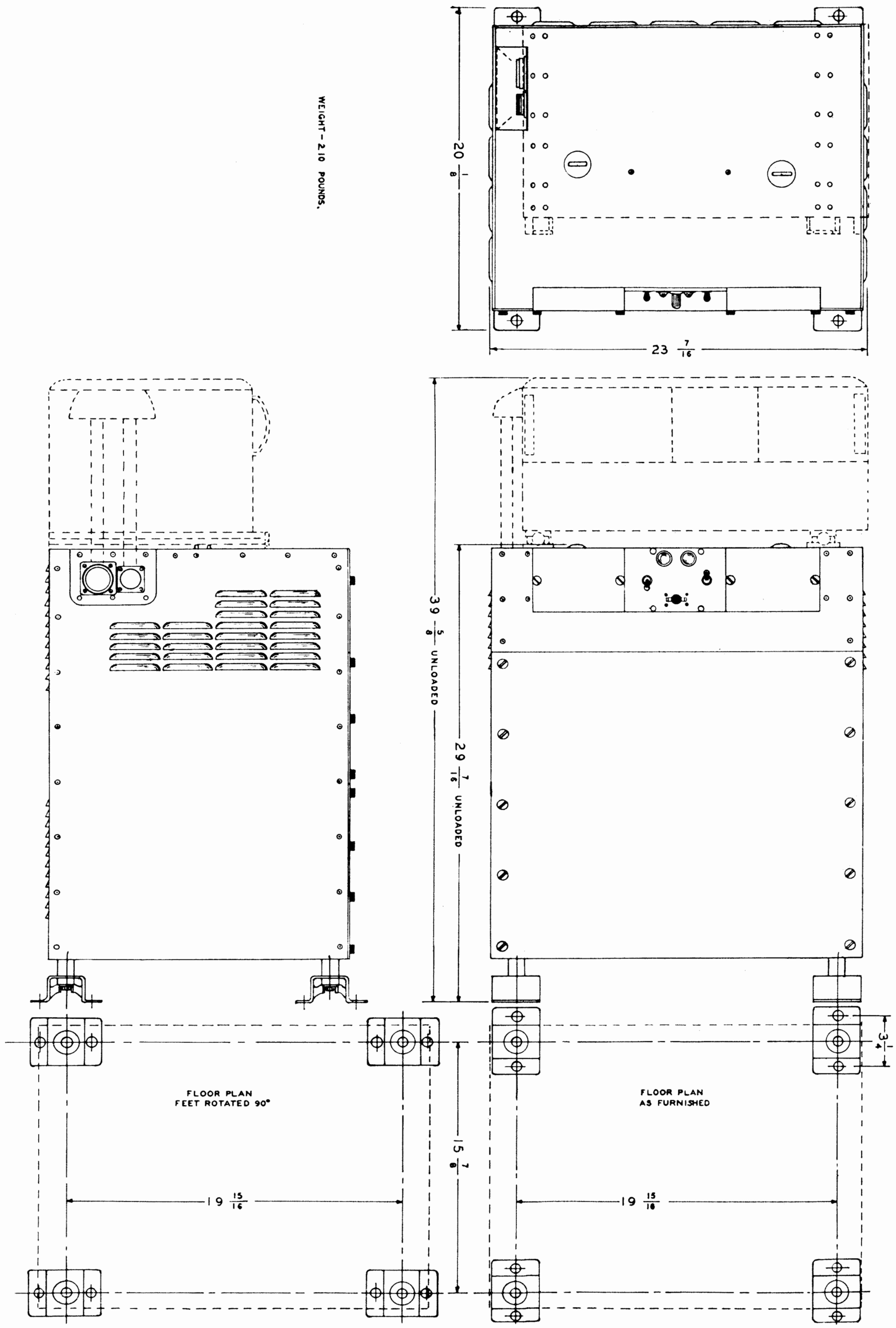


Fig. 81 Type COL–211102 Dynamotor Assembly Installation Diagram (Dwg. No. K1084C)

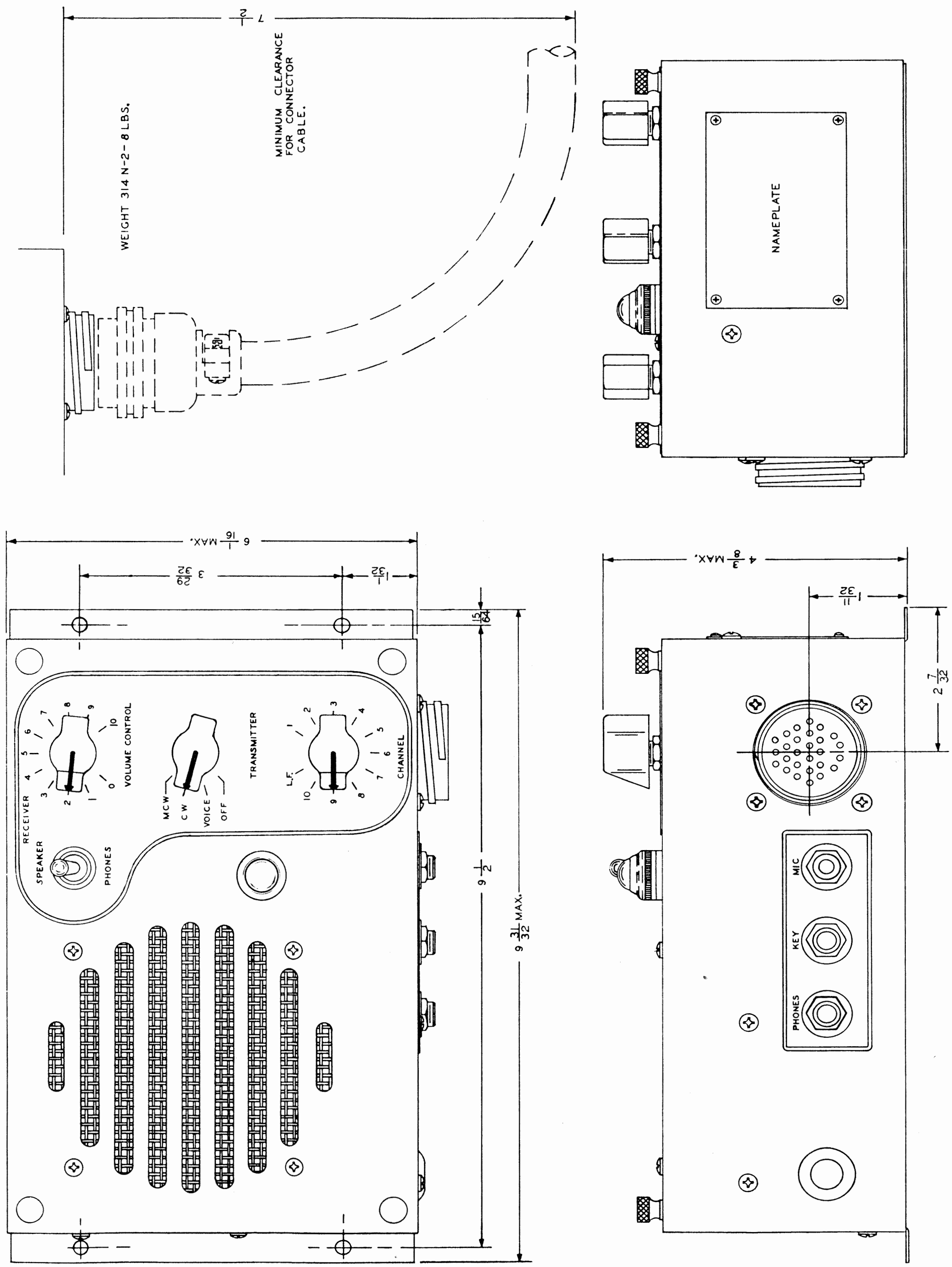


Fig. 82 Type COL–23410 Remote Control Unit Installation Diagram (Dwg. No. K1104C)

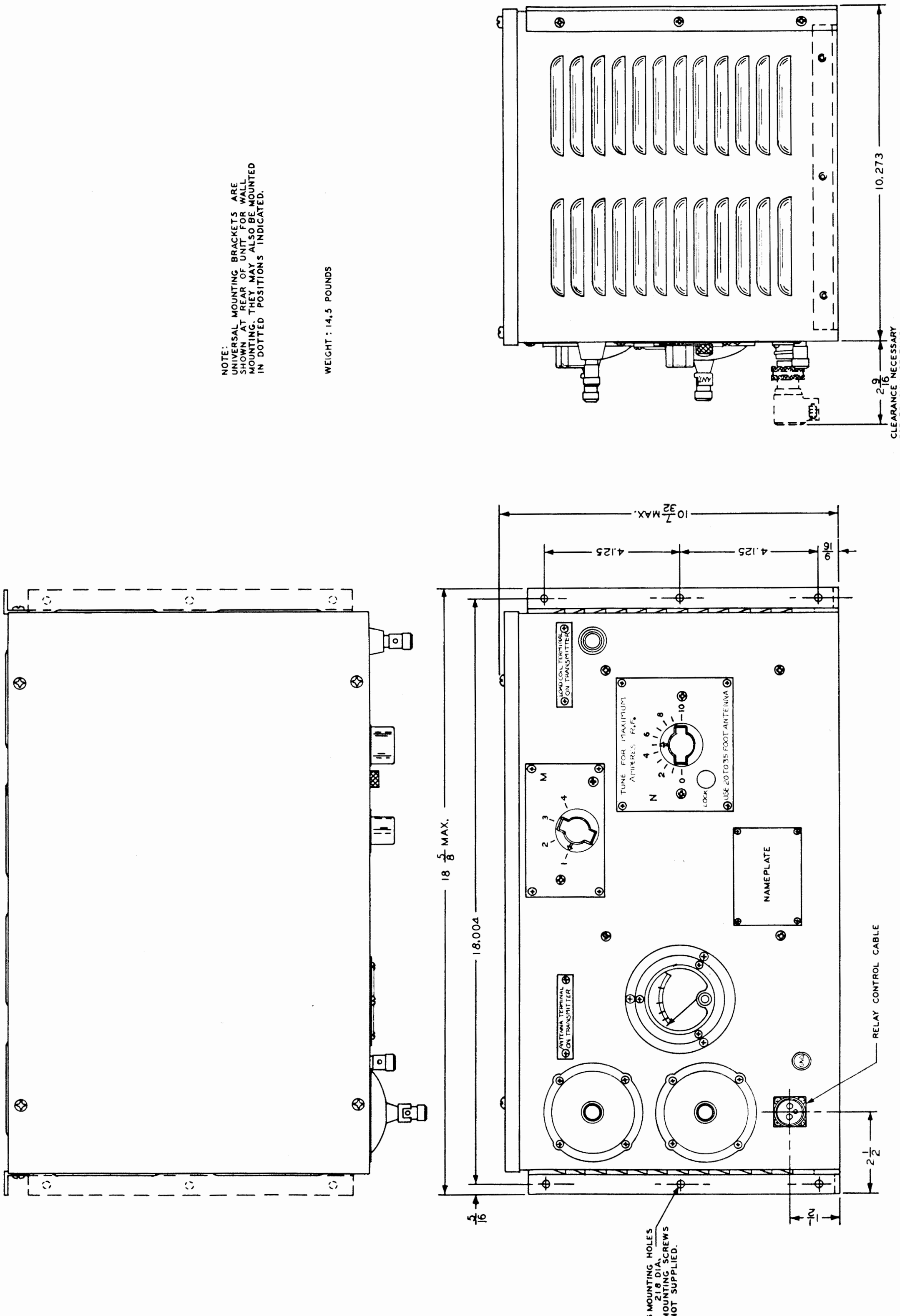


Fig. 83 Type COL–47370 Antenna Loading Coil Installation Diagram (Dwg. No. K1107C)

	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
6	A	#8-32 X 5/16 S.S. PH. B.HD. SCR.	343 0186 00		
6	B	#8 EXT SHAKE WASHER	373 8030 00		
3	C	25MMF. CAPACITOR	914 1762 00		
1	D	CAPACITOR MTG. PLATE ASS'Y.	571 1722 10		
1	X	ASS'Y OF PARTS PER GR. A	571 1370 20		

WEIGHT: 1 POUND 9.5 OZ.

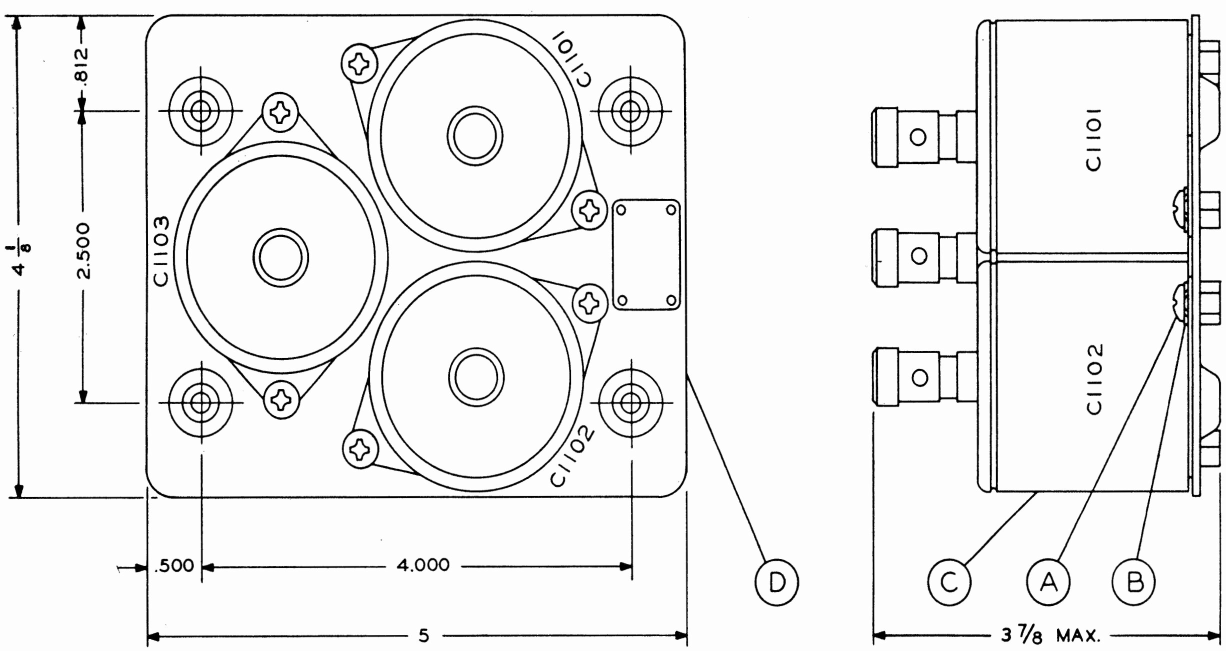
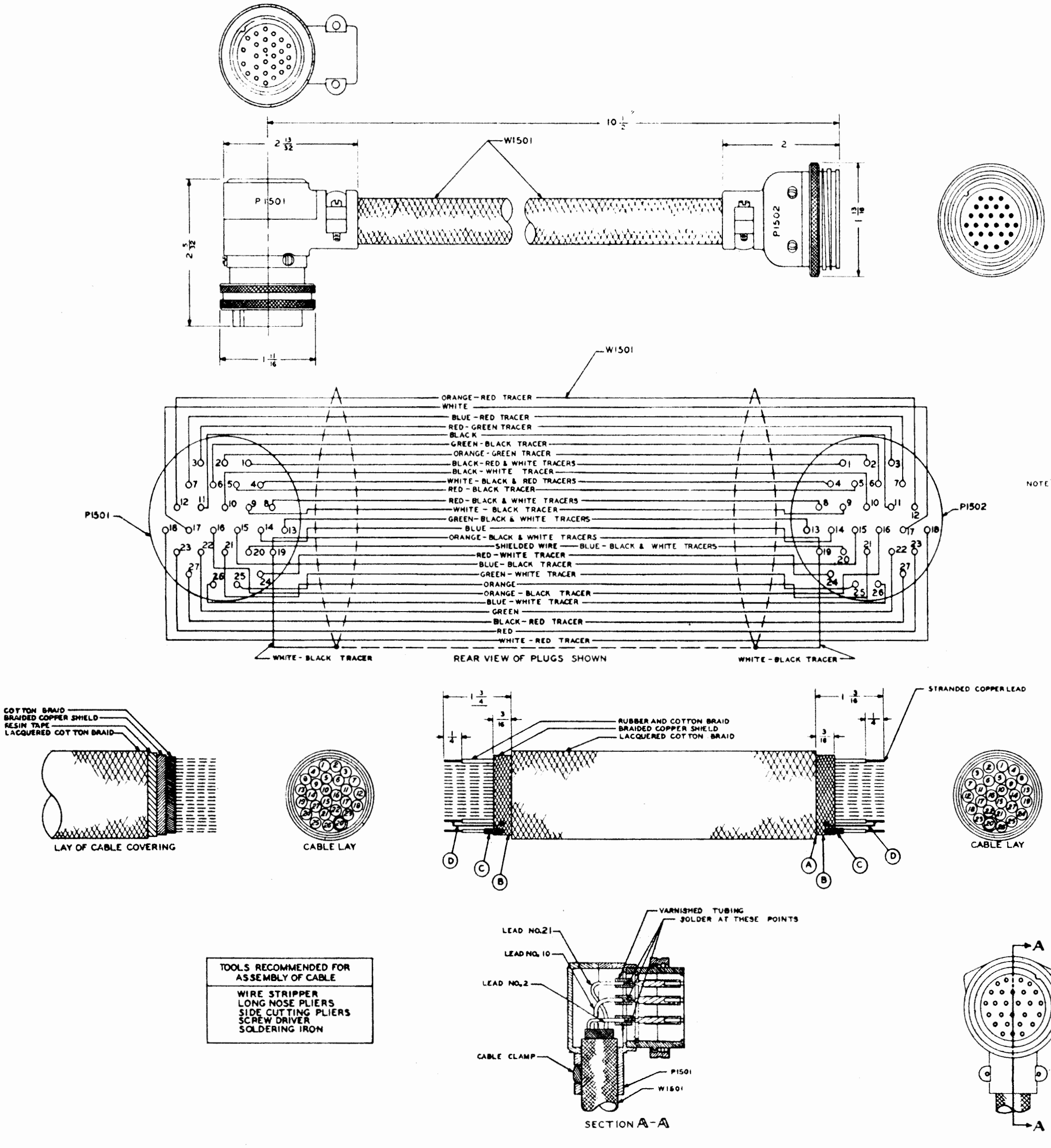


Fig. 84 Type COL-481628 Antenna Shunt Capacitor Installation Diagram (Dwg. No. 1370B)



NOTE ALL WIRES ARE OF THE SAME GUAGE. CONNECT PINS IN P1501 TO LIKE NUMBERED PINS IN P1502.

QTY.	ITEM NO.	DESCRIPTION	COLLINS PART NO.	MFG. PART NO.	MFG.
1	P1501	CONNECTOR PLUG-FEMALE	371 4060 00	NK-27-21-C11/16	10C
1	P1502	CONNECTOR PLUG-MALE	371 4049 00	RNK 27-22-C11/16	10C
.9	W1501	CABLE-27 CONDUCTOR FT.	424 2710 00		24B
1.1		.118 INSULATING SLEEVING FT.	152 1226 7610 00		
0.3		#22 HOOKUP WIRE -A90- FT.	440 0902 2902 00		

1. CUT THE CABLE TO THE PROPER LENGTH FOR THE INSTALLATION INVOLVED. ALLOW ENOUGH ADDITIONAL LENGTH SO THAT THE RADIUS OF ANY BEND IN THE CABLE IS NEVER LESS THAN 8 INCHES, AND THE CABLE IS NOT TIGHT ENOUGH TO INTERFERE WITH THE ACTION OF THE SHOCKMOUNTS, OR TO DAMAGE THE CONNECTIONS.
2. CHECK DRAWING FOR PROPER CABLE LAY.
3. FOR PLUG P1502, CUT THE LACQUERED COTTON BRAID AND RESIN TAPE 1-3/16 INCH FROM THE END OF THE CABLE. A
4. SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID; UNBRAID THE SHIELD AND CUT OFF THE LOOSE WIRES AND COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD. B
5. UNBRAID THE SHIELD ON #20 WIRE, TURN BACK AND SOLDER TO MAIN SHIELD. C
6. STRIP INSULATION 1/4 INCH BACK FROM ENDS OF WIRES.
7. ON WIRE #19 TWIST AND SOLDER A PIECE OF #22 WIRE, BRING BACK AND SOLDER TO MAIN SHIELD. D
8. TIN ENDS OF WIRES.
9. SLIP THE PLUG CAP AND LOCKING RING OVER CABLE.
10. SLIP A 1/2 INCH PIECE OF VARNISHED TUBING OVER EACH WIRE. USE VARNISHED TUBING WHICH GIVES A SNUG FIT.
11. SOLDER WIRES TO PLUG TERMINALS AND SLIP VARNISHED TUBING OVER THE CONNECTION.
12. WHEN ALL WIRES HAVE BEEN SOLDERED TO THE PLUG TERMINALS FASTEN THE PLUG CAP AND LOCKING RING OVER THE PLUG TERMINALS AND TIGHTEN THE CABLE CLAMP.
13. INSTRUCTIONS APPLY TO PLUG P1501 EXCEPT INSTRUCTIONS #3 SUBSTITUTE 1 3/4 INCHES IN #3
14. USE RESIN CORE SOLDER FOR ALL SOLDERED CONNECTIONS.
15. SYMBOL DESIGNATIONS AS SHOWN TO BE STAMPED ON PARTS, (NONE ON CABLE).

Fig. 85 65X-7 Control Cable Assembly Diagram
(Dwg. No. 500 1496 00D)

QTY.	ITEM NO.	DESCRIPTION	COLLINS PART NO.	MFG. PART NO.	MFG.
1	P1601	CONNECTOR PLUG-FEMALE	371 5140 00	FK-10-21-C 9/16	10C
1	P1602	CONNECTOR PLUG-MALE	371 5129 00	RFK-10-24-C 9/16	10C
0.9	W1601	CABLE-10 CONDUCTOR FT.	424 1010 00		248
0.7'	E	.018 INSULATING SLEEVING, FT.	152 1234/1610 00		
0.3'	D	#22 HOOK-UP WIRE -A9-. FT.	440 0901/2901 00		
0.2'	F	.166 INSULATING SLEEVING, FT.	152 1223/1640 00		

1. CUT THE CABLE TO THE PROPER LENGTH FOR THE INSTALLATION INVOLVED, ALLOW ENOUGH ADDITIONAL LENGTH SO THAT THE RADIUS OF ANY BEND IN THE CABLE IS NEVER LESS THAN 8 INCHES AND THE CABLE IS NOT TIGHT ENOUGH TO INTERFERE WITH THE ACTION OF THE SHOCKMOUNTS OR TO DAMAGE THE CONNECTORS.
2. CHECK DRAWING FOR PROPER CABLE LAY.
3. FOR PLUG P1601 CUT THE LACQUERED COTTON BRAID AND RESIN TAPE 1 3/16 INCH FROM THE END OF THE CABLE. (A)
4. SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID. UNBRAID THE SHIELD AND CUT OFF THE LOOSE WIRES AND THE COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD. (B)
5. STRIP INSULATION BACK 1/4 INCH FROM ENDS OF THE WIRES.
6. TWIST AND SOLDER A PIECE OF #22 WIRE TO #5 WIRE. BRING BACK AND SOLDER TO SHIELD. (C)
7. TIN ENDS OF WIRES, & SLIP SLEEVING (E) AND (F) OVER CONDUCTORS.
8. SLIP THE PLUG CAP AND LOCKING RING OVER CABLE.
9. SLIP A 1/2 INCH PIECE OF VARNISHED TUBING OVER EACH WIRE. USE VARNISHED TUBING WHICH GIVES A SNUG FIT.
10. SOLDER WIRES TO PLUG TERMINALS AND SLIP VARNISHED TUBING OVER THE CONNECTIONS.
11. WHEN ALL WIRES HAVE BEEN SOLDERED TO THE PLUG TERMINALS FASTEN THE PLUG CAP AND LOCKING RING OVER THE PLUG TERMINALS AND TIGHTEN THE CABLE CLAMP.
12. INSTRUCTIONS APPLY TO PLUG P1602 EXCEPT INSTRUCTION #3. SUBSTITUTE 1 3/8 INCH IN THIS INSTRUCTION.
13. USE RESIN CORE SOLDER ON ALL SOLDERED CONNECTIONS.
14. SYMBOL DESIGNATIONS AS SHOWN TO BE STAMPED ON PARTS (NONE ON CABLE).

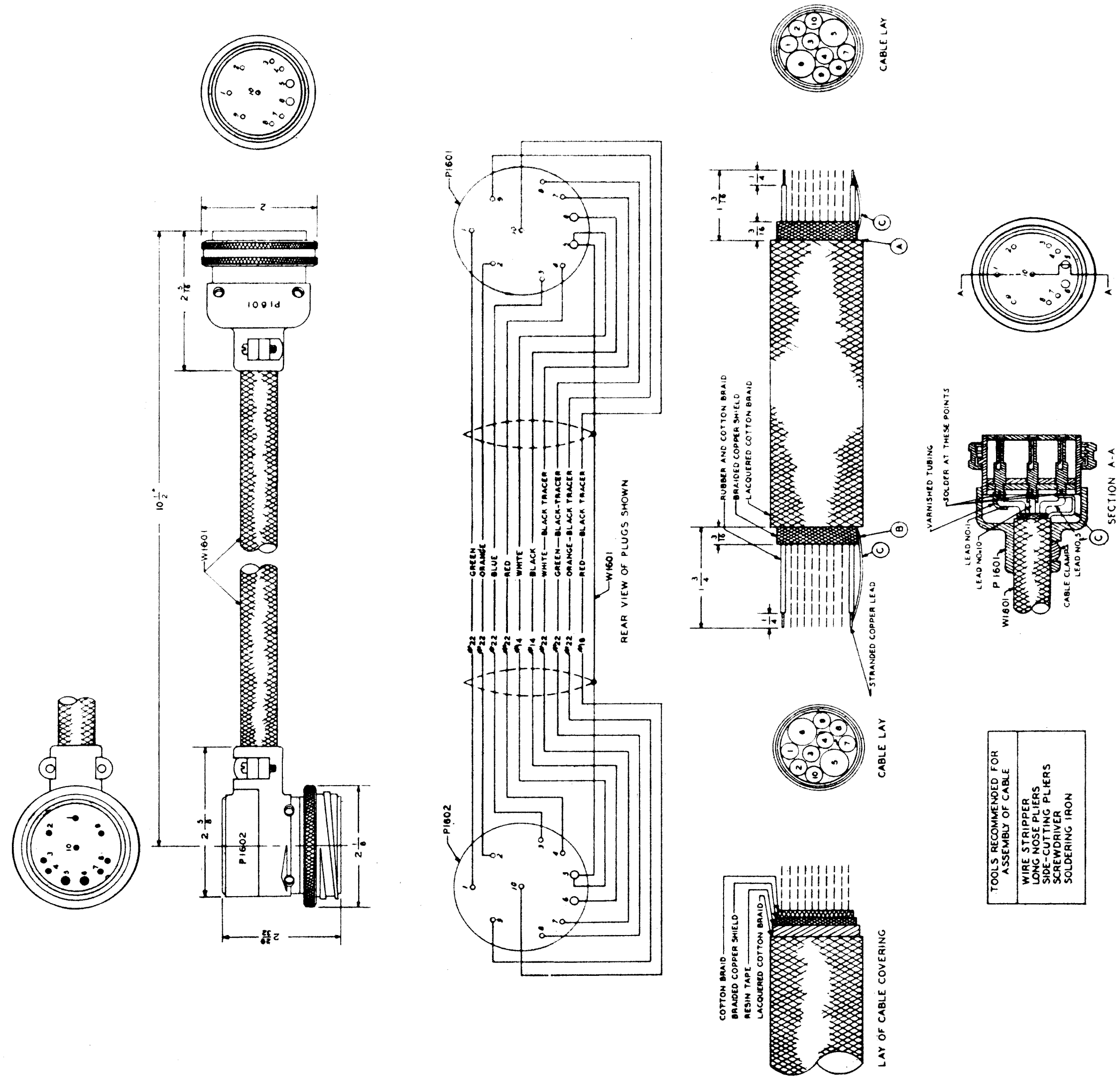
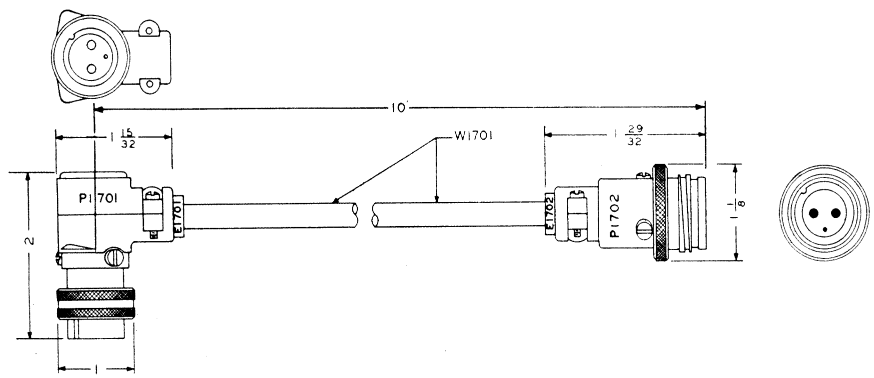
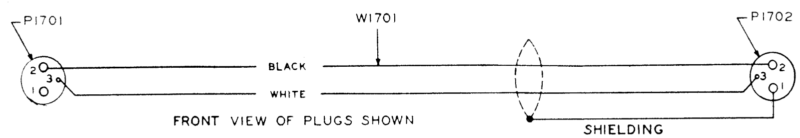


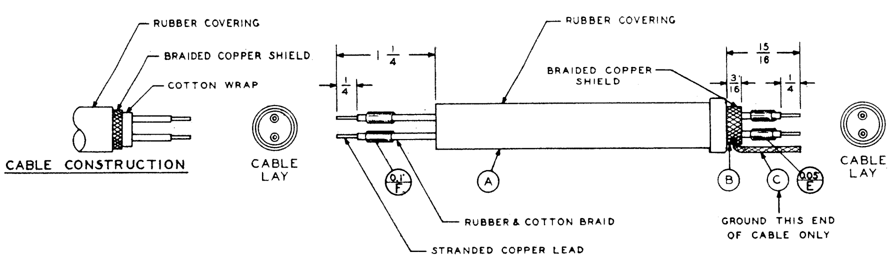
Fig. 86 65X-8 Power Cable Assembly Diagram
(Dwg. No. 500 1497 00D)



REQ'D	ITEM NO.	DESCRIPTION	COLLINS PART NUMBER	MFG PART NUMBER	MFG
1	P1701	CONNECTOR PLUG - FEMALE	371 1090 00	WK-C3-23C 7/16	10C
1	P1702	CONNECTOR PLUG - MALE	371 1109 00	RWK-C3-22C 7/16	10C
2	E1701-2	SPLIT REDUCER BUSHING	371 1110 00		10C
10.5	W1701	CABLE 2 CONDUCTOR FT.	425 0250 00	#8422	24B
0.1	E	.118 INSULATING SLEEVING FT.	152 1226 7610 00		
0.2	F	.166 INSULATING SLEEVING FT.	152 1223 7640 00		

1. CUT THE CABLE TO THE PROPER LENGTH. ALLOW ENOUGH ADDITIONAL LENGTH FOR STRIPPING BOTH ENDS OF WIRES.
2. CHECK DRAWING FOR PROPER CABLE LAY.
3. FOR PLUG P1702 CUT THE RUBBER COVERING 15/16 INCHES FROM THE END OF THE CABLE (A)
4. TURN BACK APPROXIMATELY 1/4 INCH OF THE RUBBER COVERING. SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE RUBBER COVERING; UNBRAID THE SHIELD AND TWIST. CUT OFF THE COTTON WRAP EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD (B)
5. STRIP INSULATION BACK 1/4 INCH FROM ENDS OF WIRES.
6. TIN ENDS OF WIRES, & SLIP SLEEVING (E) & (F) OVER CONDUCTORS.
7. TIN THE TWISTED SHIELD (C) 5/8 INCH FROM END AND SOLDER TO #1 PIN ON THE CONDUCTOR PLUG.
8. PUSH RUBBER COVERING BACK OVER SHIELDING.
9. SLIP THE PLUG CAP AND LOCKING RING OVER CABLE.
10. SOLDER WIRES TO PLUG TERMINALS.
11. FASTEN THE PLUG CAP AND LOCKING RING OVER THE PLUG TERMINALS AND TIGHTEN CABLE CLAMP
12. INSTRUCTIONS APPLY TO P1701, EXCEPT INSTRUCTIONS #4 #7 & #8 SUBSTITUTE 1 1/4 INCHES IN #3.
13. USE ROSIN CORE SOLDER FOR ALL SOLDERED CONNECTIONS.
14. SYMBOL DESIGNATIONS AS SHOWN TO BE STAMPED ON PARTS (NONE ON CABLE).





TOOLS RECOMMENDED FOR ASSEMBLY OF CABLE
WIRE STRIPPER LONG NOSE PLIERS SIDE-CUTTING PLIERS SCREWDRIVER SOLDERING IRON

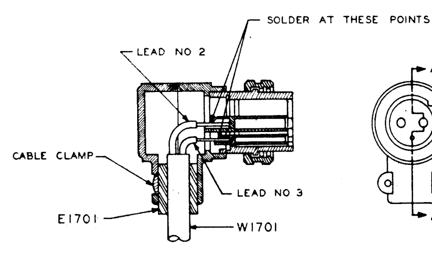
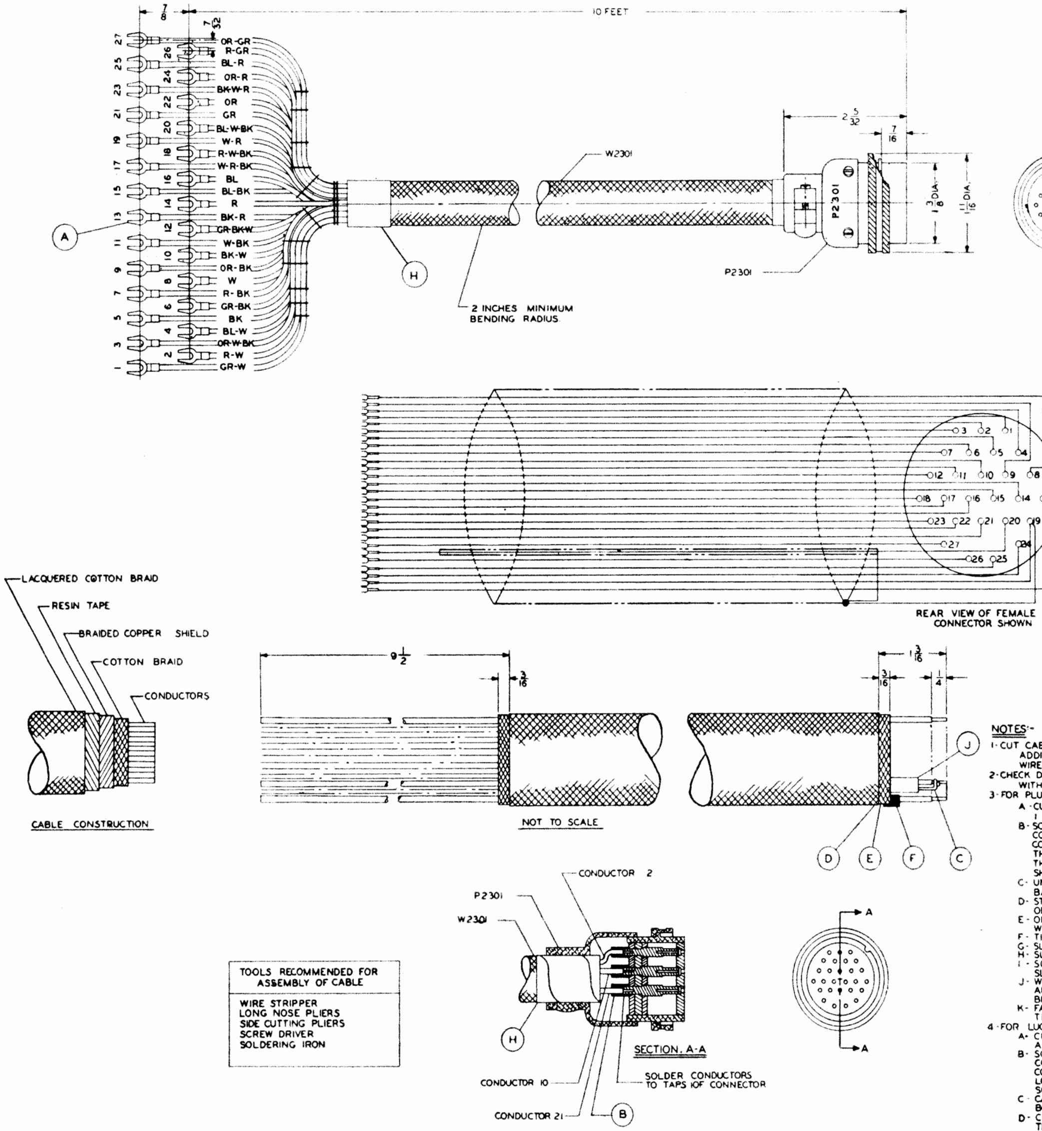


Fig. 87 65X-9 Antenna Loading Coil Cable Assembly Diagram (Dwg. No. 500 1498 00C)



REQ'D	ITEM NO	PART NAME		COLLINS PART NO.	MFG. PART NO.	MFG.
1	P2301	FEMALE CONNECTOR		371 4020 00	NK-27-21C 11/16	10C
10.5	W2301	CABLE -27 CONDUCTOR	FT.	424 2710 00		24B
27	A	SOLDER LUG		304 4900 00	WE134	2030
1.1	B	SLEEVING	FT.	152 1226 00		
.3	C	WIRE-22 A.W.G.	FT.	440 [illegible] 00		
.8	H	FRICTION TAPE	FT.	004 0175 00		
.1	J	SLEEVING	FT.	152 1223 00		

TERM. NO.	BASIC COLOR	1 ST. TRACER	2 ND. TRACER
1	GREEN	WHITE	
2	RED	WHITE	
3	ORANGE	WHITE	BLACK
4	BLUE	WHITE	
5	BLACK		
6	GREEN	BLACK	
7	RED	BLACK	
8	WHITE		
9	ORANGE	BLACK	
10	BLACK	WHITE	
11	WHITE	BLACK	
12	GREEN	BLACK	WHITE
13	BLACK	RED	
14	RED		
15	BLUE	BLACK	
16	BLUE		
17	WHITE	RED	BLACK
18	RED	WHITE	BLACK
19	WHITE	RED	
* 20	BLUE	WHITE	BLACK
21	GREEN		
22	ORANGE		
23	BLACK	WHITE	RED
24	ORANGE	RED	
25	BLUE	RED	
26	RED	GREEN	
27	ORANGE	GREEN	

* CONDUCTOR 20 IS SHIELDED

NOTES:-

1- CUT CABLE TO PROPER LENGTH ALLOWING ENOUGH ADDITIONAL LENGTH FOR STRIPPING BOTH ENDS OF WIRES.
2- CHECK DRAWING TO INSURE PROPER ASSEMBLY OF WIRES WITH THE TERMINALS ON THE PLUG.
3- FOR PLUG P2301:
   A- CUT THE LACQUERED COTTON BRAID & RESIN TAPE 1 3/16 INCHES FROM THE END OF THE CABLE (D)
   B- SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID, UNBRAID THE SHIELD AND CUT OFF THE LOOSE WIRES & COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD. (E)
   C- UNBRAID THE SHIELD (F) ON CONDUCTOR 20. TURN BACK AND SOLDER TO MAIN SHIELD. (E)
   D- STRIP INSULATION 1/4 INCH BACK FROM THE ENDS OF THE CONDUCTORS.
   E- ON CONDUCTOR 19 TWIST & SOLDER ONE END OF WIRE (C) BRING BACK AND SOLDER TO MAIN SHIELD.
   F- TIN ENDS OF CONDUCTORS.
   G- SLIP THE PLUG CAP & LOCKING RING OVER CABLE.
   H- SLIP SLEEVING (B) (J) 1/2 IN. LG. OVER EACH CONDUCTOR.
   I- SOLDER CONDUCTORS TO PLUG TERMINALS AND SLIP SLEEVING OVER CONNECTION.
   J- WRAP APPROXIMATELY 2 TURNS OF FRICTION TAPE (H) AROUND THE END OF THE LACQUERED COTTON BRAID & COPPER SHIELDING.
   K- FASTEN THE PLUG CAP & LOCKING RING OVER PLUG TERMINALS AND TIGHTEN CABLE CLAMP.
4- FOR LUG END OF CABLE:
   A- CUT THE LACQUERED COTTON BRAID & RESIN TAPE AS SHOWN FROM END OF CABLE.
   B- SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID UNBRAID THE SHIELD AND CUT OFF LOOSE WIRES & COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD.
   C- CABLE & CUT WIRES TO LENGTH PER TERMINAL BOARD 1545B AS SHOWN.
   D- CLAMP THE SOLDER LUGS (A) OVER THE ENDS OF THE CONDUCTORS & INSULATION AND SOLDER.
   E- WRAP APPROXIMATELY 2 TURNS OF FRICTION TAPE (H) AROUND THE END OF LACQUERED COTTON BRAID & COPPER SHIELDING.
5- ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.
6- SYMBOL DESIGNATION AS SHOWN TO BE STAMPED ON PLUG, (NONE ON CABLE).

