



INSTRUCTION MANUAL
FOR
MODEL 518(D)-DL
ONE THOUSAND WATT
FREQUENCY MODULATED
BROADCAST TRANSMITTING
EQUIPMENT

RADIO
ENGINEERING
LABORATORIES

Crystal Oven -
Bliley - type TC-92

ser 6911

Use this book

INSTRUCTION MANUAL
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ACCESSORY DATA SUPPLIED WITH THIS MANUAL IN REAR COVER POCKET:-
6 COPIES DEFECTIVE MATERIAL NOTIFICATION FORM
6 COPIES DEFECTIVE MATERIAL RETURN FORM

IN SEPARATE DRAWING FOLDER:-

<u>TITLE</u>	<u>NUMBER</u>
INSTALLATION DRAWING	T-68
STATION WIRING DIAGRAM	B-654
MODEL 518 WIRING DIAGRAM	SS-638
CONTROL CIRCUITS - ACROSS THE LINE DIAGRAM	B-629

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SECTION 1

INSPECTION OF RECEIVED MATERIAL RE-ASSEMBLY OF PARTS REMOVED FOR SHIPMENT - CLAIMS FOR BREAKAGE IN SHIPMENT.

1. INSPECTION OF RECEIVED MATERIAL

Received material should be carefully inspected at the time of uncrating for evidence of damage or breaking due to careless handling in transit. Care and good sense should be used in the process of unpacking or uncrating the equipment. Hasty use of improper tools such as crowbars, etc., may easily result in damage to the enclosed equipment. Be sure to note and follow externally marked instructions such as, "This End up" or "Open This End", etc. All equipment is carefully packed at the factory to insure safe delivery with reasonably careful handling. When removing items from packing material check item by item against the enclosed packing list for errors or short shipment.

2. CLAIMS FOR BREAKAGE IN SHIPMENT

In cases of damage to equipment due to faulty handling in shipment, notify carrier immediately leaving broken or damaged item or items exactly as found in package. Do not destroy or remove any of the wrappings or protective material involved in the wrapping of the damaged item. Carrier companies will not accept claims for "Damage in Shipment" unless they can inspect the damaged item and its associated packing material. Claims must usually be made within five days of receipt of shipment.

SECTION II

GENERAL DESCRIPTION OF EQUIPMENT

A. General Description

The REL Model 518 FM Broadcast Transmitter is designed to deliver 1000 watts of radio frequency power at any selected frequency from 88 to 108 megacycles. Modulation is accomplished by the Armstrong Dual Channel Phase Shift method, the modulator being an integral part of the transmitter.

The equipment is completely housed in a vertical steel cabinet normally finished in two tone green lacquer with chrome trim. The cabinet is 84" high, 40" wide and 36" deep.

Various functional units in the equipment have been sectionalized on individual chassis. Each separate chassis is hinged at one end and may be swung out for convenient inspection or maintenance work.

B. Primary Power Connections

Refer to drawing B-654 which shows details of the transmitter input terminal boards and connections.

208/230 volts, 60 cycles single phase should be terminated at the terminals marked A, B, using #10 AWG wire or larger. Primary load for rated output is approximately 3700 volt amperes at 89% power factor. 110 to 120 volts single phase should be connected to terminals 53 and 54 using #12 AWG wires for powering the convenience outlet and interior lighting.

A good low resistance ground should be connected to the terminal marked "0" on the terminal board which is located on the left vertical frame member just inside the lower front panel.

C. Output Transmission Line Connections

The equipment is supplied for operation with a single 7/8" coaxial transmission line which enters the top of the cabinet. Location of this point may be determined by reference to outline drawing T-68.

D. Accessory Data

A 600 ohm balanced audio input line must be connected to the twin conductor jack, which is located behind the lower front panel on the right hand corner post. This line should be of the insulated shielded twisted pair type and should avoid proximity to high level AC lines. Since there is not pre-emphasis included in the transmitter standard 75 micro second pre-emphasis should be included at some point in the audio equipment.

A coaxial jack is provided beside the audio input jack for connecting the monitor to the sampling loop in the power amplifier cabinet.

SECTION III

ASSEMBLY AND INSTALLATION

A. After the equipment has been unpacked remove all panels to permit easy access to the interior. A considerable amount of packing material shipping straps and braces will be found within the equipment, notably in the high voltage supply relay panel, modulator power supply, and power amplifier compartment. This material should all be removed and the supported parts carefully examined for any damage which may have occurred while the equipment was in transit.

B. After the equipment has been located in its final position the power lines may be connected. Provision has been made in the cabinet design to permit cable entrance either through exposed conduit or concealed floor trench type wiring. A "TEE" shaped duct is built into the base of the transmitter which allows conduit entrance via either side near the front or through the rear center. The location of these knockouts is indicated on the installation drawing T-68. In addition an 8" x 2" opening covered with a removable plate is provided for entrance of cables via a floor trench. If used, this plate should be removed and holes cut to permit passage of the cables. Unless the plate is reinstalled, an air leak will result, thus destroying the effectiveness of the intake air filter.

Primary power connections are made to terminals "A" and "B". The auxiliary lighting circuit connections are connected to terminals 53 and 54.

C. The output transmission line connections may now be made up.

D. Connect the audio input line and the monitor by means of the plugs which are provided in their respected jacks.

E. Install plug in resistors which are located as noted below:

<u>SYMBOL NO.</u>	<u>STOCK NO.</u>	<u>RESISTANCE</u>	<u>LOCATION</u>
R-800	R-5104 or R-5273	200,000 ohms	Resistor panel left side, bottom row, center.
R-801	R-5105	5 megohm	Resistor panel, bottom row, rear.
R-803	R-5097 or R-5269	500 ohms	Resistor panel, bottom row, front.
R-805	R-5109 or R-5271	250 ohms	Resistor panel, middle row.
R-806	Same as R-805		Resistor panel, middle row.
R-807	R-5321	500 ohms	Bottom of grid circuit.
R-808	Same as R-805		Resistor panel, middle row.
R-809	Same as R-805		Resistor panel, middle row.
R-810	R-5321	500 ohms	Below PA tube deck, left.
R-811	R-5269	500 ohms	Resistor board, lower right side.
R-812	Same as R-811		Resistor board, lower right side.
R-818	R-5336	1250 ohms	Resistor panel, left side, top row, rear.
R-819	R-5337	2000 ohms	Resistor panel, left side, top row, front.
R-820	R-5321	500 ohms	Below PA tube deck, right.

F. Install all tubes. Pilot lights and glass fuses are shipped in their respective sockets.

G. There are five lumiline lamps to be installed. Two are used to illuminate the meter panel and the sockets for these will be found directly below the meters. Two are used inside the power amplifier compartment and operate when the compartment door is opened. One is located inside the plate compartment on the top front panel. The other is located under the PA tube deck just inside the front flange. The fifth light is located on the rear of the same cornerpost which supports the audio input jack.

SECTION IV

THEORY OF OPERATION

A. POWER CONTROL CIRCUIT

1. General

The power controls are designed to provide either complete manual or semi-automatic control with facilities provided for remote control of the application of power to the various stages, proper protection of equipment in the case of overloads, and reasonable time delays between the application of filament and plate voltages. All cabinet doors with the exception of those over the modulator compartment and the main front doors, are interlocked for the protection of personnel.

2. Primary Power Source

The main operating power is completely supplied by a 208/230 volt (plus or minus 5%) 60 cycles, single phase source. All filament transformer primary voltages are controlled by the variable auto transformer YR-800 which is located on the right hand control panel, and should be adjusted to produce a reading of 5.0 volts on the front panel "FILAMENT VOLTAGE".

3. Control Circuits

The schematic diagram of the control circuits is shown on drawing SS-638. A functional across the line diagram is shown on drawing B-629 which will be useful in understanding the sequence of control operation.

The STANDBY switch S808 should always be on, except for maintenance work on the standby circuit. Even so, the input side of S808 and the main circuit breaker, K800, will be energized, hence it is advisable to open the main safety switch which powers the entire transmitter when maintenance work is required. When S808 is closed, transformer T703 is energized through fuse F806 and protective resistor R-715. The secondary of T703 operates the crystal heater when the transmitter is off the air. The standby fuses F807 and F808 provide protection for the standby and blower shut down circuits.

With all of the switches except the STANDBY SWITCH S808 open, the first switch to be closed is the PRIMARY POWER circuit breaker K800. The coil of the blower relay K806A is energized through the standby fuses F807 and F808 closing contacts K806B, K806C, and K806D. The blower time delay relay K807 is also energized through the normally closed contact K801C of the time delay relay K801. However relay K807 will not operate at this time since its normal time delay is 2 minutes, and contact K801C will open 60 seconds after switch S800 is closed. Contacts K806C and K806D apply power to the blower B800 through the thermal element K806E, and also to the blower pilot light, I803. The meter lights I805 and I806 should come on when K800 is closed.

When the FILAMENT switch S800 is closed and the blower B800 has reached its proper speed, the air switch S807 will be closed thus energizing the filament variable auto transformer YR800 which in turn controls the voltage on T700 through F801 which supplies 6.5 volts AC for the modulator AC filaments; T701 through F802 which supplies 6.6 volts DC for the modulator DC filaments; K700 which switches the crystal heater from 6.0 volts AC standby to 6.6 volts DC operate; T800 through F803 which controls the screen the bias supply filaments; T801 supplying the power amplifier filaments at 5 volts which is read on the FILAMENT VOLTAGE meter; T804, T805 and T806 which supply the high voltage rectifier filaments; K801 the rectifier tube time delay (60 seconds) which withholds application of high voltage until the rectifier tube cathodes are hot and finally I800, the filament pilot light.

60 seconds after the closing of the FILAMENT switch S800, the time delay relay K801 will operate, closing contact K801B and opening contact K801C. If all door interlocks are closed and the MODULATOR HIGH VOLTAGE switch is closed, then the coil of relay K802A will be energized closing contacts K802B and K802C. K802B, when closed, applies power to the modulator high voltage transformer T702 and the modulator high voltage pilot light I801, through fuse F804. K802C when closed energizes the high voltage recycling time delay (5 seconds) through the overload relay contact K805B, and the bias high voltage transformer T802 through fuse F805.

After 5 seconds from the time the MODULATOR HIGH VOLTAGE switch S801 was closed time delay relay K803 will operate, closing its contact, K803B. Then if the HIGH VOLTAGE switch S805 is closed, the PA high voltage relay K804 will be energized, closing contacts K804B and K804C through which power will be applied to the primary of the high voltage transformer T803 through the tap changing switch S818, and to the high voltage pilot light I802. The closing of the power amplifier high voltage switch completes the cycle of manual operation and the equipment is ready for transmission provided that the equipment has been previously adjusted for proper voltages and the tuning controls were properly set. The switching controls are designed so as to control the cycle of operation at any stage desired. If any of the control switches S-800, S-801 or S-805 are opened, the cycle of operation will automatically continue to the stage controlled by the particular switch that is opened and then stop. Further continuation of the operating cycle requires the closing of the switch or switches that follow.

The manual "OFF" operation is performed in the reverse sequence of the "ON" operation, the power amplifier HIGH VOLTAGE SWITCH S-805 is turned off which removes the power amplifier high voltage then the modulator high voltage switch S-801 is turned off, followed by the turning off of the filament power switch S-800 and finally the primary power circuit breaker, K-800.

If for any reason, by manual "OFF" operation or by a heavy overload, the overload breaker K-800 is opened, only one of the parallel sources of supply for the blower relay coil K-806A is removed and contacts K-806C and K-806D remain closed. The power supplied through these contacts will keep the blower B-800 operating. At the same time that the circuit breaker K-800 is opened, power is removed from relay coil K-801A, thus closing contacts K-801C. Contact K-801C energizes the blower time delay relay K-807, and after 2 minutes, the normally closed contact K-807B opens thus removing the second of the two parallel sources of power for relay K-806A. This relay opens contact K-806B which turns off the blower B-800 and the blower pilot light I-803.

CAUTION

The standby crystal heater switch S-808 should never be turned off until the blower B-800 has stopped.

Assuming that S-808 is "on" in the standby position, semi-automatic operation of the control circuit is obtained by turning on all switches (S-800, S-801, S-805) except the main PRIMARY POWER circuit breaker K-800. Then when K-800 is closed, the relays function as previously described and after approximately 65 seconds, the equipment is ready for transmission. The "stop" operation is performed by simply opening circuit breaker K-800. Approximately 2 minutes after the "stop" operation, the blower B-800 will stop and the standby crystal heater power will be the only power on. Care must be exercised when working near switch S-808.

In the power amplifier H.V. supply, an automatic reset overload current relay K-805 protects this stage from overloading. Relays K-802, and K-803 and K-804 will function as previously described under normal conditions after relay K-805 has been opened and automatically closed.

No provision is made to limit the number of recycling periods in the event of serious overload or short circuit in the high voltage circuit. Therefore if recycling persists, the equipment should be turned off and the source of trouble determined. The PRIMARY POWER circuit breaker K-800, which is a manual reset overload breaker protects the entire unit and will open only under much heavier overloads than the other overload relay K-805. Caution should be taken before closing K-800 after an overload.