Fig. 88 65X-10 Remote Cable (Dwg. No. 500 4474 00D)

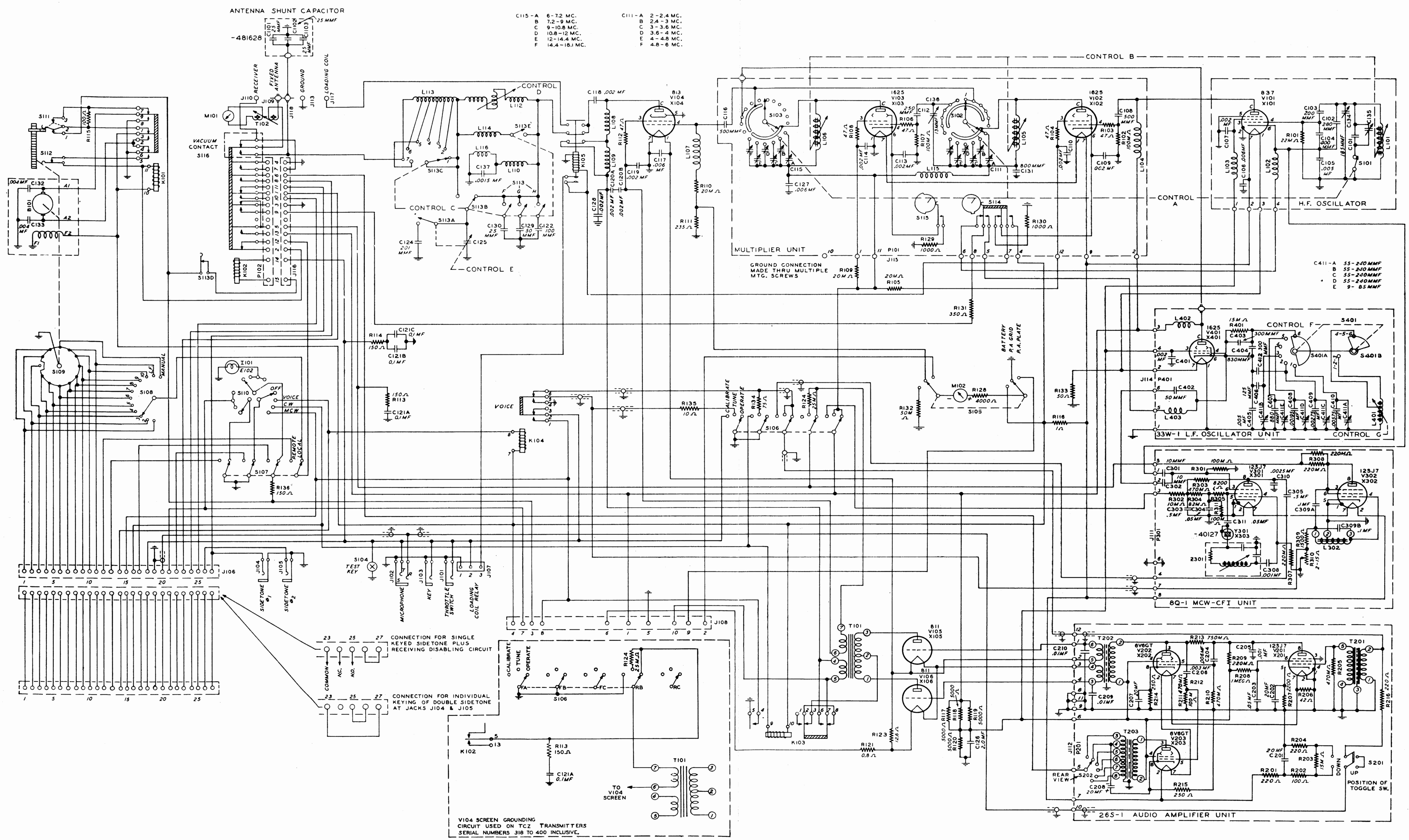


Fig. 89 Type COL–52286 Radio Transmitter Schematic
(Dwg. No. 500 1461 00E)

Fig. 89 Type COL–52286 Radio Transmitter Schematic
(Dwg. No. 500 1461 00E)

FIG. 89 TYPE COL-52286 RADIO TRANSMITTER SCHEMATIC (Dwg. No. 500 1461 00E)

Fig. 90 Type COL–211101 Motor-Generator-Rectifier Power Unit Schematic (Dwg. No. K1081C)

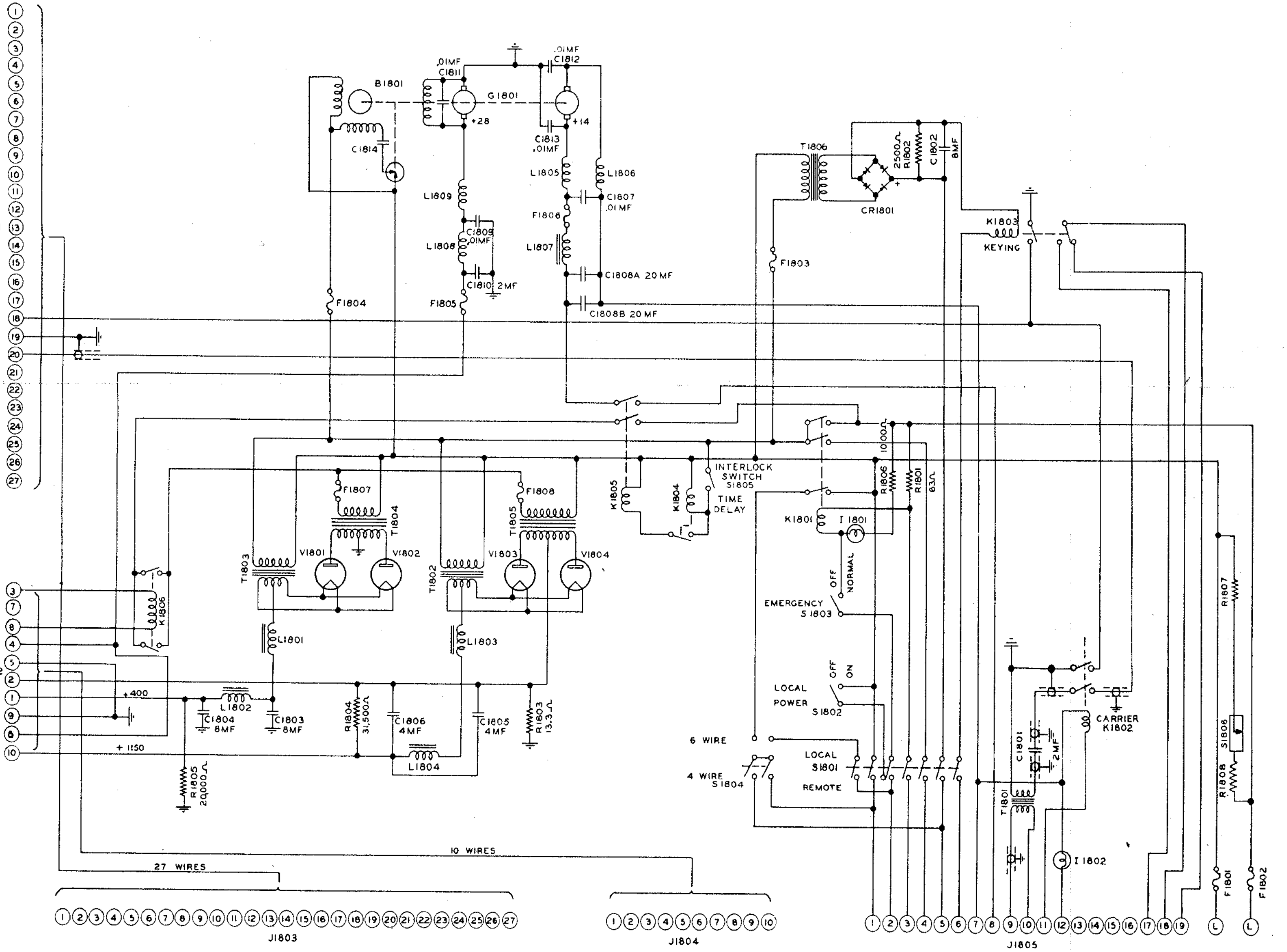


Fig. 90 Type COL–211101 Motor-Generator-Rectifier Power Unit Schematic (Dwg. No. K1081C)

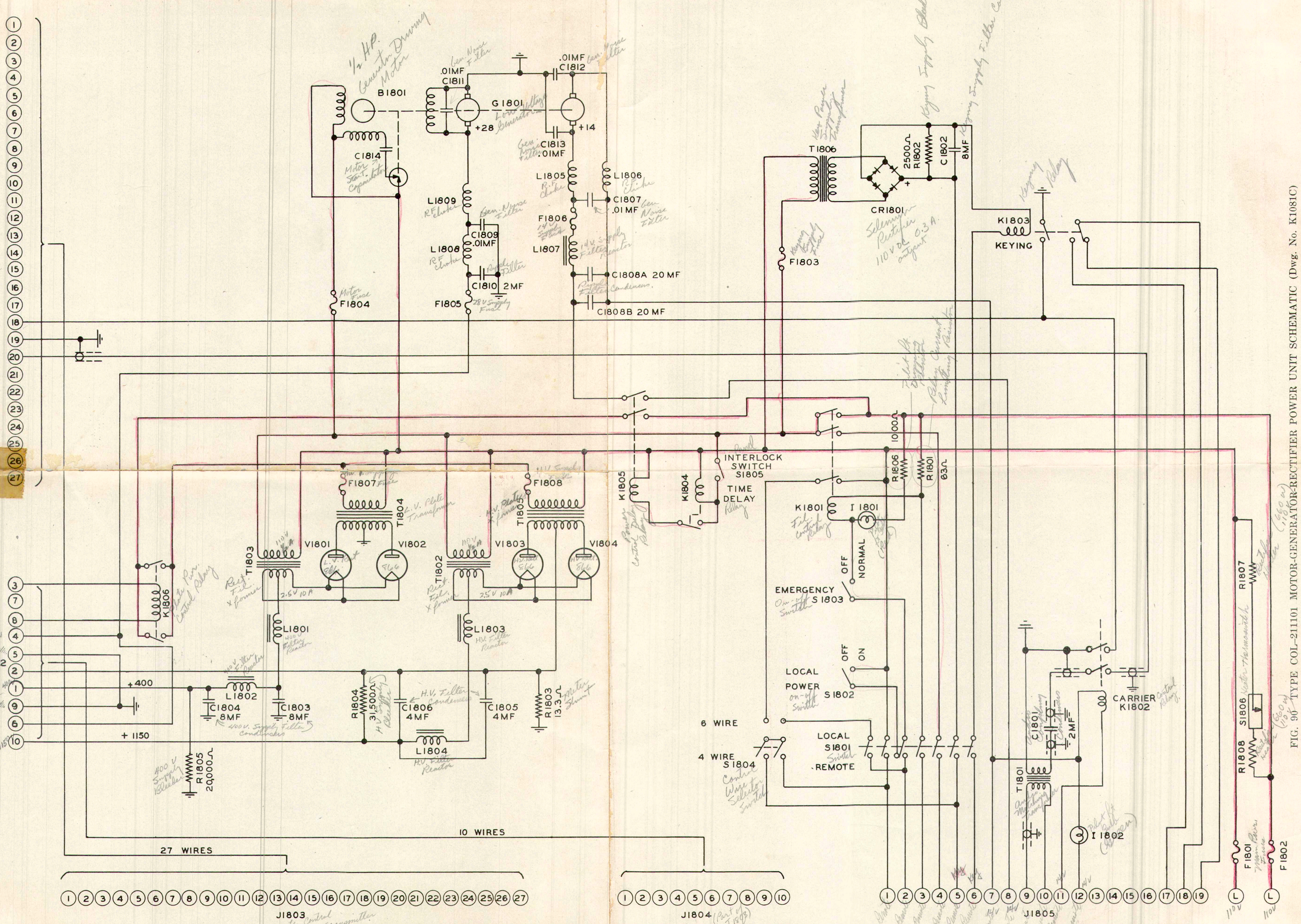


FIG. 90 TYPE COL–211101 MOTOR-GENERATOR-RECTIFIER POWER UNIT SCHEMATIC (Dwg. No. K1081C)

FIG. 90 TYPE COL–211101 MOTOR-GENERATOR-RECTIFIER POWER UNIT SCHEMATIC (Dwg. No. K1081C)

Fig. 91 Type COL–211102 Dynamotor Assembly Schematic
(Dwg. No. K1083C)

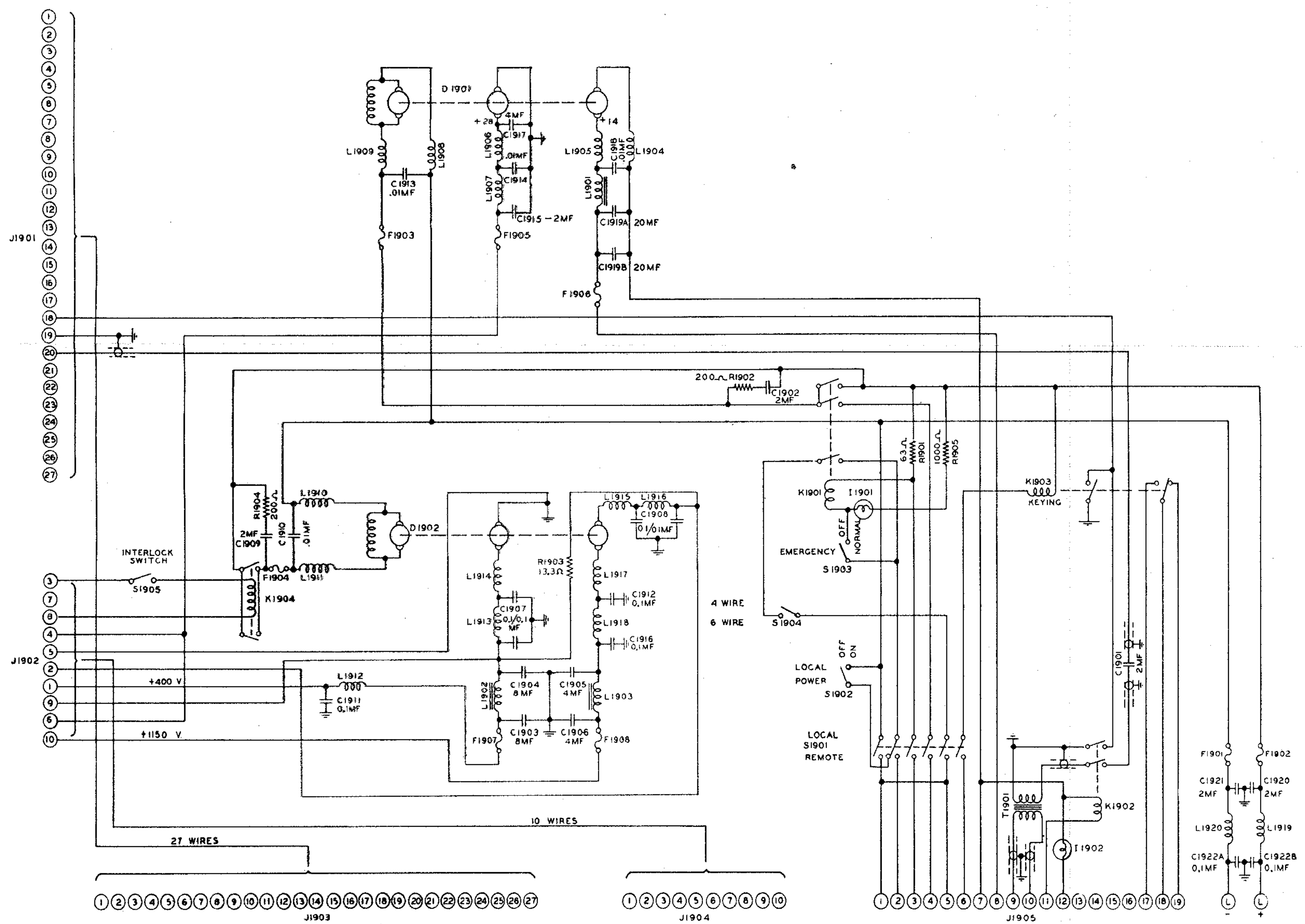


Fig. 91 Type COL–211102 Dynamotor Assembly Schematic
(Dwg. No. K1083C)

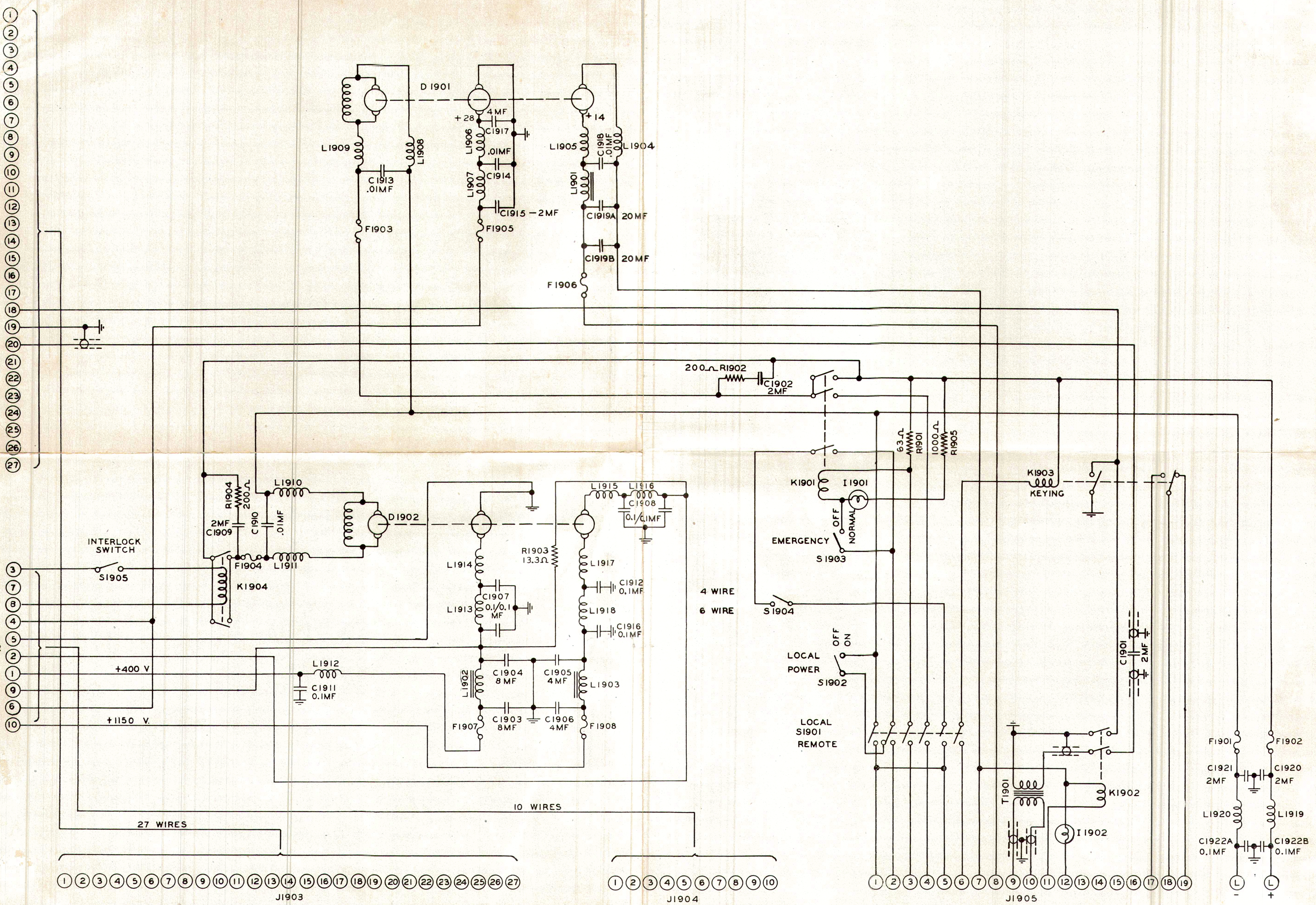


FIG. 91 TYPE COL-211102 DYNAMOTOR ASSEMBLY SCHEMATIC (Dwg. No. K1083C)

FIG. 91 TYPE COL-211102 DYNAMOTOR ASSEMBLY SCHEMATIC (Dwg. No. K1083C)

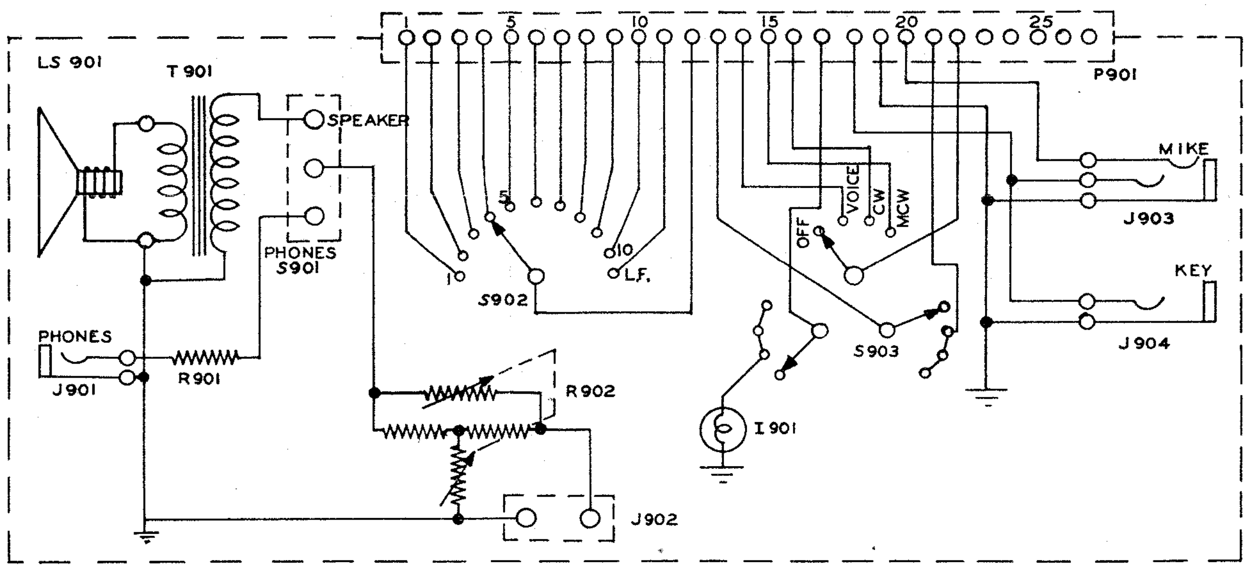


Fig. 92 Type COL–23410 Remote Control Unit Schematic
(Dwg. No. K1267A)

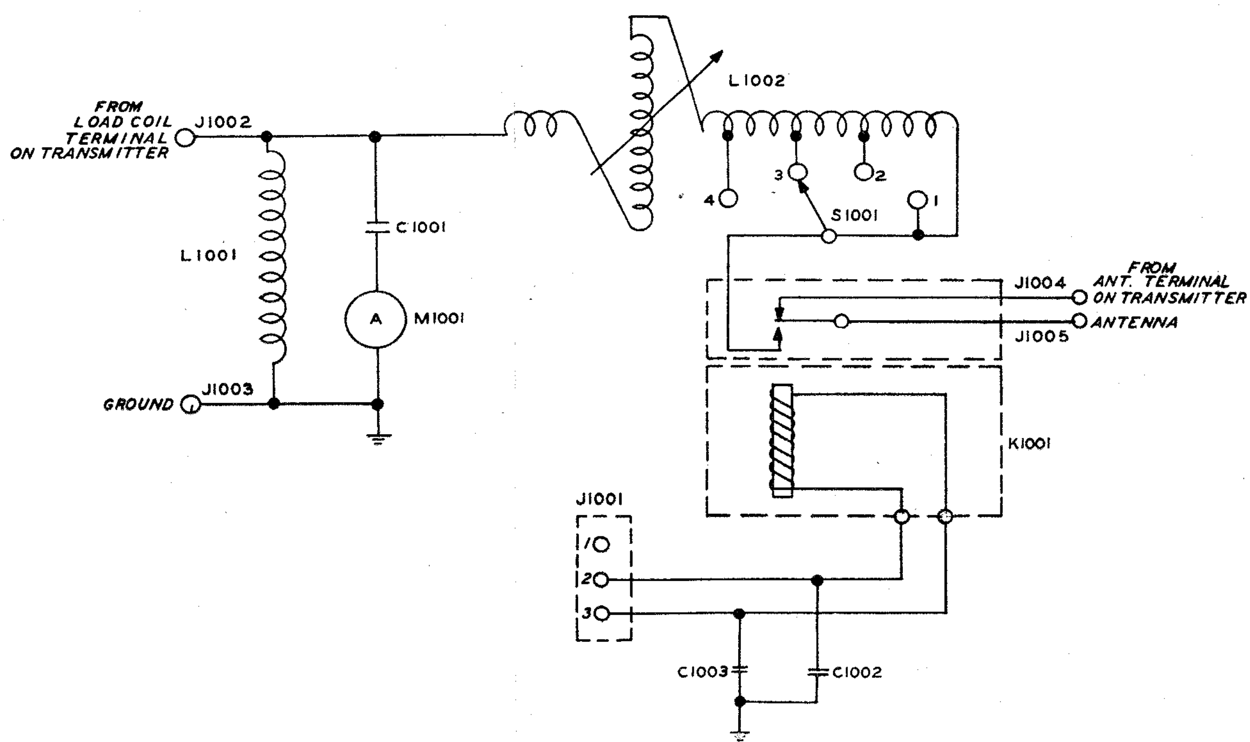


Fig. 93 Type COL–47370 Antenna Loading Coil Schematic
(Dwg. No. K1432A)

Fig. 92 Type COL–23410 Remote Control Unit Schematic
(Dwg. No. K1267A)
Fig. 93 Type COL–47370 Antenna Loading Coil Schematic
(Dwg. No. K1432A)

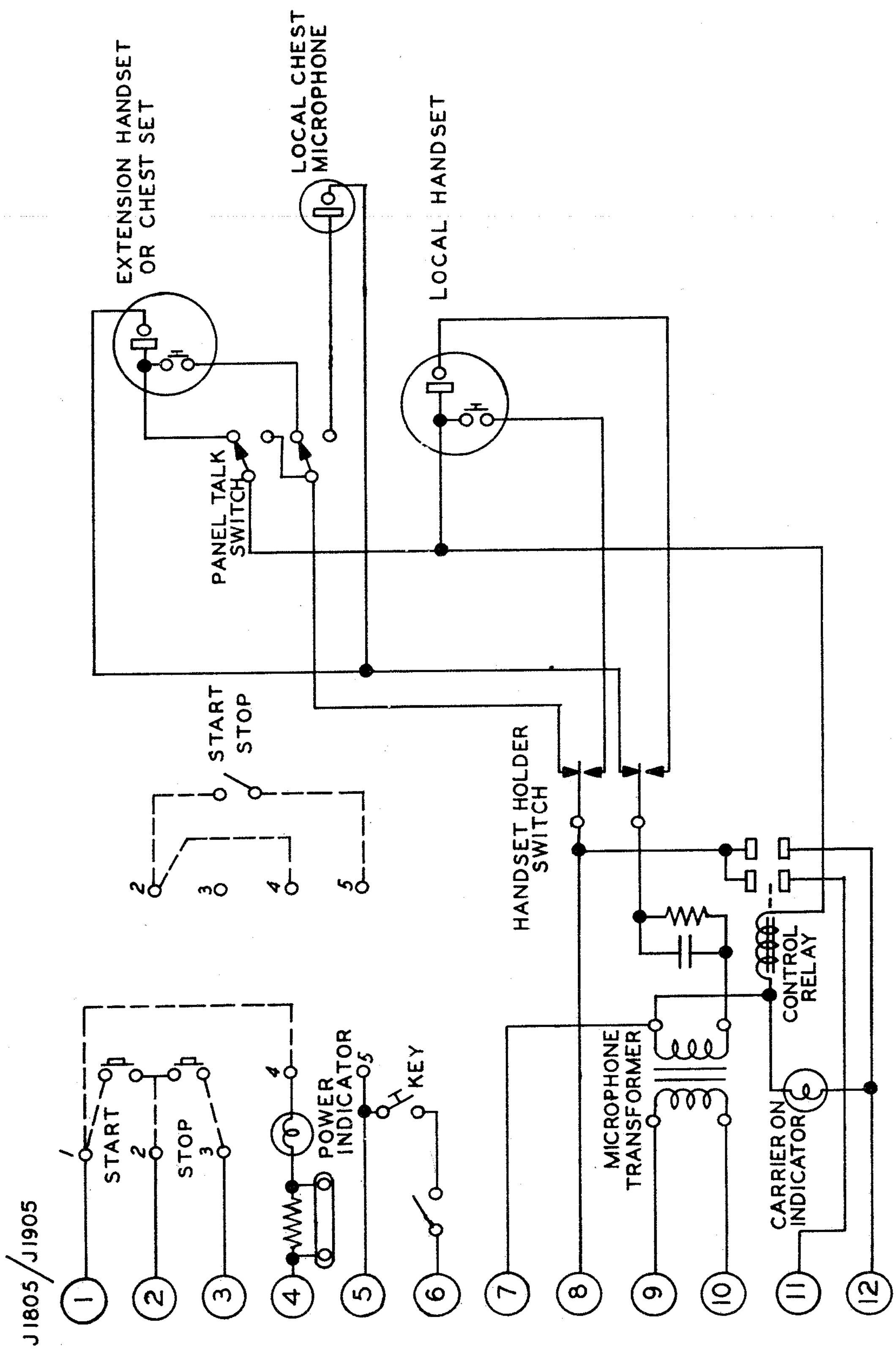


Fig. 94 Applicable External Microphone and Control Circuits
(Dwg. No. 500 1455 00A)

The connection from S106RB to R137 is grounded and R137 is not present in transmitters with serial numbers lower than 2300.

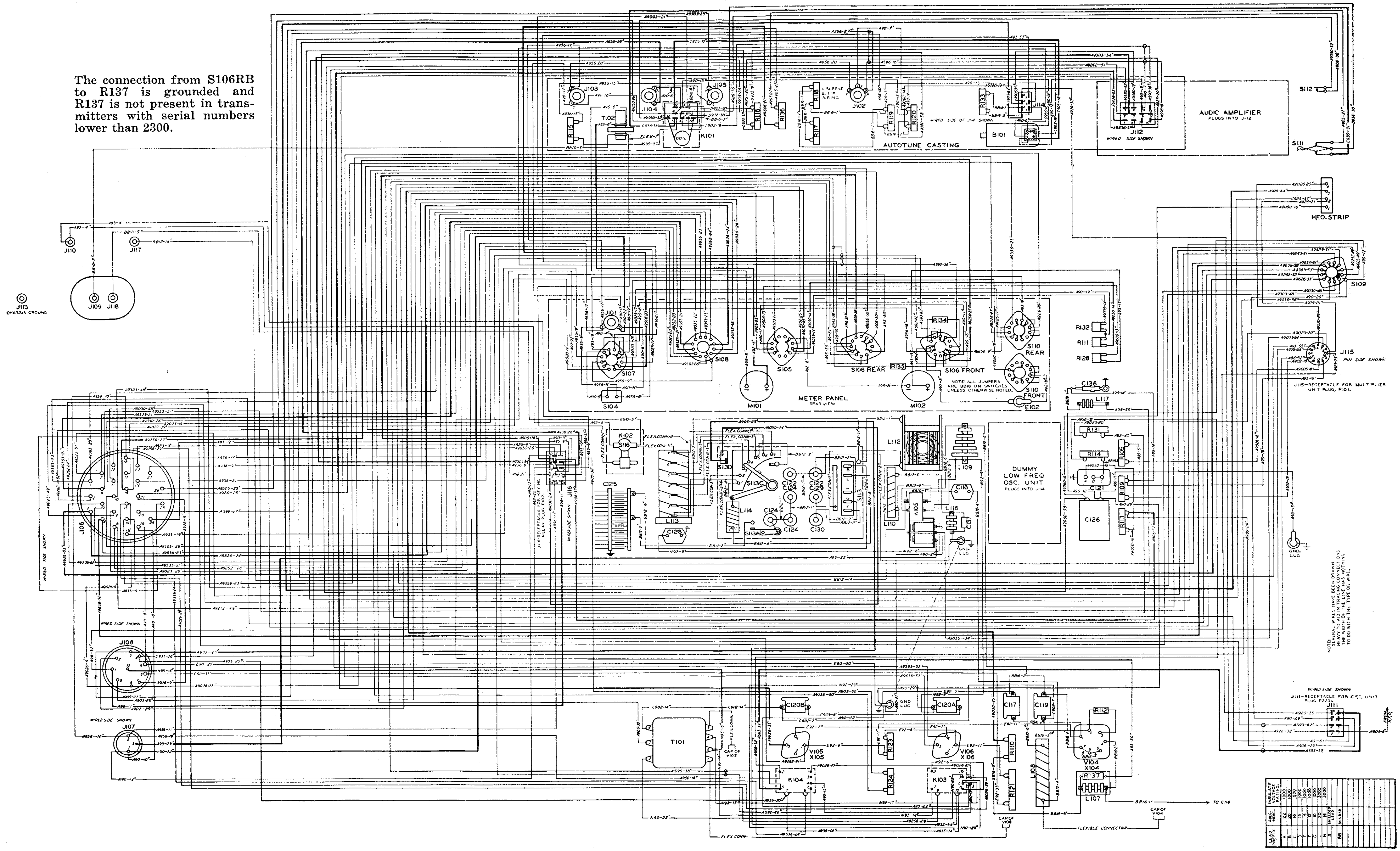


Fig. 95 Type COL–52286 Radio Transmitter Practical Wiring Diagram (Dwg. No. 502 0805 006)

Fig. 95 Type COL–52286 Radio Transmitter Practical Wiring Diagram (Dwg. No. 502 0805 006)

The connection from S106RB to R137 is grounded and R137 is not present in transmitters with serial numbers lower than 2300.

LEAD PREFIX	A.W.G. INDIC.	INSULATE VOLTAGE RATING.
A	22	1000
B	20	1000
C	18	1000
D	16	1000
E	14	1000
F	12	1000
G	10	1000
L	20	3000
N	16	3000
S	SHIELDED LEAD	
BB	BUS BAR	

FIG. 95 TYPE COL–52286 RADIO TRANSMITTER PRACTICAL WIRING DIAGRAM (Dwg. No. 502 0805 006)

FIG. 95 TYPE COL–52286 RADIO TRANSMITTER PRACTICAL WIRING DIAGRAM (Dwg. No. 502 0805 006)

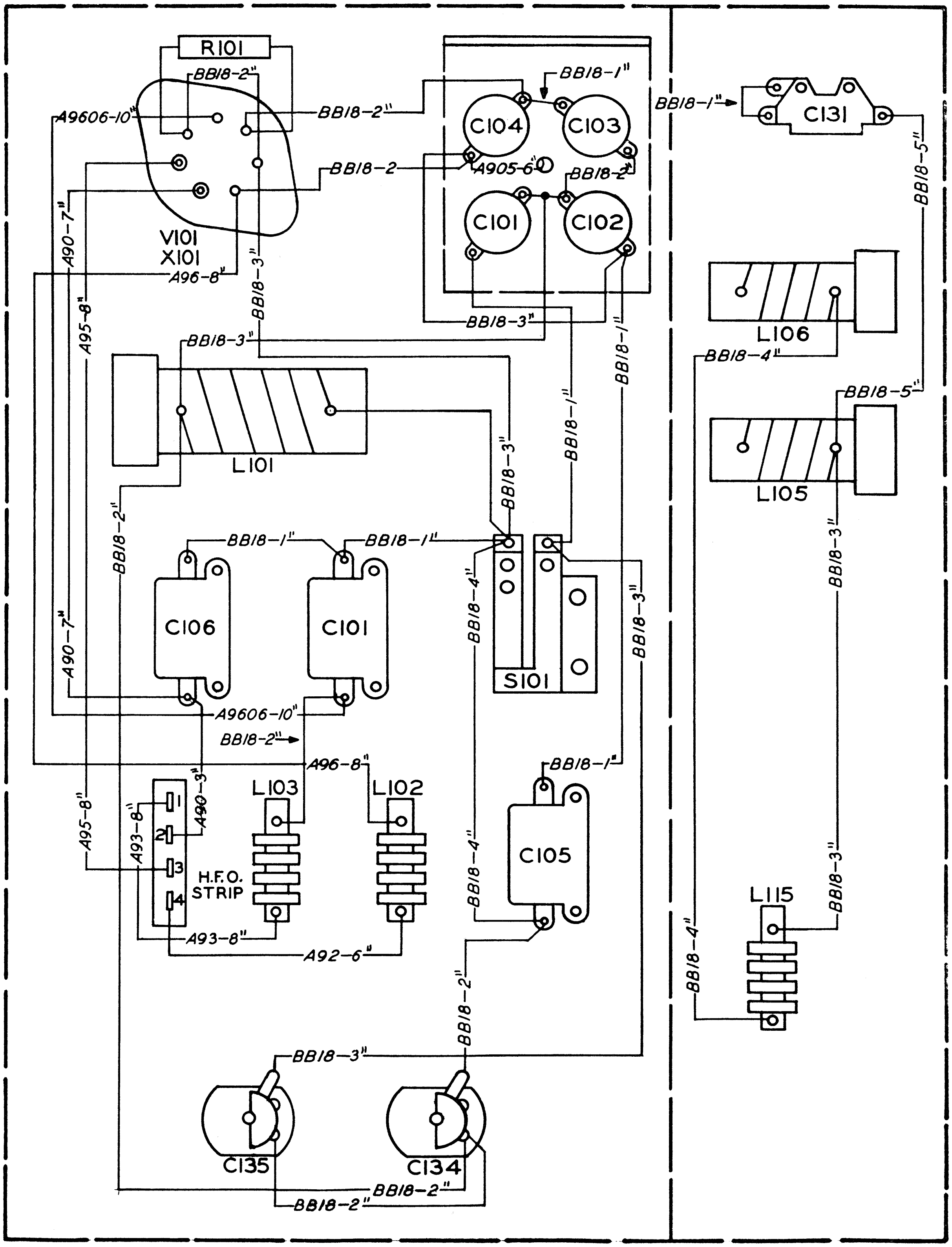


Fig. 96 High Frequency Oscillator Practical Wiring Diagram
(Dwg. No. 502 0804 003)

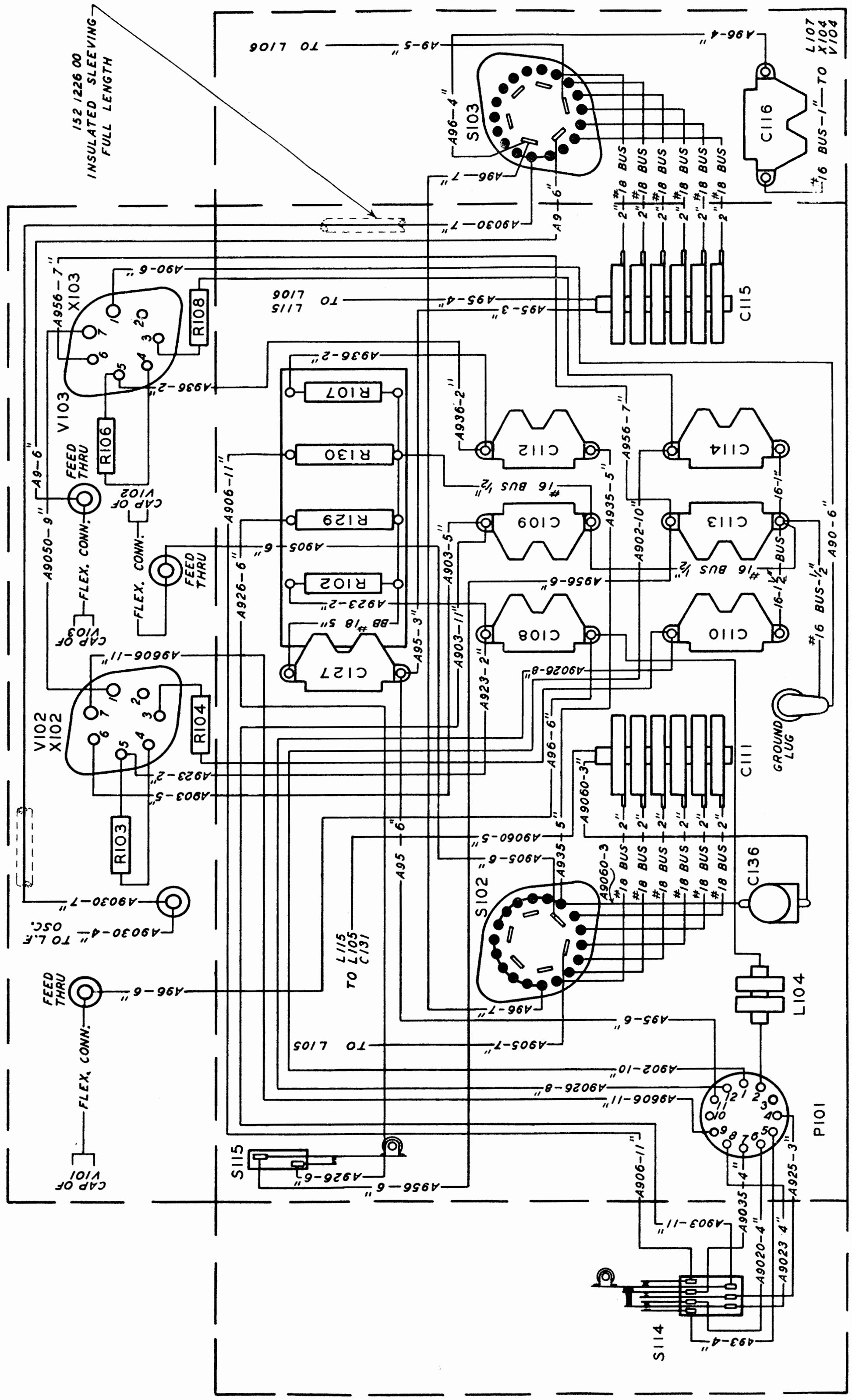


Fig. 97 Multiplier Practical Wiring Diagram
(Dwg. No. K1572C)

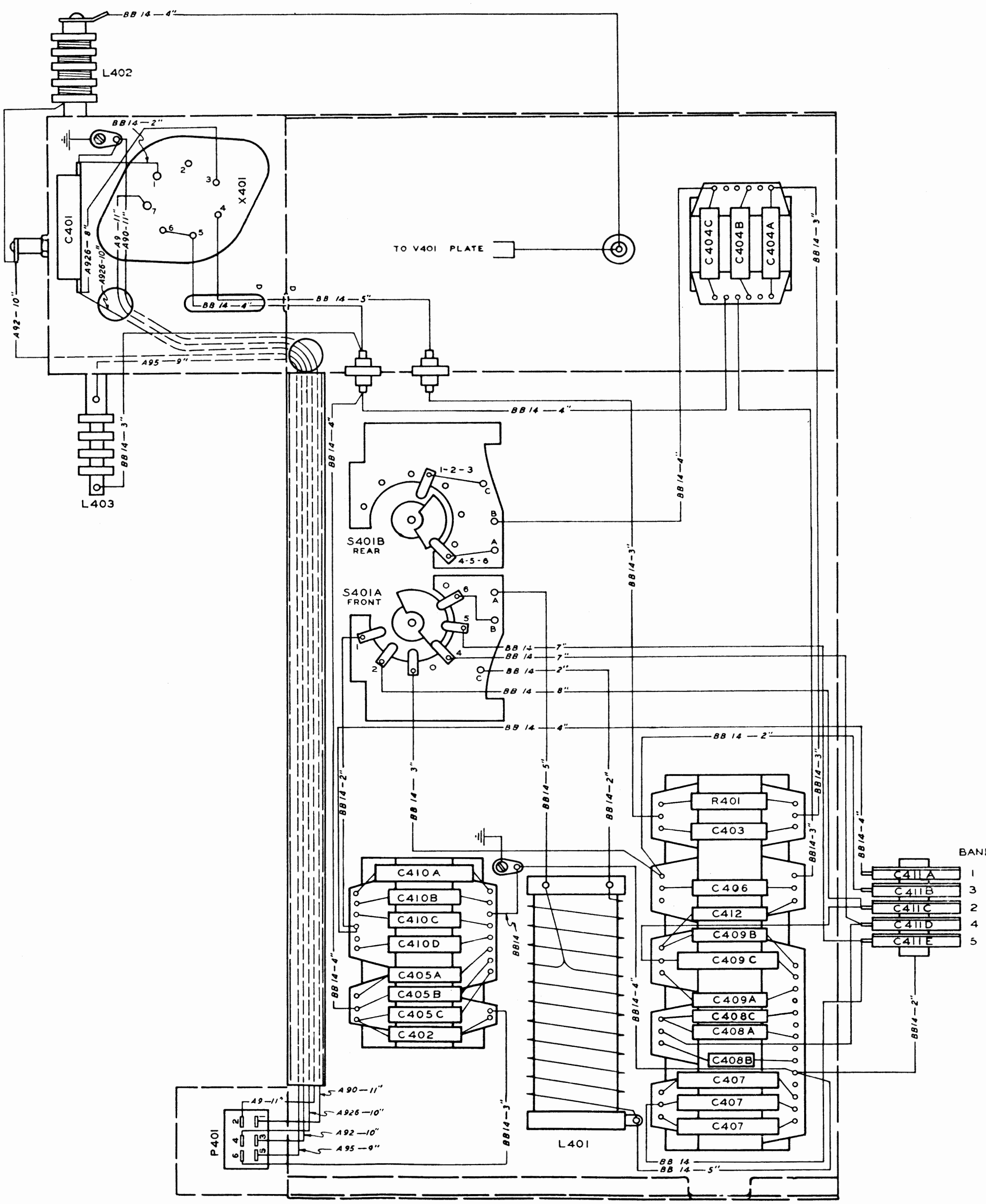


Fig. 98 Low Frequency Oscillator Practical Wiring Diagram
(Dwg. No. K1146C)

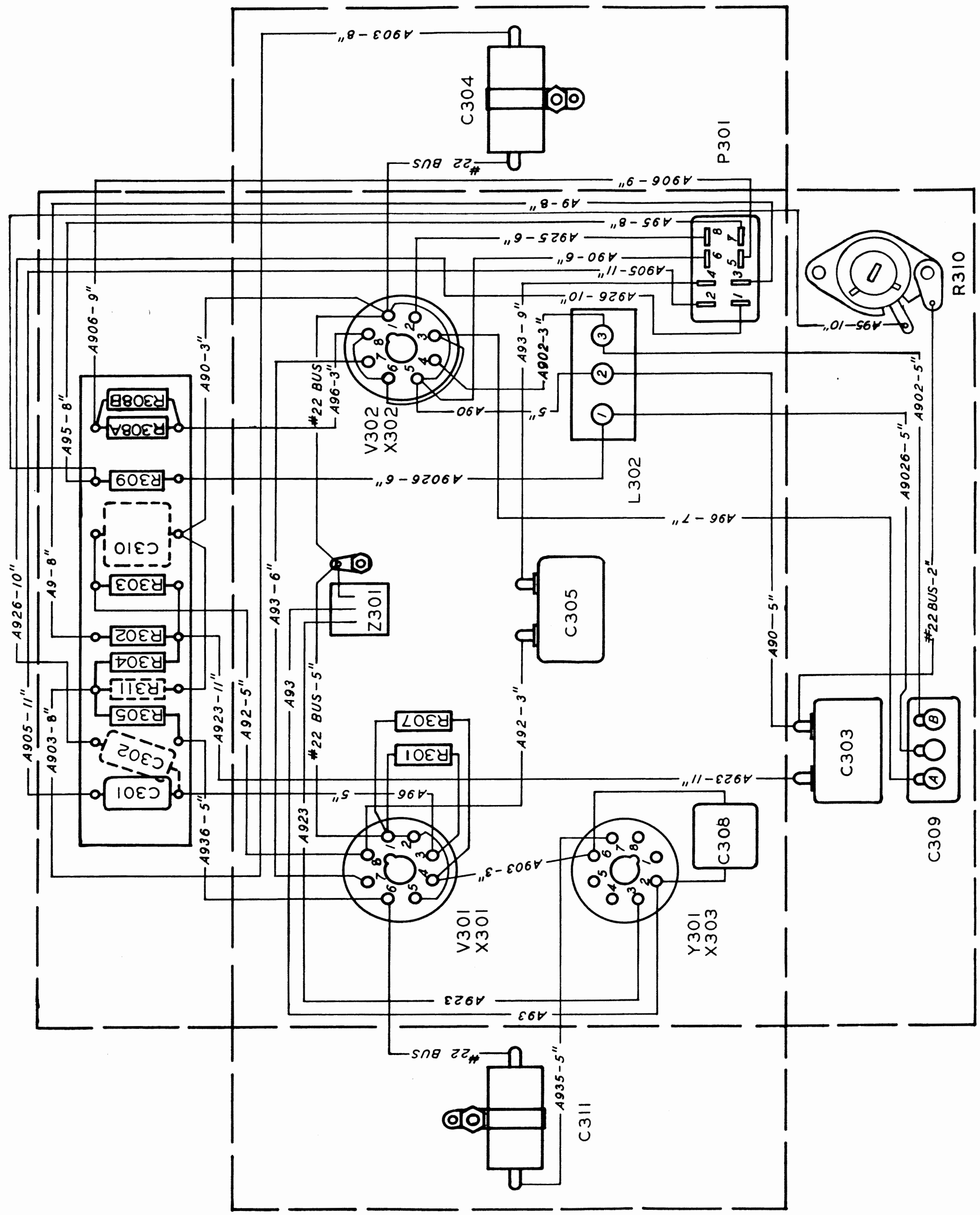


Fig. 99 MCW-CFI Unit Practical Wiring Diagram
(Dwg. No. K1496B)

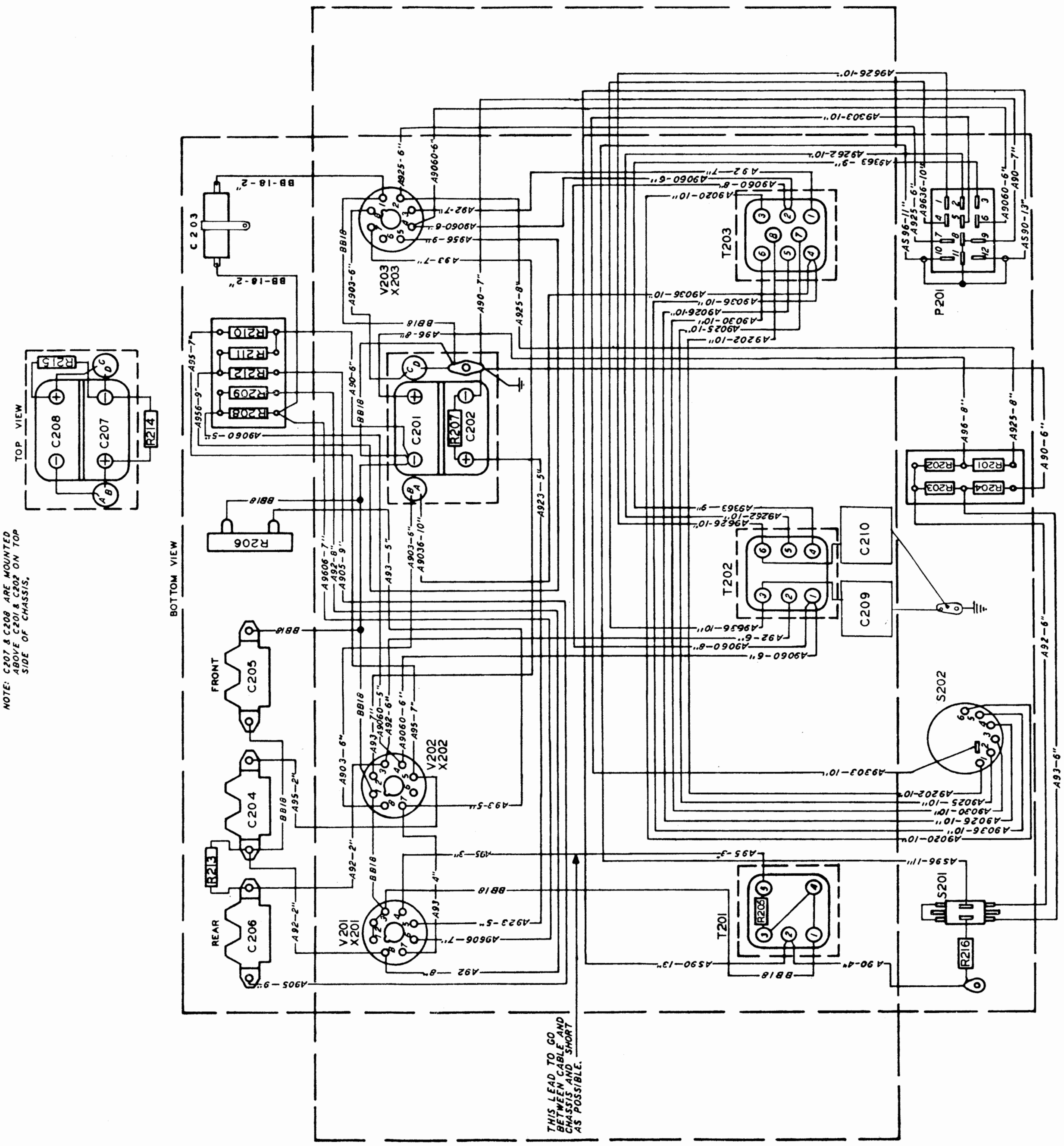
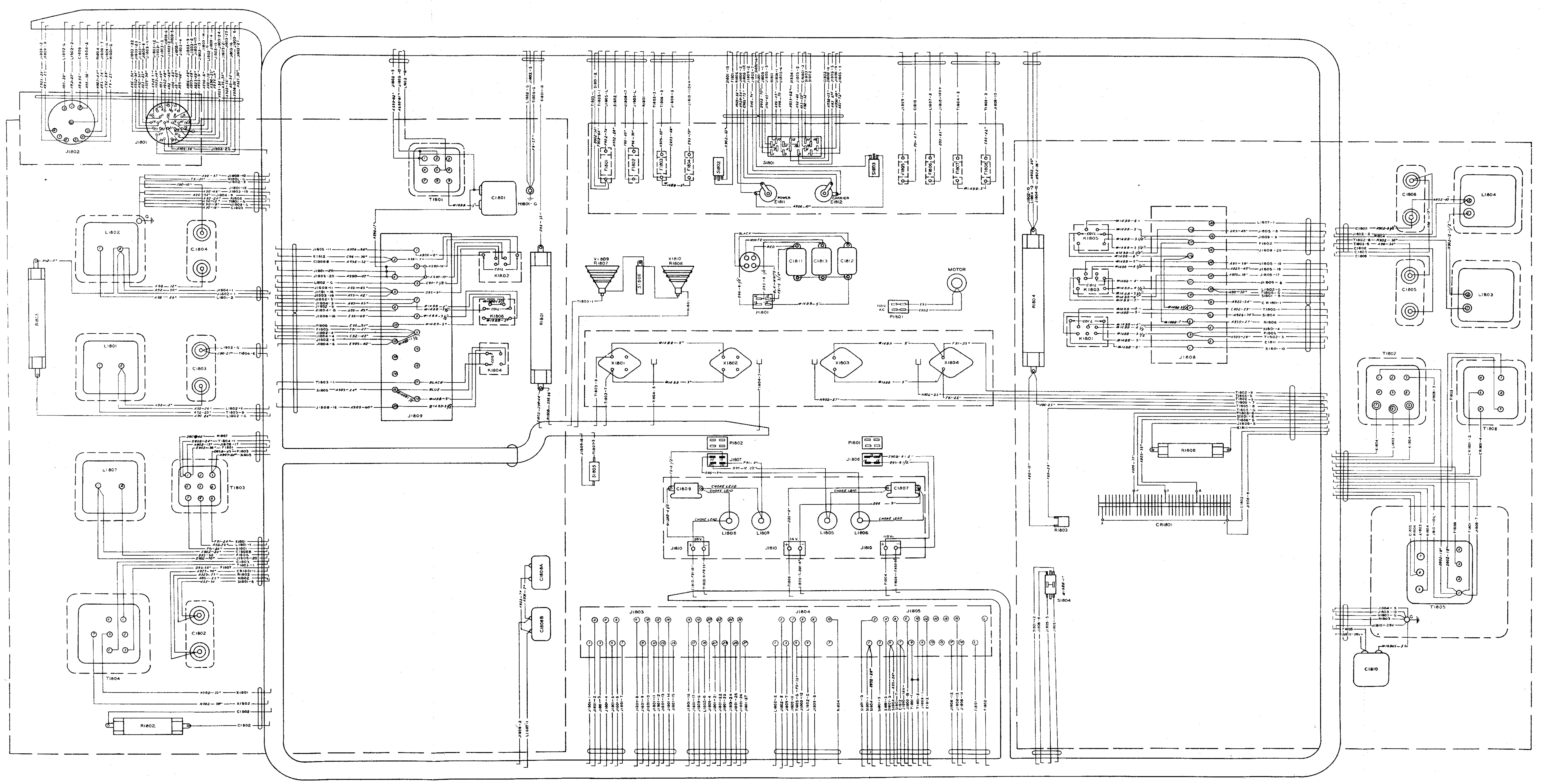


Fig. 100 Audio Amplifier Practical Wiring Diagram
(Dwg. No. K1111C)



500	ITEM NO.	PART NUMBER	PRINT NO. PART NAME
3.5		152 7610 00	INSULATED SLEEVING FT.
7.4		152 7640 00	INSULATED SLEEVING FT.
8.5		152 7670 00	INSULATED SLEEVING FT.
2		152 7760 00	INSULATED SLEEVING FT.
7		304 1500 00	HEAVY 1/8 SOLDER LUG
97		304 1800 00	LIGHT 3/16 SOLDER LUG
21		304 2000 00	HEAVY 3/16 SOLDER LUG
44		304 5200 00	SPADE SOLDER LUG
14.3	BB14	421 1420 00	#14 SINGLE CONDUCTOR MAG. WIRE FT.
1.0	BB18	421 1820 00	#18 SINGLE CONDUCTOR MAG. WIRE FT.
11.3	F9	440 0401 00	#12 ROCKBESTOS WIRE FT.
12.2	F91	440 0403 00	#12 ROCKBESTOS WIRE FT.
9.6	F96	440 0408 00	#12 ROCKBESTOS WIRE FT.
11.5	F902	440 0409 00	#12 ROCKBESTOS WIRE FT.
10.6	E93	440 0505 00	#14 ROCKBESTOS WIRE FT.
7.8	E95	440 0507 00	#14 ROCKBESTOS WIRE FT.
3.0	E902	440 0509 00	#14 ROCKBESTOS WIRE FT.
7.5	E903	440 0510 00	#14 ROCKBESTOS WIRE FT.
5.5	D93	440 0605 00	#16 ROCKBESTOS WIRE FT.
14.8	D95	440 0607 00	#16 ROCKBESTOS WIRE FT.
21.8	D96	440 0608 00	#16 ROCKBESTOS WIRE FT.
23.0	D902	440 0609 00	#16 ROCKBESTOS WIRE FT.
3.6	D936	440 0617 00	#16 ROCKBESTOS WIRE FT.
2.1	C90	440 0702 00	#18 ROCKBESTOS WIRE FT.
5.8	C92	440 0704 00	#18 ROCKBESTOS WIRE FT.
3.2	C96	440 0709 00	#18 ROCKBESTOS WIRE FT.
2.4	C902	440 0709 00	#18 ROCKBESTOS WIRE FT.
6.3	C903	440 0710 00	#18 ROCKBESTOS WIRE FT.
8.5	A9	440 0901 00	#22 ROCKBESTOS WIRE FT.
20.3	A902	440 0907 00	#22 ROCKBESTOS WIRE FT.
22.3	A903	440 0912 00	#22 ROCKBESTOS WIRE FT.
24.3	A905	440 0916 00	#22 ROCKBESTOS WIRE FT.
19.1	A908	440 0918 00	#22 ROCKBESTOS WIRE FT.
30.8	A90	440 0902 00	#22 ROCKBESTOS WIRE FT.
34.3	A92	440 0903 00	#22 ROCKBESTOS WIRE FT.
26.4	A93	440 0904 00	#22 ROCKBESTOS WIRE FT.
35.8	A95	440 0905 00	#22 ROCKBESTOS WIRE FT.
35.0	A96	440 0906 00	#22 ROCKBESTOS WIRE FT.
20.9	A923	440 0921 00	#22 ROCKBESTOS WIRE FT.
12.2	A925	440 0922 00	#22 ROCKBESTOS WIRE FT.
12.4	A928	440 0925 00	#22 ROCKBESTOS WIRE FT.
11.7	A935	440 0929 00	#22 ROCKBESTOS WIRE FT.
10.8	A936	440 0932 00	#22 ROCKBESTOS WIRE FT.
8.0	A958	440 0937 00	#22 ROCKBESTOS WIRE FT.
22.1	AS90	443 2229 00	#22 SHIELDED ROCKBESTOS WIRE FT.
23.0	N902	447 1690 20	#16 ROCKBESTOS WIRE FT.

LEAD PREFIX	AWG INDIC.	INSULATION VOLT RATE
A	22	1000
B	20	1000
C	18	1000
D	16	1000
E	14	1000
F	12	1000
J	6	1000
L	20	3000
N	16	3000
-S	SHIELDED LEAD	
BB	BUS BAR	

Fig. 101 Type COL–211101 Motor-Generator-Rectifier Power Unit Practical Wiring Diagram (Dwg. No. 500 4446 00F)

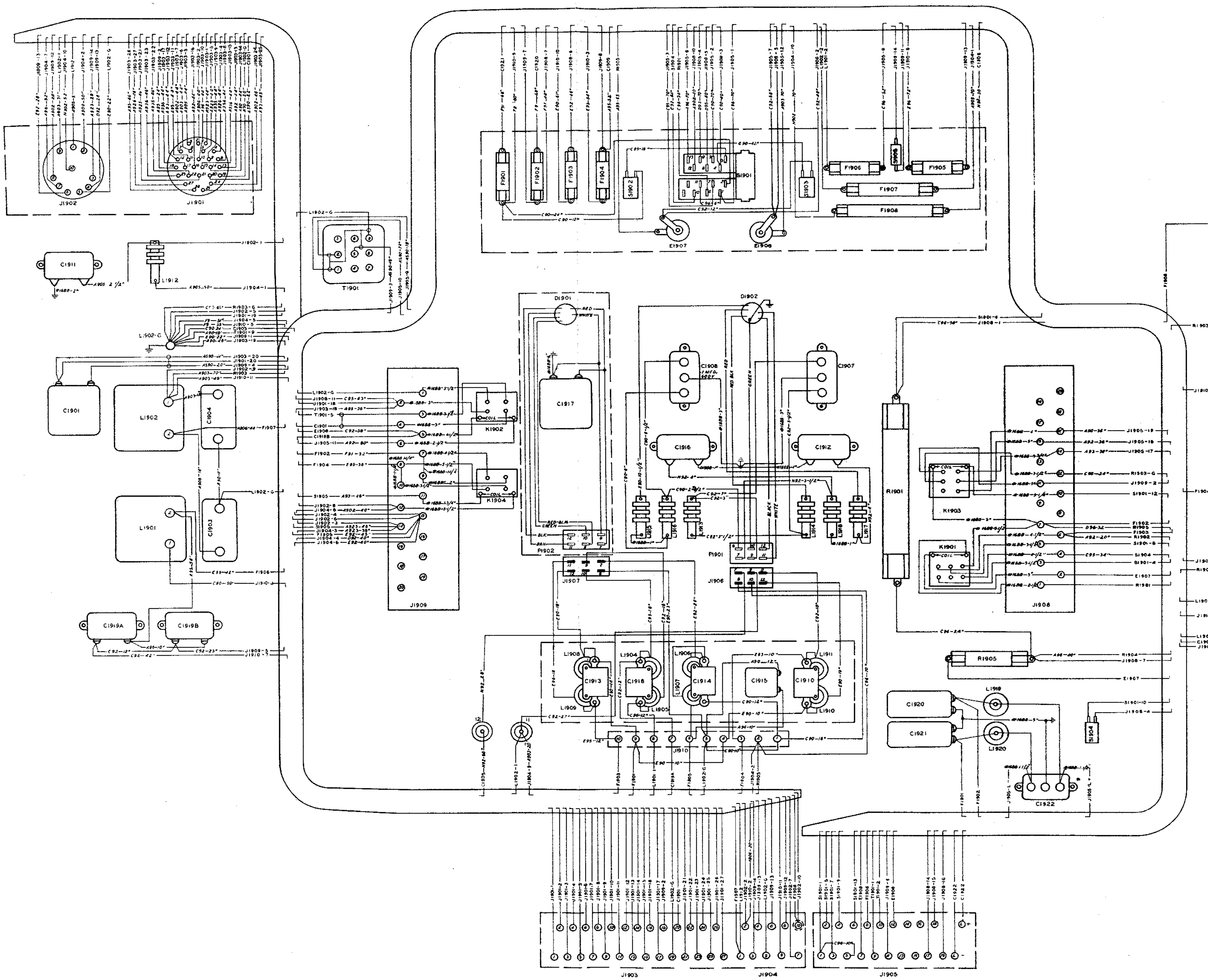
Fig. 101 Type COL–211101 Motor-Generator-Rectifier Power Unit Practical Wiring Diagram (Dwg. No. 500 4446 00F)

FIG. 101 TYPE COL–211101 MOTOR-GENERATOR-RECTIFIER POWER UNIT PRACTICAL WIRING DIAGRAM (Dwg. No. 500 4446 00F)

500	ITEM NO.	PART NUMBER	PRINT NO. PART NAME	
3.5		152 7610 00	INSULATED SLEEVING	FT.
7.4		152 7640 00	INSULATED SLEEVING	FT.
6.5		152 7670 00	INSULATED SLEEVING	FT.
2		152 7700 00	INSULATED SLEEVING	FT.
7		304 1500 00	HEAVY 1/4 SOLDER LUG	
97		304 1800 00	LIGHT 3/16 SOLDER LUG	
21		304 2000 00	HEAVY 3/16 SOLDER LUG	
44		304 5200 00	SPADE SOLDER LUG	
14.3	BB14	421 1420 00	#14 SINGLE CONDUCTOR MAG. WIRE	FT.
1.0	BB18	421 1820 00	#18 SINGLE CONDUCTOR MAG. WIRE	FT.
11.3	F9	440 0401 00	#12 ROCKBESTOS WIRE	FT.
12.2	F91	440 0403 00	#12 ROCKBESTOS WIRE	FT.
9.6	F96	440 0408 00	#12 ROCKBESTOS WIRE	FT.
11.5	F902	440 0409 00	#12 ROCKBESTOS WIRE	FT.
10.8	E93	440 0505 00	#14 ROCKBESTOS WIRE	FT.
7.8	E95	440 0507 00	#14 ROCKBESTOS WIRE	FT.
3.0	E902	440 0509 00	#14 ROCKBESTOS WIRE	FT.
7.5	E903	440 0510 00	#14 ROCKBESTOS WIRE	FT.
5.5	D93	440 0605 00	#16 ROCKBESTOS WIRE	FT.
14.8	D95	440 0607 00	#16 ROCKBESTOS WIRE	FT.
21.6	D96	440 0608 00	#16 ROCKBESTOS WIRE	FT.
23.0	D902	440 0609 00	#16 ROCKBESTOS WIRE	FT.
3.6	D936	440 0617 00	#16 ROCKBESTOS WIRE	FT.
2.1	C90	440 0702 00	#18 ROCKBESTOS WIRE	FT.
5.8	C92	440 0704 00	#18 ROCKBESTOS WIRE	FT.
3.2	C96	440 0708 00	#18 ROCKBESTOS WIRE	FT.
2.4	C902	440 0709 00	#18 ROCKBESTOS WIRE	FT.
6.3	C903	440 0710 00	#18 ROCKBESTOS WIRE	FT.
8.5	A9	440 0901 00	#22 ROCKBESTOS WIRE	FT.
20.3	A902	440 0907 00	#22 ROCKBESTOS WIRE	FT.
22.3	A903	440 0912 00	#22 ROCKBESTOS WIRE	FT.
24.3	A905	440 0916 00	#22 ROCKBESTOS WIRE	FT.
19.1	A906	440 0918 00	#22 ROCKBESTOS WIRE	FT.
30.8	A90	440 0902 00	#22 ROCKBESTOS WIRE	FT.
34.3	A92	440 0903 00	#22 ROCKBESTOS WIRE	FT.
26.4	A93	440 0904 00	#22 ROCKBESTOS WIRE	FT.
35.6	A95	440 0905 00	#22 ROCKBESTOS WIRE	FT.
35.0	A96	440 0906 00	#22 ROCKBESTOS WIRE	FT.
20.9	A923	440 0921 00	#22 ROCKBESTOS WIRE	FT.
12.2	A925	440 0922 00	#22 ROCKBESTOS WIRE	FT.
12.4	A926	440 0925 00	#22 ROCKBESTOS WIRE	FT.
11.7	A935	440 0929 00	#22 ROCKBESTOS WIRE	FT.
10.8	A936	440 0932 00	#22 ROCKBESTOS WIRE	FT.
8.0	A956	440 0937 00	#22 ROCKBESTOS WIRE	FT.
22.1	AS90	443 2229 00	#22 SHIELDED ROCKBESTOS WIRE	FT.
25.0	N902	447 1690 20	#16 ROCKBESTOS WIRE	FT.

LEAD PREFIX	AWG INDIC.	INSULATION VOLT RATE
A	22	1000
B	20	1000
C	18	1000
D	16	1000
E	14	1000
F	12	1000
J	6	1000
L	20	3000
N	16	3000
-S	SHIELDED LEAD	
BB	BUS BAR	

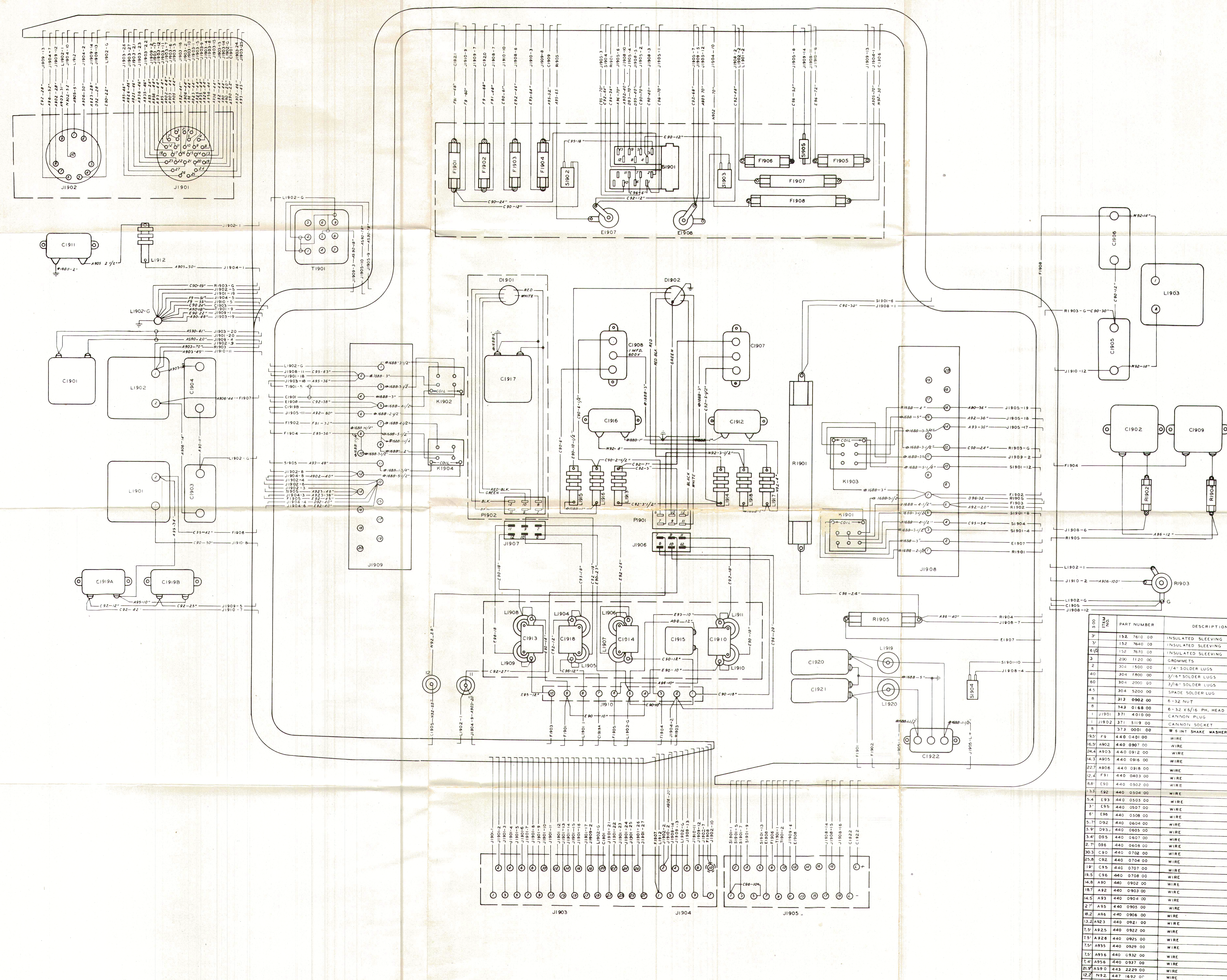
FIG. 101 TYPE COL–211101 MOTOR-GENERATOR-RECTIFIER POWER UNIT PRACTICAL WIRING DIAGRAM (Dwg. No. 500 4446 00F)



500	ITEM NO.	PART NUMBER	DESCRIPTION
3'		152 7610 00	INSULATED SLEEVING
3'		152 7640 00	INSULATED SLEEVING
6 1/2		152 7670 00	INSULATED SLEEVING
3		200 1120 00	GROMMETS
2		304 1500 00	1/4" SOLDER LUGS
40		304 1800 00	3/16" SOLDER LUGS
60		304 2000 00	3/16" SOLDER LUGS
45		304 5200 00	SPADE SOLDER LUG
8		313 0002 00	6-32 NUT
6		343 0168 00	6-32 X 6/16 PH. HEAD SCREW
1	J1901	371 4010 00	CANNON PLUG
1	J1902	371 3119 00	CANNON SOCKET
8		373 0001 00	# 6 INT. SHAKE. WASHER
19.5'	F9	440 0401 00	WIRE
16.5'	A902	440 0907 00	WIRE
24.4'	A903	440 0912 00	WIRE
14.3'	A905	440 0916 00	WIRE
22.7'	A906	440 0918 00	WIRE
12.4'	F91	440 0403 00	WIRE
8.8'	E90	440 0502 00	WIRE
13.3'	E92	440 0504 00	WIRE
5.4'	E93	440 0505 00	WIRE
3'	E95	440 0507 00	WIRE
6'	E96	440 0508 00	WIRE
5.7'	D92	440 0604 00	WIRE
5.9'	D93	440 0605 00	WIRE
3.4'	D95	440 0607 00	WIRE
2.7'	D96	440 0608 00	WIRE
30.3'	C90	440 0702 00	WIRE
25.8'	C92	440 0704 00	WIRE
19'	C95	440 0707 00	WIRE
19.5'	C96	440 0708 00	WIRE
14.8'	A90	440 0902 00	WIRE
18.7'	A92	440 0903 00	WIRE
14.5'	A93	440 0904 00	WIRE
27'	A95	440 0905 00	WIRE
18.2'	A96	440 0906 00	WIRE
13.2'	A923	440 0921 00	WIRE
7.5'	A925	440 0922 00	WIRE
7.5'	A926	440 0925 00	WIRE
7.5'	A935	440 0929 00	WIRE
7.5'	A936	440 0932 00	WIRE
7.4'	A956	440 0937 00	WIRE
21.5'	A530	443 2229 00	WIRE
12.2'	N92	447 1692 00	WIRE
10.2'	N902	447 1690 20	WIRE
1	J1905	500 3964 008	21 TERMINAL STRIP
1		507 6308 00	RECEPTACLE MOUNTING PLATE
1	J1903-J1904	571 1545 20	37 TERMINAL STRIP

Fig. 102 Type COL–211102 Dynamotor Assembly Practical Wiring Diagram (Dwg. No. 500 4600 00E)

Fig. 102 Type COL–211102 Dynamotor Assembly Practical Wiring Diagram (Dwg. No. 500 4600 00E)