B. Bias and Screen Supplies

1. The bias and screen grid power supplies are located on the upper hinged chassis on the right side of the cabinet; and are shown schematically on drawing SS-638.
2. Filament voltage is adjusted by the FILAMENT voltage control on the front panel.
3. Primary voltage to the bias high voltage transformer T-802 is applied between common lead #10 and control lead #22 which is energized by closing the "MOD HV" switch. The bias output, after adequate filtering, is connected by lead #48 to the four 250 ohm series connected bleeder resistors R-805, R-806, R-808 and R-809 which are located on the resistor board on the left side of the equipment. The output of the bias supply is approximately -200 volts resulting in 50 volt steps across each of the four bleeder resistors. Lead #29 connects to this bleeder at the -50 volt point to provide bias for the 829B tubes in the IPA chassis and lead #30 connects the -150 volt point to the grid current meter, which in turn connects to the grid leak resistor R-807.
4. The high voltage winding for the screen power supply is contained in the main high voltage transformer, the terminals appearing in a row below the primary terminals. Leads 47 to 49 provide the plate excitation for the screen rectifier tube V-804, and since the screen high voltage winding is part of the plate transformer, screen voltage increases with plate voltage. The DC screen voltage after filtering is connected to both the 50,000 ohm bleeder resistor R-804 and the series screen resistors R-818 and R-819 by lead #15. From this point it is connected via the screen current meter and switch to the screen grids of the power tubes.

C. High Voltage Supply

1. The high voltage anode supply for the power amplifier is obtained from the high voltage transformer T-803 and the four type 872A rectifier tubes which are mounted on the phenolic shelf in the base of the cabinet. Plate voltage is controlled by the PLATE VOLTAGE switch S-816 which is located on the right control panel.
2. Filament voltage for the high voltage rectifier tubes is adjusted by the variable transformer YR-800. Indication is provided by the filament volt meter M-800 which is mounted on the meter panel and should be adjusted to read 5.0 volts.
3. The rectifier circuit is a conventional single phase full wave bridge. Filtering is accomplished by the use of a double section filter consisting of L-800, L-801, C-800, and C-801. In addition an auxiliary filter consisting of C-821 and R-811 and R-812 is connected in series between the high voltage bus and the negative return of the power supply to damp out any parasitic oscillations which might be generated by the input choke.
4. The high voltage lead is connected to both the main bleeder resistor R-800 and the high voltage meter multiplier resistor R-801 and the plate circuit of the power amplifier. The low voltage end of the multiplier resistor is grounded through a parallel circuit consisting of the 10,000 ohm safety resistor R-802 and the high voltage meter M-803. The function of R-802 is to

provide an auxiliary path to ground for the multiplier current in the event that the high voltage meter movement or any of its associated wiring should become open circuited, the resistance being high enough not to impair the meter accuracy, but still low enough to handle bleeder currents.

5. The negative return lead of the power supply is connected to one side of the filter capacitors C-800 and C-801, the low voltage end of the auxiliary filter, the safety resistor R-803 and by lead #46 to the coil of the plate overload relay K-805 and then by lead #13 through the plate current meter M-802 to ground. The function of the 500 ohm safety resistor R-803 is to maintain a secure ground on the return of the power supply in the event that any of the inter-connecting wires or components in the normal return circuit might become open circuited.

D. Modulator

1. The modulator is diagramed in block fashion by figure #1, and schematically by drawing SS-638. It consists of the following equipment:

	<u>CAT.</u>
a. Modulator power supply	592A
b. Balanced Modulator	587A
c. Audio Panel	586A
d. Multiplier and Single Ended Converter	589
e. Multiplier and Balanced Converter	588
f. Semi Final Multiplier	590
g. Intermediate Power Multiplier	590

V-202
4 and
rter,
The latter

2. The modulator power supply furnishes filament and plate voltages for the modulator chassis. On the modulator power supply terminal board; terminal #3 supplies the crystal heater with 6.0 volts AC during standby, and 6.6 volts DC while operating #4 is the DC filaments for the modulator, #8 is the filament supply, #9 the regulated 250 volt plate supply, and #11 the unregulated 450 volt plate supply.
3. The Balanced Modulator Cat. #587A contains a source of low radio frequency energy Y-200 and V-200, which is differentially phase modulated by V-202 and V-203 after amplification by the buffer amplifier V-201. V-204 and V-205 are triplers which drive the Multiplier and Single Ended Converter, Cat. #589, and the Multiplier and Balanced Converter, Cat. #588. The latter two panels are parallel frequency multiplying channels with a total multiplication of 81 times with their frequency deviations separated by 180° and terminated in a converter stage. If as an example a 200 KC crystal is used in the balanced modulator panel the input voltages to the two converters from the channels will be 16,200 KC.
4. The audio panel contains in addition to the audio stages, the control frequency oscillator, the frequency of which is 1/48 that of the transmitter output frequency. To continue the example of paragraph 3, assume a control crystal frequency of 2,000 KC. This voltage is introduced into the balanced converter and heterodyned with the multiplied input from the first crystal at 16,200 KC. The plate circuit of the balanced converter is tuned to

the difference frequency or 14,200 KC. This voltage is combined in the single ended converter with the 16,200 KC from the second channel and again the difference frequency, 2,000 KC, appears in the plate circuit. This voltage is used to drive the semi-final multiplier panel and has an operating frequency of plus/minus 1,560 cycles.

5. The purpose of this dual conversion is multi-fold;
 - a. A large amount of multiplication is provided so that the initial Phase shift in the modulator tubes may be kept as low as possible while at the same time maintaining a low multiplication of the control frequency oscillator thereby producing a stable center frequency. Multiplication ratios are 7776 over all but only 48 times from the control frequency crystal.
 - b. By the use of the dual conversion dual channel system the output frequency of the transmitter becomes independent of the low frequency oscillator, its stability being dependent only upon the stability of the control frequency oscillator.
 - c. Noise products which are generated in the low frequency oscillator and buffer amplifier stages are cancelled out in the conversion process thereby producing noise levels of minus 70 db. below 100% modulation.
 - d. Since the modulation is applied differentially to each channel the conversion process results in an additional double in the deviation frequency without the use of an additional multiplier.
6. The Semi-final multiplying panel provides a multiplication of 8 times in two amplifier and three doubler stages. Its output, and again using the example above, is 16 megacycles. The final multiplier panel provides a multiplication of 6 times in a doubler stage, a tripler stage, and an amplifier stage. The output from this panel for the conditions of the example will be 96 megacycles, which is coupled by a balanced transmission line consisting of RG-8U cable to the grids of the power amplifier.

E. Power Amplifier

The power amplifier stage of the model 518 transmitter utilizes 2 Eimac type 4-400A internal anode tetrodes in conjunction with linear circuit elements comprised of short sections of 2 wire transmission lines.

The balanced coaxial coupling line from the final multiplier panel is terminated in a hairpin which in turn is coupled to the grid circuit.

Neutralization is accomplished by resonating the screen grid lead of each tube to ground with a variable capacitor. Screen voltage is applied to each tube through a 500 ohm wire wound resistor which acts as a heavily damped choke. Individual screen currents and total screen current are metered by means of the SCREEN CURRENT meter and selector switch which are located at the top of the right control panel.

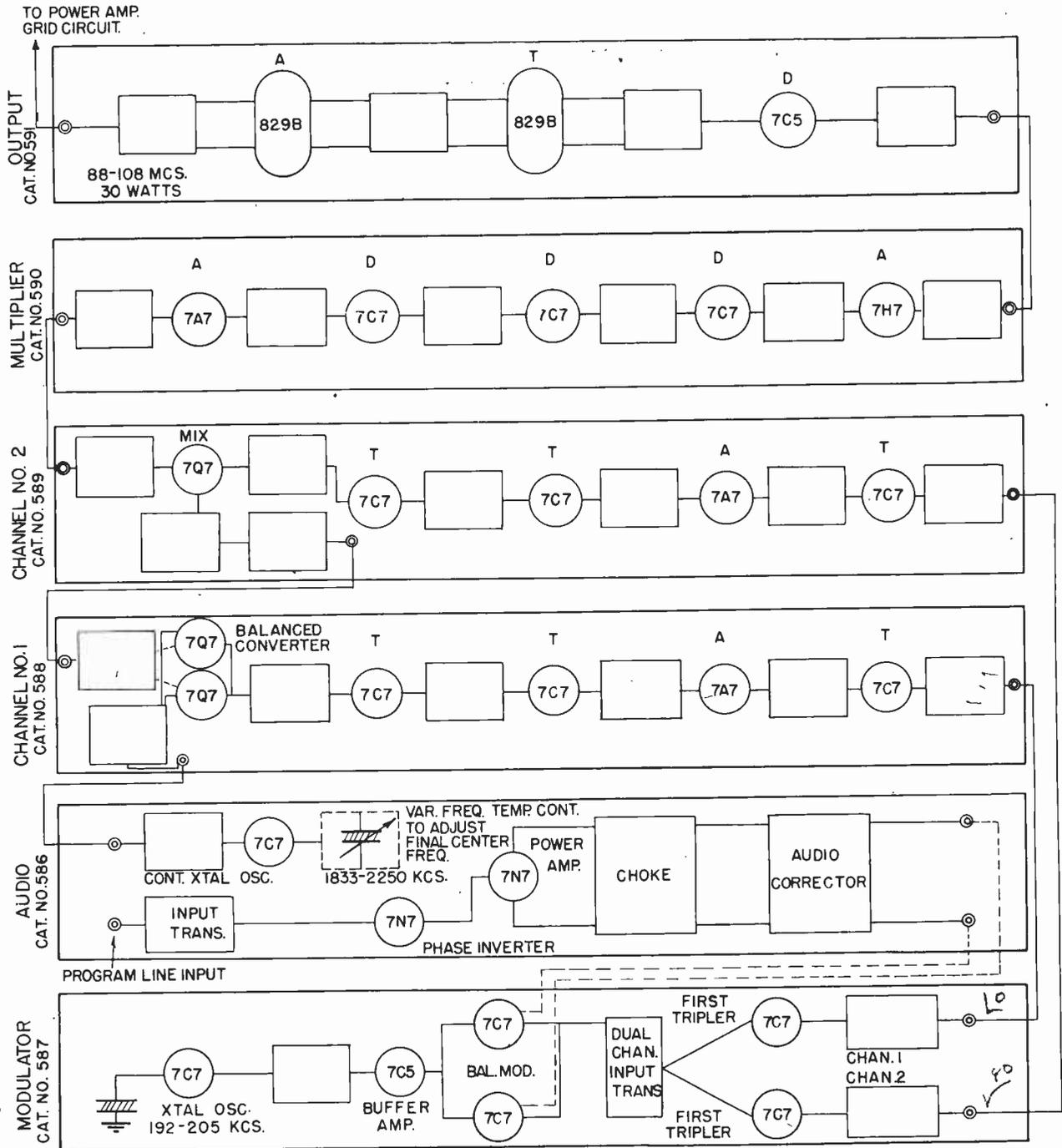
Output coupling from the anode circuit is accomplished by means of a hairpin mounted on the rear wall of the power amplifier compartment. The position of this hairpin with respect to the plate lines is variable from the right hand control panel for coupling control. Two air dielectric series capacitors are provided just behind the hairpin for tuning purposes.

Connection of the single 7/8" output transmission line is accomplished just inside the top of the transmitter proper.

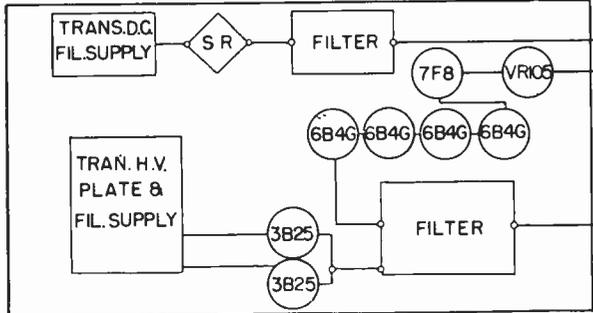
F. Power Output Indicator

The power output indicator is a voltage operated device which provides a relative indication of transmission line voltage at the point of insertion into the transmission line. The pickup unit is brazed to the short section of transmission line inside the power amplifier cabinet. It consists of a small adjustable probe, a crystal detector, and RF filters. The indicator is a 1 milliampere meter mounted on the meter panel, accessible behind the upper right panel of the power amplifier cabinet for setting a convenient mid-scale meter reading for full power output.

BLOCK DIAGRAM OF THE DUAL CHANNEL MODULATOR



A = AMPLIFIER
 D = DOUBLER
 T = TRIPLER
 MIX = MIXER



FILAMENT AND PLATE SUPPLY TO ALL UNITS EXCEPT "OUTPUT" UNIT.

FILAMENT AND PLATE SUPPLY TO OUTPUT UNIT.