5 00	ITEM NO.	PART NUMBER	DESCRIPTION
3'		152 7610 00	INSULATED SLEEVING
3'		152 7640 00	INSULATED SLEEVING
6 1/2'		152 7670 00	INSULATED SLEEVING
3		200 1120 00	GROMMETS
2		304 1500 00	1/4" SOLDER LUGS
40		304 1800 00	3/16" SOLDER LUGS
60		304 2000 00	3/16" SOLDER LUGS
45		304 5200 00	SPADE SOLDER LUG
8		313 0002 00	6-32 NUT
8		343 0168 00	6-32 X 5/16 PH. HEAD SCREW
1	J1901	371 4010 00	CANNON PLUG
1	J1902	371 5119 00	CANNON SOCKET
8		373 0001 00	# 6 INT SHAKE WASHER
19.5'	F9	440 0401 00	WIRE
16.5'	A902	440 0907 00	WIRE
24.4'	A903	440 0912 00	WIRE
14.3'	A905	440 0916 00	WIRE
22.7'	A906	440 0918 00	WIRE
12.4'	F91	440 0403 00	WIRE
8.8'	E90	440 0502 00	WIRE
13.3'	E92	440 0504 00	WIRE
5.4'	E93	440 0505 00	WIRE
3'	E95	440 0507 00	WIRE
6'	E96	440 0508 00	WIRE
5.7'	D92	440 0604 00	WIRE
5.9'	D93	440 0605 00	WIRE
3.4'	D95	440 0607 00	WIRE
2.7'	D96	440 0608 00	WIRE
30.3'	C90	440 0702 00	WIRE
25.8	C92	440 0704 00	WIRE
19'	C95	440 0707 00	WIRE
19.5'	C96	440 0708 00	WIRE
14.8	A90	440 0902 00	WIRE
18.7'	A92	440 0903 00	WIRE
14.5'	A93	440 0904 00	WIRE
27'	A95	440 0905 00	WIRE
18.2'	A96	440 0906 00	WIRE
13.2'	A923	440 0921 00	WIRE
7.5'	A925	440 0922 00	WIRE
7.5'	A926	440 0925 00	WIRE
7.5'	A935	440 0929 00	WIRE
7.5'	A936	440 0932 00	WIRE
7.4'	A956	440 0937 00	WIRE
21.5'	AS90	443 2229 00	WIRE
12.2'	N92	447 1692 00	WIRE
10.2'	N902	447 1690 20	WIRE
1	J1905	500 3964 00B	21 TERMINAL STRIP
1		507 6308 00	RECEPTACLE MOUNTING PLATE
1	J1903-J1904	571 1545 20	37 TERMINAL STRIP

FIG. 102 TYPE COL-211102 DYNAMOTOR ASSEMBLY PRACTICAL WIRING DIAGRAM (Dwg. No. 500 4600 00E)

FIG. 102 TYPE COL-211102 DYNAMOTOR ASSEMBLY PRACTICAL WIRING DIAGRAM (Dwg. No. 500 4600 00E)

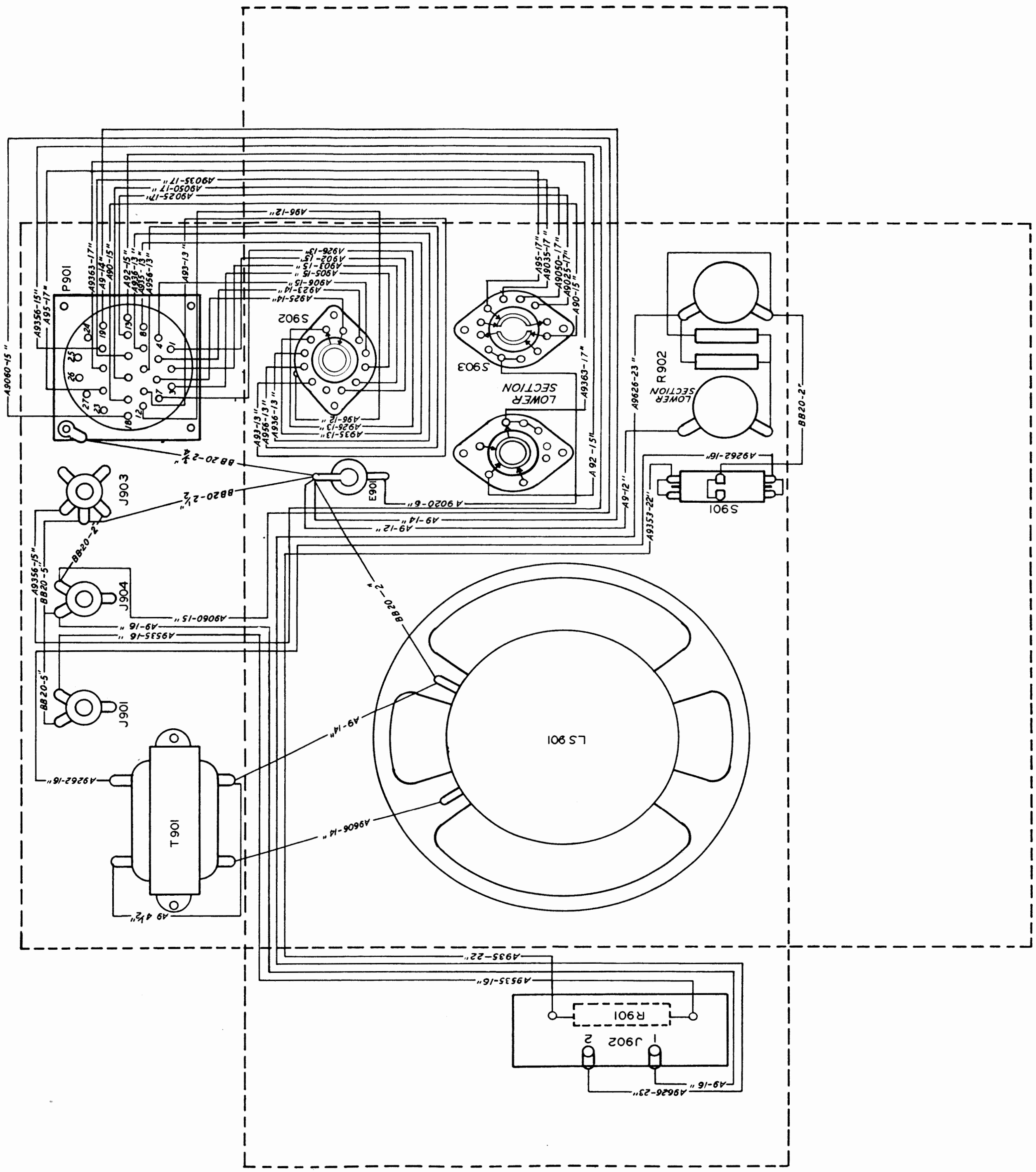


Fig. 103 Type COL–23410 Remote Control Unit Practical Wiring Diagram (Dwg. No. K1064C)

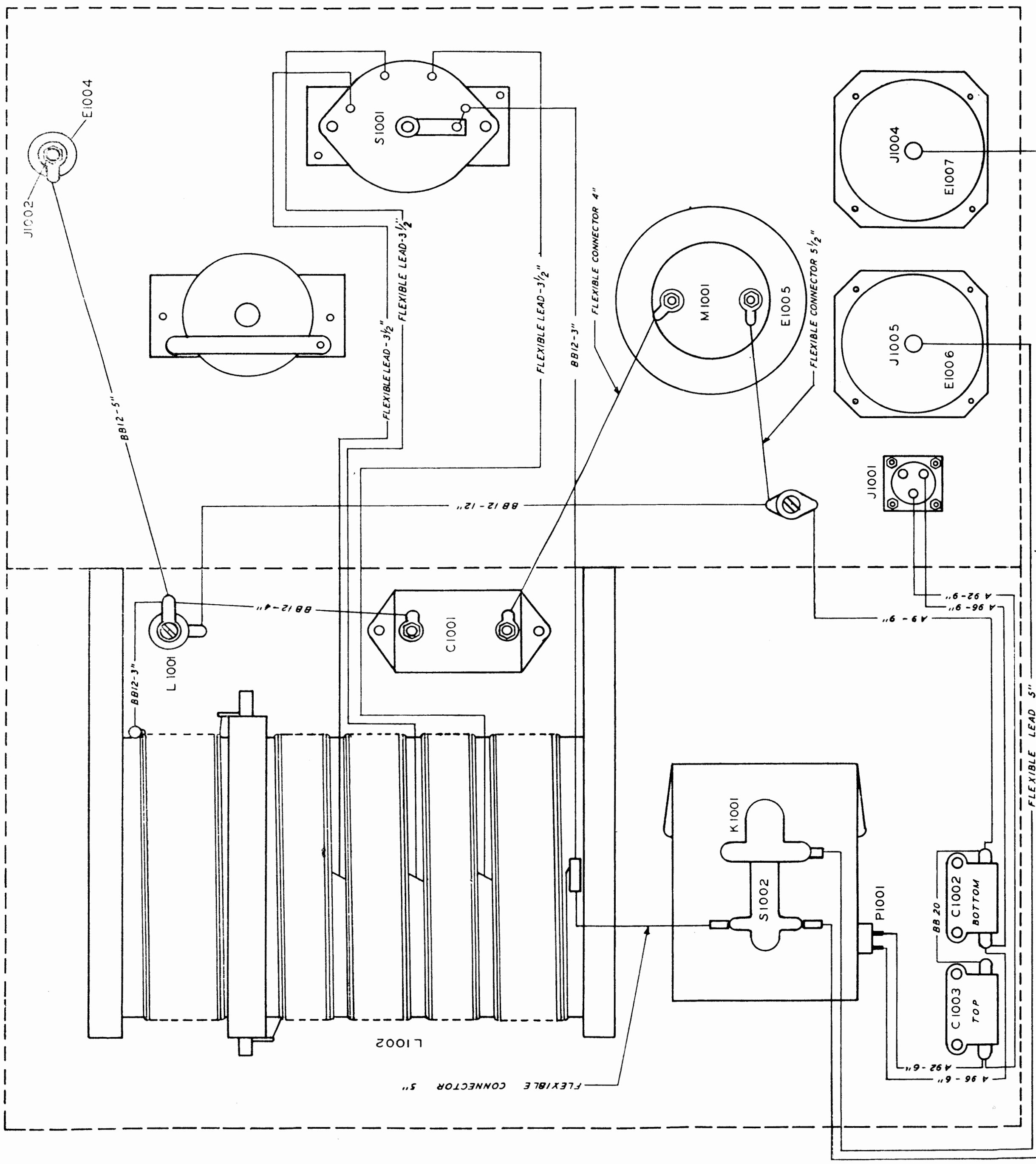
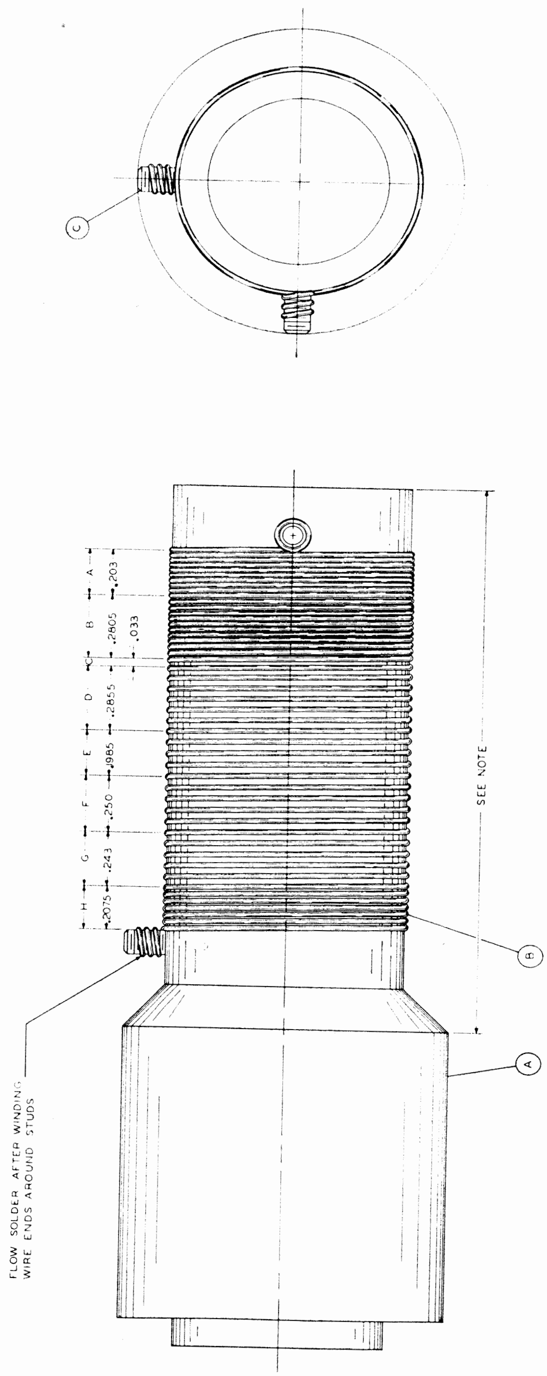


Fig. 104 Type COL–47370 Antenna Loading Coil Practical Wiring Diagram (Dwg. No. K1110C)

IT.		PART NO.	DESCRIPTION	MAT'L	FIN.
1	A	507 5718 00	COIL FORM		
15 ft.	B	421 2440 00	#24 D.E. WIRE FT.		
2	C	312 3480 00	4-40 X 3/8 BRASS STUD		



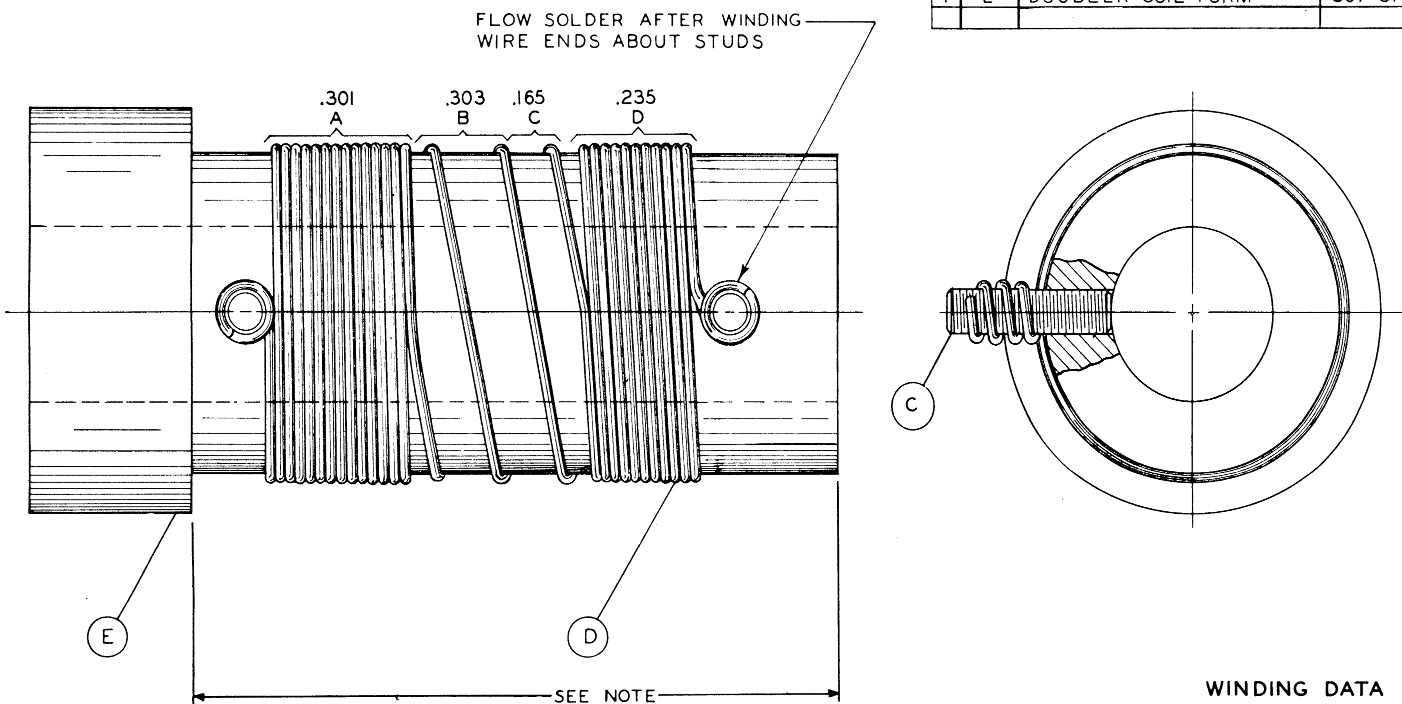
WINDING DATA

WINDINGS	NUMBER OF TURNS	PITCH	TURNS PER INCH
A	9	.02255	44.346
B	11	.0255	39.215
C	1	.0332	30
D	6	.04758	21.017
E	4	.04962	20.154
F	5	.0500	20
G	5	.0486	20.576
H	6 1/4	.0332	30

ASSEMBLY NOTES:
1. CEMENT STUDS (C) INTO COIL FORM (A) WITH SAUEREISEN CEMENT
2. WIND COIL AS PER WINDING DATA.
3. APPLY WITH BRUSH OR SPRAY GUN ONE COAT OF POLYSTYRENE CEMENT #912 AFTER WINDING.

Fig. 105 H.F. Oscillator Grid Inductor L101
(Dwg. No. 671D)

	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
2	C	#2-56 X 7/16 BRASS STUD	312 3390 00		
7.	D	#24 D.E. WIRE FT.	421 2440 00		
1	E	DOUBLER COIL FORM	507 5716 00		



WINDING DATA

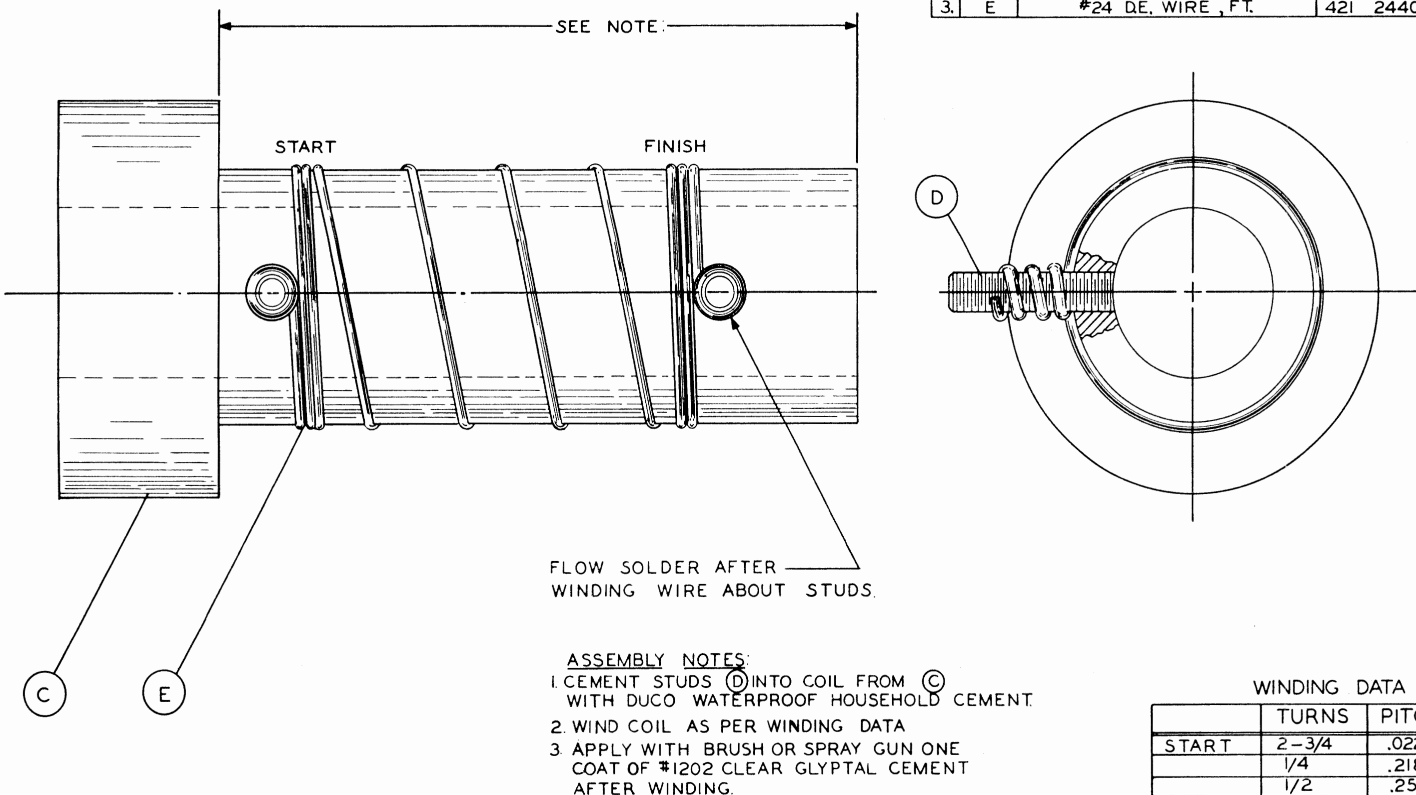
WINDING		NO. OF TURNS	PITCH	TURNS PER INCH
A	A	14	.0215	46.51
B	B	2	.1515	6.61
C	C	1	.165	6.06
D	D	11	.0215	46.51

ASSEMBLY NOTES

1. CEMENT STUDS Ⓒ INTO COIL FORM Ⓔ WITH DUCO WATERPROOF HOUSEHOLD CEMENT.
2. WIND COIL AS PER WINDING DATA.
3. APPLY WITH BRUSH OR SPRAY GUN ONE COAT OF #1202 CLEAR GLYPTAL CEMENT AFTER WINDING.

Fig. 106 1st Multiplier Plate Inductor L105
(Dwg. No. 1687B)

	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
1	C	COIL FORM	507 5717 00		
2	D	#2-56 X7/16 BRASS STUD	312 3390 00		
3.	E	#24 D.E. WIRE, FT.	421 2440 00		

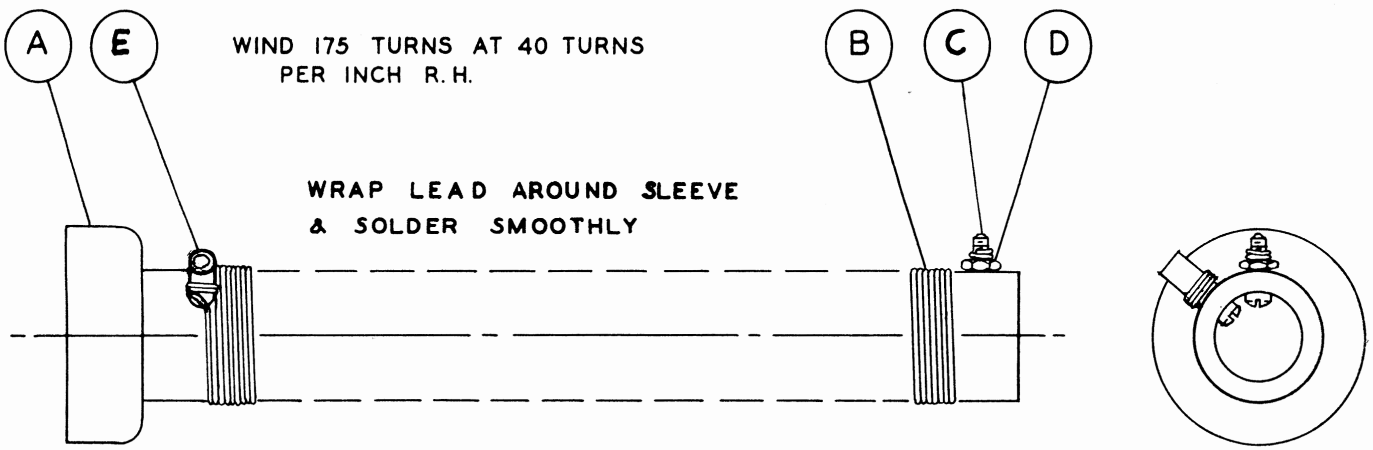


WINDING DATA

	TURNS	PITCH	TOTAL
START	2-3/4	.022	.0605
	1/4	.218	.115
	1/2	.252	.241
	1/2	.178	.330
	1/2	.170	.415
	1/2	.168	.499
	1/2	.212	.605
	1/2	.174	.692
	1/4	.188	.739
	1/2	.230	.854
FINISH	2-1/4	.023	.906

Fig. 107 2nd Multiplier Plate Inductor L106
(Dwg. No. 1686B)

	IT.	DESCRIPTION	PART NO.	MAT'L	FIN.
I	A	COIL FORM	507 5739 10		
X	B	#27 CHROME OXIDE WIRE 3 1/2 FT. L.	421 2730 00		
2	C	#2-56 X 3/8 FILL. HD. SCR.	321 0022 00		
I	D	#2-56 HEX. NUTS	313 0006 00		
I	X	ASSEMBLY PER QUANT. "A."	571 1448 10		
I	E	SOLDERING SLEEVE	507 6842 00		

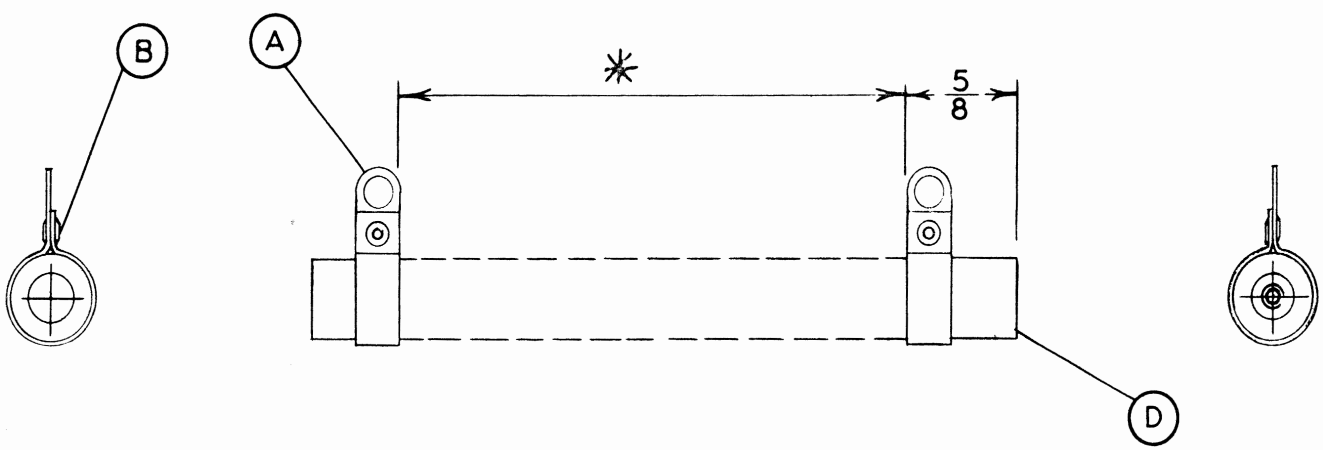


GLUE ITEMS C INTO A WITH SOUEREISEN.

SOLDER ENDS OF WIRE TO ITEM C.

Fig. 108 P.A. Plate Feed Choke L108 (Dwg. No. 1448A)

	IT.	DESCRIPTION	PART NO.	MAT'L	FIN.
2	A	CLAMP	139 4600 00		
2	B	.087 x .167 EYELETS	307 2800 00		
1	C	40 FEET #35 S.S.E. COPPER WIRE	421 3530 00		
1	D	COIL FORM	507 5742 00		
1	X	ASS'Y OF PARTS PER GROUP A.	571 2103 10		



CLOSE WIND *—— TURNS ITEM C
FOR 190MH ± 10MH INDUCTANCE
SOLDER ENDS TO ITEM B
* APPROXIMATELY 340 TURNS

Fig. 109 Output Network Static Drain Choke L110
(Dwg. No. 2103A)

	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
1	A	ROTOR COIL 5 FT. WIRE	421 0006 00	NOTE	
2	B	ROTOR MTG. BAR # 2	507 6092 00		
2	C	ROTOR MTG. BAR # 1	507 6093 00		
2	D	ROTOR ATTACHMENT PLATE	507 6098 00		
4	E	6-32 X 5/16 PH. BRASS SCREW	343 0112 00		
4	F	#6 PHOS. BR. INT. SHAKE WASHER	373 3020 00		
1	X	ASS'Y. OF PARTS PER. QUANT. A	571 1246 20		

COIL #10 (.100) MEDIUM HARD DRAWN
SILVER PLATED COPPER WIRE

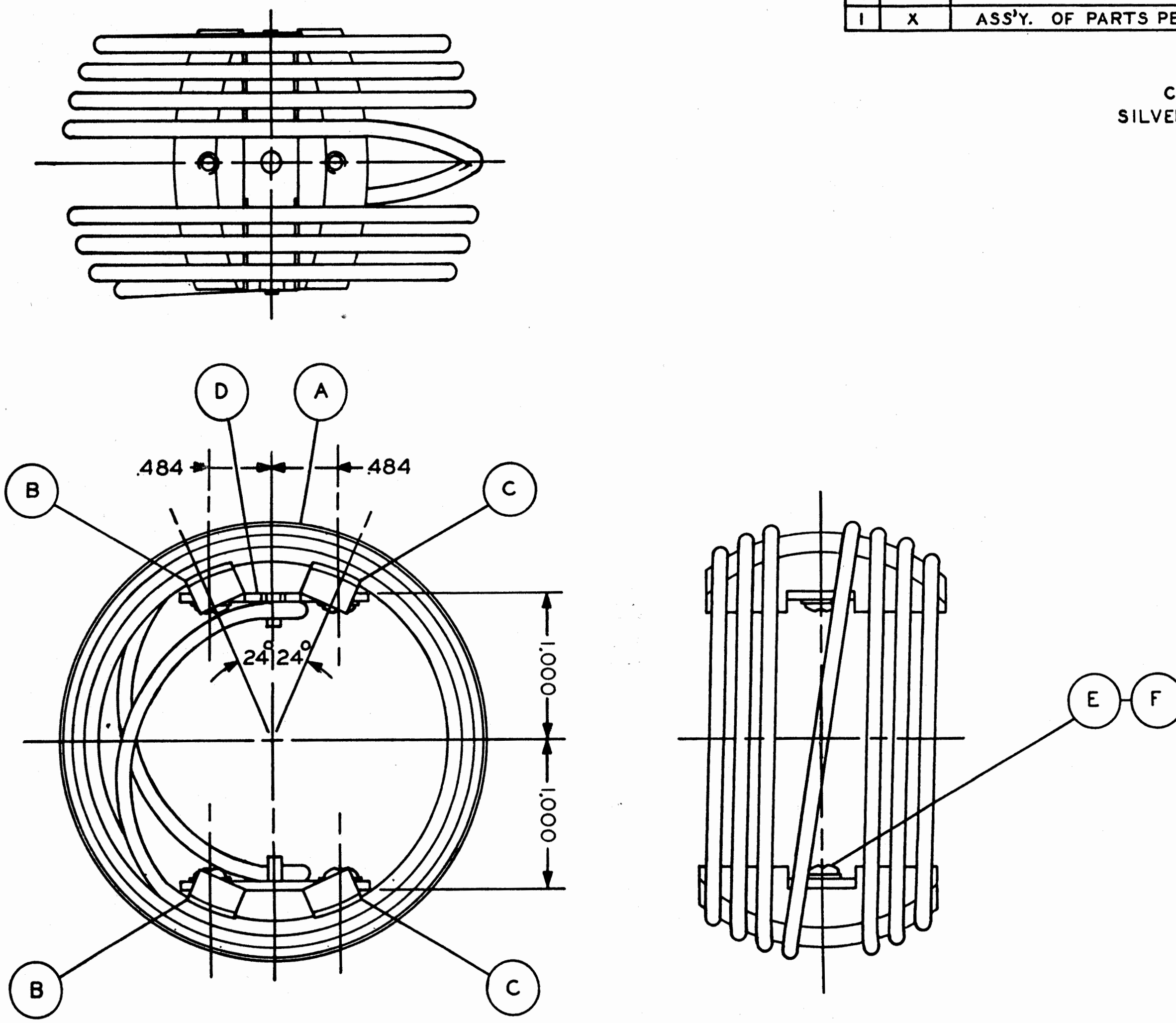
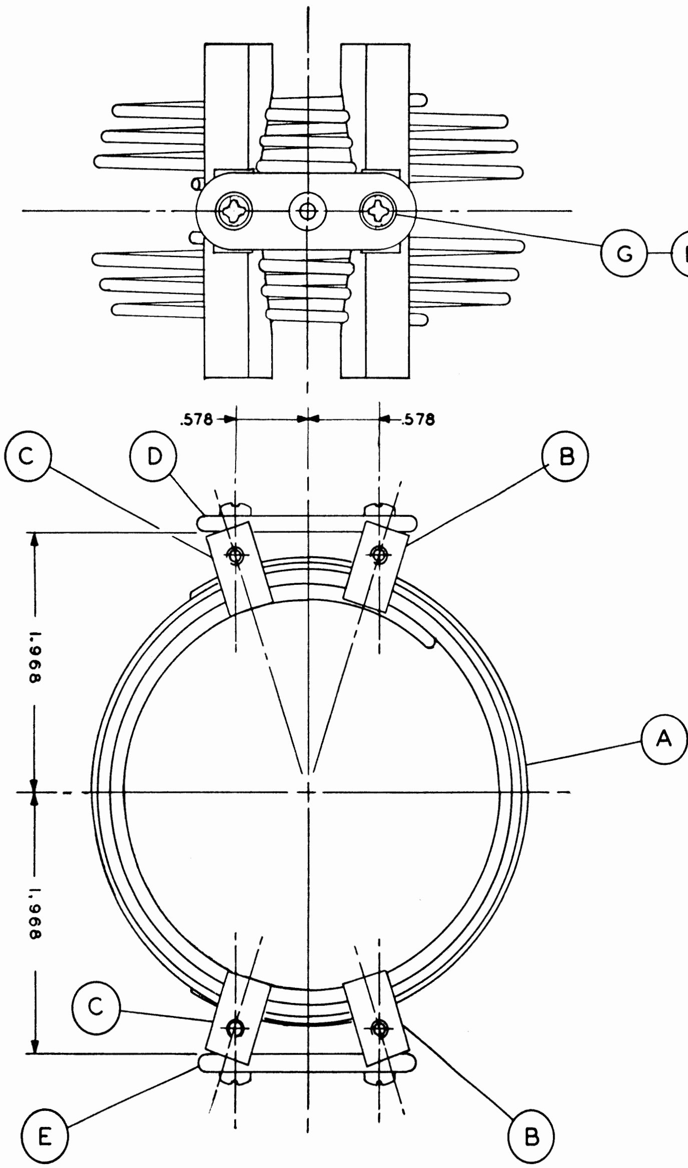


Fig. 110 P.A. Plate Inductor—Rotor for L112
(Dwg. No. 1246B)

	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
1	A	STATOR COIL 5FT. OF WIRE	421 000600	NOTE	
2	B	MOUNTING BAR #2	507 6100 00		
2	C	MOUNTING BAR #1	507 6099 00		
1	D	ROTOR BEARING BAR #1	507 6090 00		
1	E	ROTOR BEARING BAR #2	507 6091 00		
	F				
4	G	6-32 x 5/16 PH. BIND. HD. SCREW. BRASS	343 0112 00		
4	H	#6 PHOS. BR. INT. SHAKE. WASHER	373 3020 00		
1	X	ASS'Y OF PARTS PER QT. "A"	571 1245 20		

COIL: #10 (.100) MEDIUM HARD DRAWN SILVER PLATED COPPER WIRE.

NOTE: ENDS OF COILS TO BE ROUND AND FREE FROM SHARP EDGES.



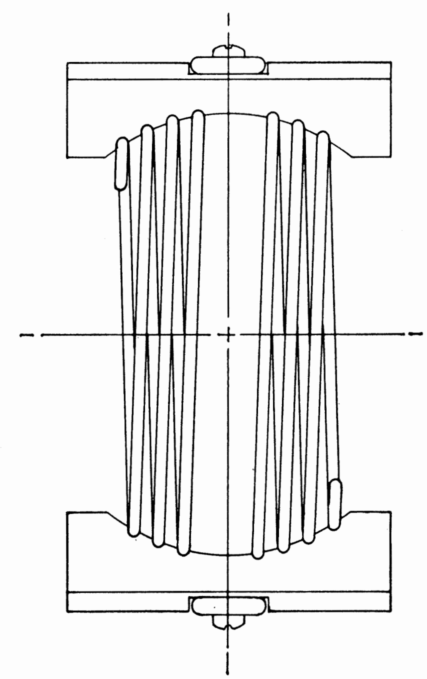
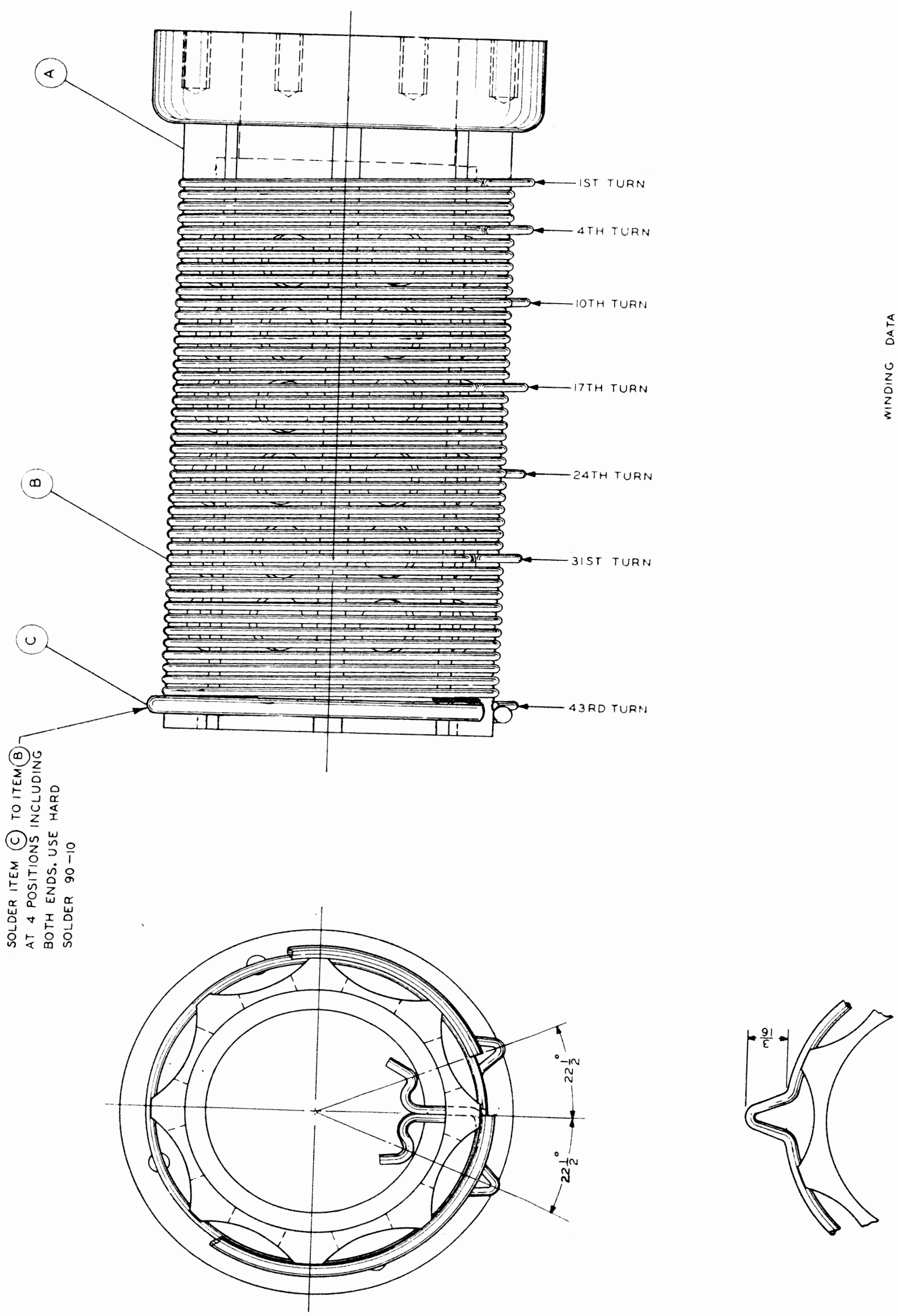


Fig. 111 P.A. Plate Inductor—Stator for L112
(Dwg. No. 1245B)

	IT.	PART NO.	DESCRIPTION	MAT'L	FIN.
1	A	571 1100 20	COIL FORM		
1	B	421 1421 00	28 FT. #14 LEAD COVERED COPPER WIRE		
1	C	507 7350 00	CORONA RING		

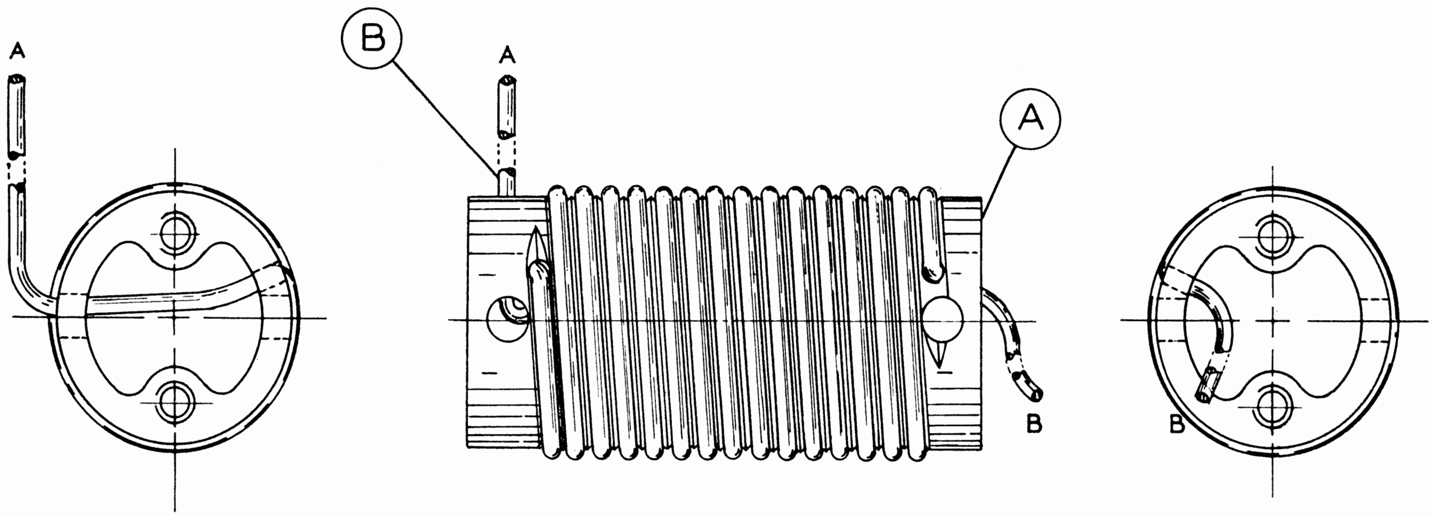


WINDING DATA

WIRE	GUAGE	PART NO.	APPROXIMATE NUMBER OF TURNS	TYPE OF WINDING	L.	DIST. C.	Q.	FREQ.	CAP.
LEAD COVERED COPPER WIRE	14	421 1421 00	43	SINGLE LAYER	42μH.		325	2.0M C.	150μμFD.

Fig. 112 Antenna Loading Inductor L113
(Dwg. No. 1258C)

	IT.	DESCRIPTION	PART NO.	MAT'L	FIN.
1	A	COIL FORM	5075922 00		
4.	B	#16 LEADED COPPER WIRE FT	421 1621 00		



END "A" IS THREE INCHES LONG

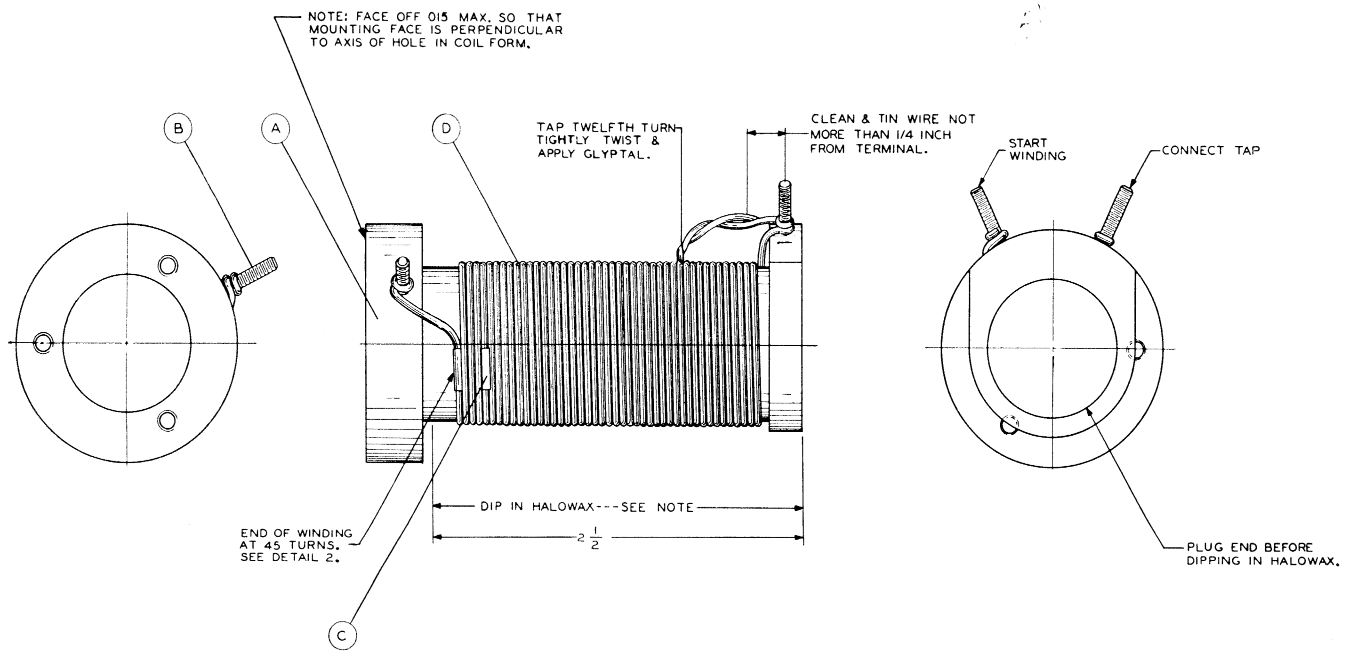
END "B" IS ONE INCH LONG

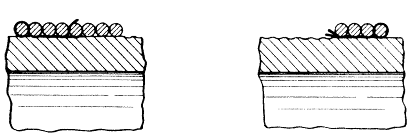
WINDING & TEST DATA (WITH Q METER)

WIRE	GUAGE	PART NUMBER	NO. OF TURNS	TYPE OF WINDING	L. μh (MIN)	Q.	FREQ. (mc)	CAP. (μμf)
LEADED COPPER WIRE	16	421 1621 00	15	SINGLE LAYER	2.1 ± 5%	270. MIN.	18.	37.

Fig. 113 P.A. Plate Tank Padding Inductor L114
(Dwg. No. 1114A)

	IT.	PART NO.	DESCRIPTION	MAT'L	FIN.
1	A	571 1868 20	L.F. OSCILLATOR COIL FORM		
3	B	312 3380 00	2-56 X 5/8 STUD		
0.2	C	014 4000 00	TAPE 1/4 X .005 FT.		
130	D	422 5100 00	48-38 LITZ WIRE, FT.		





DETAIL NO. 2

TAPE AT END OF WINDING.

DETAIL NO. 1

TAPE AT START OF WINDING.

ASSEMBLY NOTES:

1. IMPREGNATE WITH CERESE AA OR EQUIVALENT AT TEMPERATURE OF 121°-126°C. (250°-260°F.) UNTIL AIR BUBBLES CEASE. LET COOL, THEN FLASH DIP IN HALOWAX NO. 2141 AT TEMPERATURE OF 176°-182°C. (350°-360°F.)

   NOTE: THE COAT OF WAX MUST BE FREE FROM BUBBLES & BLOW HOLES & NOT MORE THAN 1/32 IN. THICK.

2. CEMENT ITEM (B) TO ITEM (A) WITH DUCO CEMENT 4N457

WINDING DATA NOTE: INDUCTANCE AT 1000 C.P.S. 20.0 MH.

WIRE	GUAGE	PART NO.	NO OF TURNS	TYPE OF WINDING	L.	DIST. C.	Q.	FREQ.	CAP.
48-38 LITZ	19	422 5100 00	45	SINGLE LAYER	19,956 µh ±1%	3,166 MMF.	104 ±8%	2000 KC.	320 MMF.

Fig. 114 L-F Oscillator Grid Inductor L401
(Dwg. No. 1259C)

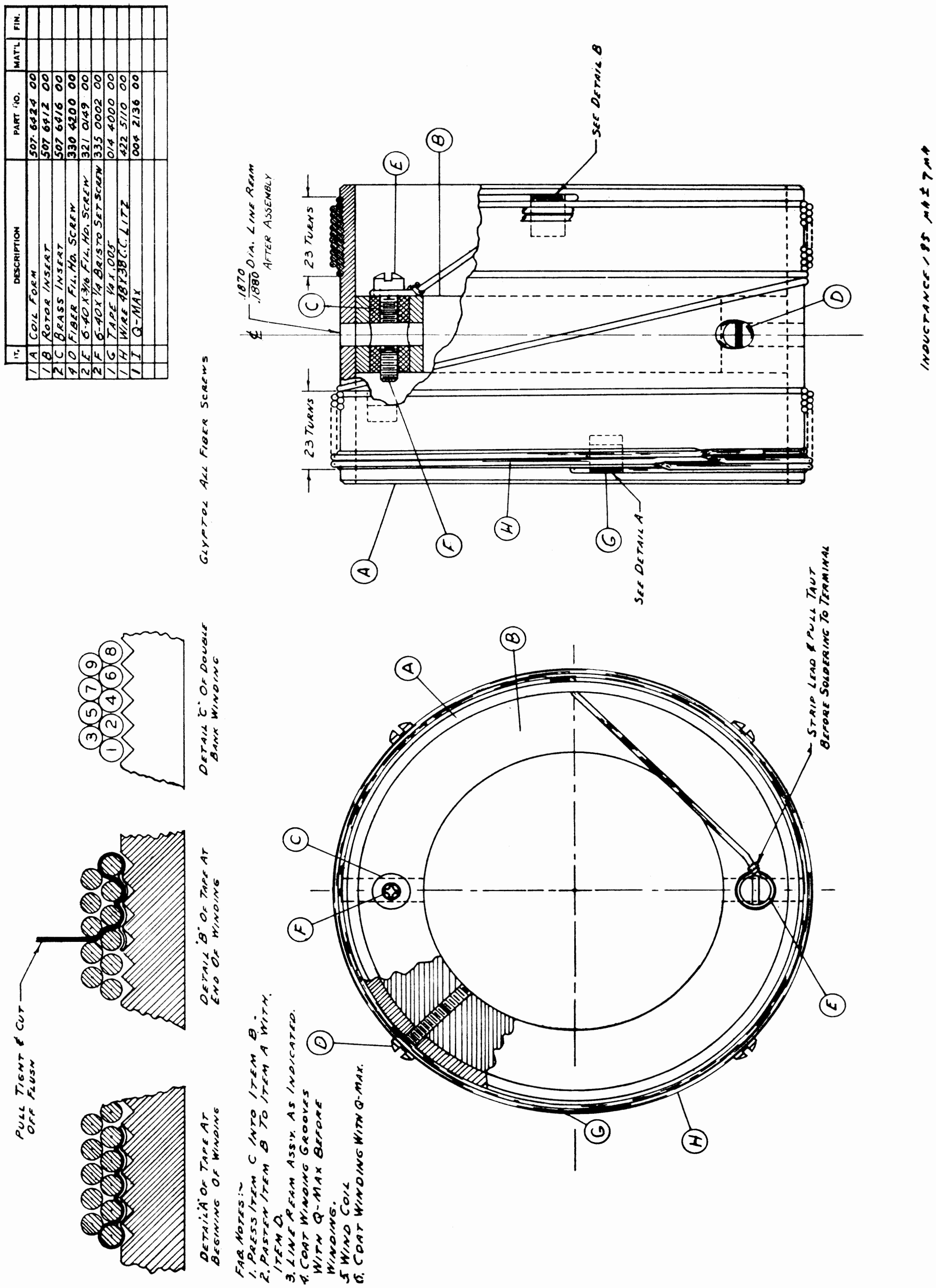


Fig. 115 Antenna Loading Coil—Rotor for L1002
(Dwg. No. 1117C)

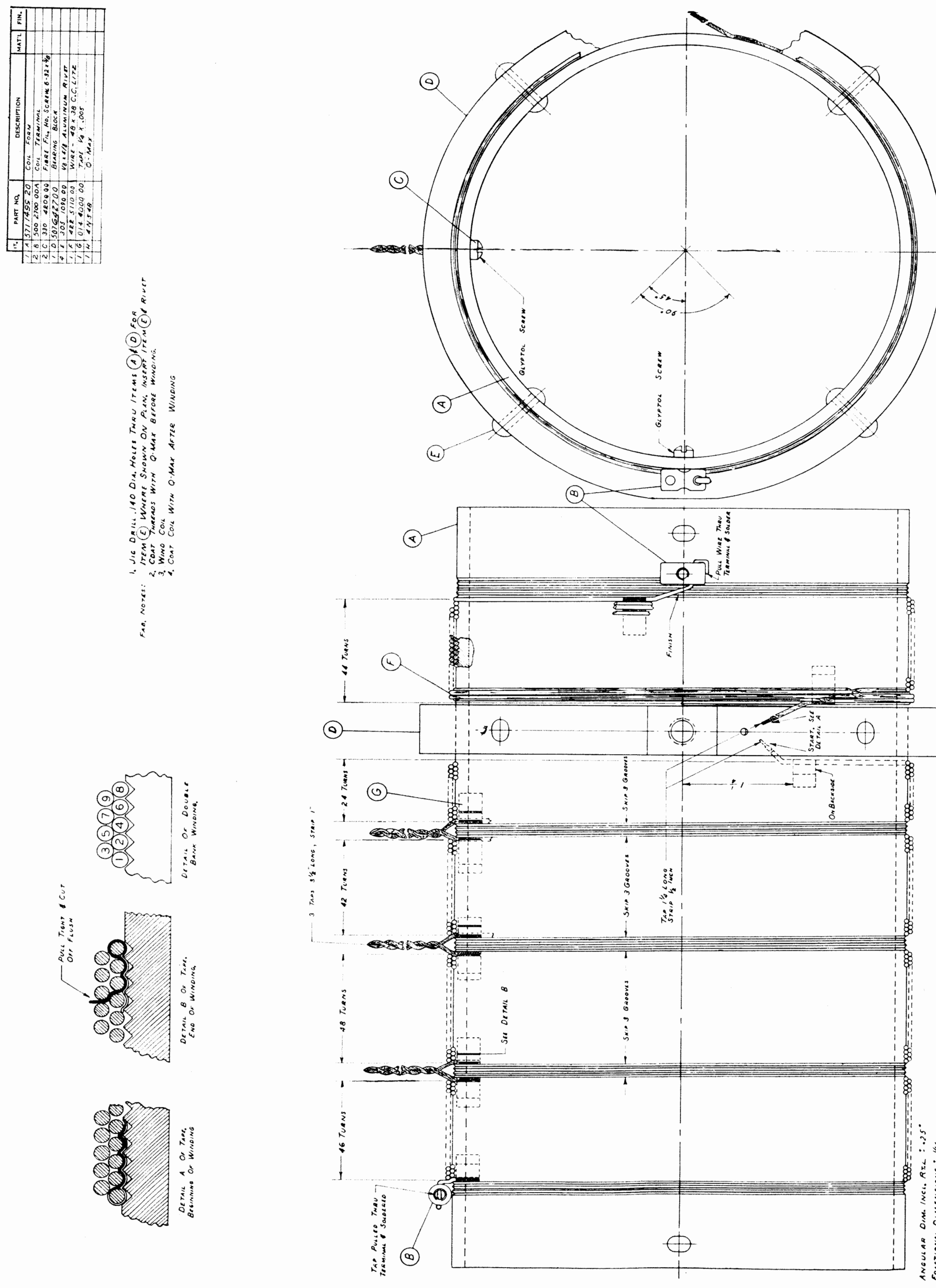


Fig. 116 Antenna Loading Coil—Stator for L1002
(Dwg. No. 512D)

CHARACTERISTICS

ELECTRICAL:

FREQUENCY— 200 KC

CRYSTAL CUT— DT

TEMP. RANGE — -10°C TO +70°C

CALIBRATION — ±.01 % THROUGHOUT TEMPERATURE RANGE

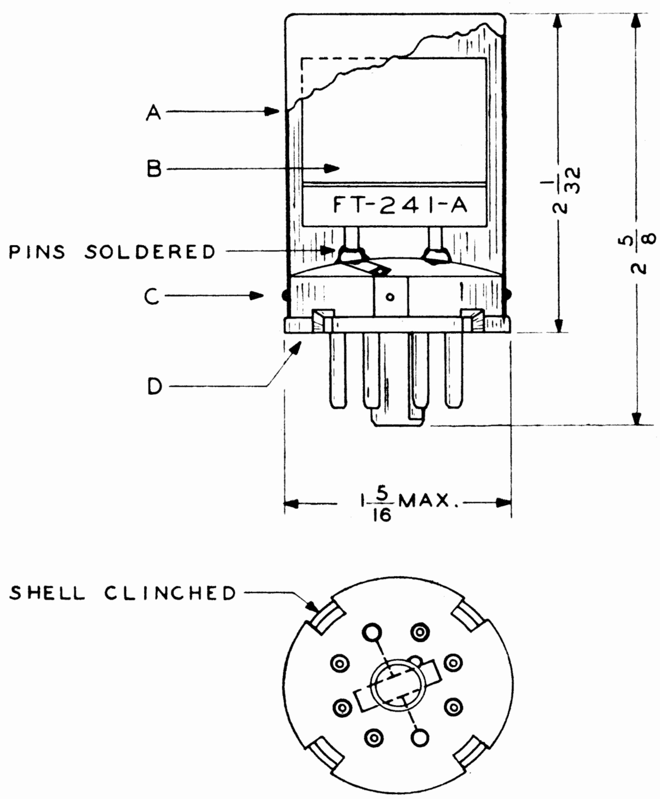
CONNECTIONS — PINS #3 & #7, PIN #7 IS GROUND

MECHANICAL:

SOCKET—STANDARD OCTAL

ELECTRODES — SEE SPECIFICATIONS FT-241-A (SIGNAL CORPS)

WEIGHT— 1.75 OZ.



QTY.	IT.	PART NO.	DESCRIPTION
1	A	292 0001 00	SHELL
1	B	291 0001 00	FT-241-A CRYSTAL UNIT
4	C	330 2010 00	DRIVE SCREW
1	D	292 0002 00	ADAPTOR

Fig. 117 Type –40127 Crystal Holder (Dwg. No. 502 0799 002)

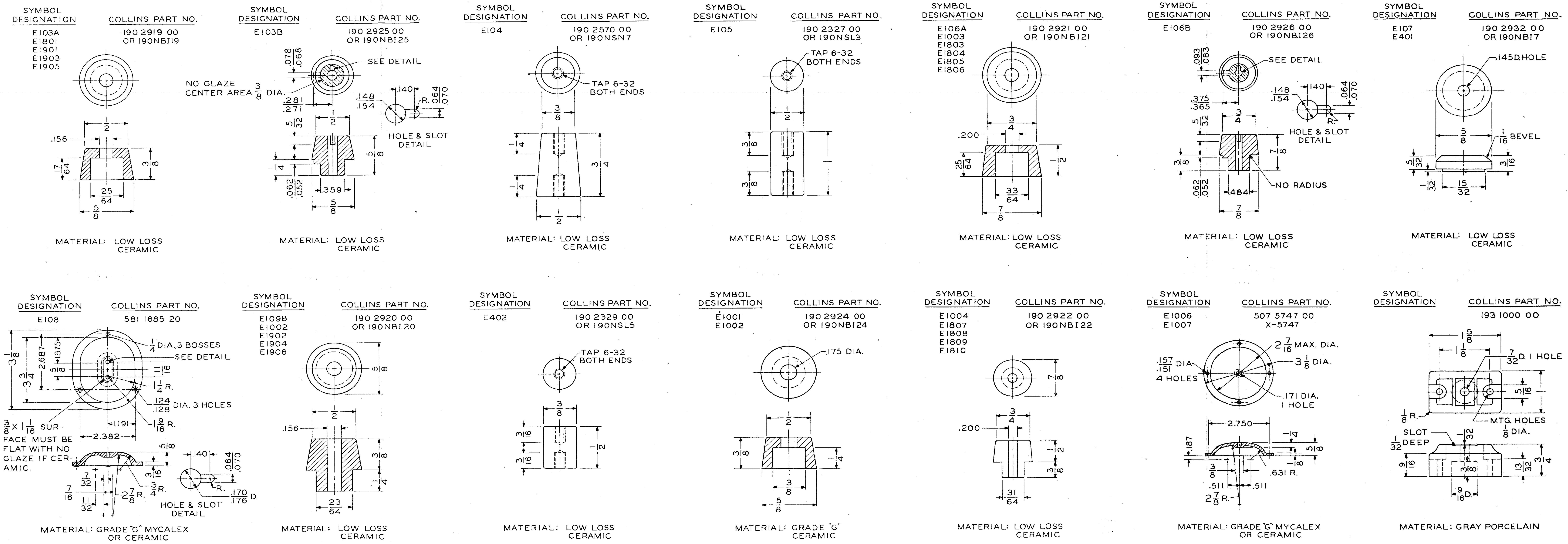
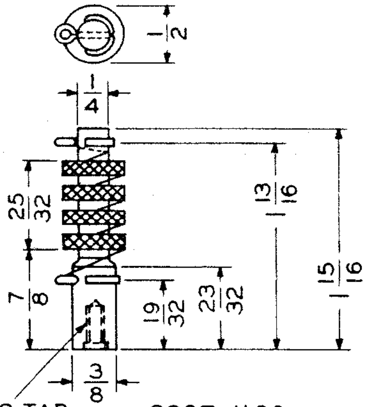


Fig. 118 Ceramic Insulators (Dwg. No. 502 0803 005)

Fig. 118 Ceramic Insulators (Dwg. No. 502 0803 005)

SYMBOL DESIGNATION	COLLINS PART NO.
L102 L103 L115	240 5300 00 OR 240N53

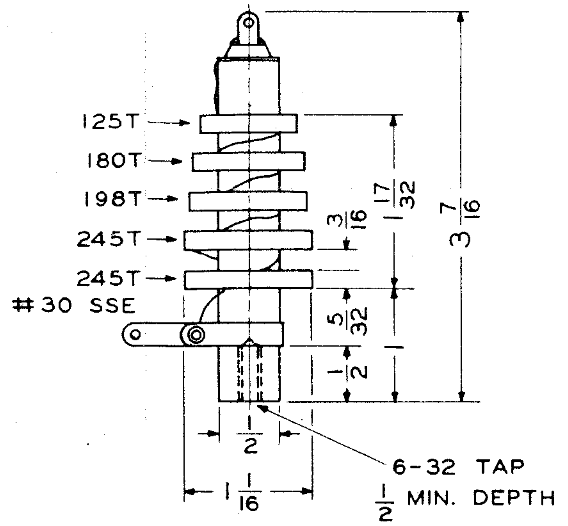


6-32 TAP 3/8 DEEP
CTR.BR. .144 D., X 1/16 DEEP

220T #36
SSE PER PIE

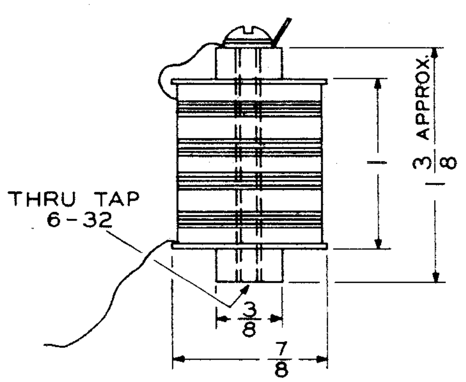
IND.-2.5 MH. ± 10%
MAX. CURRENT-0.125 AMP.
DC RES.-50 OHMS

SYMBOL DESIGNATION	COLLINS PART NO.
L109 L1001	240 5900 00 OR 240N59



IND.-6MH. ± 5%
DC RES.-21 OHMS

SYMBOL DESIGNATION	COLLINS PART NO.
L402 L403	240 4100 00 OR 240N4A

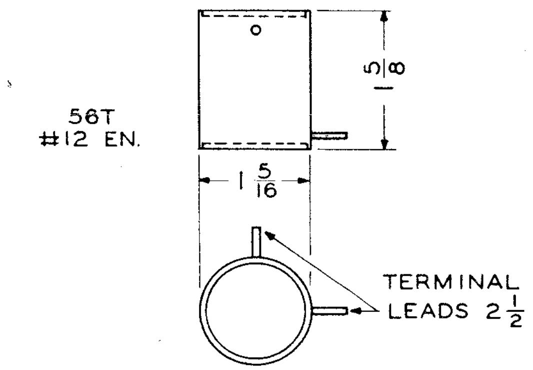


4 SECT. 234T EACH
#36 DSC

IND.-5.4 MH. ± 10%
MAX. CURRENT-0.125 AMP.
DC RES.-70 OHMS

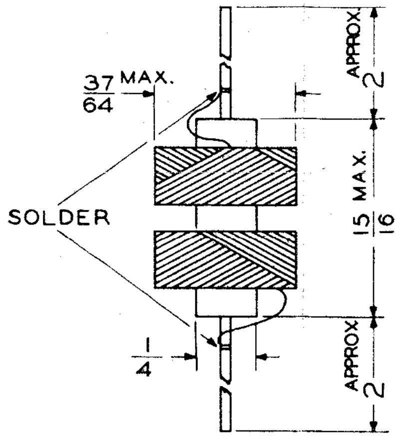
SYMBOL DESIGNATION	COLLINS PART NO.
L1805, L1806, L1808, L1809, L1904, L1905, L1906, L1907, L1908, L1909, L1910, L1911	240 5400 00 OR 240N54

56T
#12 EN.



IND.-22 MICROH. ± 20%
DC RES.-.02 OHMS

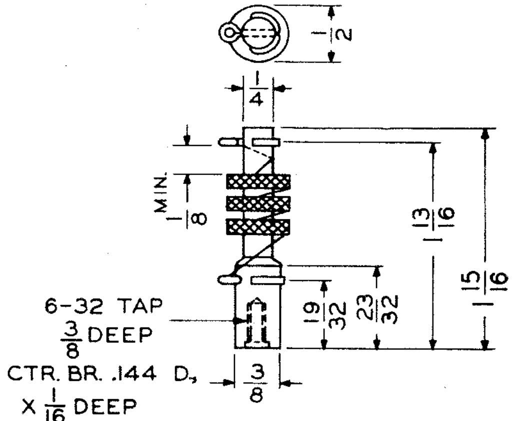
SYMBOL DESIGNATION	COLLINS PART NO.
L104	240 6000 00 OR 240N60



2 SECT. 105T EACH
#28 DSC

IND.-208 MICROH.
DC RES.-2 OHMS

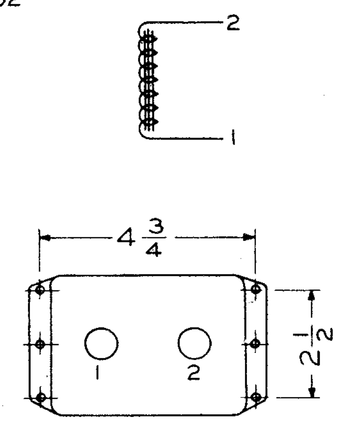
SYMBOL DESIGNATION	COLLINS PART NO.
L116, L1912, L1913, L1914, L1915, L1916, L1917, L1918, L1919, L1920	240 5800 00 OR 240N58



190 TURNS #32
SSE PER PIE

IND.-1 MH ± 10%
MAX. CURRENT-300 MA
DC RES.-10 OHMS

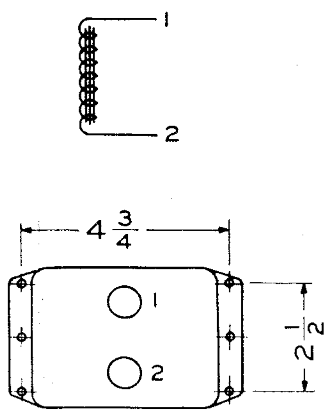
SYMBOL DESIGNATION	COLLINS PART NO.
L1801 L1802 L1902	678 2390 00 OR 678N239



2050T
#23 EN.

IND.-6 HY. +20-0%
MAX. CURRENT-0.3 AMP.
DC RES.-40 OHMS

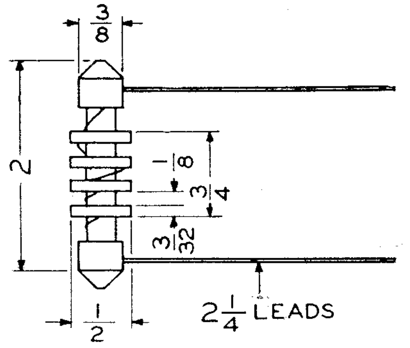
SYMBOL DESIGNATION	COLLINS PART NO
L1807 L1901	678 2600 00 OR 678N260



320T
#17 EN.

IND.-0.15 HY.
MAX. CURRENT-1 AMP.

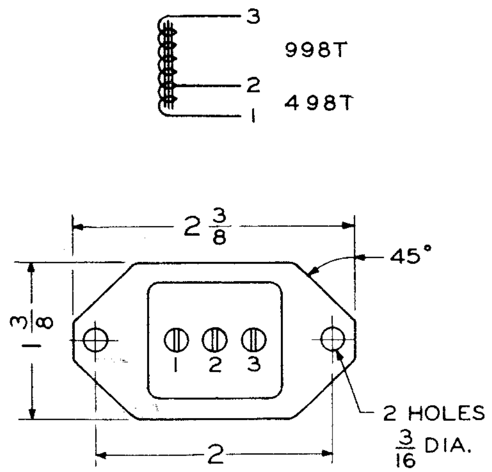
SYMBOL DESIGNATION	COLLINS PART NO.
L107	240 2100 00 OR 240N2A



4 SECT. 222T EACH
#35 SSE

IND.-2.5 MH ± 20%
MAX. CURRENT-0.125 AMP.
DC RES.-35 TO 50 OHMS

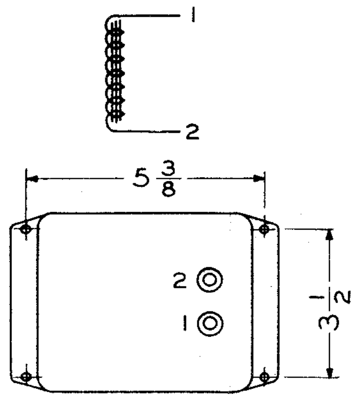
SYMBOL DESIGNATION	COLLINS PART NO.
L302	678 2470 00 OR 678N247



1496T
#33 EN.

IND.-0.25 HY ± 5%

SYMBOL DESIGNATION	COLLINS PART NO.
L1803 L1804 L1903	678 1510 00 OR 678N151



2088T
#24 EN.

IND.-6 HY+20-0%
MAX. CURRENT-0.4 AMP.
DC RES.-48.4 OHMS

LEGEND

EN.-PLAIN ENAMEL WIRE
SSE.-SINGLE SILK ENAMELED
DSC.-DOUBLE SILK COVERED
T.-TURNS

Fig. 119 Inductors and Reactor Winding Data
(Dwg. No. 502 0802 004)

Fig. 119 Inductors and Reactor Winding Data
(Dwg. No. 502 0802 004)

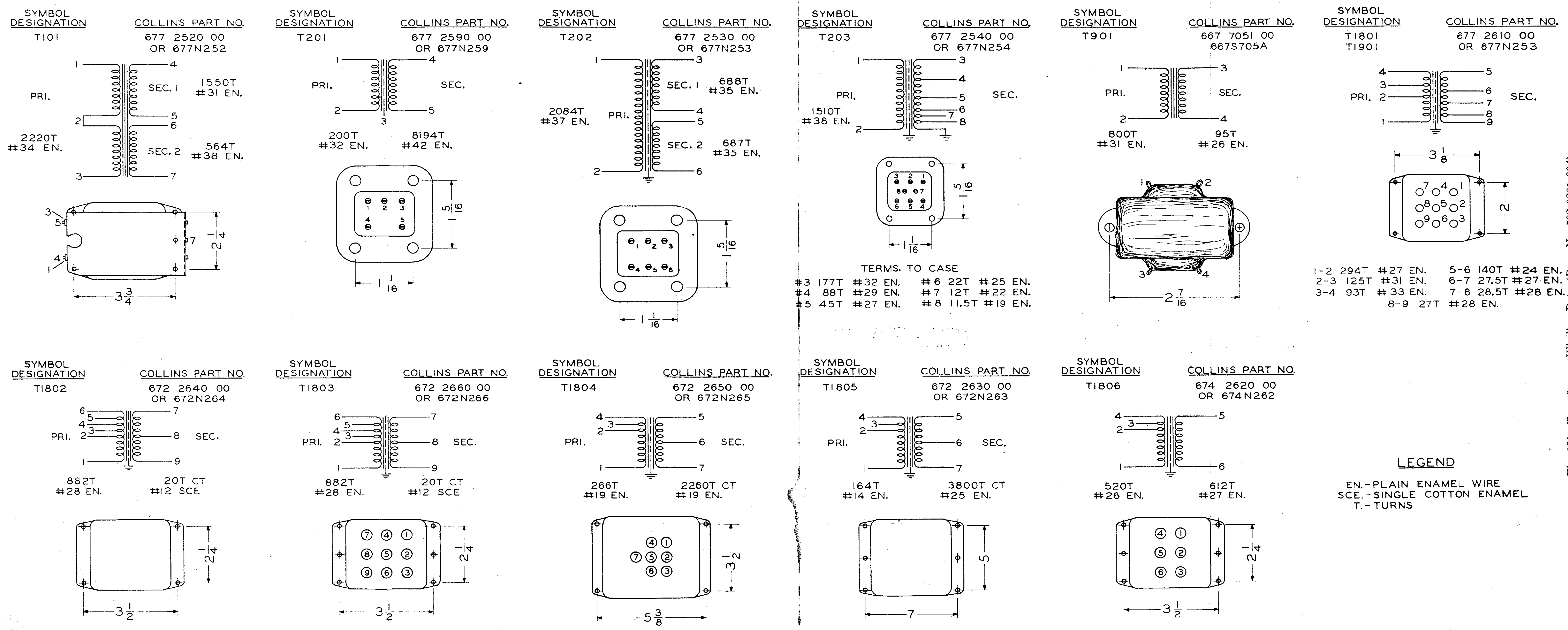


Fig. 120 Transformer Winding Data (Dwg. No. 502 0801 004)

Fig. 120 Transformer Winding Data (Dwg. No. 502 0801 004)

APPENDIX

COMMERCIAL ASSEMBLIES

The following drawings and parts lists cover standard commercial assemblies for which replacement parts are obtainable. Ordering information is given such as to permit identification of any part which is subject to failure as a result of normal wear in service.

Because of special design the manufacturers of the following relays consider it impractical to replace parts of these assemblies. If any of these units fail, a complete assembly should be ordered.

Part Number (Item No.)	Function
405NB201A (K101)	Autotune Motor Control Relay
410N18 (K105)	Output Circuit Selecting Relay
405NB204A (K1801)	Filament Control Relay
405NB205A (K1802), (K1902)	Carrier Control Relay
405NB208 (K1803), (K1903)	Keying Relay
402N18 (K1804)	Time Delay Relay
405NB207 (K1805)	Power Control Delay Relay
405NB206 (K1806), (K1904)	Plate Power Control Relay
405NB203A (K1901)	Filament Control Relay

Adjustment data on the following items is included:

405NB201A (K101)	Autotune Motor Control Relay
410N19A (K102)	Keying Relay
410N17 (K103)	CW Emission Control Relay
410N16 (K104)	Voice Emission Control Relay
410N18 (K105)	Output Circuit Selecting Relay

1. GENERAL REQUIREMENTS FOR SATISFACTORY OPERATION

(a) All screws and nuts should be tight.

(b) All relay assemblies should be securely mounted.

(c) When replacing parts such as coils or contacts, the wires should have a little slack, but not enough to interfere with moving parts. All unnecessary solder should be removed and bare wire should be bent in such a manner that it will not touch adjacent metal parts.

(d) When replacing armatures or contacts, the bushings and springs should be carefully aligned and checked for free operation.

(e) When adjusting contact springs, the bends in the springs should be gradual rather than sharp bends or kinks.

(f) Contacts should be carefully aligned and under no condition should the contacts be more than one-fourth of the diameter of the contacts out of alignment with respect to each other as gauged by eye.

(g) The coils should measure within $\pm 5\%$ of the specified d-c resistance. NOTE: The resistance values of the windings are based upon a normal temperature of 68 degrees F. If the resistance is measured at a temperature other than 68 degrees F. corrections should be made for the difference in temperature.

(h) It is important that the relay contacts be kept free from corrosion and pits. The relays should be inspected regularly and if the contacts have become corroded a burnishing tool should be used to remove the corrosion.

(i) The armature should not make contact with the core.

2. RELAY ADJUSTMENT

(a) 405NB201A (K101)

The contacts should be adjusted so that when the relay is in the unoperated position the spacing between the movable contact and the stationary contact is between .040 inch and .050 inch. The armature should be adjusted so that the spacing between the armature and the top edge of the field pole is .040 inch. The tension of the armature spring should be adjusted so that the armature back tension is 7 ounces. This relay should operate with a minimum of 16 volts d.c. and a maximum of 32 volts d.c. The d-c resistance of the coil, measured at 68 degrees F., should be 150 ohms.

(b) 410N19A (K102)

This relay has been provided with three adjusting screws. The two adjusting screws located on the side of the relay opposite the multi-terminal connector plugs, Item 20, control the position and tension of the relay armature when the relay is unoperated. The lower adjusting screw determines the position of the armature and the upper screw determines the tension of the armature return spring. The tension of the armature return spring, as measured at the top of the bakelite strip should be between 23 ounces and 24 ounces.

To set the armature position, leave the relay in the unoperated condition and rotate the lower adjusting screw in a clockwise direction until the movable contacts just begin to lift from the fixed contacts. Then rotate the adjusting screw approximately one-half revolution in a counterclockwise direction. Two of the movable contacts should rest firmly against the fixed contacts. The position of each fixed contact is adjustable and may be set by loosening the locking nut and rotating the contact. Check the adjustment of the remaining fixed contacts by applying between 18 volts d.c. and 32 volts d.c. to the relay coil (terminals 14 and 15 on the multi-terminal connector plug, Item 20) and observing the position of the movable contacts. The movable contacts should rest firmly against the corresponding fixed contact.

The contacts of the relay should be adjusted so that the gap between the movable contacts and the fixed contacts, when the relay is unoperated, is between .015 inch and .020 inch. The relay will operate with a minimum of 18 volts d.c. applied to the coil but will only follow keying of eight impulses per second with this voltage. With 24 volts d.c. applied to the relay coil the armature will follow keying at 16 impulses per second. With 28 volts d.c. applied to the relay coil, the armature will follow keying of 35 words-per-minute. The maximum voltage that should be applied to the relay coil is 32 volts d.c.