FIG. 1

SECTION VI

MODULATOR AND POWER AMPLIFIER ADJUSTMENT PROCEDURE

A. MODULATOR LINE UP PROCEDURE

The tuning of the modulator is extremely simple, and ordinarily should require only a few minutes. In each of the panels the signal direction is from right to left, and one must proceed this way in alignment. Assuming that complete alignment is needed, the following procedure should be followed:

1. Place the voltmeter probe in J-204 and adjust the trimmer on Z-200 until a voltage is obtained. This serves to indicate that the low frequency crystal oscillator is operative. ○
2. With the probe in J-303 go through the Balanced Modulator Chassis, Cat. #587A from right to left adjusting Z-201, Z-203 and Z-204 for maximum drive as read at J-303. Z-202 is not adjusted at this time. See paragraph 26 for detailed procedure. Then, when Z-300 is peaked the drive at J-303 should be 20 to 30 volts. ^{AMP 2300} 23V
3. With the probe in J-402, Z-205 and Z-400 are peaked for maximum drive. the voltage at J-402 should be 20 to 30 volts. 17V
4. Return the probe to J-204 and tune the low frequency oscillator tank, Z-200, until the voltage indicated is zero. It is important that V-201 is not driven into the grid current region, which is indicated by a voltage reading at J-204. ○
5. The multiplier and Balanced Converter, Cat. #588, may now be tuned by inserting the probe in J-304 and peaking transformer Z-301 for a 20 to 30 volt indication. 21.5V
6. Insert the probe in J-305 and peak Z-302 for a 60 to 70 volt indication. 70V
7. With the probe in J-306, peak Z-303 for 35 to 45 volts of drive. 34.5V
8. Insert the probe in J-307 and peak Z-304 for a reading of 5.0 to 8.0 volts. 4.2V
9. Insert the probe in J-308 and tune Z-100 in the control crystal oscillator circuit and Z-305 to maximum. After Z-305 is peaked lower the drive with Z-100 until 8 to 10 volts at J-308 is obtained. 11V
10. For line up of the Multiplier and Single Ended Converter Cat. #589, insert the probe in J-403 and peak transformer Z-401 for a 20 to 30 volt indication. 17.5V
11. Insert the probe in J-404 and peak Z-402 for a 60 to 70 volt indication. 60V
12. With the probe in J-405, peak Z-403 for 35 to 45 volts of drive. 32V
13. Insert the probe in J-406 and peak Z-404 for a 6 to 10 volt reading. 5V
14. Insert the probe in J-408 and peak Z-306 and Z-406 for a 0.5 to 4 volt indication. 3V

SECTION VI

MODULATOR AND POWER AMPLIFIER ADJUSTMENT PROCEDURE

15. The Semi Final Multiplier, Cat. #590 is now tuned by inserting the probe in J-501 and peaking Z-405 and Z-500 for 15 to 25 volts of drive. *16.5V*
16. Insert the probe in J-502, and peak Z-501 for 40 to 50 volts. *48V, 52*
17. With the probe in J-503, Z-502 is peaked for 45 to 55 volts. *48.5V*
18. Z-503 is next peaked for 60 to 70 volts as read at J-504. *75V, 50*
19. Insert the probe in J-505 and peak Z-504 for a 50 to 60 volt indication. *61V*
20. The Final Multiplier Cat. #591A is tuned by inserting the probe in J-601 and peaking Z-505 and Z-600 for 40 to 50 volts. Approximate resonance of Z-505 may be noted by a slight increase of approximately 1 volt at J-505 as Z-505 becomes resonant. *62V*
21. With the probe in J-602 the doubler plate and tripler grid are tuned for 120 to 150 volts of drive. *178V*
22. Tune the tripler plate for minimum reading on the plate meter, M-600, (Plate resonance dip.) *60Ma.*
23. Insert the probe in J-603 and tune the amplifier grid for maximum drive repeak both the tripler plate and amplifier grid controls. The amplifier grid drive should be between 130 and 180 volts, and the tripler plate current, as shown on the plate current meter, between 60 to 100 mills. *130V*
24. Tune the amplifier plate for minimum reading on the plate meter M-601, (Plate resonance dip.)
25. Tune Power Amplifier grid circuit and the intermediate Amplifier output tuning for maximum indication on the Power Amplifier grid meter. Check Amplifier plate and output tuning and grid tuning for maximum drive. The grid meter should read 30 to 35 ma. This completes the Modulator tuning adjustments. A simplified chart of the above adjustments is included on the next page.
26. Z-202 and Z-407 cannot be adjusted by simply peaking a reading on a volt-meter. In the absence of proper equipment necessary for their adjustments, they must be set at the factory marked position, which is not in the least critical. The equipment required for these adjustments is, as follows:
 - a. Distortionless or very low distortion receiver.
 - b. Distortion measuring equipment.
 - c. A means of determining frequency deviation. The REL Cat. #600 Monitor may be used for this or one of the more fundamental methods may be used.
 - d. A good, high gain, oscilloscope such as the Dumont 208B.
 - e. A source of sinusoidal 50 cps.

SECTION VI

MODULATOR AND POWER AMPLIFIER ADJUSTMENT PROCEDURE

Z-202 is merely adjusted for minimum distortion, with a modulation frequency of 50 cycles per second and a deviation of plus/minus 75 kc. This adjustment is very broad and not critical as to distortion.

Z-407 is adjusted by modulating 100% (plus/minus 75 Kc. deviation) at 50 cycles and observing the output of the low distortion receiver on the oscilloscope. Make the image very large and observe particularly the peaks. Then adjust Z-407 for the purest sine wave peak. If no high frequency hash is seen on the peaks of the 50 cycles waveform, do not disturb the adjustment of Z-407. Again this adjustment is non-critical making approximately 0.1 db difference in distortion measurements at 50 cycles.

SIMPLIFIED CHART OF MODULATOR TUNING

PLACE PROBE IN JACK	ADJUST	APPROXIMATE RANGE OF CORRECT INDICATION	ORDER OF TUNING OPERATION
J-204	Z-200	(All voltages negative with respect to ground) Any voltage	1
J-303	Z-201, Z-203 ✓ Z-204, Z-300 ✓	20 - 30V	2
J-402	Z-205, Z-400 ✓	20 - 30V	3
J-204	Z-200 ✓	Must be zero.	4
J-304	Z-301 ✓	20 - 30V	5
J-305	Z-302 ✓	60 - 70V	6
J-306	Z-303 ✓	35 - 45V	7
J-307	Z-304 ✓	5 - 8V	8
J-308	Z-100, Z-305 ✓	After tuning Z-305 to maximum, lower voltage with Z-100 to 8-10 volts.	9
J-403	Z-401 ✓	20 - 30V	10
J-404	Z-402 ✓	60 - 70V	11
J-405	Z-403 ✓	35 - 45V	12
J-406	Z-404 ✓	6V - 10V	13
J-408	Z-306, Z-406 ✓	0.5V - 4V	14
J-501	Z-405, Z-500 ✓	15V - 25V	15
J-502	Z-501 ✓	40V - 50V	16
J-503	Z-502 ✓	45 - 55V	17
J-504	Z-503 ✓	60 - 70V	18
J-505	Z-504 ✓	50 - 60V	19
J-601	Z-505, Z-600 ✓	40 - 50V	20
J-602	Doubler Plate & Tripler Grid	120 - 150V	21

Z-400?

SIMPLIFIED CHART OF MODULATOR TUNING

<u>PLACE PROBE IN JACK</u>	<u>ADJUST</u>	<u>APPROXIMATE RANGE OF CORRECT INDICATION</u>	<u>ORDER OF TUNING OPERATION</u>
Observe Tripler Plate Cur. Meter	Tripler Plate	Tune for dip 66 - 100 Ma.	22
J-603	Amp. Grid & Tripler Plate	130 180V Drive	23
Observe Intermediate Amplifier Plate Cur- rent meter.	Intermediate Amplifier Plate	Tune for dip 110 - 150 Ma.	24
Observe Power Ampli- fier Grid current meter.	Intermediate Amp- lifier Plate, Out- put tuning, P.A. Grid tuning.	30 to 35 Ma Grid Drive on Power Amplifier	25

MODULATOR AND POWER AMPLIFIER ADJUSTMENT PROCEDURE

B. POWER AMPLIFIER ADJUSTMENTS

1. Neutralizing

- a. Neutralizing of the final amplifier is conventional and straight forward. Decouple the output coupling link as far as possible. Set the neutralizing capacitors at half capacity.
- b. Turn on the driver and tune the power amplifier grid circuit. Tune the plate circuit while observing both grid and plate current meters. A slight dip in the low reading of the plate current meter will indicate resonance. If the grid current passes through a minimum at this point, peak it with the neutralizing capacitors. Recheck the plate tuning. It will be necessary to repeat this procedure several times until no reaction or perhaps a slight peaking of the grid current occurs as the plate circuit is tuned through resonance.
- c. Remove the plate cap from the right front high voltage rectifier tube, and set the high voltage selector switch to the low position. Turn on the high voltage.
- d. Check the grid tuning, then tune the plate circuit. Perfect neutralizing occurs when, as the plate current passes through its dip, the grid current passes through its peak. If this condition is not apparent readjust the neutralizing capacitors slightly until it is.
- e. Replace the cap on the high voltage rectifier tube and tune the plate circuit off resonance on each side. A condition may appear in which the plate current will swing to approximately 500 Ma. on the low frequency side of resonance but will not reach this value on the high frequency side before breaking over and starting into another dip. In this case tune the plate circuit in the high frequency direction stopping just before the plate current starts to dip again. At this point adjust the neutralizing capacitors slightly in the direction which will tend to raise the grid current. Recheck the coincidence of plate current dip and grid current peak and then detune the plate circuit on the high frequency side of resonance to see that the plate current rises to approximately the same value as that achieved on the low frequency side. It may be necessary to repeat this procedure several times before the plate current swing is roughly equal on both sides of resonance.
- f. Hold down the interlock of the door over the final multiplier panel and open the switch which controls the 829B screen voltage. Plate and grid current on the final amplifier should disappear completely. If a slight residual current remains, adjust the neutralizing capacitors until it disappears, then turn on the drive again and recheck the tracking of grid and plate currents and the off resonance swing of the plate current.

SECTION V

PRELIMINARY ADJUSTMENTS & OPERATION OF THE EQUIPMENT

A. CONTROL CIRCUIT ADJUSTMENTS

(All necessary control circuit adjustments have been made at the factory, however for future checks, they are listed below.)

1. FILAMENT TIME DELAY K801

This relay should be adjusted for approximately 60 seconds. Adjustment is made by the small screw at the top of the relay, and direction of rotation is indicated.

2. HIGH VOLTAGE TIME DELAY K803

This relay should be adjusted for approximately 3 to 5 seconds. Adjustment procedure is the same as for filament time delay, K801, above.

3. BLOWER TIME DELAY RELAY K807

This relay should be adjusted for 2 to 2½ minutes. Adjustment procedure is the same as for the filament time delay K801 above.

4. OVERLOAD RELAY K805

This relay should be adjusted to trip at 600 milliamperes. Adjustment instructions are given on the relay itself.

B. ADJUSTMENTS FOR TURNING ON THE TRANSMITTER

NOTE: Adjustments and checks given below have all been made at the factory, but should be re-checked for the station line voltage and to disclose any damage to adjustments during shipping.

1. 110V CIRCUITS

(a) With 110 volts, single phase, 60 cycle AC connected to terminals 53 and 54, the convenience outlet in the rear base of the transmitter should be checked for power availability.

(b) After the lumiline lamps have been installed the power amplifier compartment should be illuminated when its door is opened. With the front lower panel or the right lower panel removed the bottom deck should be illuminated.

2. APPLICATION OF POWER

NOTE: All switches should be opened.

A. STANDBY CIRCUIT

1. Close the standby switch S-808, and the crystal pilot light, I-804 should light.

2. The voltage at the crystal heater should be checked and if not 6.0 to 6.3 volts AC, R-715 behind the rear cover plate of the modulator power supply should be adjusted to give the proper voltage. This resistor is mounted near T-703 and is connected in series with terminal #1 of T-703.

SECTION V

PRELIMINARY ADJUSTMENTS & OPERATION OF THE EQUIPMENT

3. S-808 is normally closed to provide standby power for the crystal heater and blower shutdown circuits and should not be opened unless work is being performed on these circuits.

3. FILAMENT CIRCUIT

- a. Close the main circuit breaker K-800, the blower B-800 should start, the blower pilot light I-803 should light and the meter lights I-805 and I-806 should light.
- b. The filament switch S-800 may now be closed. The filament voltage control should be raised until the filament volt meter reads 5.0 volts. As the voltage is raised, relay K-700 will close and may chatter a bit, but when the meter reads 5.0 volts the relay will have sealed closed.
- c. All tube filaments will now be energized, and the crystal heater will be powered by DC after relay K-700 closes. A check should be made of the DC filament voltage at terminal #4 on the Modulator Chassis. R-712 should be adjusted for 6.6V DC at terminal #4, to ground, while the crystal is heating up. Terminal #8 on the multiplier and balanced converter chassis should be checked to see that 6.6 volts AC exist between it and ground.
- d. The compensating resistor, R-711, should be checked for proper setting to absorb the power normally taken by the crystal heater when the heater thermostat opens. The voltage while the crystal is heating up will be 6.6V DC as explained in (C) above. When the heater has reached its temperature and the thermostat opens, relay K-701A will open and contact K-701B, will close putting R-711 in place of the crystal heater. Therefore, to keep the 6.6V DC constant, R-711 should be adjusted so that when the crystal is removed from its socket the DC voltage remains at 6.6 volts.
- e. The Filament Pilot light will also be lighted.

4. MODULATOR HIGH VOLTAGE

- a. If all door interlocks are closed, and relay K-801 has closed its contact K-801A after 60 seconds time delay, then closing the Modulator High Voltage switch S-801 will close relay K-802.
- b. Modulator high voltage will be on, and the 250 volt regulated supply may be checked at terminal #9 on the Modulator Power Supply chassis. If other than 250 volts, R-709 should be adjusted to give the proper value. The unregulated supply should be checked at terminal #11 for approximately 450 volts.
- c. The bias high voltage will also be on and R-808 on the resistor board should indicate approximately - 200 volts to ground.
- d. The relay K-803 will be energized and start its 5 second time delay cycle. The Modulator High Voltage Pilot light will be on.
- e. Check the operation of the door interlocks by opening each door and panel with the exception of those over the modulator compartment and see that the Modulator High Voltage pilot light and modulator high voltage go off.

SECTION V

PRELIMINARY ADJUSTMENTS & OPERATION OF THE EQUIPMENT

- f. Tune the Power Amplifier grid circuit. See Section VI for detailed modulator and power amplifier adjustment data.

5. P.A. HIGH VOLTAGE

- a. Close the P.A. High Voltage switch S-805. If 5 seconds have elapsed since the closing of the modulator high voltage switch S-801, the high voltage recycling time delay K-803 will have closed, thus energizing the coil of the high voltage relay K-804 which closes contacts K-804B and K-804C, and applying power to the primary of the high voltage transformer through the tap changing switch S-816. Plate voltage should be indicated by the Plate Voltage Meter M-803, and screen voltage (about 350-400 volts) should be present at lead #15 on the resistor panel. At the screens of the tubes, under normal operating conditions, this voltage will be approximately 190 volts due to the action of the series resistors R-818 and R-819. The P.A. HV pilot light I-802 should light.
- b. Tune the amplifier plate circuit to resonance. See Section VI for detailed power amplifier tuning procedure.

C. TURNING OFF THE TRANSMITTER

1. The transmitter may be turned off by opening each switch, except the Standby switch S-808, and the Primary Power circuit breaker. The equipment will shut down in sequence, the crystal heater will be in the standby mode of operation, and the blower will stop after 2 to 2.5 minutes, depending upon the adjustment of time delay K-807.
2. The equipment may also be shut down by merely opening the Primary Power circuit breaker, leaving all other switches on with the results noted above.

D. TURNING ON THE TRANSMITTER - SEMI-AUTOMATIC OPERATION

To turn on the equipment semi-automatically, close all switches including the Primary Power circuit breaker and select the high voltage desired by means of the high voltage tap changing switch S-816. The equipment will then cycle up automatically, with the application of all supply voltages controlled by time delay action.

MODULATOR AND POWER AMPLIFIER ADJUSTMENT PROCEDURE

2. ADJUSTMENT OF OUTPUT TUNING CAPACITORS

CAUTION

FOR THE PROTECTION OF BOTH TRANSMISSION LINES AND THE TRANSMITTER - THE TRANSMISSION LINE SYSTEM MUST BE WELL TERMINATED BEFORE ATTEMPTING TO APPLY POWER.

- a. A poorly terminated transmission line system will reflect reactance into the plate circuit of the transmitter, the severity of the reflection depending upon the magnitude of the transmission line standing wave ratio - Under poor conditions of termination, ie. standing wave ratios in excess of 1.5 to 1, it is very difficult to make the correct initial adjustments of the power amplifier output circuits.
- b. Adjust the output coupling control so that the output coupling link is swung in for about 75% of its total available adjustment. With the high voltage switch in the low position turn on the plate voltage. Resonate the plate circuit.
- c. Rotate the coupling control so that the link is backed away from the plate circuit. Retune the plate circuit, noting the direction of rotation of the plate tuning control. If the plate circuit requires lengthening, more capacity is required in the series output capacitors. The balance between these capacitors should be maintained closely. Conversely, if the plate lines required shortening less series capacity is required.
- d. After noting the sense of the capacity change required, adjust the series capacitors by approximately one turn in the proper direction. Engage the coupling hairpin again and repeat the above procedure until plate resonance is maintained regardless of the position of coupling hairpin. It should be noted that as the resonance point of the series capacitors is approached their effect becomes much more pronounced and even a quarter turn may be sufficient to go through the true resonance point.

3. SCREEN CURRENT BALANCE -- ANODE COLOR

- a. With the transmitter completely tuned, the output coupling link should be adjusted for approximately 250 Ma. plate current. Raise the plate voltage to the medium position by means of the selector switch. Check the screen currents on each tube as well as the anode color. If an unbalance is present as indicated by either the screen current or the anode color, a slight readjustment of the output tuning capacitors, that is, slightly less capacity on one side with a corresponding increase on the other to maintain the resonance of the output circuit, will generally rectify any tendency to unbalance.

4. WARMING UP THE EQUIPMENT

- a. When starting the transmitter, it is advisable to operate at the low voltage level for approximately 5 minutes before raising the plate voltage to normal operating level. During the first few minutes the grid and plate circuits may be slightly out of resonance until they reach operating temperature. It should be unnecessary to retune any of the circuits during

MODULATOR AND POWER AMPLIFIER ADJUSTMENT PROCEDURE

this period of warm up and under no condition should an attempt be made to touch up neutralizing unless the transmitter is at its operating temperature.

5. OUTPUT VOLTMETER COUPLING

- a. The pickup probe for the RF output meter is attached to the output coaxial line inside the transmitter cabinet. If insufficient indication is obtained even with the control potentiometer R-821 at maximum, unscrew the large section of the probe housing and with a 7/16" socket wrench remove the miniature spark plug from the line. A brass probe is attached to the center conductor of the plug and may be extended slightly or enlarged if necessary.

SECTION VI

TYPICAL METER READINGS

POWER AMPLIFIER

<u>Filament Voltage</u>	<u>Grid Current</u>	<u>Grid Voltage - Term. #44</u>	<u>Screen Currents</u>		
5.0	30-35ma	- 140	#1 20ma	#2 20ma	Total 40ma

<u>Screen Voltage</u>	<u>Plate Current</u>	<u>Plate Voltage</u>	<u>Power Output</u>	<u>Efficiency</u>
185	365ma	3900	1000 watts	70%

MODULATOR

NOTE: Readings should be taken with a 20,000 Ohms/volt multitester, Voltohmyst, or similar type of instrument. Readings indicated below taken with a Voltohmyst.

Audio Panel Cat. 586A

<u>Jack</u>	<u>Reading</u>	<u>Comments</u>
J-100	+2.2V.	Average
J-101	+8.5V.	Average

Balanced Modulator Cat. 587A

<u>Jack</u>	<u>Reading</u>	<u>Comments</u>
J-204	0.0	Should always read zero.

Multiplier and Balanced Converter Cat. 588

<u>Jack</u>	<u>Reading</u>	<u>Comments</u>
J-303	-25V	Average
J-304	-25V	Average
J-305	-65V	Average
J-306	-30V	Average
J-307	-6.6V	Average
J-308	-8 to -10	Critical

SECTION VI

TYPICAL METER READINGS

Multiplier and Single Ended Converter Cat. 589

<u>JACK</u>	<u>READING</u>	<u>COMMENTS</u>
J-402	-25V	Average
J-403	-25V	Average
J-404	-65V	Average
J-405	-40V	Average
J-406	-8.0	Average
J-408	-2.2	Average

Semi-Final Multiplier Cat. 590

<u>JACK</u>	<u>READING</u>	<u>COMMENTS</u>
J-501	-20V	Average
J-502	-45V	Average
J-503	-50V	Average
J-504	-65V	Average
J-505	-55V	Average

Intermediate Power Multiplier Cat. 695

<u>JACK</u>	<u>READING</u>	<u>COMMENTS</u>
J-601	-45V	Average
J-602	-135V	Average
M-600	80Ma.	V-601 Plate Current as read on trip- ler plate met- er.
J-603	-155V	Average
M-601	130Ma.	V-601 plate current as read on ampli- fier plate met- er.

SECTION VI

TYPICAL METER READINGS

Modulator Power Supply

<u>TERMINAL NUMBER</u>	<u>READING</u>	<u>COMMENT</u>
#3	6.6V DC	In operating condition
	6.3V AC	In standby condition
#8	6.6V AC	AC Fil voltage
#4	+ 6.6V DC	DC Fil. voltage
#9	+ 250 volts	Regulated high voltage
#11	+ 450 volts	Unregulated high voltage

SECTION VII

PARTS LIST FOR CAT. #586A
AUDIO PANEL FOR F.M. MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-100	C-5178-S1	Capacitor - fixed, mica, .00015 mfd, 500 VDCW, 10%
C-101	C-5122-I4	Capacitor - fixed, dry electrolytic, 25 mfd. 50 VDCW
C-102	C-5089-H2	Capacitor, variable, air, 35 mmfd.
C-103	C-5107-I4	Capacitor - fixed, paper, oil filled, 1 mfd. 600 VDCW
C-104		Capacitor - Same as C-103
C-105	C-5124-I4	Capacitor - fixed, paper, oil filled, 0.05 mfd. 400 VDCW
C-106		Capacitor - Same as C-105
C-107		Capacitor - Same as C-103
C-108	C-5016-M6	Capacitor - fixed, molded paper, .01 mfd. 300 VDCW 20%
C-109	C-5125-I4	Capacitor - fixed, paper, oil filled, 0.5 mfd. 400 VDCW
C-110		Capacitor - Same as C-109
C-111		Capacitor - Same as C-109
C-112	C-5047-S1	Capacitor - fixed, mica, .001 mfd. 500 VDCW, 20%
C-113		Capacitor - Same as C-112
C-114		Capacitor - Same as C-112
C-115		Capacitor - Same as C-112
C-116		Capacitor - Same as C-108
C-117	C-5165-E5	Capacitor - fixed, ceramic, 3 mmfd, 500 VDCW, 5%
C-118		Capacitor - See Z-100
C-119		Capacitor - See Z-100
C-120		Capacitor - Same as C-112
C-121		Capacitor - Same as C-112

PARTS LIST FOR CAT. #586A
AUDIO PANEL FOR F.M. MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-122	C-5017-S7	Capacitor - fixed, paper, 1 mfd. 400 VDCW, 20%
C-123		Capacitor - Same as C-108
C-124		Capacitor - Same as C-112
C-125		Capacitor - Same as C-112
C-126		Capacitor - Same as C-112
C-127		Capacitor - Same as C-112
C-128	C-5000-M5	Capacitor - 1200 mfd. ceramic, 300 VDCW, 20%
C-129		Capacitor - Same as C-124
E-100	E-5004-J2	Terminal Strip 4 terminals
J-100	J-5015-I1	Jack - pin type, female contact
J-101		Jack - Same as J-100
J-102	J-5018-A5	Jack - twin contacts, chassis connector, female contacts
J-103	J-5001-A5	Jack - female contact, chassis mounting type
J-103A	J-5017-A5	Jack Hood - for use with REL part J-5001-A5
J-104		Jack - Same as J-103
J-104A		Jack Hood - Same as J-103A
J-105		Jack - Same as J-103
J-105A		Jack Hood - Same as J-103A
L-100	L-5012-C14	Choke, A.F. - 50 henries C.T.
L-101	L-5027-R7	Choke, R.F. - 7.5 microhenries
L-102	L-5026-R7	Choke, R.F. - 12.5 microhenries
L-103		Choke, R.F. - Same as L-101
L-104	L-5028-M3	Choke, R.F. - 2.5 millihenries

PARTS LIST FOR CAT. #586A
AUDIO PANEL FOR F.M. MODULATOR

SYMBOL NO.		
L-105		Choke, R.F. - 40 microhenries
L-106		Same as L-105
R-101	R-5087-A11	Resistor, fixed, composition, 500 ohms, 1 watt, 10%
R-102	R-5231-A11	Resistor - fixed, composition, 1500 ohms, 1/2 watt, 10%
R-103		Resistor - Same as R-102
R-104	R-5181-A11	Resistor - fixed, composition, 0.27 meg ohm, 1 watt, 10%
R-105	R-5187-A11	Resistor - fixed, composition, 470 ohms, 1 watt, 10%
R-106	R-5084-I2 or R-5186-A11	Resistor - fixed, composition, 50,000 ohms, 1 watt, 10% Resistor - fixed, composition, 47,000 ohms, 1 watt, 10%
R-107	R-5057-A11	Resistor - fixed, composition, 1000 ohms, 2 watts, 10%
R-108	R-5200-A11	Resistor - fixed, composition, 100,000 ohms, 1/2 watt, 10%
R-109		Resistor - not used
R-110		Resistor - Same as R-104
R-111		Resistor - Same as R-104
R-112		Resistor - Same as R-104
R-113	R-5112-A11	Resistor - fixed, composition, 100,000 ohms, 1 watt, 10%
R-114		Resistor - Same as R-104
R-115		Resistor - Same as R-105
R-116	R-5182-A11	Resistor - fixed, composition, 390,000 ohms, 1 watt, 10%
R-117		Resistor - Same as R-104
R-118	R-5191-A11	Resistor - fixed, composition, 39,000 ohms, 1 watt, 10%
R-119		Resistor - Same as R-104
R-120		Resistor - Same as R-118
R-121	R-5198-A11	Resistor - fixed, composition, 10 ohms, 1 watt, 5%
R-122		Resistor - Same as R-121