(c) 260N601 (S116)

This vacuum contact is mounted on relay 410N19A. The vacuum contact must be adjusted to operate properly when the relay 410N19A is adjusted as described in the preceding paragraphs. A single adjusting screw near the multi-terminal connector plug permits the adjustment of the mounting yoke so that the movable contact operating arm will operate the arm to close the contact but will not apply enough pressure to damage the vacuum tube. To adjust the mounting yoke, loosen the studs, Item 17, and with relay unoperated, rotate the adjusting screw, Item 16, in a direction that allows the movable contact within the vacuum tube to rest firmly against the fixed contact that is ordinarily connected to the RECEIVER terminal of the transmitter, that is, Item 10 on the relay drawing. When this adjustment has been completed, tighten the studs, Item 17, and apply voltage to the relay coil (Terminals 14 and 15 on the multi-terminal connector plug, Item 20) and, with the relay operated, check the position of the movable contact within the vacuum tube. The movable contact arm should rest firmly against the fixed contact that is ordinarily connected to the COND. terminal on the transmitter. The contact should be firm but the movable arm should not apply enough pressure to the fixed arm to endanger the vacuum seal. If the movable contact is applying too much pressure to the fixed contact when the relay is operated, readjust the lower adjusting screw on the side of relay 410N19A, opposite the connector plug, to reduce the pressure.

(d) 410N17 (K103)

The contacts of this relay should be adjusted so that when the relay is unoperated the gap between the fixed contact and the movable contact, Item 17, is between .045 inch and .050 inch. The gap between the armature and the front edge of the field piece should be $\frac{3}{32}$ inch. The armature return spring, Item 8, should be adjusted so that the pressure against the top contacts when the relay is unoperated is between 75 and 80 grams. The pressure between the movable contacts and the fixed contacts when the relay is operated should be between 50 and 55 grams. The d-c resistance of the coil is 125 ohms. The minimum voltage required for satisfactory operation is 18 volts d.c. The voltage applied to the coil should never exceed 32 volts d.c.

(e) 410N16 (K104)

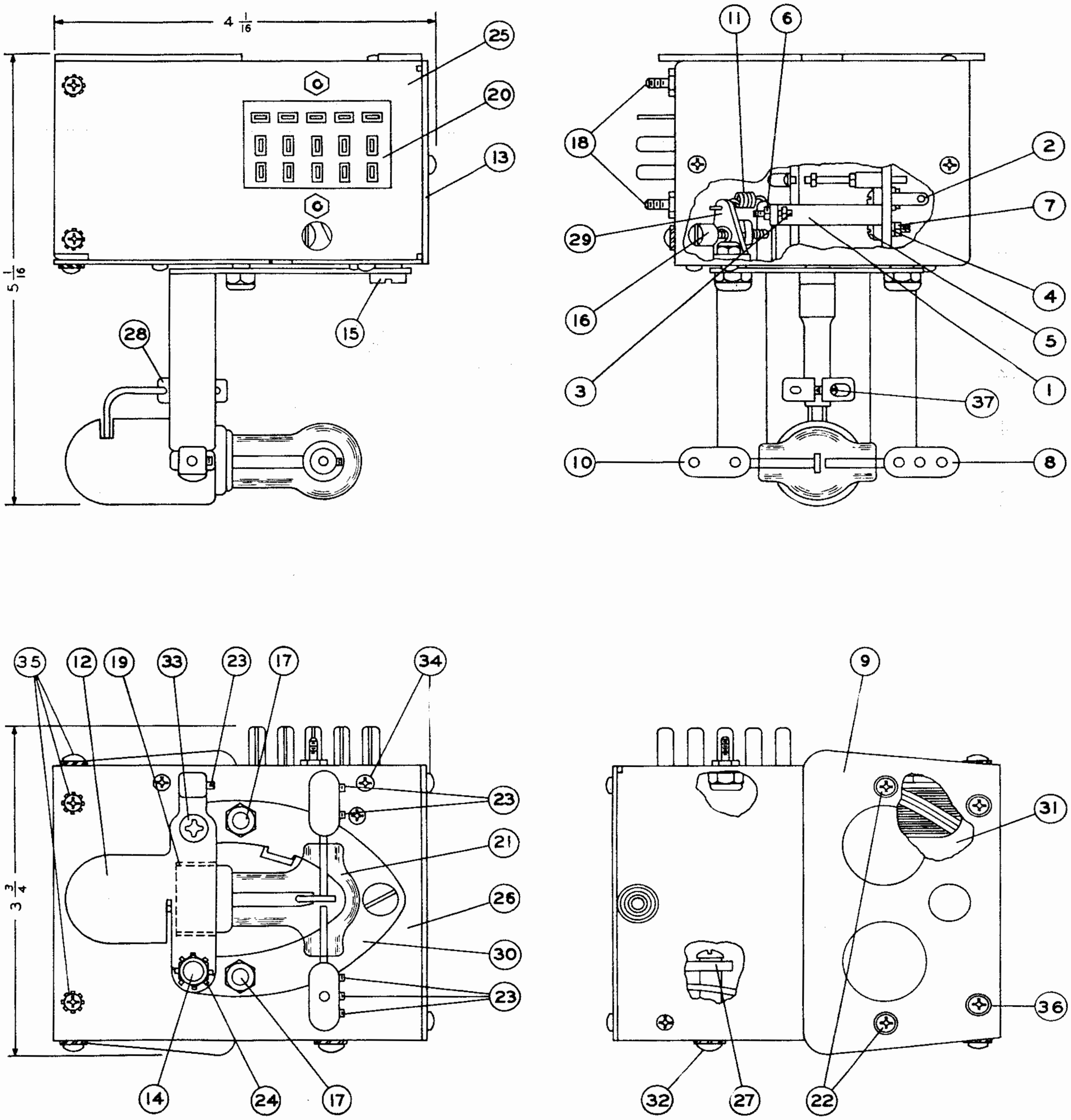
The contacts should be adjusted so that the air gap between the movable contacts, Item 3, and the fixed contacts, Item 9, is .030 inch. The armature return spring, Item 6, should be adjusted so that the pressure between the movable contacts and the upper fixed contacts is 50 grams. When the relay is operated the pressure between the movable contacts and the lower fixed contacts should be 70 grams. The air gap between the field piece and the armature, as measured at the front edge of the field piece, should be .035 inch. The d-c resistance of the coil measured at 68 degrees F. is 150 ohms. The relay should operate with a minimum of 18 volts d.c. and the voltage applied to the coil should never exceed 32 volts d.c.

(f) 410N18 (K105)

The air gap between the normally open contacts and the fixed contacts should be adjusted to between .015 inch and .020 inch. The normally closed contacts should be adjusted so that the air gap between the contacts when the relay is operated and the fixed contacts is between .055 inch and .060 inch. The d-c resistance of the coil is 125 ohms. The minimum voltage necessary for satisfactory operation is 18 volts d.c. The maximum voltage that should be applied to the relay coil is 32 volts d.c. continuous operation.

PARTS LIST FOR 410N19A KEYING RELAY
(Guardian Type G-32877)

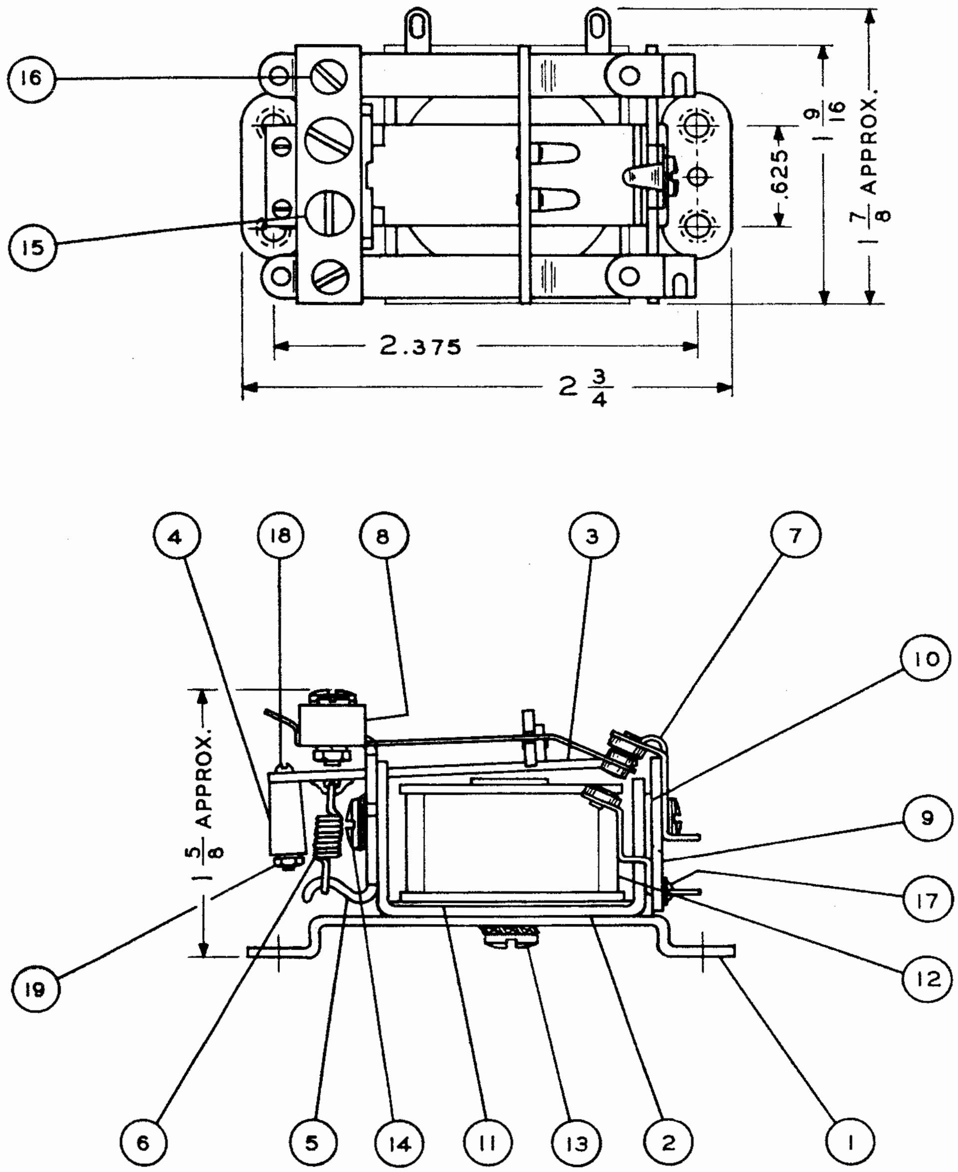
Item	Qty.	Guardian Part No.	Description
1	1	BR-599-A	Contact Mounting Bracket
2	1	#2522-4	Solder Lug
3	1	SW-57-A	Adj. Contact Screw
4	2		#4 Split Lock Washers
5	2		4-40 x 3/8″ Binder Head Mch. Screw
6	1		4-48 x 3/16″ Hex. Nuts
7	2		4-40 x 3/16″ Hex. Nuts
8	1	BU-110	Vacuum Tube Terminal
9	1	BM-161	Mounting Plate
10	1	BU-102	Vacuum Tube Terminal
11	1	CS-142	Adjusting Bracket Spring
12	1	CV-81	Tube End Cover
13	1	CV-94	Cover (Top)
14	1	N-19	Hex. Cap. Nut
15	1	ST-157	Lever Bearing Stud
16	1	SW-54	Tube Adjusting Screw
17	2	SW-56	Adjustment Screw
18	2	SW-60	Insert Screw
19	1	X-380	Rubber Cushion
20	1	X-382	Contact Plug
21	1	X-399	Vacuum Switch
22	6		4-40 x 3/8″ Flat Head Mch. Screw
23	6		4-48 x 1/16″ Bristol Head
24	1		#8 External Shakeproof Washer
25	1	CVA-20	Side Cover Assembly
26	1	CVA-21	Side Cover Assembly
27	1	X-386	Terminal Block Assembly
28	1	X-381	Collar & Arm Assembly
29	1	BRA-97	Stop Bracket Assembly
30	1	BRA-98	Tube Adjusting Bracket Assembly
31	1	FIA-85	Coil & Armature Assembly
32	2		6-32 x 1/4″ Binder Head Mch. Screw
33	1		8-32 x 5/8″ Binder Head Mch. Screw
34	6		4-40 x 5/16″ Binder Head Mch. Screw
35	6		4-40 x 3/16″ Binder Head Mch. Screw
36	2		4-40 x 3/16″ Flat Head Mch. Screw
37	1		2-56 x 3/8″ Round Head Mch. Screw



410N19A Keying Relay (K102) (Dwg. 500 0240 00C)

PARTS LIST FOR 410N16 RELAY
(Guardian Type G-32734)

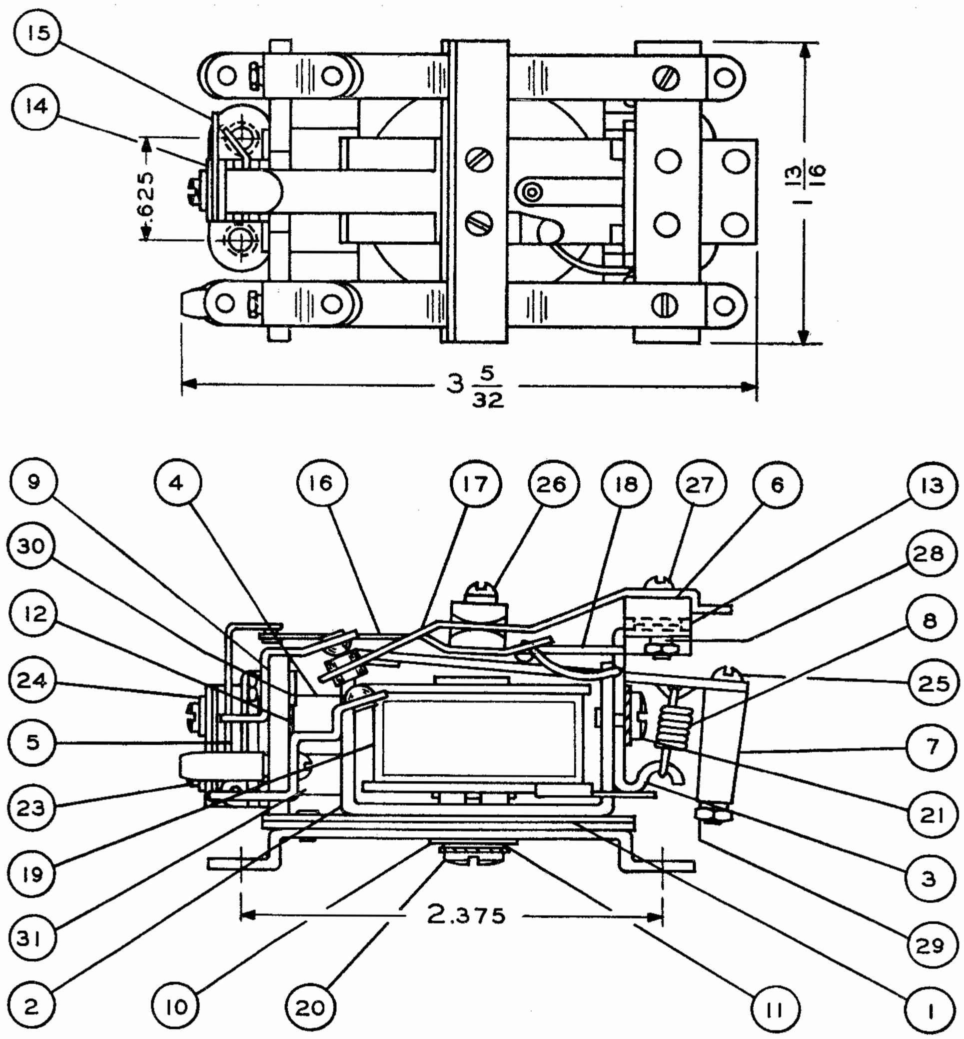
Item	Qty.	Guardian Part No.	Description
1	1	BR-611-B	Relay Mounting Brkt.
2	1	FI-48	Field Piece
3	1	ARA-319	Armature Assembly
4	1	X-241	Counterweight
5	1	BR-487	Armature Retainer Bracket
6	1	CS-120	Armature Spring
7	1	US-128-C	Armature Stop Bracket
8	1	BBA-74	Contact Block & Spring Assembly
9	1	BBA-61	Contact Bracket & Block Assembly
10	1	BB-141	Spacer Block
11	1	FP-23	Coil Insulator
12	1	SP-220-W	Coil Assembly
13	1		8-32 x 3/8″ Binder Head Screw
14	1		8-32 x 3/16″ Binder Head Screw
15	2		6-32 x 3/8″ Binder Head Screw
16	2		6-32 x 7/16″ Binder Head Screw
17	1		2-56 x 3/16″ Round Head Screw
18	2		2-56 x 5/8″ Round Head Screw
19	2		2-56 x 3/16″ Hex. Nuts



410N16 "Voice" Relay (K104) (Dwg. 500 0231 00B)

PARTS LIST FOR 410N17 RELAY
(Guardian Type G-32811)

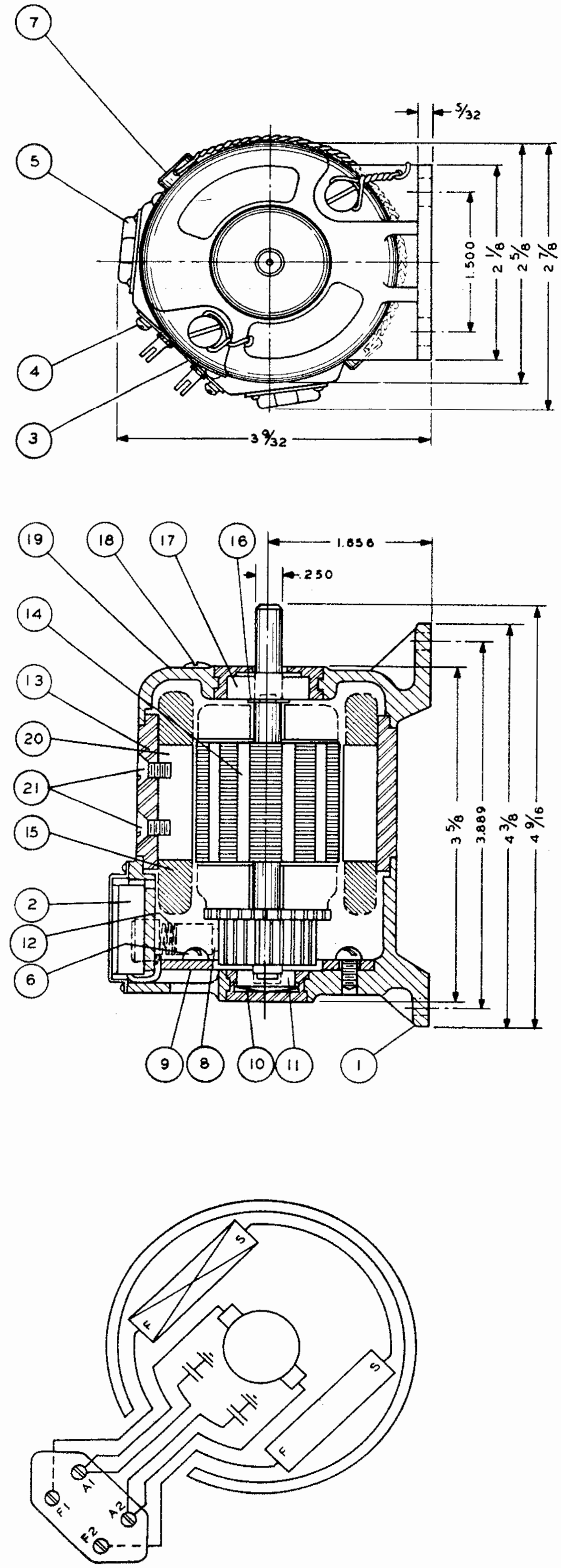
Item	Qty.	Guardian Part No.	Description
1	1	BRA-101	Mounting Bracket Assembly
2	1	FI-64	Field Piece
3	1	BR-487A	Armature Retainer Bracket
4	2	SPA-85	Spacers
5	1	CXA-829	A-2 Contact Assembly
6	1	B-179	Contact Spring Mounting Bar
7	1	X-389	Counterweight
8	1	CS-122	Armature Spring
9	1	BBA-76	Contact Bracket & Block Assembly
10	1	FW-16	Bakelite Washer
11	1	MW-47-D	Plain Brass Washer
12	2	FW-90	Cushion Washers
13	4	FW-91	Cushion Washers
14	1	CS-18-J	Separator Plate
15	1	CX-21	Lug Adapter
16	1	ARA-424	Armature Assembly
17	2	CX-350	Contact Spring Assembly
18	1	BRA-99-A	Armature Bracket Assembly
19	1	SP-222-W	Coil Assembly
20	1		8-32 x 1/2″ Binder Head Screw
21	1		8-32 x 3/16″ Binder Head Screw
22	2		#8 Shakeproof
23	2		5-40 x 5/8″ Fillister Head Screw
24	2		#5 Split Lock Washers
25	2		2-56 x 7/8″ Round Head Screw
26	2		2-56 x 3/8″ Round Head Screw
27	2		2-56 x 7/16″ Round Head Screw
28	6		#2 Split Lock Washers
29	4		2-56 x 3/16″ Hex. Nuts
30	2		2-56 x 1/4″ Special Mch. Screw
31	2		2-56 x 1/4″ Round Head Screw



410N17 CW Relay (K103) (Dwg. 500 0236 00B)

PARTS LIST FOR EMERSON MOTOR NY-818C-A

Item	Qty.	Guardian Part No.	Description
1	1	94716-D	Brushholder End Bracket
2	2	96580-A	Condenser
3	1	96953-A	Terminal Assembly
4	2	96030-A-15	Terminal Screws
5	2	96509-A	Condenser Covers
6	3	96030-A-14	Brushholder Mounting Screws
7	2	96254-A	Brushholder Cap
8	2	94718-A	Brush
9	1	94717-B	Brushholder
10	1	3520-14	Bearing Load Spring
11	1	S1DD7	Bearing
12	2	95320-A	Brush Spring
13	1	94713-B	Motor Yoke
14	1	94715-B	Armature Ass'y. (without bearing)
15	1		Field Coil
16	1	96065-A-17	Thrust Washer
17	1	37DD	Bearing
18	2	94719-A	Motor Stud
19	1	94714-D	End Bracket
20	2		Pole Piece Assembly
21	4		Pole Piece Screws



NY-818C-A Motor (Dwg. 500 0238 00C)

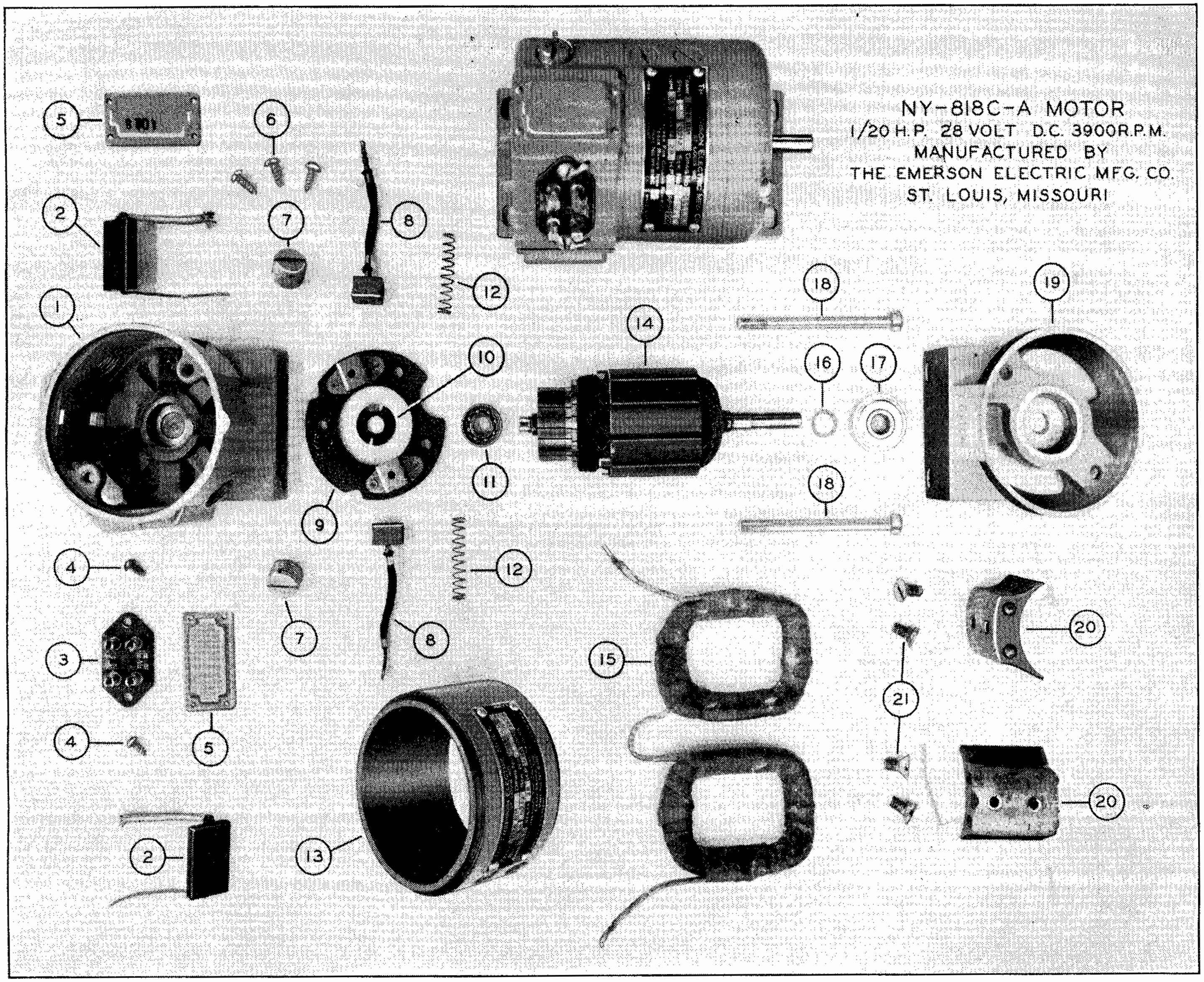

NY-818C-A MOTOR
1/20 H.P. 28 VOLT D.C. 3900 R.P.M.
MANUFACTURED BY
THE EMERSON ELECTRIC MFG. CO.
ST. LOUIS, MISSOURI
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TABLE XIX—TUBE COMPLEMENT

Tube Type	Quan.	Function
837	1	H-F Oscillator
1625	1	1st Frequency Multiplier
1625	1	2nd Frequency Multiplier
813	1	Power Amplifier
811	2	Modulators
12SJ7	1	Audio Amplifier
6V6GT	1	Audio Driver
6V6GT	1	Sidetone Amplifier
12SJ7	1	Calibration Oscillator
12SJ7	1	MCW Oscillator
1625	1	L-F Oscillator
866/866A*	2	L.V. Rectifiers
866/866A*	2	H.V. Rectifiers

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

1. Operate all tube filaments within ±5% of rated voltage.
2. Do not exceed rated plate current in any of the tubes during normal operation of the equipment.
3. 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 the tubes.

ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

The following tube data is reproduced by permission of Radio Corporation of America.

* Use when employing the COL–211101 Power Unit.

837
R-F POWER AMPLIFIER PENTODE

Heater°	Coated Unipotential Cathode	
Voltage□	12.6	a-c or d-c volts ←
Current	0.7	amp.
Transconductance for plate current of 24 ma.	3400	µmhos
Direct Interelectrode Capacitances:		
Grid to Plate (with external shielding)	0.20 max.	µµf
Input	16	µµf
Output	10	µµf
Maximum Overall Length		5-7/8"
Maximum Diameter		2-1/16"
Bulb		ST-16
Cap		Small Metal
Base		Medium 7-Pin Ceramic, Bayonet

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage			500 max.	volts
D-C Suppressor Voltage (Grid #3)			200 max.	volts
D-C Screen Voltage (Grid #2)			200 max.	volts
D-C Plate Current			40 max.	ma.
Plate Input			16 max.	watts
Suppressor Input			5 max.	watts
Screen Input			5 max.	watts
Plate Dissipation			12 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	500	volts
D-C Suppressor Voltage	0	0	40	volts
D-C Screen Voltage	200	200	200	volts
D-C Grid Voltage (Grid #1)	-25	-25	-25	volts
Peak R-F Grid Voltage	28	25	24	volts
Internal Shield	Connected to cathode at socket			
D-C Plate Current	35	30	30	ma.
D-C Screen Current	10	15	12	ma.
D-C Grid Current	1	0	0	approx. ma.
Driving Power *	0.4	0.2	0.1	approx. watt
Power Output	4	5	5.5	approx. watts

* At crest of a-f cycle with modulation factor of 1.0.

SUPPRESSOR-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage	500 max.	volts
D-C Screen Voltage (Grid #2)	200 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	volts
D-C Plate Current	40 max.	ma.
D-C Grid Current	8 max.	ma.
Plate Input	16 max.	watts
Screen Input	8 max.	watts
Plate Dissipation	12 max.	watts

□ Should not deviate more than ±10% from rated value.
° See NOTE on DATA 3 page.
← Indicates a change.

837
R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

Typical Operation:			
D-C Plate Voltage	400	500	volts
D-C Suppressor Voltage (Grid #3)	-55	-65	volts
D-C Screen Voltage△	6500	14000	ohms
D-C Grid Voltage□§ ←	{ -20	-20	volts
	{ 2500	5700	ohms
Peak A-F Suppressor Voltage	55	65	volts
Peak R-F Grid Voltage	45	32	volts
Internal Shield	Connected to cathode at socket		
D-C Plate Current	35	30	ma.
D-C Screen Current	37	23	ma.
D-C Grid Current	8	3.5	approx. ma.
Driving Power	0.4	0.1	approx. watt
Power Output	4	5	approx. watts

△ Voltage taken from unmodulated plate-voltage supply through resistor.
□ From fixed supply or grid-leak resistor.

GRID-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage			500 max.	volts
D-C Suppressor Voltage (Grid #3)			200 max.	volts
D-C Screen Voltage (Grid #2)			200 max.	volts
D-C Grid Voltage (Grid #1)			-200 max.	volts
D-C Plate Current			40 max.	ma.
Plate Input			16 max.	watts
Suppressor Input			5 max.	watts
Screen Input			5 max.	watts
Plate Dissipation			12 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	500	volts
D-C Suppressor Voltage	0	0	40	volts
D-C Screen Voltage	200	200	200	volts
D-C Grid Voltage § ←	-50	-45	-43	volts
Peak R-F Grid Voltage	58	48	44	volts
Peak A-F Grid Voltage	25	20	18	volts
Internal Shield	Connected to cathode at socket			
D-C Plate Current	35	30	30	ma.
D-C Screen Current	9	7	6	ma.
D-C Grid Current	1	0	0	approx. ma.
Driving Power *	0.5	0.2	0.15	approx. watt
Power Output	4	5	5.5	approx. watts

* At crest of a-f cycle with modulation factor of 1.0

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Pentode Connection

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage	400 max.	volts
D-C Suppressor Voltage (Grid #3)	200 max.	volts
D-C Screen Voltage (Grid #2)	200 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	volts
D-C Plate Current	50 max.	ma.

§ See end of tabulation.
← Indicates a change.

837
R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

D-C Grid Current	8 max.	ma.
Plate Input	20 max.	watts
Screen Input	5 max.	watts
Suppressor Input	5 max.	watts
Plate Dissipation	8 max.	watts
Typical Operation:		
D-C Plate Voltage	400	volts
D-C Suppressor Voltage	40	volts
D-C Screen Voltage #	{ 13000	ohms
	{ 140	volts
D-C Grid Voltage▲ § ←	{ -40	volts
	{ 8000	ohms
Peak R-F Grid Voltage	60	volts
Internal Shield	Connected to cathode at socket	
D-C Plate Current	45	ma.
D-C Screen Current	20	ma.
D-C Grid Current	5	approx. ma.
Driving Power	0.3	approx. watt
Power Output	11	approx. watts

\# From modulated fixed supply or modulated plate-voltage supply through resistor.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Tetrode Connection - Grids #2 & #3 tied together

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage	400 max.	volts
D-C Screen Voltage (Grids #2 & #3)	200 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	volts
D-C Plate Current	50 max.	ma.
D-C Grid Current	8 max.	ma.
Plate Input	20 max.	watts
Screen Input	7.5 max.	watts
Plate Dissipation	8 max.	watts
Typical Operation:		
D-C Plate Voltage	400	volts
D-C Screen Voltage ##	{ 10000	ohms
	{ 100	volts
D-C Grid Voltage▲ § ←	{ -70	volts
	{ 10000	ohms
Peak R-F Grid Voltage	100	volts
Internal Shield	Connected to cathode at socket	
D-C Plate Current	45	ma.
D-C Screen Current	30	ma.
D-C Grid Current	7	approx. ma.
Driving Power	0.7	approx. watt
Power Output	11	approx. watts

\#\# Preferably from unmodulated plate-voltage supply through resistor.
▲ Obtained by grid-leak resistor or by partial self-bias methods.
§ See end of tabulation.
← Indicates a change.

837
R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Pentode Connection

Key-down conditions per tube without modulation °°

D-C Plate Voltage			500 max.	volts
D-C Suppressor Voltage (Grid #3)			200 max.	volts
D-C Screen Voltage (Grid #2)			200 max.	volts
D-C Grid Voltage (Grid #1)			-200 max.	volts
D-C Plate Current			80 max.	ma.
D-C Grid Current			8 max.	ma.
Plate Input			32 max.	watts
Suppressor Input			5 max.	watts
Screen Input			8 max.	watts
Plate Dissipation			12 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	500	volts
D-C Suppressor Voltage	0	0	40	volts
D-C Screen Voltage♦	200	200	200	volts
	6300	10000	20000	ohms
→ D-C Grid Voltage■ §	-40	-85	-75	volts
	5000	10600	18700	ohms
Peak R-F Grid Voltage	70	120	100	volts
Internal Shield	Connected to cathode at socket			
D-C Plate Current	70	60	60	ma.
D-C Screen Current	32	30	15	ma.
D-C Grid Current	8	8	4	approx. ma.
Driving Power	0.5	0.8	0.4	approx. watt
Power Output	16	20	22	approx. watts

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Tetrode Connection – Grids #2 & #3 tied together

Key-down conditions per tube without modulation °°

D-C Plate Voltage		500 max.	volts
→ D-C Screen Voltage (Grids #2 & #3)		200 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.	volts
D-C Plate Current		80 max.	ma.
D-C Grid Current		8 max.	ma.
Plate Input		32 max.	watts
Screen Input		8 max.	watts
Plate Dissipation		12 max.	watts
Typical Operation:			
D-C Plate Voltage	400	500	volts
D-C Screen Voltage ♦	11600	28000	ohms
	110	80	volts
D-C Grid Voltage ■ §	8700	8700	ohms
	-70	-70	volts
Peak R-F Grid Voltage	115	110	volts
Internal Shield	Connected to cathode at socket		

°° Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

♦,■ See next page.

§ See end of tabulation.

← Indicates a change.

837
R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

D-C Plate Current	70	60	ma.
D-C Screen Current	25	15	ma.
D-C Grid Current	8	8	approx. ma.
Driving Power	0.75	0.7	approx. watt
Power Output	18	20	approx. watts

♦ Obtained from fixed supply or plate-voltage supply through resistor.

■ Obtained by grid-leak resistor or other self- or fixed-bias method.

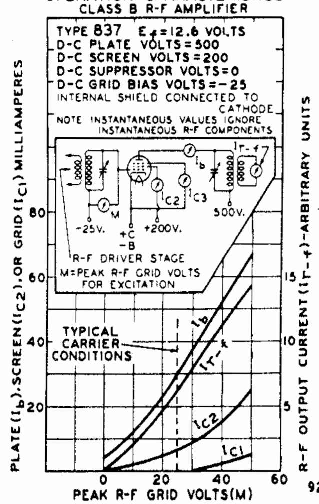
§ Maximum total effective grid circuit resistance should not exceed 25000 ohms.

NOTE. In circuits where the cathode is not directly connected to the heater, the potential difference between them should not exceed 100 volts.

The 837, as a crystal-controlled oscillator with either pentode or tetrode connection, may be operated under the conditions shown for class C telegraph services. Because the internal shielding in this tube is unusually effective, it generally is necessary to introduce external feedback in those circuits which depend on the control-grid-to-plate capacity for oscillation.

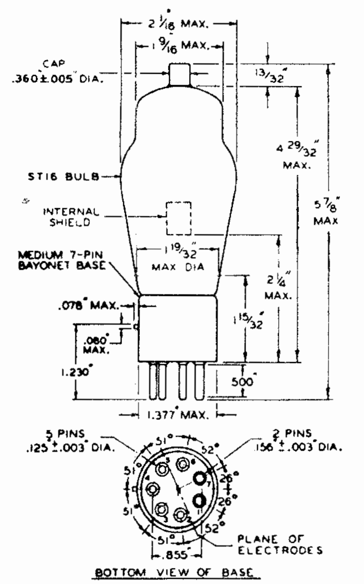
For use of the 837 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.