PARTS LIST FOR CAT. #586A
 AUDIO PANEL FOR F.M. MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
T-100	T-5020-C14	Transformer, AF - primary impedance 500 ohms, secondary impedance 500 ohms, input level 6 milliwatts, frequency characteristic flat from 30 - 15,000 cycles, distortion less than .1% RMS
V-100		Tube - Type 7N7 loctal
V-101		Tube - Same as V-100
V-102		Tube - Type 7C7 loctal
X-100	X-5007-E1 or X-5047-A5	Socket - loctal, ceramic Socket - loctal, mica filled bakelite
X-101		Socket - Same as X-100
X-102		Socket - Same as X-100
X-103	X-5018-J4	Socket - for crystal - ceramic, 7 prong large
Y-100	Y-5011-B4	Crystal, quartz - Frequency dependent upon customers required frequency
Z-100	Z-5028-S5	Tuning assembly - tuning range 1833-2250 kc. - Consists of: Primary Inductance - 120 microhenries, 3% Secondary Inductance - 40 microhenries, 5% C-118 - Capacitor, variable, air 3.4 - 32 mmf. C-119 - Capacitor, fixed, ceramic, 10 mmf, 500 VDCW, 5%

SECTION VII

PARTS LIST CAT. #587A
BALANCED MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-200	C-5016-M6	Capacitor - fixed, molded paper, .01 mfd. 300 VDCW, 20%
C-201		Capacitor - Same as C-200
C-202		Capacitor - Same as C-200
C-203		Capacitor - See Z-200
C-204		Capacitor - See Z-200
C-205		Capacitor - Same as C-200
C-206		Not used.
C-207		Capacitor - Same as C-200
C-208		Capacitor - See Z-201
C-209		Capacitor - See Z-201
C-210		Capacitor - See Z-201
C-211		Capacitor - See Z-201
C-212	C-5082-E5	Capacitor - fixed, ceramic, 200 mmfd. 500 VDCW, 1%
C-213		Capacitor - Same as C-212
C-214	C-5122-I4	Capacitor - fixed, dry electrolytic, 25 mfd. 50 VDCW
C-215		Capacitor - Same as C-200
C-216		Capacitor - Same as C-200
C-217		Capacitor - Same as C-200
C-218		Capacitor - See Z-202
C-219		Capacitor - Same as C-200
C-220		Capacitor - Part of Z-202 Assembly
C-221		Capacitor - Part of Z-203 Assembly
C-222		Capacitor - Part of Z-203 Assembly
C-223		Capacitor - Part of Z-203 Assembly

PARTS LIST CAT. #587A
BALANCED MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-224		Capacitor - Same as C-200
C-225		Capacitor - Same as C-200
C-226		Capacitor - See Z-205
C-227		Capacitor - See Z-205
C-228		Capacitor - Same as C-200
C-229		Capacitor - Same as C-200
C-230		Capacitor - See Z-204
C-231		Capacitor - See Z-204
C-232		Capacitor - Not used
C-238	C-5047-S1	Capacitor - fixed, mica, .001 mfd., 500 VDCW, 20%
C-239		Capacitor - Same as C-238
C-240		Capacitor - Same as C-238
C-241		Capacitor - Same as C-238
C-242		Capacitor - See Z-200
C-243		Capacitor - Same as C-200
C-244		Capacitor - Part of Z-202 Assembly
C-245	C-5165-E5	Capacitor - fixed, ceramic, 3 mmfd, 500 VDCW, 5%
C-246	C-5000-M5	Capacitor - fixed, ceramic, 1200 mmfd, 300 VDCW, 20%
C-247		Capacitor - Same as C-246
E-200	E-5012-J2	Terminal strip, 3 terminals
J-200	J-5001-A5	Jack - female contact - chassis mounting type
J-200A	J-5017-A5	Jack Hood - For use with J-5001-A5
J-201		Jack - Same as J-200
J-201A		Jack Hood - Same as J-200A

PARTS LIST CAT. #587A
BALANCED MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
J-202		Jack - Same as J-200
J-202A		Jack Hood - Same as J-200A
J-203		Jack - Same as J-200
J-203A		Jack Hood - Same as J-200A
J-204	J-5015-I1	Jack - pin type, female contact
L-200	L-5028-M3	Choke, R. F. - 2.5 millihenries
L-202	L-5027-R7	Choke, R. F. - 7.5 microhenries
L-203	L-5026-R7	Choke, R. F. - 12.5 microhenries
L-204		Choke - Same as L-200
L-205		Choke - Same as L-200
R-200	R-5181-A11	Resistor - fixed, composition, 0.27 meg ohm 1 watt, 10%
R-201	R-5187-A11	Resistor - fixed, composition, 470 ohms, 1 watt, 10%
R-202	R-5086-A11	Resistor - fixed, composition, 1000 ohms, 1 watt, 10%
R-203	R-5185-A11	Resistor - fixed, composition, 27,000 ohms, 1 watt, 10%
R-204		Resistor - Same as R-203
R-206	R-5113-A11	Resistor - fixed, composition, 270 ohms, 1 watt, 10%
R-209	R-5234-A11	Resistor - fixed, composition, 100 ohms, 1 watt, 5%
R-210		Resistor - Same as R-209
R-211	R-5193-A11	Resistor - fixed, composition, 2700 ohms, 1 watt, 10%
R-212		Resistor - See Z-202
R-213		Resistor - Same as R-202
R-214		Resistor - See Z-202
R-215	R-5235-A11	Resistor - fixed, composition, 330,000 ohms, 1 watt, 5%
R-216		Resistor - Same as R-215

PARTS LIST CAT. #587A
BALANCED MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
R-217		Resistor - See Z-203
R-218	R-5236-A11	Resistor - fixed, composition, 4700 ohms, 1 watt, 5%
R-219		Resistor - See Z-204
R-220		Resistor - Same as R-218
R-221		Resistor - See Z-205
R-222		Resistor - Same as R-203
R-223		Resistor - Same as R-203
V-200		Tube - Type 707, loctal
V-201		Tube - Type 705, loctal
V-202		Tube - Same as V-200
V-203		Tube - Same as V-200
V-204		Tube - Same as V-200
V-205		Tube - Same as V-200
X-200	X-5007-E1 or X-5047-A5	Socket - loctal tube, ceramic Socket - loctal, mica filled bakelite
X-201		Socket - Same as X-200
X-202		Socket - Same as X-200
X-203		Socket - Same as X-200
X-204		Socket - Same as X-200
X-205		Socket - Same as X-200
X-208	X-5019-M2	Socket - crystal, 2 prong.
Y-200	Y-5000-B4	Crystal, quartz - Frequency dependent upon customers requirements

PARTS LIST FOR CAT. #587A
BALANCED MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-200	Z-5023-S5	Tuning assembly, tuning range 192-205KC. Consists of: Inductance: 2 millihenries, 3% C-203 - Capacitor, variable, air, 5-97 mmf. C-204 - Capacitor, fixed, mica, .01 mfd, 400 VDCW, 10% C-242 - Capacitor, fixed, ceramic, 240 mmf, 500 VDCW, 5%
Z-201	Z-5024-S5	Tuning Assembly, tuning range 192-205KC Consists of: Primary Inductance: 1.5 millihenries, 3% Secondary Inductance: 4.7 millihenries, 3% C-208 - Capacitor, fixed, ceramic, 350 mmf, 500 VDCW, 1% C-209 - Capacitor, variable, air, 5-97 mmf. C-210 - Capacitor, fixed, ceramic, 10 mmf, 500 VDCW, 5% C-211 - Capacitor, variable, air, 3.6-40 mmf.
Z-202	Z-5025-S5	Tuning assembly, tuning range 192-205KC Consists of: Inductance: 8.5 millihenries, 3% C-218 - Capacitor, fixed, mica, .01 mfd, 400 VDCW, 10% C-220 - Capacitor, variable, air, 3.6-43 mmf C-244 - Capacitor, fixed, ceramic, 47 mmf, 500 VDCW, 1% R-212 - Resistor, fixed, composition, 10,000 ohms, 1 watt, 5% R-214 - Resistor, fixed, composition, 220,000 ohms, 1 watt, 10%

PARTS LIST FOR CAT. #587A
BALANCED MODULATOR

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-203	Z-5026-S5	Tuning Assembly, tuning range 192-205KC Consists of: Inductance: 2 - 3.3 millihenry coils, 3% connected series aiding C-221 - Capacitor, variable, air, split stator, 5-50 mmf per section C-222 - Capacitor, fixed, ceramic, 75 mmf, 500 VDCW, 1% C-223 - Same as C-222 R-217 - Resistor, fixed, composition, 62,000 ohms, 1 watt, 5%
Z-204	Z-5027-S5	Tuning Assembly - tuning range 576-615KC Consists of: Primary Inductance: 1 millihenry, 3% Secondary Inductance: 300 microhenries, 5% C-230 - Capacitor, fixed, ceramic, 36 mmf, 500 VDCW, 5% C-231 - Capacitor, variable, air, 3.4-36 mmf. R-219 - Resistor, fixed, composition, 47,000 ohms, 1 watt, 10%
Z-205	Z-5027-S5	Tuning assembly, same as Z-204

SECTION VII

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND BALANCED CONVERTER - CAT. #588

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-300		Capacitor - See Z-300
C-301		Capacitor - See Z-300
C-302	C-5016-M6	Capacitor - fixed, molded paper, .01 mfd. 300 VDCW, 20%
C-303		Capacitor - Same as C-302
C-304		Capacitor - See Z-301
C-305		Capacitor - See Z-301
C-306		Capacitor - See Z-301
C-307		Capacitor - See Z-301
C-308		Capacitor - Same as C-302
C-309		Capacitor - Same as C-302
C-310		Capacitor - Same as C-302
C-311		Capacitor - See Z-302
C-312		Capacitor - See Z-302
C-313		Capacitor - See Z-302
C-314		Capacitor - See Z-302
C-315		Capacitor - Same as C-302
C-316		Capacitor - See Z-303
C-317		Capacitor - See Z-303
C-318		Capacitor - See Z-303
C-319		Capacitor - See Z-303
C-320		Capacitor - Same as C-302
C-321		Capacitor - Same as C-302
C-322		Capacitor - See Z-304

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND BALANCED CONVERTER - CAT. #588

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-323		Capacitor - See Z-304 Assembly
C-324		Capacitor - Not used
C-325		Capacitor - See Z-304 Assembly
C-326		Capacitor - Same as C-302
C-327		Capacitor - See Z-305
C-328		Capacitor - See Z-305
C-329		Capacitor - Same as C-302
C-330		Capacitor - See Z-305
C-331		Capacitor - Same as C-302
C-332		Capacitor - Same as C-302
C-333		Capacitor - Same as C-302
C-334		Capacitor - See Z-306
C-336		Capacitor - Same as C-302
C-337		Capacitor - Same as C-302
C-339	C-5047-S1	Capacitor - fixed, mica, .001 mmd. 500 VDCW, 20%
C-340		Capacitor - Same as C-339
C-341		Capacitor - Same as C-339
C-342		Capacitor - Same as C-339
E-300	E-5012-J2	Terminal strip, 3 terminals
J-300	J-5001-A5	Jack - female contact, chassis mounting type
J-300A	J-5017-A5	Jack Hood - for use with part J-5001-A5
J-301		Jack - Same as J-300
J-301A		Jack Hood - Same as J-300A

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND BALANCED CONVERTER - CAT. #588

SYMBOL. NO.	REL STOCK NO.	DESCRIPTION
J-302		Jack - Same as J-300
J-302A		Jack Hood - Same as J-300A
J-303	J-5015-11	Jack - pin type, female contact, black bakelite insulation
J-304		Jack - Same as J-303
J-305		Jack - Same as J-303
J-306		Jack - Same as J-303
J-307		Jack - Same as J-303
J-308		Jack - Same as J-303
J-309		Jack - Same as J-303
L-300	L-5026-R7	Coil, R.F. - 12.5 microhenries
L-301	L-5027-R7	Coil, R.F. - 7.5 microhenries
R-300		Resistor - See Z-300
R-301	R-5189-All	Resistor - fixed, composition, 220,000 ohms, 1 watt, 10%
R-302	R-5185-All	Resistor - fixed, composition, 27,000 ohms, 1 watt, 10%
R-303		Resistor - See Z-301
R-304		Resistor - See Z-301
R-305	R-5112-All	Resistor - fixed, composition, 100,000 ohms, 1 watt, 10%
R-306	R-5113-All	Resistor - fixed, composition, 270 ohms, 1 watt, 10%
R-307		Resistor - Same as R-302
R-308		Resistor - See Z-302
R-309		Resistor - See Z-302
R-310		Resistor - Same as R-305
R-311		Resistor - Same as R-302
R-312		Resistor - See Z-303

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND BALANCED CONVERTER - CAT. #588

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
R-313		Resistor - See Z-303
R-314		Resistor - Same as R-305
R-315		Resistor - Same as R-302
R-316		Resistor - See Z-304
R-317		Resistor - See Z-304
R-318	R-5197-I2	Resistor - fixed, composition, 20,000 ohms, 1 watt, 10%
R-319	R-5051-All	Resistor - fixed, composition, 10,000 ohms, 1 watt, 10%
R-320		Resistor - Same as R-319
R-321	R-5119-All	Resistor - fixed, composition, 100 ohms, 1 watt, 10%
R-322	R-5060-All	Resistor - fixed, composition, 22,000 ohms, 2 watts, 10%
R-323		Resistor - Same as R-322
R-324	R-5086-All	Resistor - fixed, composition, 1000 ohms, 1 watt, 10%
R-325		Resistor - See Z-306
V-300		Tube - type 7C7, loctal
V-301		Tube - type 7A7, loctal
V-302		Tube - Same as V-300
V-303		Tube - Same as V-300
V-304		Tube - type 7Q7, loctal
V-305		Tube - Same as V-304
X-300	X-5007-E1 or X-5047-A5	Socket - loctal, ceramic Socket - loctal, mica filled bakelite
X-301		Socket - Same as X-300
X-302		Socket - Same as X-300
X-303		Socket - Same as X-300

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND BALANCED CONVERTER - CAT. #588

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
X-304		Socket - Same as X-300
X-305		Socket - Same as X-300
Z-300	Z-5004-S5	Tuning Assembly, tuning range 576-615KC
		Consists of:
		Primary Inductance: 300 microhenries, 5%
		Secondary Inductance: 1 millihenry, 3%
		C-300 - Capacitor, fixed, ceramic, 36 mmf., 500 VDCW, 5%
		C-301 - Capacitor, variable, air, 3.4-36 mmf.
		R-300 - Resistor, fixed, composition, 100,000 ohms, 1 watt, 10%
Z-301	Z-5005-S5	Tuning Assembly, tuning range 1728-1845KC.
		Consists of:
		Primary Inductance: 80 microhenries $\pm 3\%$
		Secondary Inductance: 80 microhenries $\pm 3\%$
		C-304 - Capacitor, variable, air 3.6-40 mmf.
		C-305 - Capacitor, fixed, ceramic, 62 mmf., 500 VDCW, 5%
		C-306 - Capacitor, Same as C-305
		C-307 - Capacitor, Same as C-304
		R-303 - Resistor, fixed, composition, 22,000 ohms, 1 watt, 10%
		R-304 - Resistor, fixed, composition, 47,000 ohms, 1 watt, 10%

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND BALANCED CONVERTER - CAT. #588

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-302	Z-5006-S5	Tuning Assembly, tuning range 1728-1845KC Consists of: Primary Inductance: 120 microhenries, 3% Secondary Inductance: 120 microhenries, 3% C-311 - Capacitor, variable, air, 3.2-29 mmf. C-312 - Capacitor, fixed, ceramic, 39 mmf, 500 VDCW, 5% C-313 - Capacitor, Same as C-312 C-314 - Capacitor, Same as C-311 R-308 - Resistor, fixed, composition, 39,000 ohms, 1 watt, 10% R-309 - Resistor, fixed, composition, 180,000 ohms, 1 watt, 10%
Z-303	Z-5007-S5	Tuning Assembly, tuning range 5184-5535KC. Consists of: Primary Inductance: 20 microhenries, 3% Secondary Inductance: 20 microhenries, 3% C-316 - Capacitor, variable, air, 3-21 mmf. C-317 - Capacitor, fixed, ceramic, 20 mmf., 500 VDCW, 5% C-318 - Capacitor, Same as C-317 C-319 - Capacitor, Same as C-316 R-312 - Resistor, fixed, composition, 27,000 ohms, 1 watt, 10% R-313 - Resistor, fixed, composition, 68,000 ohms, 1 watt, 10%

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND BALANCED CONVERTER - CAT. #588

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-304	Z-5008-S5	Tuning Assembly, tuning range 15.5-16.6MC Consists of: Primary Inductance: 3 microhenries, 3% Secondary Inductance: Same, less one turn C-322 - Capacitor, variable, air, 2.8-10 mmf., C-323 - Capacitor, fixed, ceramic, 15 mmf., 500 VDCW, 5% C-325 - Capacitor, variable, air, 2.8-14 mmf. R-316 - Resistor, fixed, composition, 22,000 ohms, 1 watt, 10% R-317 - Resistor, fixed, composition, 4700 ohms, 1 watt, 10%
Z-305	Z-5009-S5	Tuning Assembly, tuning range 1833-2250KC Consists of: Primary Inductance: 40 microhenries, 5% Secondary Inductance: 120 microhenries, 3%, C.T. C-327 - Capacitor, fixed, ceramic, 51 mmf, 500 VDCW, 1% C-328 - Capacitor, Same as C-327 C-330 - Capacitor, variable, air, 4-50 mmf.
Z-306	Z-5010-S5	Tuning Assembly, tuning range 13.4-14.6 MC Consists of: Primary Inductance: 4 microhenries, 3%, C.T. Secondary Inductance: 5 turn link, interwound on primary. C-334 - Capacitor, variable, air, 3.6-43 mmf. R-325 - Resistor, fixed, composition, 22,000 ohms, 1 watt, 10%

SECTION VII

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND SINGLE ENDED CONVERTER - CAT. #589

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-400		Capacitor - See Z-400
C-401		Capacitor - See Z-400
C-402	C-5016-M6	Capacitor - fixed, paper, .01 mfd. 300 VDCW, 20%
C-403		Capacitor - Same as C-402
C-404		Capacitor - See Z-401
C-405		Capacitor - See Z-401
C-406		Capacitor - See Z-401
C-407		Capacitor - See Z-401
C-408		Capacitor - Same as C-402
C-409		Capacitor - Same as C-402
C-410		Capacitor - See Z-402
C-411		Capacitor - See Z-402
C-412		Capacitor - See Z-402
C-413		Capacitor - See Z-402
C-414		Capacitor - Same as C-402
C-415		Capacitor - Same as C-402
C-416		Capacitor - See Z-403
C-417		Capacitor - See Z-403
C-418		Capacitor - See Z-403
C-419		Capacitor - See Z-403
C-420		Capacitor - Same as C-402
C-421		Capacitor - Same as C-402
C-422		Capacitor - See Z-404
C-423		Capacitor - See Z-404

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND SINGLE ENDED CONVERTER - CAT. #589

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-424		Capacitor - See Z-404
C-425		Capacitor - See Z-404
C-426		Capacitor - Same as C-402
C-427		Capacitor - Same as C-402
C-428		Capacitor - Same as C-402
C-429		Capacitor - Same as C-402
C-430		Capacitor - See Z-405
C-431		Capacitor - See Z-405
C-433		Capacitor - See Z-406
C-434		Capacitor - See Z-406
C-435		Capacitor - Same as C-402
C-436		Capacitor - See Z-407
C-437		Capacitor - See Z-407
C-438	C-5047-S1	Capacitor - fixed, mica, .001 mfd. 500 VRCW, 20%
C-439		Capacitor - Same as C-438
C-440		Capacitor - Same as C-438
C-441		Capacitor - Same as C-438
E-400	E-5012-J2	Terminal strip, 3 terminals
J-400	J-5001-A5	Jack - female contact, chassis mounting type
J-400A	J-5017-A5	Jack Hood - for use with part J-5001-A5
J-401		Jack - Same as J-400
J-401A		Jack Hood - Same as J-400A
J-402	J-5015-II	Jack - pin type, female contact
J-403		Jack - Same as J-402

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND SINGLE ENDED CONVERTER - CAT. #589

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
J-404		Jack - Same as J-402
J-405		Jack - Same as J-402
J-406		Jack - Same as J-402
J-407		Jack - Same as J-400
J-407A		Jack Hood - Same as J-400A
J-408		Jack - Same as J-402
J-409		Jack - Same as J-402
L-400		Choke R.F., - Not used
L-401	L-5026-R7	Choke, R.F. - 12.5 microhenries
L-402	L-5027-R7	Choke, R.F. - 7.5 microhenries
R-400		Resistor - See Z-400
R-401	R-5116-A11	Resistor - fixed, composition, 200,000 ohms, 1 watt, 10%
R-402	R-5185-A11	Resistor - fixed, composition, 27,000 ohms, 1 watt, 10%
R-403		Resistor - See Z-401
R-404		Resistor - See Z-401
R-405	R-5112-A11	Resistor - fixed, composition, 100,000 ohms, 1 watt, 10%
R-406		Resistor - See Z-406
R-407		Resistor - Same as R-402
R-408		Resistor - See Z-402
R-409		Resistor - See Z-402
R-410		Resistor - Same as R-405
R-411		Resistor - Same as R-402

**PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND SINGLE ENDED CONVERTER - CAT. #589**

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
R-412		Resistor - See Z-403
R-413		Resistor - See Z-403
R-414		Resistor - Same as R-405
R-415		Resistor - Same as R-402
R-416		Resistor - See Z-404
R-417		Resistor - See Z-404
R-418		Resistor - Same as R-405
R-419	R-5190-All	Resistor - fixed, composition, 560 ohms, 1 watt, 10%
R-420	R-5136-All	Resistor - fixed, composition, 20,000 ohms, 2 watt, 10%
R-421	R-5086-All	Resistor - fixed, composition, 1000 ohms, 1 watt, 10%
R-422		Resistor - See Z-405
R-423	R-5084-All	Resistor - fixed, composition, 50,000 ohms, 1 watt, 10%
V-400		Tube - type 707, loctal
V-401		Tube - type 7A7, loctal
V-402		Tube - Same as V-400
V-403		Tube - Same as V-400
V-404		Tube - type 7Q7, loctal
X-400	X-5007-E1 or X-5047-A5	Socket - loctal, ceramic Socket - loctal, mica filled bakelite
X-401		Socket - Same as X-400
X-402		Socket - Same as X-400
X-403		Socket - Same as X-400
X-404		Socket - Same as X-400

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND SINGLE ENDED CONVERTER - CAT. #589

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-400	Z-5004-S5	Tuning Assembly, tuning range 576-615KC Consists of: Primary Inductance: 300 microhenries, 5% Secondary Inductance: 1 millihenry, 3% C-400 - Capacitor, fixed, ceramic, 36 mmf, 500 VDCW, 5% C-401 - Capacitor, variable, air, 3.4-36 mmf. R-400 - Resistor, fixed, composition, 100,000 ohms, 1 watt, 10%
Z-401	Z-5005-S5	Tuning Assembly, tuning range 1728-1845KC Consists of: Primary Inductance: 80 microhenries $\pm 3\%$ Secondary Inductance: 80 microhenries $\pm 3\%$ C-404 - Capacitor, variable, air 3.6-40 mmf. C-405 - Capacitor, fixed, ceramic, 62 mmf., 500 VDCW, 5% C-406 - Capacitor, same as C-405 C-407 - Capacitor, same as C-404 R-403 - Resistor, fixed, composition, 22,000 ohms, 1 watt, 10% R-404 - Resistor, fixed, composition, 47,000 ohms, 1 watt, 10%
Z-402	Z-5006-S5	Tuning Assembly, tuning range 1728-1845KC Consists of: Primary Inductance: 120 microhenries, 3% Secondary Inductance: 120 microhenries, 3% C-410 - Capacitor, variable, air, 3.2-29 mmf. C-411 - Capacitor, fixed, ceramic 39 mmf. 500 VDCW, 5%

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND SINGLE ENDED CONVERTER - CAT. #589

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
		C-412 - Capacitor, same as C-411
		C-413 - Capacitor, same as C-410
		R-408 - Resistor, fixed, composition, 39,000 ohms, 1 watt, 10%
		R-409 - Resistor, fixed, composition, 180,000 ohms, 1 watt, 10%
Z-403	Z-5011-S5	Tuning Assembly, tuning range 5184-5535KC
		Consists of:
		Primary Inductance: 20 microhenries, 3%
		Secondary Inductance: 20 microhenries, 3%
		C-416 - Capacitor, variable, air, 3-21 mmf.
		C-417 - Capacitor, fixed, ceramic, 20 mmf., 500 VDCW, 5%
		C-418 - Capacitor, same as C-417
		C-419 - Capacitor, same as C-416
Z-404	Z-5011-S5	Tuning Assembly, tuning range 15.5-16.6MC
		Consists of:
		Primary Inductance: 3 microhenries, 3%
		Secondary Inductance: 3 microhenries, 3%
		C-422 - Capacitor, variable, air 2.8-10 mmf.
		C-423 - Capacitor, fixed, ceramic, 15 mmf., 500 VDCW, 5%
		C-424 - Capacitor, fixed, ceramic, 10 mmf., 500 VDCW, 5%
		C-425 - Capacitor, same as C-422
		R-416 - Resistor, fixed, composition, 22,000 ohms, 1 watt, 10%
		R-417 - Resistor, fixed, composition, 4700 ohms, 1 watt, 10%

PARTS LIST FOR SINGLE CHANNEL MULTIPLIER
AND SINGLE ENDED CONVERTER - CAT. #589

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-405	Z-5012-S5	Tuning Assembly, tuning range 1833-2250KC. Consists of: Primary Inductance: 120 microhenries, 3% Secondary Inductance: 40 microhenries, 5% C-430 - Capacitor, variable, air, 3.4-32 mmf. C-431 - Capacitor, fixed, ceramic, 27 mmf., 500 VDCW, 5% R-422 - Resistor, fixed, composition, 39,000 ohms, 1 watt, 10%
Z-406	Z-5013-S5	Tuning Assembly, tuning range 13.4-14.6MC Consists of: Primary Inductance: 5 turn link Secondary Inductance: 4 microhenries, 3% C-433 - Capacitor, fixed, ceramic, 6 mmf., 500 VDCW, 5% C-434 - Capacitor, variable, air, 3.2-25 mmf., R-406 - Resistor, fixed, composition, 22,000 ohms, 1 watt, 10%
Z-407	Z-5014-S5	Tuned filter unit, tuning range 15.5-16.6MC. Consists of: Inductance: #24 tinned wire or 5/8" form, 5 3/4 turns 1/4" long. C-436 - Capacitor, fixed, ceramic, 39 mmf., 500 VDCW, 5% C-437 - Capacitor, variable, air, 5-97 mmf.