OPERATION CHARACTERISTICS
CLASS B R-F AMPLIFIER



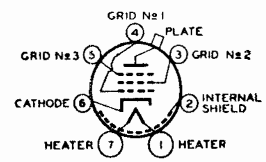
92C-4596

837
R-F POWER AMPLIFIER PENTODE



92C-4832

TOP VIEW OF SOCKET CONNECTIONS



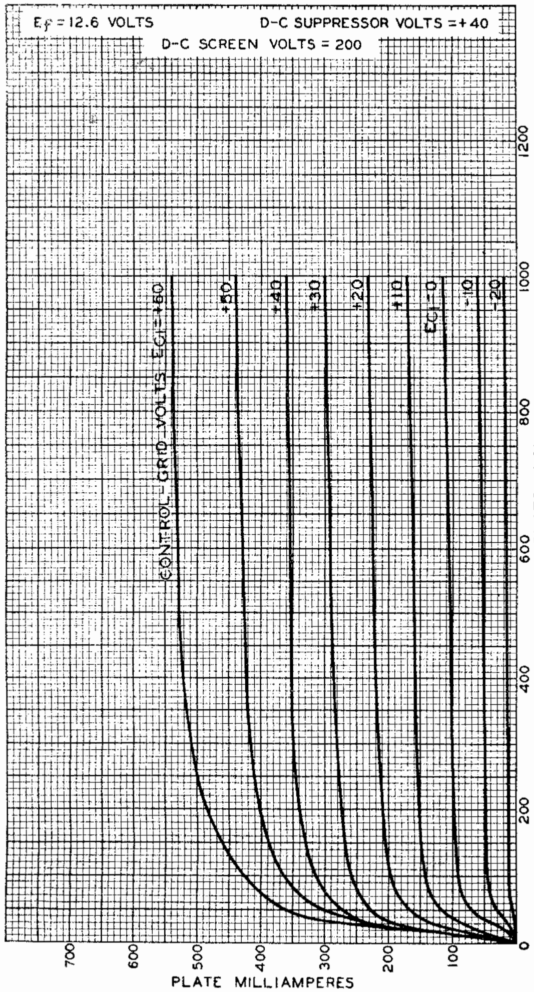
TUBE MOUNTING POSITION

VERTICAL OR HORIZONTAL

APPENDIX

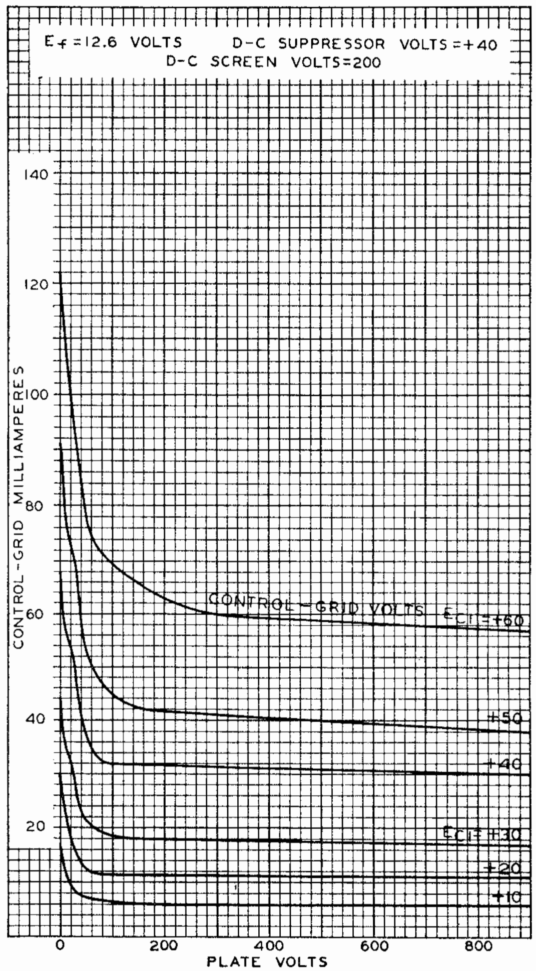
837

AVERAGE PLATE CHARACTERISTICS



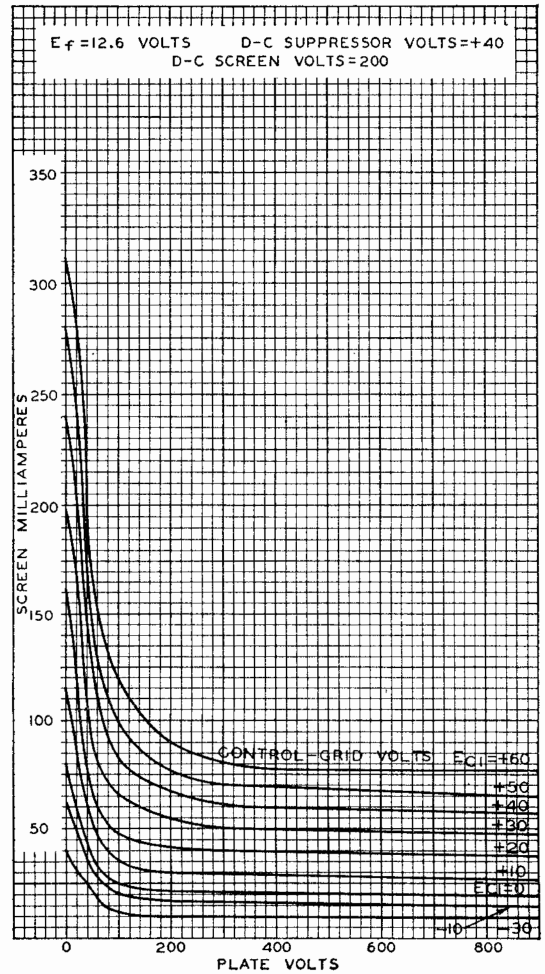
837

AVERAGE CHARACTERISTICS



837

AVERAGE CHARACTERISTICS



1625

Except for the heater rating, the electrical characteristics of the 1625 are the same as those of the 807 shown below. The heater rating of the 1625 is 12.6 volts, 0.45 amp.

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TRANSMITTING BEAM POWER AMPLIFIER

Heater •	Coated Unipotential Cathode		
Voltage	6.3	a-c or d-c volts	
Current	0.9	amp.	
Transconductance for plate cur. of 72 ma.	6000 approx.	μmhos	←
Grid-Screen Mu-Factor	8		
Direct Interelectrode Capacitances:			
Grid to Plate (With external shielding)	0.2 max.	μμf	
Input	11	μμf	
Output	7	μμf	
Maximum Overall Length	5-3/4"		
Maximum Diameter	2-1/16"		
Bulb	ST-16		
Cap	Small Metal		
Base	Medium 5-Pin, MICANOL△		

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

A-F POWER AMPLIFIER & MODULATOR - Class AB_2#

	CCS	ICAS	
D-C Plate Voltage	600 max.	750 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	300 max.	volts
Max.-Signal D-C Plate Cur.*	120 max.	120 max.	ma.
Max.-Signal Plate Input*	60 max.	90 max.	watts
Screen Input*	3.5 max.	3.5 max.	watts
Plate Dissipation*	25 max.	30 max.	watts

Typical Operation:

Unless otherwise specified, values are for 2 tubes

	CCS			ICAS		
D-C Plate Voltage	400	500	600	750	volts	
D-C Screen Voltage	300	300	300	300	volts	
D-C Grid Voltage (Fixed bias, Grid #1)	-25	-25	-30	-32	volts	
Peak A-F Grid-to-Grid Voltage	78	78	78	92	volts	←→
Zero-Sig. D-C Plate Cur.	100	100	60	60	ma.	→
Max.-Sig. D-C Plate Cur.	240	240	200	240	ma.	←→
Zero-Sig. D-C Screen Cur.	5	5	5	5	ma.	←→
Max.-Sig. D-C Screen Cur.	10	10	10	10	ma.	
Load Resistance (Per tube)	800	1060	1600	1740	ohms	→ ←
Effective Load Resistance (Plate to plate)	3200	4240	6400	6950	ohms	←
Peak Grid Input Power °	0.2	0.2	0.1	0.2	approx. watt	←
Max.-Sig. Power Output**	55	75	80	120	approx. watts	←

* In circuits where the cathode is not directly connected to the heater, the potential difference between them should not exceed 100 volts. Under the maximum plate and screen dissipation conditions, the heater voltage should not fluctuate so that it exceeds 7.0 volts.
* Averaged over any audio-frequency cycle of sine-wave form.
# Subscript 2 indicates that grid current flows during some part of input cycle.
△ Registered trademark.
← Indicates a change.
°, **: See next page.

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TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS	ICAS	
D-C Plate Voltage	600 max.	750 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	300 max.	volts
D-C Plate Current	80 max.	90 max.	ma.
Plate Input	37.5 max.	45 max.	watts
Screen Input	2.5 max.	2.5 max.	watts
Plate Dissipation	25 max.	30 max.	watts

Typical Operation:

	CCS			ICAS	
D-C Plate Voltage	400	500	600	750	volts
D-C Screen Voltage	250	250	250	300	volts
D-C Grid Volt. (Grid #1) †	-25	-25	-25	-35	volts
Peak R-F Grid Voltage	30	30	20	27	volts
D-C Plate Current	75	75	62.5	60	ma.
D-C Screen Current	4	4	3	3	ma.
D-C Grid Cur. (Approx.)	0	0	0	0	ma.
Driving Power (Approx.) °°	0.25	0.25	0.2	0.12	watt
Power Output (Approx.)	9	12.5	12.5	15	watts

°° At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS	ICAS	
D-C Plate Voltage	475 max.	600 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	300 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	-200 max.	volts
D-C Plate Current	83 max.	100 max.	ma.
D-C Grid Current	5 max.	5 max.	ma.
Plate Input	40 max.	60 max.	watts
Screen Input	2.5 max.	2.5 max.	watts
Plate Dissipation	16.5 max.	25 max.	watts

Typical Operation:

	CCS			ICAS	
D-C Plate Voltage	325	400	475	600	volts
D-C Screen Voltage ◊	225	225	225	275	volts
	20000	30000	50000	50000	ohms
D-C Grid Voltage ▲ †	-75	-80	-85	-90	volts
	25000	22800	21300	22500	ohms
Peak R-F Grid Voltage	90	95	110	115	volts
D-C Plate Current	80	80	83	100	ma.
D-C Screen Current	5	5.75	5	6.5	ma.

° Driver stage should be capable of supplying the grids of the class AB_2 stage with the specified peak values at low distortion. The effective resistance per grid circuit of the class AB_2 stage should be kept below 500 ohms and the effective impedance at the highest desired response frequency should not exceed 700 ohms.
◊ Obtained preferably from *modulated* fixed supply, or from *modulated* plate supply through resistor of value shown.
▲ May be obtained from grid resistor (25000, 22800, 21300, 22500) although combination of either grid resistor and cathode resistor or grid resistor and fixed supply is recommended.
** With zero-impedance driver and perfect regulation, plate-circuit distortion does not exceed 2%. In practice, plate-voltage regulation, screen-voltage regulation, and grid-bias regulation, should not be greater than 5%, 5%, and 3%, respectively.
† See end of tabulation.
← Indicates a change.

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TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

	CCS			ICAS		
D-C Grid Current (Approx.)	3	3.5	4	4	ma.	←
Driving Power (Approx.)	0.25	0.3	0.4	0.4	watt	←
Power Output (Approx.)	17.5	22.5	27.5	42.5	watts	←

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

	CCS	ICAS	
D-C Plate Voltage	600 max.	750 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	300 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	-200 max.	volts
D-C Plate Current	100 max.	100 max.	ma.
D-C Grid Current	5 max.	5 max.	ma.
Plate Input	60 max.	75 max.	watts
Screen Input	3.5 max.	3.5 max.	watts
Plate Dissipation	25 max.	30 max.	watts

Typical Operation:

	CCS			ICAS		
D-C Plate Voltage	400	500	600	750	volts	
D-C Screen Voltage §	250	250	250	250	volts	
	20000	42000	50000	85000	ohms	←
D-C Grid Voltage □ †	-45	-45	-45	-45	volts	←
	12800	12800	12800	12800	ohms	←
	410	410	410	410	ohms	←
Peak R-F Grid Voltage	65	65	65	65	volts	←
D-C Plate Current	100	100	100	100	ma.	←
D-C Screen Current	7.5	6	7	6	ma.	←
D-C Grid Cur. (Approx.)	3.5	3.5	3.5	3.5	ma.	←
Driving Power (Approx.)	0.2	0.2	0.2	0.2	watt	←
Power Output (Approx.)	25	30	40	50	watts	←

† The total effective grid-circuit resistance should not exceed 25000 ohms.
Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
§ Obtained from separate source, from a potentiometer, or from plate supply through a series resistor of value shown.
□ Obtained from fixed supply, by grid resistor (12800), by cathode resistor (410), or by combination methods.

Data on operating frequencies for the 807 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

← Indicates a change.

1625

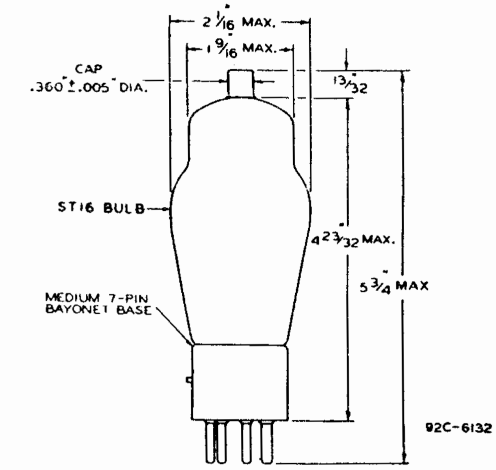
Except for the heater rating, the electrical characteristics of the 1625 are the same as those of the 807 shown below. The heater rating of the 1625 is 12.6 volts, 0.45 amp.

1625
TRANSMITTING BEAM POWER AMPLIFIER

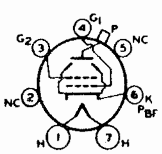
Heater°	Coated Unipotential Cathode	
Voltage	12.6	a-c or d-c volts
Current	0.45	amp.
Maximum Overall Length		5-3/4"
Maximum Diameter		2-1/16"
Bulb		ST-16
Cap		Small Metal
Base		Medium 7-Pin, MICANOL* Bayonet

° In circuits where the cathode is not directly connected to the heater, the potential difference between them should not exceed 100 volts. Under the maximum plate and screen dissipation conditions, the heater voltage should not fluctuate so that it exceeds 14 volts.
* Registered trademark.

Except for the heater rating, the electrical characteristics of the 1625 are the same as those of the 807



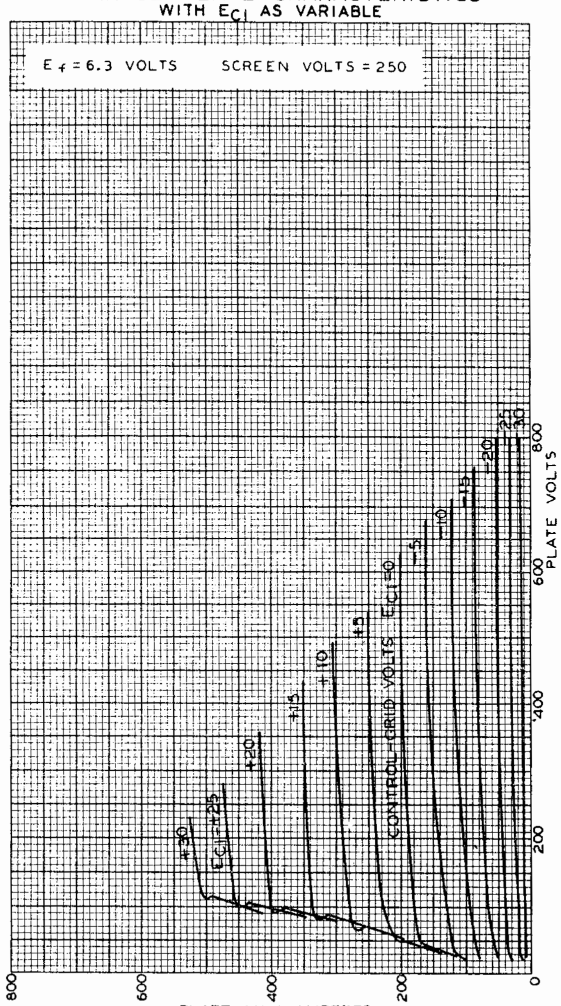
BOTTOM VIEW OF SOCKET CONNECTIONS



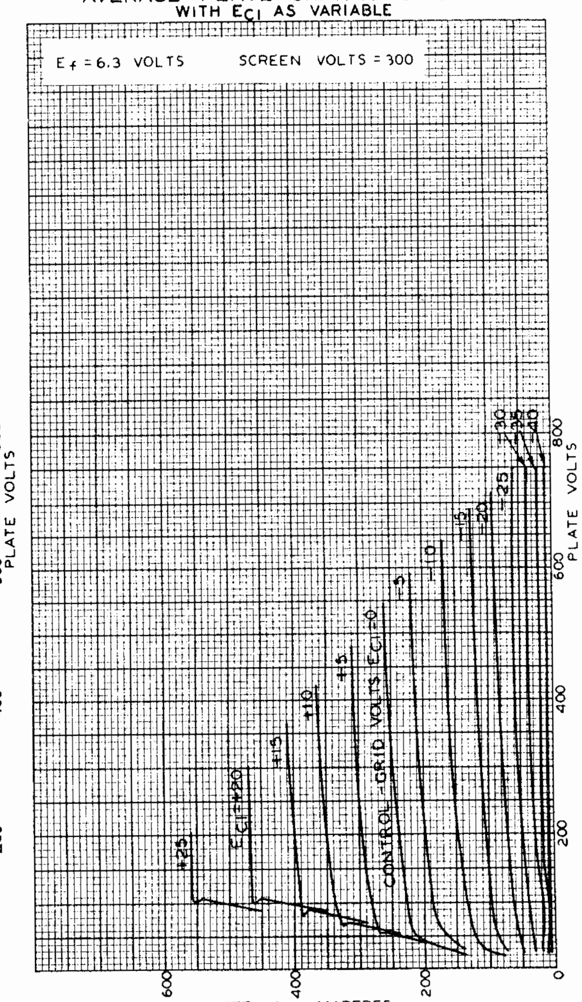
Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - Screen
Pin 4 - Grid
Pin 5 - No Connection
Pin 6 - Cathode, Beam-Forming Plates
Pin 7 - Heater
Cap - Plate

TUBE MOUNTING POSITION
VERTICAL or HORIZONTAL

807
AVERAGE PLATE CHARACTERISTICS
WITH E_{C1} AS VARIABLE



807
AVERAGE PLATE CHARACTERISTICS
WITH E_{C1} AS VARIABLE

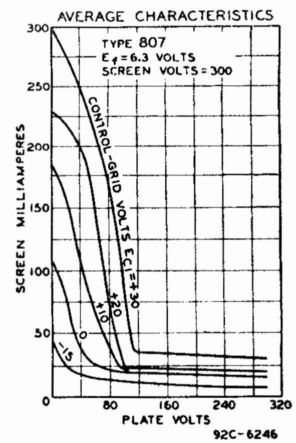


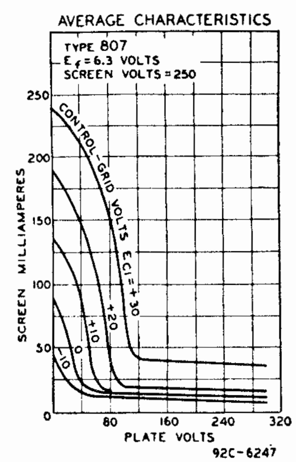
1625

Except for the heater rating, the electrical characteristics of the 1625 are the same as those of the 807 shown below. The heater rating of the 1625 is 12.6 volts, 0.45 amp.

807

TRANSMITTING BEAM POWER AMPLIFIER





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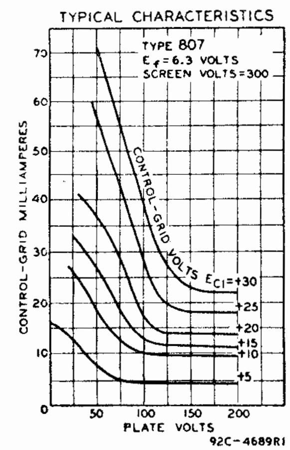
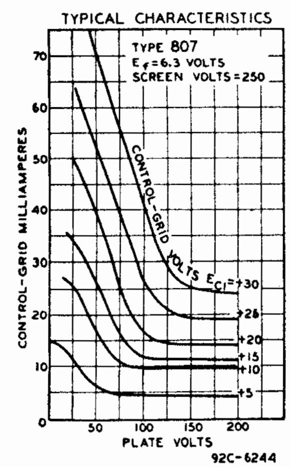
TRANSMITTING BEAM POWER AMPLIFIER





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TRANSMITTING BEAM POWER AMPLIFIER

Filament	Thoriated Tungsten	
Voltage	10.0	a-c or d-c volts
Current	5	amp.
Transconductance for plate current of 50 ma.	3750 approx.	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate (with external shielding)	0.2 max.	μμf
Input	16.3	μμf
Output	14	μμf
Maximum Overall Length		7-1/2"
Maximum Diameter		2-9/16"
Bulb		T-20
Cap		Medium Metal
Base		Giant 7-Pin, Bayonet
RCA Socket		Type UT-104

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

R-F POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		2000 max.	volts
D-C Screen Voltage (Grid #2)		400 max.	volts
D-C Plate Current		100 max.	ma.
Plate Input		150 max.	watts
Screen Input		15 max.	watts
Plate Dissipation		100 max.	watts
Typical Operation:			
D-C Plate Voltage	1500	2000	volts
D-C Screen Voltage	400	400	volts
D-C Grid Voltage (Grid #1) ●	-60	-75	volts
Peak R-F Grid Voltage	70	80	volts
Beam-Forming Plate Voltage *	0	0	volts
D-C Plate Current	100	75	ma.
D-C Screen Current	4	3	ma.
D-C Grid Current ●	–	–	approx.ma.
Driving Power ○ ▲	–	–	approx.watt
Power Output	50	50	approx.watts

● Usually negligible. Fixed supply or by-passed cathode-resistor bias recommended.
▲ Usually negligible. Never more than 2 watts.

GRID-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. or 1.0

D-C Plate Voltage		2000 max.	volts
D-C Screen Voltage (Grid #2)		400 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.	volts
D-C Plate Current		100 max.	ma.
Plate Input		150 max.	watts
Screen Input		15 max.	watts
Plate Dissipation		100 max.	watts
Typical Operation:			
D-C Plate Voltage	1500	2000	volts
D-C Screen Voltage	400	400	volts

●, *, ○: See end of tabulation.

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TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

D-C Grid Voltage ●	-140	-120	volts
Peak R-F Grid Voltage	145	120	volts
Peak A-F Grid Voltage	60	60	volts
Beam-Forming Poate Voltage *	0	0	volts
D-C Plate Current	70	75	ma.
D-C Screen Current	3	3	ma.
D-C Grid Current ●	–	–	approx.ma.
Driving Power ○ ▲	–	–	approx.watt
Power Output	40	50	approx.watts

● Usually negligible. Fixed supply or unby-passed cathode-resistor bias recommended.
▲ Usually negligible. Never more than 2 watts.

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		1600 max.	volts
D-C Screen Voltage (Grid #2)		400 max.	volts
D-C Grid Voltage (Grid #1)		-300 max.	volts
D-C Plate Current		150 max.	ma.
D-C Grid Current		25 max.	ma.
Plate Input		240 max.	watts
Screen Input		15 max.	watts
Plate Dissipation		67 max.	watts
Typical Operation:			
D-C Plate Voltage	1250	1600	volts
D-C Screen Voltage □	400	400	volts
D-C Grid Voltage † ●	-120	-130	volts
	30000	21600	ohms
Peak R-F Grid Voltage	195	210	volts
Beam-Forming Plate Voltage *	0	0	volts
D-C Plate Current	150	150	ma.
D-C Screen Current	16	20	ma.
D-C Grid Current	4	6	approx.ma.
Driving Power	0.7	1.2	approx.watts
Power Output	135	175	approx.watts

† Total effective grid-circuit resistance should not exceed 30000 ohms. Grid bias obtained by grid leak or by partial self-bias methods.
□ Obtained from fixed supply, modulated simultaneously with plate voltage.

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation ##

D-C Plate Voltage			2000 max.	volts
D-C Screen Voltage (Grid #2)			400 max.	volts
D-C Grid Voltage (Grid #1)			-300 max.	volts
D-C Plate Current			180 max.	ma.
D-C Grid Current			25 max.	ma.
Plate Input			360 max.	watts
Screen Input			22 max.	watts
Plate Dissipation			100 max.	watts
Typical Operation:				
D-C Plate Voltage	1250	1500	2000	volts

○, ●, *, ★, ##: See end of tabulation.

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TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

D-C Screen Voltage §	300	300	400	volts
	42000	60000	107000	ohms
D-C Grid Voltage ★	-60	-70	-90	volts
	8500	11700	30000	ohms
Peak R-F Grid Voltage	145	150	160	volts
Beam-Forming Plate Voltage *	0	0	0	volts
D-C Plate Current	180	180	180	ma.
D-C Screen Current	23	20	15	ma.
D-C Grid Current	7	6	3	approx.ma.
Driving Power	1	0.8	0.5	approx.watt
Power Output	155	190	260	approx.watts

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
★ Obtained by grid leak or other self- or fixed-bias method.
§ Preferably obtained from separate source or potentiometer, although series resistor connected to plate supply may be used.
* Beam-forming plates should be connected to the mid-point of filament circuit operated on a.c., or to the negative end of filament operated on d.c.
● For a-c filament supply. If d.c. is used, the stated voltages should be decreased by 7 volts.
○ At crest of audio-frequency cycle with modulation factor of 1.0.

OPERATION AT HIGH FREQUENCIES

Maximum permissible percentage of maximum rated plate voltage and plate input

FREQUENCY (Mc)	30	45	60	120
TELEPHONY – Class B	100%	93%	88%	76%
TELEPHONY – Class C Grid Mod.	100	93	88	76
TELEPHONY – Class C Plate Mod.	100	87	75	50
TELEGRAPHY – Class C	100	87	75	50

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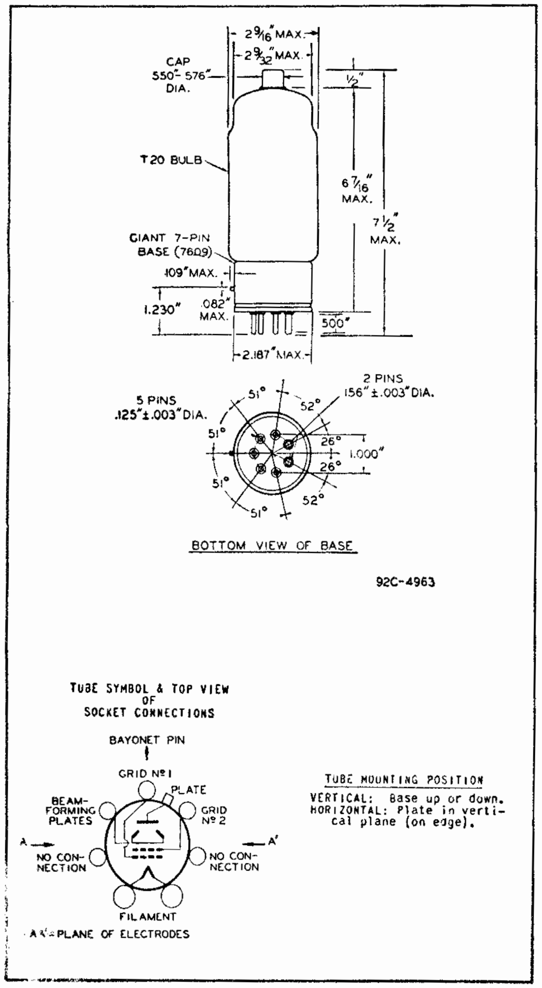
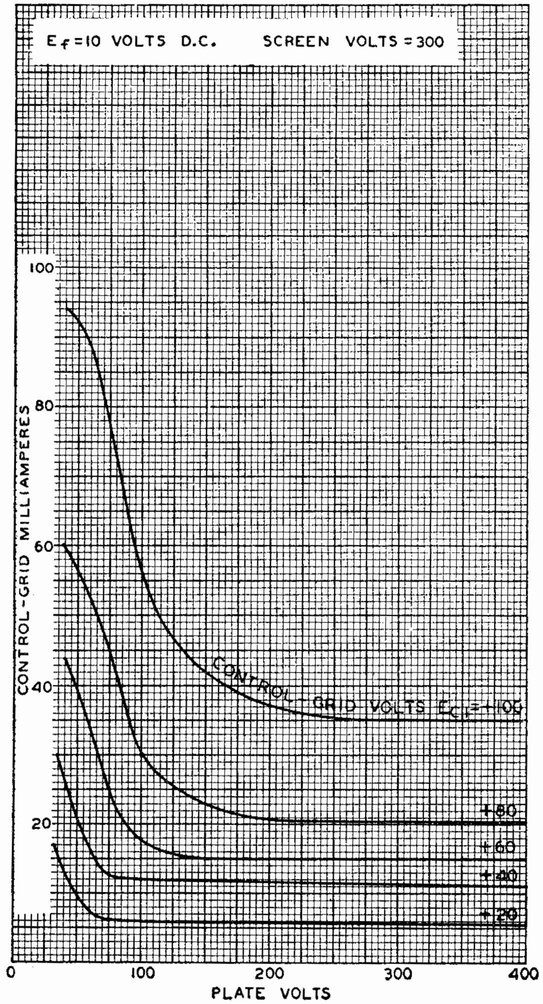
TRANSMITTING BEAM POWER AMPLIFIER



813
TYPICAL CHARACTERISTICS



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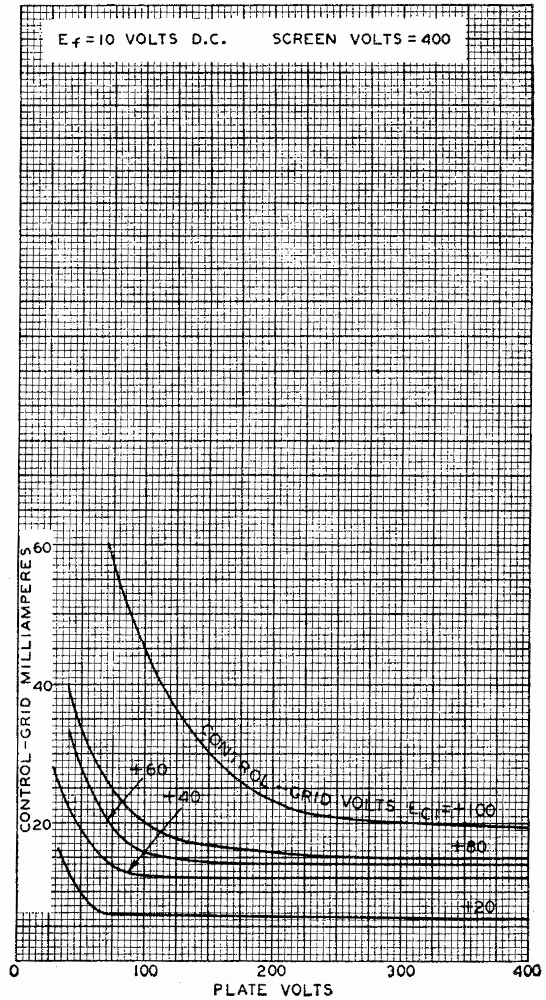
TYPICAL CHARACTERISTICS



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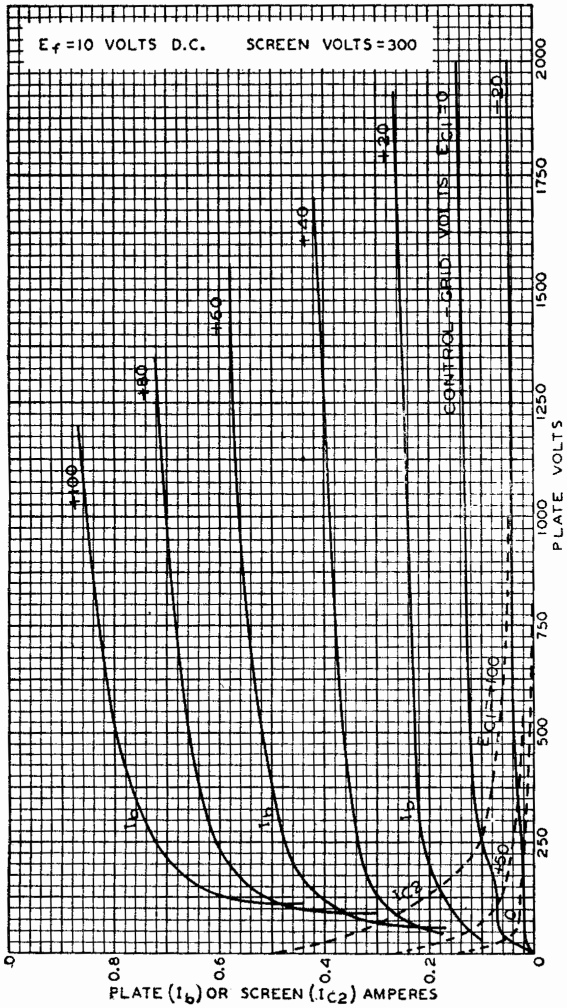
AVERAGE PLATE CHARACTERISTICS



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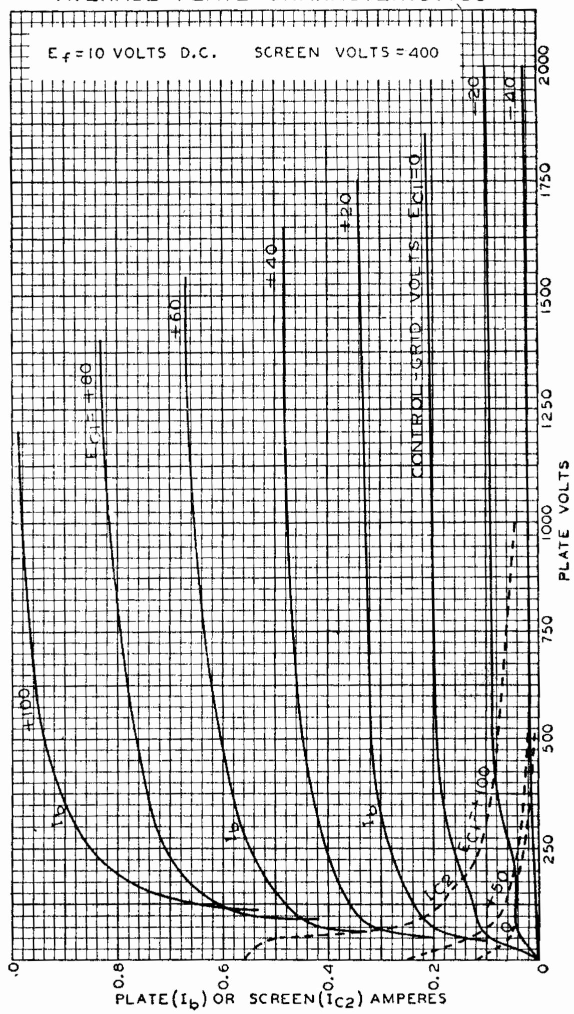
AVERAGE PLATE CHARACTERISTICS



811

TRANSMITTING TRIODE

Filament	Thoriated Tungsten	
Voltage	6.3	a-c or d-c volts
Current	4	amp.
Amplification Factor	160	
Direct Interelectrode Capacitances:		
Grid to Plate	5.5	μμf
Grid to Filament	5.5	μμf
Plate to Filament	0.6	μμf
Maximum Overall Length		6-9/16"
Maximum Diameter		2-7/16"
Bulb		ST-19
Cap		Medium Metal
Base		Medium 4-Pin,"Micanol" Bayonet
RCA Socket		UR-542-A

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

A-F POWER AMPLIFIER & MODULATOR - Class B

	CCS	ICAS	
D-C Plate Voltage	1250 max.	1500 max.	volts
Max.-Sig. D-C Plate Current*	125 max.	125 max.	ma.
Max.-Sig. Plate Input*	125 max.	150 max.	watts
Plate Dissipation*	40 max.	50 max.	watts
Typical Operation: *Unless otherwise specified, values are for 2 tubes*			
D-C Plate Voltage	1250	1500	volts
D-C Grid Voltage #	0.	-9	volts
Peak A-F Grid-to-Grid Volt.	140	160	volts
Zero-Sig. D-C Plate Current	48	20	ma.
Max.-Sig. D-C Plate Current	200	200	ma.
Max.-Sig. D-C Grid Current	38	38	ma.
Load Resistance (per tube)	3750	4500	ohms
Effective Load Resistance (plate to plate)	15000	18000	ohms
Max.-Sig. Driving Power	3.8 approx.	4.2 approx.	watts
Max.-Sig. Power Output	175 approx.	225 approx.	watts

* Averaged over any audio-frequency cycle of sine-wave form.

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	1250 max.	1500 max.	volts
D-C Plate Current	60 max.	60 max.	ma.
Plate Input	60 max.	75 max.	watts
Plate Dissipation	40 max.	50 max.	watts
Typical Operation:			
D-C Plate Voltage	1250	1500	volts

See next page.

811

TRANSMITTING TRIODE

(continued from preceding page)

	CCS	ICAS	
D-C Grid Voltage #	0	-6	volts
Peak R-F Grid Voltage	26	35	volts
D-C Plate Current	48	50	ma.
D-C Grid Current**	6 approx.	6 approx.	ma.
Driving Power** °	1 approx.	1.5 approx.	watts
Power Output	20 approx.	25 approx.	watts

° At crest of a-f cycle with modulation factor of 1.0.
Grid voltages are given for either a-c or d-c filament operation. When a.c. is used, the circuit returns are made to the midpoint of the filament circuit. When d.c. is used, the returns are made to the negative filament terminal.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	1000 max.	1250 max.	volts
D-C Grid Voltage	-200 max.	-200 max.	volts
D-C Plate Current	105 max.	125 max.	ma.
D-C Grid Current	50 max.	50 max.	ma.
Plate Input	105 max.	155 max.	watts
Plate Dissipation	27 max.	40 max.	watts
Typical Operation:			
D-C Plate Voltage	1000	1250	volts
D-C Grid Voltage □	-100	-125	volts
	2000	2500	ohms
Peak R-F Grid Voltage	195	230	volts
D-C Plate Current	105	125	ma.
D-C Grid Current**	50 approx.	50 approx.	ma.
Driving Power**	9 approx.	11 approx.	watts
Power Output	82 approx.	120 approx.	watts

□ Obtained preferably from grid leak of value shown, or combination of grid leak with either fixed supply or suitably by-passed cathode resistor.

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

	CCS	ICAS	
D-C Plate Voltage	1250 max.	1500 max.	volts
D-C Grid Voltage	-200 max.	-200 max.	volts
D-C Plate Current	125 max.	150 max.	ma.
D-C Grid Current	50 max.	50 max.	ma.
Plate Input	155 max.	225 max.	watts
Plate Dissipation	40 max.	55 max.	watts
Typical Operation:			
D-C Plate Voltage	1250	1250	volts
D-C Grid Voltage ‡	-87.5	-113	volts
	2500	3200	ohms
	550	610	ohms

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
‡ Obtained from fixed supply, or grid resistor (2500, 3200), or by cathode resistor (550, 610).
** See next page.

811

TRANSMITTING TRIODE

(continued from preceding page)

	CCS	ICAS	
Peak R-F Grid Voltage	180	225	volts
D-C Plate Current	125	150	ma.
D-C Grid Current**	35 approx.	35 approx.	ma.
Driving Power**	7 approx.	8 approx.	watts
Power Output	115 approx.	170 approx.	watts

** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

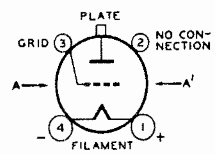
HIGH-FREQUENCY OPERATION

Maximum permissible percentage of maximum rated plate voltage and plate input.

FREQUENCY (MC)	60	80	100
TELEPHONY Class B	100	90	83
TELEPHONY Class C, Plate Mod.	100	75	60
TELEGRAPHY - Class C	100	75	60

OUTLINE DIMENSIONS for the 811 the same as those for the 809.

TOP VIEW OF SOCKET CONNECTIONS

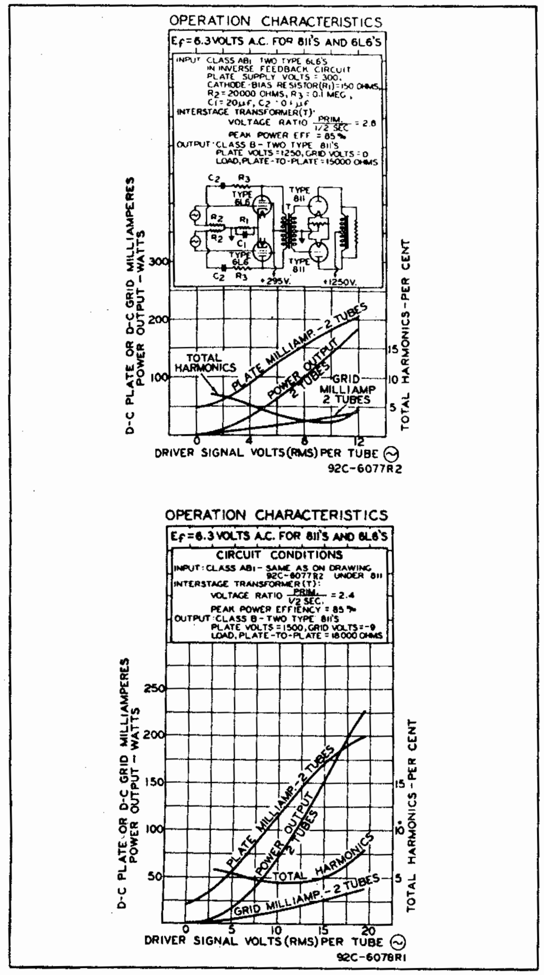


AA' = PLANE OF ELECTRODES

MOUNTING POSITION
VERTICAL: Base down.
HORIZONTAL: Plane of electrodes vertical.