SECTION VII

PARTS LIST FOR SEMI FINAL
MULTIPLIER - CAT. #590

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-500		Capacitor - See Z-500
C-501		Capacitor - See Z-500
C-502	C-5016-M6	Capacitor - fixed, molded paper, .01 mfd. 300 VDCW, 20%
C-503		Capacitor - Same as C-502
C-504		Capacitor - See Z-501
C-505		Capacitor - See Z-501
C-506		Capacitor - See Z-501
C-507		Capacitor - See Z-501
C-508		Capacitor - Same as C-502
C-509		Capacitor - Same as C-502
C-510		Capacitor - See Z-502
C-511		Capacitor - See Z-502
C-512		Capacitor - Same as C-502
C-513		Capacitor - Same as C-502
C-514		Capacitor - See Z-503
C-515		Capacitor - See Z-503
C-516		Capacitor - Same as C-502
C-517		Capacitor - Same as C-502
C-518		Capacitor - See Z-504
C-519		Capacitor - See Z-504
C-520		Capacitor - Same as C-502
C-521		Capacitor - Same as C-502
C-522		Capacitor - Same as C-502
C-523		Capacitor - See Z-505

PARTS LIST FOR SEMI FINAL
MULTIPLIER - CAT. #590

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-524	C-5047-S1	Capacitor - fixed, mica, .001 mfd. 500 VDCW, 20%
C-525		Capacitor - Same as C-524
C-526		Capacitor - Same as C-524
C-527		Capacitor - Same as C-524
E-500	E-5012-J2	Terminal strip - 3 terminals
J-500	J-5001-A5	Jack - female contact - chassis mounting type
J-500A	J-5017-A5	Jack Hood - for use with part J-5001-A5
J-501	J-5015-I1	Jack - pin type, female contact, black bakelite insulation
J-502		Jack - Same as J-501
J-503		Jack - Same as J-501
J-504		Jack - Same as J-501
J-505		Jack - Same as J-501
J-506		Jack - Same as J-501
J-507		Jack - Same as J-500
J-507A		Jack Hood - Same as J-500A
L-500	L-5028-M3	Choke, R.F. - 2.5 millihenries,
L-501	L-5026-R7	Choke, R.F. - 12.5 microhenries
L-502	L-5027-R7	Choke, R.F. - 7.5 microhenries
R-500	R-5112-A11	Resistor - fixed, composition, 100,000 ohms, 1 watt, 10%
R-501	R-5185-A11	Resistor - fixed, composition, 27,000 ohms, 1 watt, 10%
R-502		Resistor - Same as R-500
R-503		Resistor - Same as R-501

PARTS LIST FOR SEMI FINAL
MULTIPLIER - CAT. #590

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
R-504		Resistor - Same as R-500
R-505		Resistor - Same as R-501
R-506		Resistor - Same as R-500
R-507		Resistor - Same as R-501
R-508		Resistor - Same as R-500
R-509	R-5115-All	Resistor - fixed, composition, 40,000 ohms, 1 watt, 10%
R-510		Resistor - See Z-500
R-511		Resistor - See Z-501
R-512		Resistor - See Z-501
R-513		Resistor - See Z-502
R-514		Resistor - See Z-503
R-515		Resistor - See Z-504
R-516		Resistor - See Z-505
V-500		Tube - type 7A7, loctal
V-501		Tube - type 7C7, loctal
V-502		Tube - Same as V-501
V-503		Tube - Same as V-501
V-504		Tube - type 7H7, loctal
X-500	X-5007-E1 or X-5047-A5	Socket - loctal, ceramic Socket - loctal, mica filled bakelite
X-501		Socket - Same as X-500
X-502		Socket - Same as X-500
X-503		Socket - Same as X-500
X-504		Socket - Same as X-500

PARTS LIST FOR SEMI FINAL
MULTIPLIER - CAT. #590

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-500	Z-5015-S5	Tuning Assembly, tuning range 1833-2250KC <p>Consists of:</p> <p>Primary Inductance: 40 microhenries, 5%</p> <p>Secondary Inductance: 120 microhenries, 3%</p> <p>C-500 - Capacitor, fixed, ceramic, 18 mmf., 500 VDCW, 1%</p> <p>C-501 - Capacitor, variable, air 3.6-40 mmf.</p> <p>R-510 - Resistor, fixed, composition, 180,000 ohms, 1 watt, 10%</p>
Z-501	Z-5016-S5	Tuning Assembly, tuning range 1833-2250KC <p>Consists of:</p> <p>Primary Inductance: 120 microhenries, 3%</p> <p>Secondary Inductance: 120 microhenries, 3%</p> <p>C-504 - Capacitor, variable, air 3.6-40 mmf.</p> <p>C-505 - Capacitor, fixed, ceramic, 15 mmf., 500 VDCW, 5%</p> <p>C-506 - Capacitor, same as C-504</p> <p>C-507 - Capacitor, same as C-505</p> <p>R-511 - Resistor, fixed, composition, 39,000 ohms, 1 watt, 10%</p> <p>R-512 - Resistor, fixed, composition, 180,000 ohms, 1 watt, 10%</p>
Z-502	Z-5017-S5	Tuning Assembly, tuning range 3667-4500KC <p>Consists of:</p> <p>Primary Inductance: 40 microhenries, 3%</p> <p>Secondary Inductance: 40 microhenries, 3%</p> <p>C-510 - Capacitor, variable, air, 3.4-36 mmf.</p> <p>C-511 - Capacitor, same as C-510</p> <p>R-513 - Resistor, fixed, composition, 47,000 ohms, 1 watt, 10%</p>

PARTS LIST FOR SEMI FINAL
MULTIPLIER - CAT. #590

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
Z-503	Z-5018-S5	Tuning Assembly, tuning range 7300-9000 KC Consists of: Primary Inductance: 13 microhenries, 3% Secondary Inductance: 13 microhenries, 3% C-514 - Capacitor, variable, air 3.4-32 mmf. C-515 - Capacitor, same as C-514 R-514 - Resistor, fixed, composition, 100,000 ohms, 1 watt, 10%
Z-504	Z-5019-S5	Tuning Assembly, tuning range 14.6-18.0MC Consists of: Primary Inductance: 3.5 microhenries, 3% Secondary Inductance: 3.5 microhenries, 3% C-518 - Capacitor, variable, air 3.4-32 mmf. C-519 - Capacitor, same as C-518 R-515 - Resistor, fixed, composition, 47,000 ohms, 1 watt, 10%
Z-505	Z-5020-S5	Tuning Assembly, tuning range 14.6-18.0MC Consists of: Primary Inductance: 3.5 microhenries, 3% Secondary Inductance: 5 turn link C-523 - Capacitor, variable, air 3.4-32 mmf. R-516 - Resistor, fixed, composition, 47,000 ohms, 1 watt, 10%

SECTION VII
PARTS LIST
FINAL MULTIPLIER PANEL CAT. 591A

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-600		Capacitor - part of Z-600
C-601	C-5047-S1	Capacitor - fixed, mica, .001 mfd., 500 VDCW, 20%
C-602	C-5016-M6	Capacitor - fixed, molded paper, .01 mfd., 300 VDCW, 20%
C-603		Capacitor - Same as C-601
C-604		Capacitor - Same as C-602
C-605	C-5089-H2	Capacitor - variable, air, 35 mmfd.
C-606		Capacitor - Same as C-601
C-607	C-5088-H2	Capacitor - variable, air split stator, 35 mmfd. per section
C-608		Capacitor - Same as C-601
C-609		Capacitor - Same as C-607
C-610	C-5121-S1	Capacitor - fixed, mica, .001 mfd. 1200 VDCW, 20%
C-611		Capacitor - Same as C-607
C-612		Capacitor - Same as C-607
C-613		Capacitor - Same as C-601
C-614		Capacitor - Same as C-601
C-615		Capacitor - Same as C-601
C-616		Capacitor - Same as C-601
C-617		Capacitor - Same as C-610
C-618		Capacitor - Same as C-610
C-619		Capacitor - Same as C-610
C-620		Capacitor - Same as C-601
C-621		Capacitor - Same as C-601
C-622		Capacitor - Same as C-601

PARTS LIST
FINAL MULTIPLIER PANEL CAT. #591A

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-623		Capacitor - Same as C-601
C-624		Capacitor - Same as C-601
C-625		Capacitor - Same as C-601
C-626		Capacitor - Same as C-605
C-627		Capacitor - Not used
C-628		Capacitor - Same as C-602
E-600	E-5003-J2	Terminal strip - 5 terminals
J-600	J-5001-A5	Jack - for coaxial cable female contact, chassis mounting type.
J-600A	J-5017-A5	Jack Hood - for part J-5001-A5
J-601	J-5015-I1	Jack - pin type, female contact, black insulation bakelite
J-602		Jack - Same as J-601
J-603		Jack - Same as J-601
J-604		Jack - Same as J-600
J-604A		Jack Hood - Same as J-600A
J-605		Jack - Same as J-600
J-605A		Jack Hood - Same as J-600A
L-600		Coil, R.F. - tuning range 29.2-36 MC, when used with 35 mmfd. variable condenser
L-600A		Coil, R.F. - coupling link mtd. with L-600
L-601		Coil, R.F.,-C.T. - tuning range 29.2-36 MC, when used with 35 mmfd. section split stator variable condenser
L-601A		Coil, R.F. - coupling link mtd. with L-601
L-602		Coil, R.F., C.T. - tuning range 88-108 MC, when used with 35 mmfd. section split stator variable condenser

PARTS LIST
FINAL MULTIPLIER PANEL - CAT. #591A

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
L-602A		Coil, R.F. - coupling link mtd. with L-602
L-603		Coil, R.F. - tuning range 88-108 MC, used with 35 mmfd/ section split stator variable condenser
L-603A		Coil, R.F. - coupling link mtd. with L-603
L-604		Coil, R.F. - tuning range 88-108 MC, when used with 35 mmfd/section split stator variable condenser
L-604A		Coil, R.F. - output coupling link
L-605	L-5018-01	Choke, R.F. - 2.3 microhenries
L-610	L-5026-R7	Choke, R.F. - 12.5 microhenries
L-611		Choke, R.F. - Same as L-610
L-612		Choke, R.F. - Same as L-610
L-613	L-5027-R7	Choke, R.F. - 7.5 microhenries
M-600	M-5005-W2	Meter - 300 Ma, full scale, 2%
M-601		Meter - Same as M-600
R-600	R-5084-A11	Resistor - fixed, composition, 50,000 ohms, 1 watt, 10%
R-601	R-5113-A11	Resistor - fixed, composition, 270 ohms, 1 watt 10%
R-602	R-5139-A11	Resistor - fixed, composition, 6800 ohms, 2 watt, 10%
R-603	R-5141-C18	Resistor - fixed, composition, 22,000 ohms, 5 watt, 20%
R-604		Resistor - Same as R-602
R-605	R-5010-A11	Resistor - fixed, composition, 6200 ohms, 2 watt, 5%
R-606	R-5170-A11	Resistor - fixed, composition, 1000 ohms, 1 watt, 20%
R-607		Resistor - Same as R-606
S-600	S-5015-A19	Switch - toggle, SPST, 3A at 250V

PARTS LIST
FINAL MULTIPLIER PANEL - CAT. 591A

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
V-600		Tube - loctal, type 7C5
V-601		Tube - type 829B
V-602		Tube Same as V-601
X-600	X-5007-E1 or X-5047-A5	Socket - loctal, tube, ceramic Socket - loctal, mica filled bakelite
X-601	X-5011-J4	Socket - ceramic, 7 prong, small transmitting
X-602		Socket - Same as X-601
Z-600	Z-5021-35	Tuning Assembly, tuning range 14.6-18.0 MC

Consists of:

Primary Inductance: 5 turn link

Secondary Inductance: 3.5 microhenries, 3%

C-600 - Capacitor, variable, air 3.4-32 mmf.