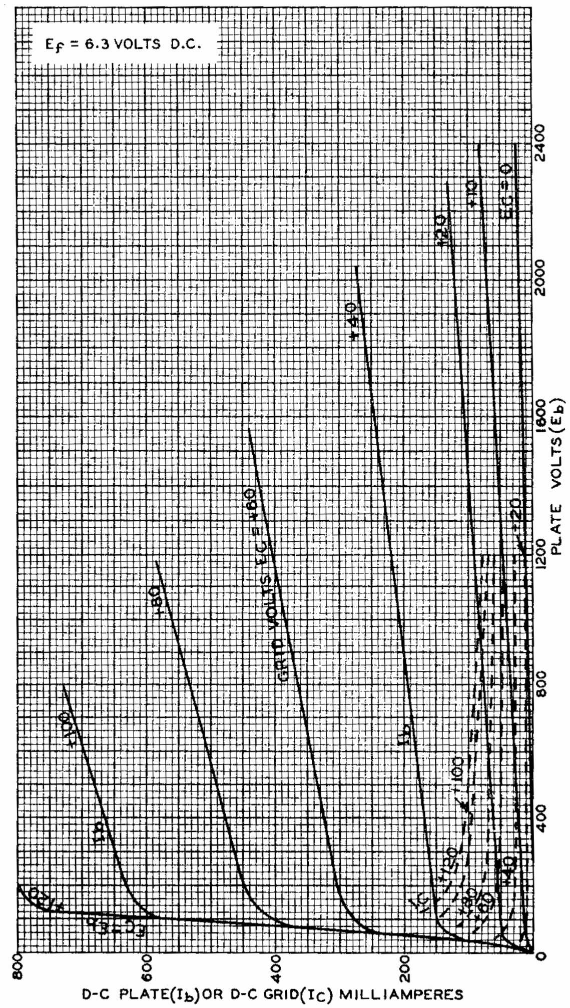
811

TRANSMITTING TRIODE



811

AVERAGE PLATE CHARACTERISTICS

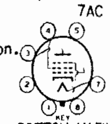


6V6, 6V6-GT/G

BEAM POWER AMPLIFIER

Heater■	Coated Unipotential Cathode		
Voltage	6.3		a-c or d-c volts
Current	0.45		amp.
Direct Interelectrode Capacitances (Approx.):			
	6V6°	*6V6-GT/G°°*	
Grid to Plate	0.3	0.7	μμf
Input	10	9.5	μμf
Output	11	7.5	μμf
Maximum Overall Length	3-1/4"	3-5/16"	
Maximum Seated Height	2-11/16"	2-3/4"	
Maximum Diameter	1-5/16"	1-5/16"	
Bulb	Metal Shell, MT-8	T-9	
Base	Small Wafer Octal 7-Pin	Intermed. Sh. Octal 7-Pin	
Basing Designation	7AC	G-7AC	

Pin 1 {6V6, Shell; 6V6-GT/G, No Con.} Pin 4 - Screen
Pin 2 - Heater Pin 5 - Grid
Pin 3 - Plate Pin 7 - Heater
Pin 8 - Cathode



BOTTOM VIEW

Mounting Position Any

Maximum Ratings Are Design-Center Values

SINGLE-TUBE AMPLIFIER

Plate Voltage	315 max.	volts
Screen Voltage	285 max.	volts
Plate Dissipation	12 max.	watts
Screen Dissipation	2 max.	watts

Typical Operation and Characteristics - Class A_1 Amplifier:

Plate Voltage	180	250	315	volts
Screen Voltage	180	250	225	volts
Grid Voltage*	-8.5	-12.5	-13	volts
Peak A-F Grid Volt.	8.5	12.5	13	volts
Zero-Sig. Plate Cur.	29	45	34	ma.
Max.-Sig. Plate Cur.	30	47	35	ma.
Zero-Sig. Screen Cur.	3	4.5	2.2	approx. ma.
Max.-Sig. Screen Cur.	4	7	6	approx. ma.
Plate Resistance	58000	52000	77000	ohms
Transconductance	3700	4100	3750	μmhos
Load Resistance	5500	5000	8500	ohms
Tot. Harmonic Dist.	8	8	12	%
Max.-Sig. Power Output	2	4.5	5.5	watts

PUSH-PULL AMPLIFIER

Plate Voltage	315 max.	volts
Screen Voltage	285 max.	volts
Plate Dissipation	12 max.	watts
Screen Dissipation	2 max.	watts

■ In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.
° With shell connected to cathode.
°° With no external shield.

*: See next page. ← Indicates a change.

6V6, 6V6-GT/G

BEAM POWER AMPLIFIER

(continued from preceding page)

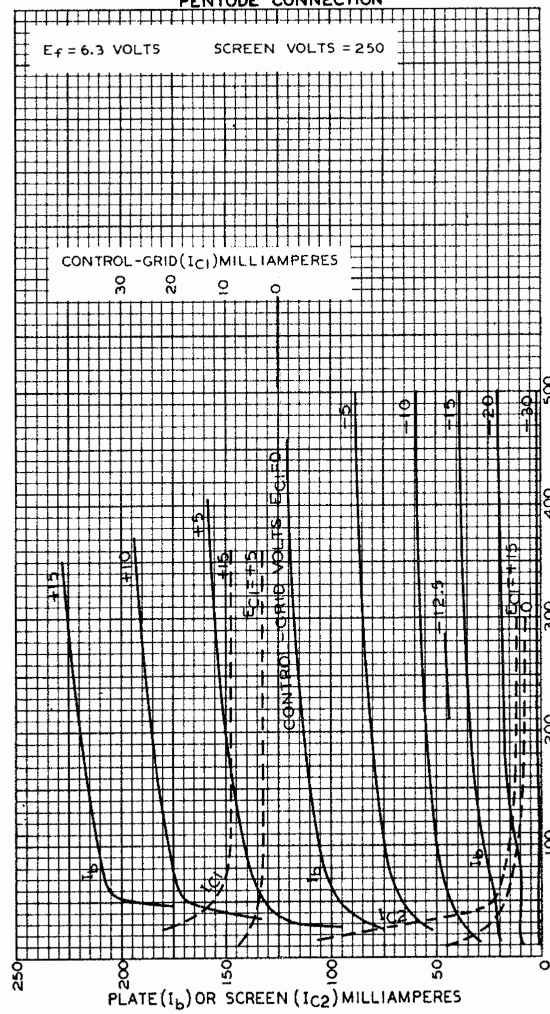
Typical Operation and Characteristics - Class AB_1 Amplifier:
Unless otherwise specified, values are for 2 tubes

Plate Voltage	250	285	volts
Screen Voltage	250	285	volts
Grid Voltage*	-15	-19	volts
Peak A-F Grid-to-Grid Volt.	30	38	volts
Zero-Sig. Plate Cur.	70	70	ma.
Max.-Sig. Plate Cur.	79	92	ma.
Zero-Sig. Screen Cur.	5	4	approx. ma.
Max.-Sig. Screen Cur.	13	13.5	approx. ma.
Plate Resistance	60000	65000	approx. ohms
Transconductance	3750	3600	μmhos
Effec. Load Res.	10000	8000	ohms
Total Harmonic Dist.	5	3.5	%
Max.-Sig. Power Output	10	14	watts

* The type of input coupling used should not introduce too much resistance in the grid circuit. Transformer- or impedance-coupling devices are recommended. When the grid circuit has a resistance not higher than 0.1 megohm, fixed bias may be used; for higher values, cathode bias is required. With cathode bias, the grid circuit may have a resistance not to exceed 0.5 megohm.

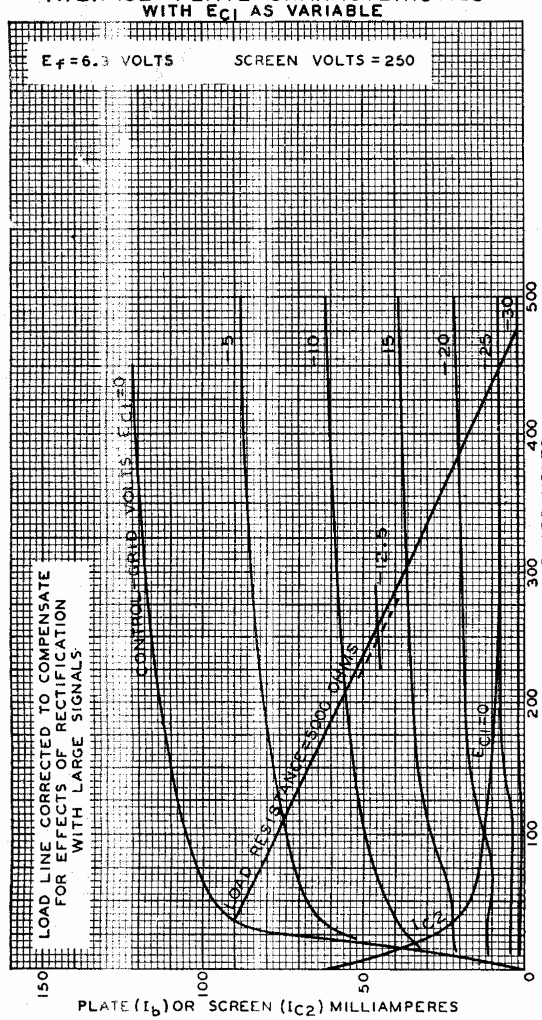
6V6

AVERAGE PLATE CHARACTERISTICS
PENTODE CONNECTION

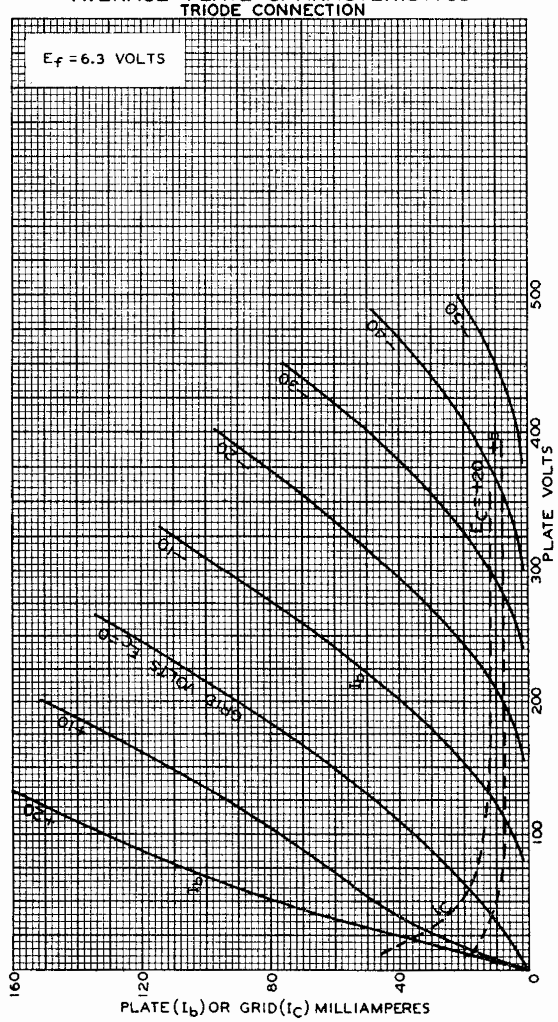


APPENDIX

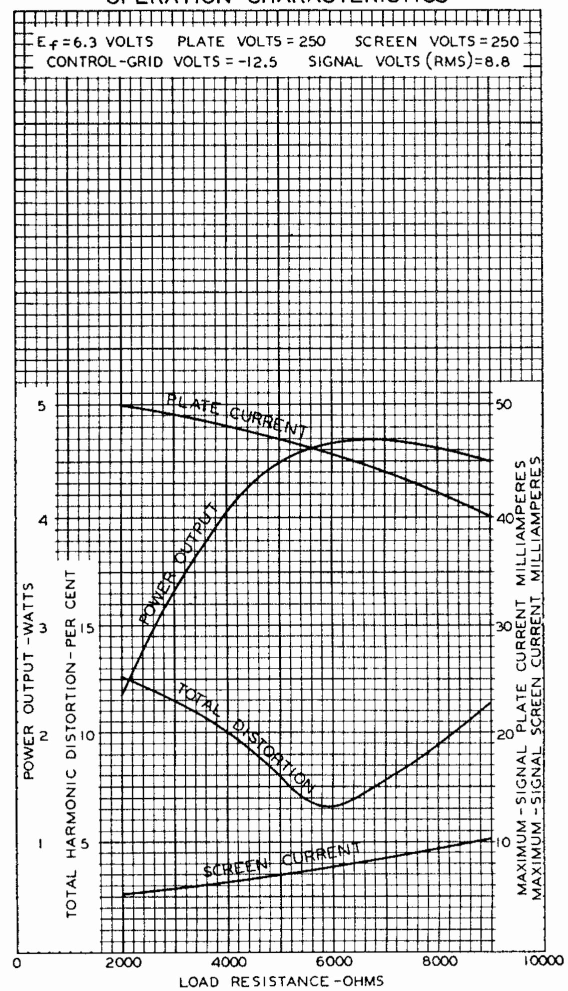
6V6-GT
AVERAGE PLATE CHARACTERISTICS
WITH E_{C1} AS VARIABLE



6V6
AVERAGE PLATE CHARACTERISTICS
TRIODE CONNECTION



6V6
OPERATION CHARACTERISTICS



12SJ7—12SJ7-GT

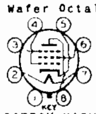
The 12SJ7 and 12SJ7-GT are same as the 6SJ7 and 6SJ7-GT respectively except for heater rating. The 12SJ7—12SJ7-GT heater rating is 12.6 volts, 0.15 amp.

6SJ7, 6SJ7-GT

TRIPLE-GRID DETECTOR AMPLIFIER

Heater ■	Coated Unipotential Cathode		
Voltage	6.3		a-c or d-c volts
Current	0.3		amp.
Direct Inter. Cap.°	*6SJ7*	*6SJ7-GT*	
Pentode Conn. Grid to Plate	0.005	0.005	max. μμf
Pentode Conn. Input	6.0	6.3	μμf
Pentode Conn. Output	7.0	10	μμf
Triode Conn.† Grid to Plate	2.8	2.8	μμf
Triode Conn.† Grid to Cathode	3.4	3.4	μμf
Triode Conn.† Plate to Cathode	11	11.0	μμf
Maximum Overall Length	2-5/8"	3-5/16"	←
Maximum Seated Height	2-1/16"	2-3/4"	←
Maximum Diameter	1-5/16"	1-5/16"	
Bulb	Metal Shell MT-8	T-9	
Base	Small Wafer Octal 8-Pin	Sm. Wafer Octal 8-Pin, Sleeve	
Basing Designation	8N	GT-8N	

Pin 1 {6SJ7, Shell; 6SJ7-GT, Base Sleeve}
Pin 2 - Heater
Pin 3 - Suppressor
Pin 4 - Grid
Pin 5 - Cathode
Pin 6 - Screen
Pin 7 - Heater
Pin 8 - Plate
Mounting Position: Any



BOTTOM VIEW

Maximum And Minimum Ratings Are Design-Center Values

AMPLIFIER (Pentode Connection)

Plate Voltage	300 max.	volts
Screen Voltage	125 max.	volts
Screen Supply Voltage	300 max.	volts
Grid Voltage	0 min.	volts
Plate Dissipation	2.5 max.	watts
Screen Dissipation	0.3 max.	watt

Typical Operation and Characteristics-Class A_1 Amplifier:

Plate	100	250	volts
Screen	100	100	volts
Grid	-3	-3	volts
Suppressor	Connected to cathode at socket		
Plate Res.	0.7	#	megohm
Transcond.	1575	1650	μmhos
Grid Bias for plate current = 10 μamp.	-8	-8	volts ←
Plate Cur.	2.9	3	ma.
Screen Cur.	0.9	0.8	ma.

AMPLIFIER (Triode Connection)†

Plate Voltage	250 max.	volts
Grid Voltage	0 min.	volts
Plate Dissipation	2.5 max.	watts

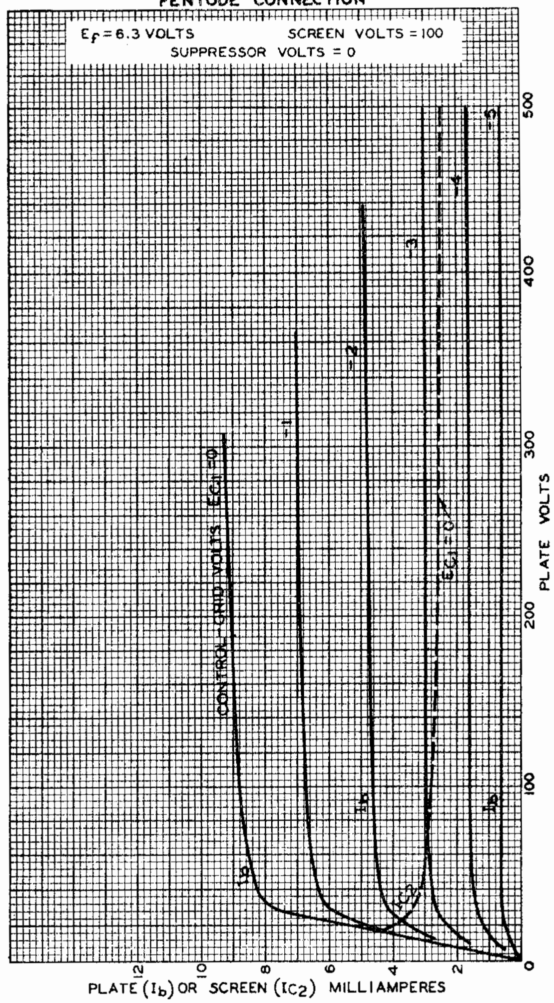
Typical Operation and Characteristics-Class A_1 Amplifier:

Plate	180	250	volts
Grid	-6	-8.5	volts
Amp. Fact.	19	19	
Plate Res.	8250	7600	ohms
Transcond.	2300	2500	μmhos
Plate Cur.	6	9.2	ma.

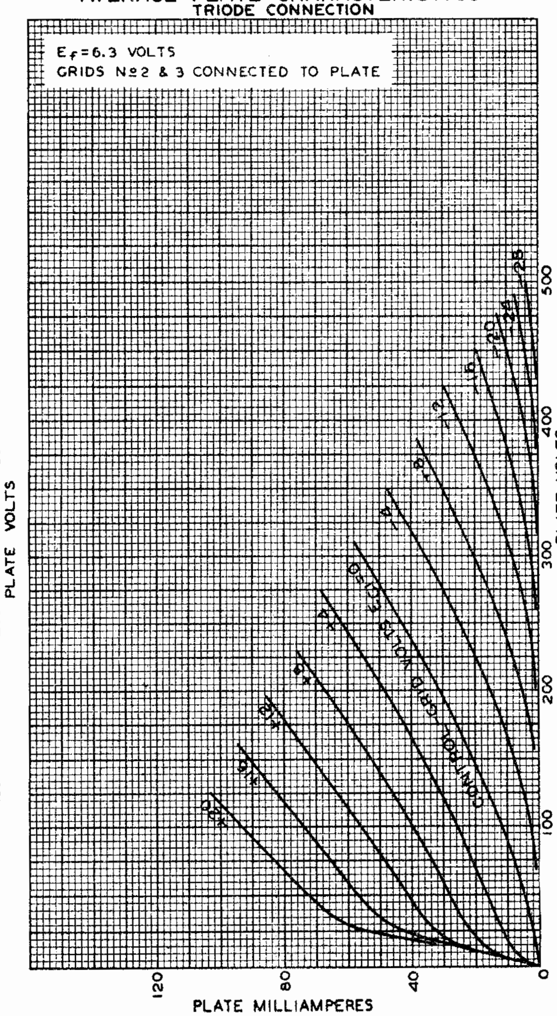
■ In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.
° With shell or external shield connected to cathode.
Greater than 1.0 megohm.
† With screen and suppressor connected to plate.
← Indicates a change.

For additional data, refer to RESISTANCE-COUPLED AMPLIFIER CHART.

6SJ7
AVERAGE PLATE CHARACTERISTICS
PENTODE CONNECTION



6SJ7
AVERAGE PLATE CHARACTERISTICS
TRIODE CONNECTION



866-A/866

HALF-WAVE MERCURY VAPOR RECTIFIER

This type supersedes RCA Types 866 and 866-A

Filament*	Coated	
Voltage	2.5	a-c volts
Current	5.0	amp.
Maximum Overall Length		6-5/8"
Maximum Diameter		2-7/16"
Bulb		ST-19
Cap		Medium Metal, with Insulating Collar
Base		Medium 4-Pin, Bayonet
RCA Socket		UR-542A

MAXIMUM RATINGS

Peak Inverse Voltage:	*Column I*	*Column II*	
For supply frequency up to 150~			
Cond. Mercury Temp. 25° to 60°C#	–	10000 max.	volts
Cond. Mercury Temp. 25° to 70°C#	200 max.	–	volts
For supply frequency up to 1000~			
Cond. Mercury Temp. 25° to 70°C#	–	5000 max.	volts
Peak Plate Current	2.0 max.	1.0 max.	amp.
Average Plate Current	0.5 max.	0.25 max.	amp.
Tube Voltage Drop (Approx.)	15	15	volts

* The filament of the 866-A/866 is partially shielded from the plate to permit operation from a power supply having a frequency up to 1000 cycles per second. The filament should be allowed to come up to operating temperature before plate voltage is applied. For average conditions, the delay is approximately 30 seconds.

\# Operation at 40° ± 5°C is recommended.

For *shielding* and *r-f filter circuits*, refer to Type 871.

NOTES ON COLUMN II

The table on the next page gives empirical values of choke inductance (L) and the condenser capacitance (C) for choke-input-to-filter circuits which will keep the peak plate current below the recommended maximum, provided the average d-c load current does not exceed the maximum load-current values shown. Values of (L) and (C) are based on a 60-cycle a-c voltage supply.

The capacitance (C) is small enough to prevent excessive surges when power is first applied to the circuit, and yet large enough to give adequate filtering. If the inductance (L) is increased, it is permissible to increase the capacitance in the same proportion. In a two-section filter with two inductances of unequal value, the larger inductance should be placed next to the rectifier tubes. With such an arrangement, the maximum value of each capacitance should be determined on the basis of the value of the inductance preceding it.

The circuits (see Type 872) of Figs. 1, 2, and 3 will give a ripple voltage less than 5% when used with a two-section filter having the minimum of inductance and the corresponding maximum of capacitance. The circuits of Figs. 4 and 5 will give a ripple voltage of less than 1%. For any of these circuits, better filtering may be obtained with the inductances larger than the minimum given in the table. For these larger inductances, the corresponding capacitances may be increased by the same percentage as the inductances to give still better results.

866-A/866

HALF-WAVE MERCURY VAPOR RECTIFIER

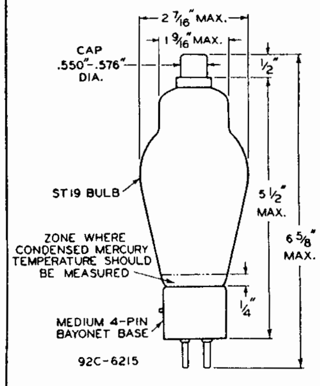
For Circuits, refer to Type 872.

(continued from preceding page)

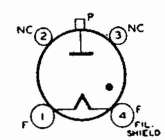
CIRCUIT	A-C INPUT VOLTS** (RMS)	MAX. D-C OUTPUT VOLTS TO FILTER	CHOKE INPUT ONE-SECTION FILTER: MIN. CHOKE (L) henrys	CHOKE INPUT ONE-SECTION FILTER: MAX. CONDENSER (C) µf	MAX. D-C LOAD CURRENT amperes
SINGLE-PHASE FULL-WAVE (2 tubes) FIG.1	3535 per tube	3180	8.0	1.25	0.5
	3000 " "	2700	6.8	1.5	0.5
	2000 " "	1800	4.5	2.1	0.5
	1500 " "	1350	3.4	2.8	0.5
SINGLE-PHASE FULL-WAVE (4 tubes) FIG.2	7070 total	6360	16.0	0.6	0.5
	6000 "	5400	13.5	0.7	0.5
	5000 "	4500	11.0	0.9	0.5
	4000 "	3600	8.9	1.1	0.5
THREE PHASE HALF-WAVE FIG.3	4080 per leg	4780	3.2	1.4	0.75
	3000 " "	3510	2.2	2.0	0.75
	2000 " "	2340	1.4	3.0	0.75
	1500 " "	1750	1.1	4.0	0.75
THREE-PHASE DOUBLE-Y PARALLEL FIG.4	4080 per leg	4780	2.0	0.5	1.5
	3000 " "	3510	1.5	0.7	1.5
	2000 " "	2340	1.0	1.1	1.5
	1500 " "	1750	0.7	1.5	1.5
THREE-PHASE FULL-WAVE FIG.5	4080 per leg	9570	1.8	0.5	0.75
	3000 " "	7020	1.4	0.7	0.75
	2000 " "	4680	0.9	1.2	0.75
	1500 " "	3510	0.7	1.5	0.75
SINGLE-PHASE FULL-WAVE (2 tubes) FIG.1*	3535 per tube	3950	–	–	0.25
	3000 " "	3390	–	–	0.25
	2000 " "	2260	–	–	0.25
	1500 " "	1700	–	–	0.25

* With condenser input to filter.

** For use under the conditions of the 10000-volt peak inverse rating. If the 866-A/866 is to be used under frequency and/or temperature conditions such that the peak inverse voltage is limited to 5000 volts, the a-c input voltage and d-c output voltage values in the table should be multiplied by a factor of 0.5 to give new values for the 5000-volt conditions.



BOTTOM VIEW OF SOCKET CONNECTIONS



Pin 1 - Filament
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Filament
Cap - Plate
● - Gas Tube Type

TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: No.

TABLE XX—APPLICABLE COLOR CODES

CAPACITOR COLOR CODES

There are two Color Codes for mica capacitors that may be applied to capacitors in this equipment.

Most generally used is the one incorporating four dots of different colors corresponding to the Standard RMA color coding as listed below:

Capacity Code	Ciphers	
0—Black	Black	None
1—Brown	Brown	0
2—Red	Red	00
3—Orange	Orange	000
4—Yellow	Yellow	0000
5—Green	Green	00000
6—Blue	Blue	000000
7—Violet	Violet	0000000
8—Gray	Gray	00000000
9—White	White	000000000

The capacity value is indicated in micro-microfarads and is determined by the sequence of the dots. The first dot in the upper left-hand corner of the capacitor is the first number and the second dot is the second number. The third dot indicates the number of ciphers to be used with the first two numbers. The fourth dot located in the lower right-hand corner or on the edge of the capacitor indicates the capacity tolerance.

The tolerance color code is as follows:

1%	Brown	6%	Blue
2%	Red	7%	Violet
3%	Orange	8%	Gray
4%	Yellow	9%	White
5%	Gold or Green	10%	Silver

The capacitor shown below has a capacity of 250 mmf (0.00025 mf). The color sequence is red (2), green (5), and brown (1). The tolerance is ±5%, as indicated by the green spot in the lower right-hand corner or on the edge.

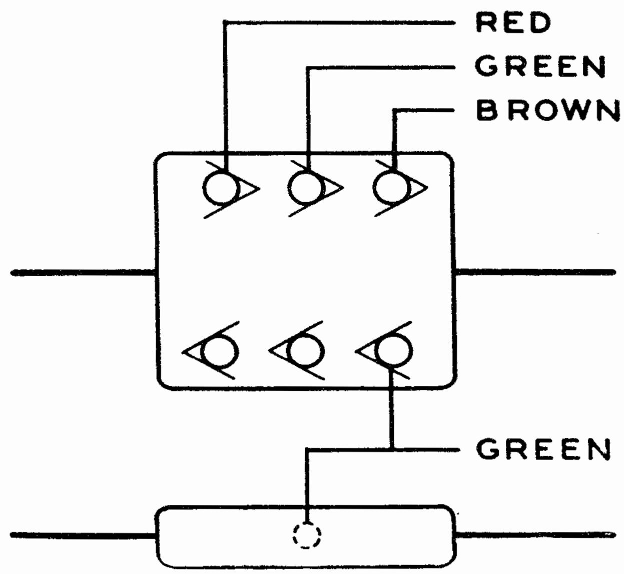


Fig. 121 RMA Capacitor Color Code Example—Four Dot (Dwg. No. 500 0246 00A)

The second capacitor color coding system is the Standard RMA system. In operation it is similar to the first system except that it uses six dots to indicate three numbers, multiplier, tolerance and voltage rating.

An example of this system is illustrated below:

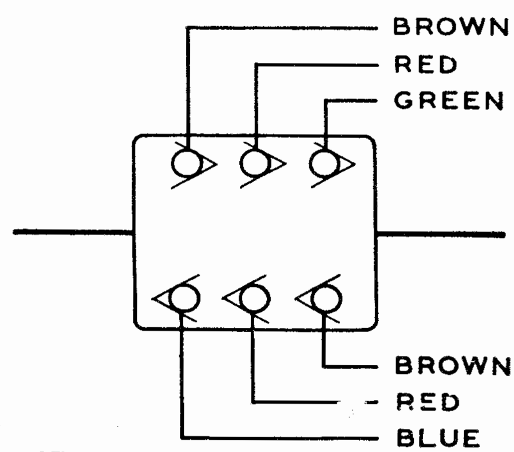


Fig. 122 RMA Capacitor Color Code Example—Six Dot (Dwg. No. 500 0245 00A)

APPLICABLE COLOR CODES

This being a 1250 mmf (0.00125 mf) 600 volt capacitor with a ±2% tolerance. The first three dots being the first three numbers and, continuing in a clockwise rotation, the fourth dot is the number of ciphers, the fifth the tolerance, and the sixth the voltage rating.

The voltage ratings are:

Brown	100 volts
Red	200 volts
Orange	300 volts
Yellow	400 volts
Green or no color	500 volts
Blue	600 volts
Violet	700 volts
Gray	800 volts
White	900 volts
Gold	1000 volts
Silver	2000 volts

CERAMIC CAPACITORS

Characteristics of ceramic capacitors are determined from the following instructions and table:

1. The temperature coefficient of capacitance is indicated by the color appearing on that end of the capacitor which provides termination for the inside plate or electrode. This color covers the entire end.

2. The next three dots or bands of color indicate the capacity in micromicrofarads.

a. The first dot or band immediately adjacent to the end color indicates the first significant figure of the capacity.

b. The second and next adjacent color dot or band indicates the second significant figure of the capacity.

c. The third and next adjacent color dot or band indicates the multiplier appropriate to the capacitor in mmf.

d. The fourth and last adjacent color dot or band indicates the capacitance tolerance either in percent, in the case of capacitors of nominal capacitance in excess of 10 mmf, or in mmf, in case of capacitors of nominal capacitance of 10 mmf or less.

CHARACTERISTICS OF CERAMIC CAPACITORS

Tolerance Values

Color	Significant Figures	Multiplier	Capacitance More than 10 mmf	Capacitance 10 mmf or less	TEMPERATURE COEFFICIENT in mmf/mmf/C°
Black	0	1	±20%	±2.0 mmf	Zero ±.00003
Brown	1	10	±1%	±0.1 mmf	−.00003
Red	2	100	±2%	±0.2 mmf	−.00008
Orange	3	1000	±3%	±0.3 mmf	−.00015
Yellow	4	10,000	±4%	±0.4 mmf	−.00022
Green	5	-----	±5%	±0.5 mmf	−.00033
Blue	6	-----	±6%	±0.6 mmf	−.00047
Violet	7	0.001	±7%	±0.7 mmf	−.00075
Gray	8	0.01	±2.5%	±0.25 mmf	
White	9	0.1	±10%	±1.0 mmf	

APPLICABLE COLOR CODES

RESISTOR COLOR CODE

The Standard RMA Color Code is used to indicate the resistance of the small resistors used in the equipment. The colors and corresponding numbers are listed below:

0.1—Gold	5—Green
0—Black	6—Blue
1—Brown	7—Violet
2—Red	8—Gray
3—Orange	9—White
4—Yellow	

The resistors are marked with three color "bands" near one end. All resistance values are in ohms. The color sequence begins with the color nearest the end of the resistor. The first "band" indicates the first number of the sequence, the second "band" the second number, and the third "band" the number of ciphers.

Tolerance values for the resistors are designated by the fourth "band" on the resistor body using the following colors to indicate the percentage of tolerance:

1%	Brown	6%	Blue
2%	Red	7%	Violet
3%	Orange	8%	Gray
4%	Yellow	9%	White
5%	Gold or Green	10%	Silver

For example, the resistor below has a resistance of 10,000 ohms and a tolerance of ±5%. Brown (1), black (0), orange (3), and gold (5).

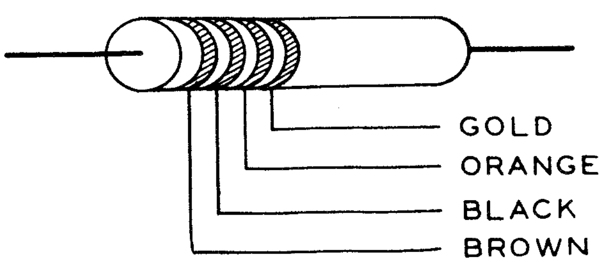


Fig. 123 RMA Resistor Color Code Example (Dwg. No. 500 0242 00A)

HOOKUP WIRE CODE

This wire code is the standard code for all unit wiring in connection with the Model TCZ Radio Transmitting Equipment.

Two classes of wire are employed, consisting of Flameproof and bus bar.

Flameproof wire is supplied in two degrees of insulation rated at 1000 volts and 3000 volts. The voltage rating of the wire is indicated by an identification thread in the strands of the conductor. A blue thread indicates 1000 volts insulation while a white thread indicates 3000 volts insulation. Two other threads of different colors serve to indicate the manufacturer of the wire and the year in which it was made.

Standard RMA Color Code Numerals are used for designating the body color and the color of the tracers. This code is as follows:

0—Black	5—Green
1—Brown	6—Blue
2—Red	7—Violet
3—Orange	8—Gray
4—Yellow	9—White

Note: Wires employing code numbers 7 and 8, also 4, are not used by this contractor.

The wire color code is made up of a letter designating the wire size and voltage rating of insulation followed by numerals designating the body color and the colors of up to three tracers. The tracers are coded as follows when viewing the wire in a horizontal position:

1 color tracer—
Criss cross tracers, both same color.

2 color tracers—
First color tracer named goes lower left to upper right.
Second color tracer named goes lower right to upper left.

3 color tracers—
Third color tracer named is parallel to and just below the second color tracer from lower right to upper left.

APPLICABLE COLOR CODES

A shielded Flameproof wire is indicated by inserting the letter S after the first letter of the code. Example: AS956 indicates a white wire with green and blue tracers in a tinned shielding braid.

The standard TCZ wire code is as follows, note that complete wire specifications are supplied:

Code for Bus-Bar

The code for bus-bar is made up of the letter designation BB followed by the wire size as shown below:

#20----BB20	#14----BB14
#18----BB18	#12----BB12
#16----BB16	

Note: * indicates shielded type of wire is used.

CABLE WIRE CODE

Color Code	Body Color	First Tracer Color	Second Tracer Color	Third Tracer Color	Wire Specifications
*A9	White				No. 22 A.W.G.
*A90	White	Black			Flameproof Insulation
*A92	White	Red			Lacquered Glass Braid
*A93	White	Orange			1000 volt rating
*A95	White	Green			Part No. 443N22 plus
*A96	White	Blue			Color Numerals
A902	White	Black	Red		example: 443N229363
A9020	White	Black	Red	Black	Shielded: 443NS229363
A9023	White	Black	Red	Orange	
A9025	White	Black	Red	Green	
A9026	White	Black	Red	Blue	
A903	White	Black	Orange		
A9030	White	Black	Orange	Black	
A9035	White	Black	Orange	Green	
A9036	White	Black	Orange	Blue	
A905	White	Black	Green		
A9050	White	Black	Green	Black	
A906	White	Black	Blue		
A9060	White	Black	Blue	Black	
A9202	White	Red	Black	Red	
A923	White	Red	Orange		
A925	White	Red	Green		
A9252	White	Red	Green	Red	
A9256	White	Red	Green	Blue	
A926	White	Red	Blue		
A9262	White	Red	Blue	Red	
A9303	White	Orange	Black	Orange	
A935	White	Orange	Green		
A9353	White	Orange	Green	Orange	
A9356	White	Orange	Green	Blue	
A936	White	Orange	Blue		
A9363	White	Orange	Blue	Orange	
A9505	White	Green	Black	Green	
A9525	White	Green	Red	Green	
A9535	White	Green	Orange	Green	
A956	White	Green	Blue		
A9606	White	Blue	Black	Blue	
A9626	White	Blue	Red	Blue	
A9636	White	Blue	Orange	Blue	

CABLE WIRE CODE (Cont.)

Color Code	Body Color	First Tracer Color	Second Tracer Color	Third Tracer Color	Wire Specifications
B9	White				No. 20 A.W.G.
*B90	White	Black			Flameproof Insulation
B91	White	Brown			Lacquered Glass Braid
B92	White	Red			1000 volt rating
B93	White	Orange			Part No. 443N20 plus
B94	White	Yellow			Color Numerals
B95	White	Green			Example: 443N2090
B96	White	Blue			Shielded: 443NS2090
B902	White	Black	Red		
B925	White	Red	Green		
C9	White				No. 18 A.W.G.
C90	White	Black			Flameproof Insulation
C92	White	Red			Lacquered Glass Braid
C95	White	Green			1000 volt rating
C96	White	Blue			Part No. 443N18 plus
C902	White	Black	Red		Color Numerals
C903	White	Black	Orange		Example: 443N18935
C925	White	Red	Green		Shielded: 443NS18935
C935	White	Orange	Green		
*CS93	White	Orange			
D9	White				No. 16 A.W.G.
D90	White	Black			Flameproof Insulation
D91	White	Brown			Lacquered Glass Braid
D92	White	Red			1000 volt rating
D93	White	Orange			Part No. 443N16 plus
D95	White	Green			Color Numerals
D96	White	Blue			Example: 443N16936
D902	White	Black	Red		Shielded: 443NS16936
D903	White	Black	Orange		
D925	White	Red	Green		
D935	White	Orange	Green		
D936	White	Orange	Blue		
E9	White				No. 14 A.W.G.
E90	White	Black			Flameproof Insulation
E92	White	Red			Lacquered Glass Braid
E93	White	Orange			1000 volt rating
E95	White	Green			Part No. 443N14 plus
E96	White	Blue			Color Numerals
E902	White	Black	Red		Example: 443N1492
E903	White	Black	Orange		Shielded: 443NS1492
E920	White	Red	Black		
E925	White	Red	Green		

CABLE WIRE CODE (Cont.)

Color Code	Body Color	First Tracer Color	Second Tracer Color	Third Tracer Color	Wire Specifications
F9 F91 F96 F906	White White White White	 Brown Blue Black	 Orange		No. 12 A.W.G. Flameproof Insulation Lacquered Glass Braid 1000 volt rating Part No. 443N12 plus Color Numerals Example: 443N1291 Shielded: 443NS1291
J9 J90	White White	 Black			No. 6 A.W.G. Flameproof Insulation Lacquered Glass Braid 1000 volt rating Part No. 443N6 plus Color Numerals Example: 443N690 Shielded: 443NS690
L92 L96	White White	Red Blue			No. 20 A.W.G. Flameproof Insulation Lacquered Glass Braid 3000 volt rating Part No. 447N20 plus Color Numerals Example: 447N2096 Shielded: 447NS2096
N90 N92 N95 N96 N902 N906	White White White White White White	Black Red Green Blue Black Black	 Red Blue		No. 16 A.W.G. Flameproof Insulation Lacquered Glass Braid 3000 volt rating Part No. 447N16 plus Color Numerals Example: 447N16906 Shielded: 447NS16906

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