SECTION VII

PARTS LIST FOR MODULATOR POWER
SUPPLY UNIT - CAT. #592

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-700	C-5104-I4	Capacitor - fixed, paper, oil filled, 8 mfd. 600 VDCW, 10%
C-701		Capacitor - Same as C-700
C-702		Capacitor - Same as C-700
C-703		Capacitor - Same as C-700
C-704		Capacitor - Same as C-700
C-705	C-5097-I4	Capacitor - fixed, paper, oil filled, 2 section each sec. 0.1 mfd. 1000 VDCW, 10%
C-706	C-5098-I4	Capacitor - fixed, paper, oil filled, 0.1 mfd. 1000 VDCW, 10%
C-707		Capacitor - Same as C-700
C-708		Capacitor - Not used
C-709	C-5108-I4	Capacitor - fixed, paper, oil filled, 1.0 mfd. 200 VDCW
C-710	C-5099-I4	Capacitor - fixed, dry electrolytic, 2000 mfd., 25 VDCW, 10%
C-711		Capacitor - Same as C-710
CR-700	CR-5004-S23	Selenium Rectifier - 6.3V 5.2A
E-700	E-5003-J2	Terminal strip - 5 terminals
E-701	E-5014-J2	Terminal strip - 11 terminals
F-700	F-5005-L3	Fuse - glass enclosed, 10 amp, 250 volt
K-700	K-5014-A2	Relay - DPDT contacts, coil for 208/230 volts, 60 cycles
K-701	K-5024-C17	Relay - DPST contacts, N.C. 3 amp - coil operates on min. current of 1.2 amps with continuous duty on 1.7 amps
L-700	L-5014-C14	Choke, A.F. - smoothing, 5 henries, 650 M.A., 75 ohms DC

PARTS LIST FOR MODULATOR POWER
SUPPLY UNIT - CAT. #592

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
L-701		Choke, A.F. - Same as L-700
L-702	L-5015-C14	Choke, A.F. - smoothing, 50 millihenries, 5.4 amps, 0.5 ohms DC, resistance tolerance 10%
R-700	R-5098-S7	Resistor - fixed, wire wound, 50,000 ohms, 10 watt, 10%
R-701	R-5099-A11	Resistor - fixed, composition, 1 meg ohm, 1 watt, 10%
R-702	R-5100-A11	Resistor - fixed, composition, 1500 ohms, 1 watt, 10%
R-703		Resistor - Same as R-702
R-704		Resistor - Same as R-702
R-705		Resistor - Same as R-702
R-706	R-5060-A11	Resistor - fixed, composition, 22,000 ohm, 2 watt, 10%
R-707	R-5101-A11	Resistor - fixed, composition, 150,000 ohm, 1 watt, 10%
R-708	R-5102-A11	Resistor - fixed, composition, 68,000 ohm, 1 watt, 10%
R-709	R-5103-06	Resistor - variable, wire wound, 25,000 ohm, max. current 11 M.A., linear taper, 10%
R-710		Resistor - Same as R-707
R-711	R-5111-01	Resistor - variable wire wound, 6 ohms, 25 watts, 2 amps max., 10%
R-712	R-5237-02	Resistor - variable, wire wound 150 ohms, 50 watts, 10%
R-713	R-5335	Resistor - fixed, wire wound, 50 ohms, 25 watts, 10%
R-714		Resistor - Same as R-713
R-715	R-5333-12	Resistor - adjustable, wire wound, 600 ohms, 10 watts, 10%
T-700	T-5024-C14	Transformer, filament - Pri. 208V, 60 cycles, single phase; Sec. #1, 2.5V, 10A - Sec. #2, 6.3V, 4.0A C.T. - Sec. #3, 6.3V, 9.0A - Insulation test 2000 volts

PARTS LIST FOR MODULATOR POWER
SUPPLY UNIT - CAT. #592

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
T-701	T-5025-C14	Transformer, filament - Pri. 208 volts, 60 cycles, single phase; Sec. 18 volts, 6.5 amps C.T. - Insulation test 2000 volts
	or	ABOVE FOR SETS SERIAL # 6877, 6880, 6879, 6878, 6883, 6884, 6885
		ALL OTHERS USE:
	T-5053-C14	Transformer, filament - Pri. 200/208 volts, 60 cycles, single phase - Sec. 19.5V, 6.5A C.T. - Insulation test 1000 volts
T-702	T-5026-C14	Transformer, plate - Pri. 208 volts, 60 cycles, single phase - Sec. 550-0-550 volts AC RMS, 650 MA - Insulation test 5000 volts
T-703	T-5027-C14	Transformer, crystal heater - Pri. 208 volts, 60 cycles, single phase - Sec. 6.3 volts, 2.0 amps
V-700		Tube - rectifier, type 3B25
V-701		Tube - Same as V-700
V-702		Tube - regulator, type 6L6, or 6B4G
V-703		Tube - Same as V-702
V-704		Tube - Same as V-702
V-705		Tube - Same as V-702
V-706		Tube - loctal, type 7F8
V-707		Tube - type VR-105
X-700	X-5005-A5	Socket - 4 prong, medium, ceramic
X-701		Socket - Same as X-700
X-702	X-5006-U5	Socket - octal, ceramic
	or	
	X-5060-A5	Socket - octal, mica filled bakelite

PARTS LIST FOR MODULATOR POWER
SUPPLY UNIT - CAT. #592

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
X-703		Socket - Same as X-702
X-704		Socket - Same as X-702
X-705		Socket - Same as X-702
X-706	X-5007-E1 or X-5047-A5	Socket - loctal, ceramic
		Socket - loctal, mica filled bakelite
X-707		Socket - Same as X-702

SECTION VII

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
B-800	B-5001-A21	Blower - centrifugal, 457 CFM against 3" static pressure. Equipped with 208/230 volt, single phase, 60 cycle, 3450 RPM, 1/2 H.P. Motor
	or B-5002-A21	Blower - centrifugal, 463 CFM against 3" static pressure, Sirocco type, equipped with 208/230 volt, 60 cycle, single phase, 3450 RPM, 1/2 H.P. Motor.
C-800	C-5103-I4	Capacitor - fixed, paper, oil filled, 4 mfd., 5000 VDCW, 10%
C-801		Capacitor - Same as C-800
C-802	C-5096-I4	Capacitor - fixed, paper, oil filled, 8 mfd. 1000 VDCW, 10%
C-803		Capacitor - Same as C-802
C-804	C-5104-I4	Capacitor - fixed, paper, oil filled, 8 mfd. 600 VDCW, 10%
C-805		Capacitor - Same as C-804
C-806	C-5047-S1	Capacitor - fixed, mica, .001 mfd. 500 VDCW, 20%
C-807		Capacitor - Same as C-806
C-808		Capacitor - Same as C-806
C-809		Capacitor - Same as C-806
C-810		Capacitor - Same as C-806
C-811		Capacitor - variable, air, 3" diameter discs.
C-812		Capacitor - fixed, "Teflon dielectric" approximately 100 mmf.
C-813		Capacitor - fixed, vinylite dielectric, approximately 400 mmf.
C-814		Capacitor - Same as C-811
C-815		Capacitor - Same as C-811
C-816		Capacitor - Same as C-811
C-817	C-5251-H2	Capacitor - variable, air, 100 mmf.
C-818		Capacitor - Same as C-817

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
C-819	C-5100-S1	Capacitor - fixed, mica, .001 mfd, 10,000 VDCW, 10%
C-820	C-5230-S1	Capacitor - fixed, mica, 0.0001 mfd, 2500 VDCW, 20%
C-821	C-5193-I4	Capacitor - fixed, paper, oil filled, .25 mfd, 6000 VDCW, 20%
C-822		Capacitor - Same as C-813
C-823		Capacitor - Not used
C-824		Capacitor - Not used
C-825	C-5000-M5	Capacitor - fixed, ceramic, 1200 mmf, 300 VDCW, 20%
C-826		Capacitor - Same as C-820
C-827		Capacitor - Same as C-820
C-828		Capacitor - Same as C-820
E-800		Terminal board - 2-1/4 x 20 stud terminals
E-801	E-5001-J2	Terminal strip - 8 terminals
E-802	E-5003-J2	Terminal strip - 5 terminals
E-803		Terminal strip - Same as E-801
E-804		Terminal strip - Same as E-801
E-805		Terminal strip - Same as E-801
E-806		Terminal strip - Same as E-801 - Not used in later units
E-807		Terminal strip - Not used
E-808		Terminal strip - 1 strip, 18 terminals, 1 strip 6 terminals
E-809		Terminal strip - Not used
E-810		Terminal strip - Same as E-802
E-811		Terminal strip - 2 terminals
E-812	E-5012-J2	Terminal strip - 4 terminals
E-813	E-5004-J2	Terminal strip - 3 terminals
E-814		Terminal strip - Same as E-813

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
E-815		Terminal strip - Same as E-813
E-816		Terminal strip - Same as E-813
E-817		Terminal strip - Same as E-812
E-818		Terminal strip - Same as E-812
E-819		Terminal strip - Same as E-802
F-801	F-5003-L3	Fuse - glass enclosed, 3 ampere, 250 volt
F-802	F-5000-L3	Fuse - glass enclosed, 1 ampere, 250 volt
F-803		Fuse - Same as F-801
F-804		Fuse - Same as F-801
F-805	F-5010-L3	Fuse - glass enclosed, 5 ampere, 250 volt
F-806	F-5002-L3	Fuse - glass enclosed, 1/2 ampere, 250 volt
F-807	F-5007-B11	Fusetron - cartridge type, 15 ampere, 250 volt
F-808		Fusetron - Same as F-807
F-809	F-5012-L3	Fuse - tiny cartridge type, bakelite enclosed, 15 ampere, 250 volt
F-810		Fuse - Same as F-809
I-800	I-5004-G2	Lamp - pilot light, candelabra base, 115 volts, 6 watts
I-801		Lamp - Same as I-800
I-802		Lamp - Same as I-800
I-803		Lamp - Same as I-800
I-804	I-5009-G2	Lamp - pilot light, double contact, bayonet base, 6-8 volts
*I-805	I-5010-G2	Lamp - illuminating, lumiline type, 115 volts, 40 watts
I-806		Lamp - Same as I-805
I-807		Lamp - Same as I-805

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
I-808		Lamp - Same as I-805
I-809		Lamp - Same as I-805
J-800	J-5001-A5	Jack - coaxial, female contact, chassis mounting type
J-801		Jack - Same as J-800
J-801A	J-5017-A5	Jack Hood - for use with part J-5001-A5
J-802		Jack - Same as J-800
J-802A		Jack Hood - Same as J-801A
J-803		Jack - Same as J-800
J-803A		Jack Hood - Same as J-801A
J-804		Jack - Same as J-800
J-805		Jack - Same as J-800
J-806	J-5018-A5	Jack - double female contacts, chassis mounting type
K-800	K-5015-H7	Breaker - magnetic, overload, time delay trip for transformer load, 2 pole, 208 volts, 18 amperes.
K-801	K-5016-A11	Relay - time delay, dashpot type, 60 sec. delay, contacts rated 3 amps, 250 volts, AC, 2 pole, one N.O., one N.C., coil for 208/230 volts, 60 cycles
	or	
	K-5038-A23	Relay - time delay, electro-pneumatic type, 60 sec. delay, DPDT contacts, coil for 208/230 volts, 60 cycles.
K-802	K-5017-A11	Relay - open type contacts rated 10 amps, 250 volts, 2 pole, N.O. coil for 208/230 volts, 60 cycles.
	or	
	K-5042-F3	
K-803	K-5018-A11	Relay - time delay, dashpot type, 5 sec. delay, contacts rated 3 amps, 250 volts, AC, one pole N.O., coil for 208/230 volts, 60 cycles.
	or	
	K-5038-A23	See alternate K-801

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
K-804	K-5019-A11 or K-5043-F3	Relay - open type, contacts rated 25 amps, 250 volts, AC, 2 pole, N.O. coil for 208/230 volts, 60 cycles.
K-805	K-5020-A11 or K-5059-W2	Relay - overload, dashpot type, adjustable trip, adjusted for 600 ma, self resetting contacts rated 3 amps, 250 volts, AC, one pole N.C. Relay - overload, direct current, self resetting contacts rated 3 amps, 250 volts, AC, SPDT, range adjustable from 0.5-2 amps.
K-806	K-5021-A11 or K-5044-F3	Relay - motor starter, open type, with 4.47 amp thermal overload elements, contacts rated 15 amps, 250 volts, AC, 3 pole N.O., coil for 208/230 volts, 60 cycles. Relay - motor starter, open type, with 5 amp thermal overload elements, contacts rated 15 amps, 250 volts, AC, 3 pole, N.O. coil for 208/230 volts, AC.
K-807	K-5023-S1 or K-5038-A23	Relay - time delay, synchronous, adjustable, motor for 230 volts, 60 cycles, contacts rated 2.5 amps, 250 volts, AC, SPST, N.O. See alternate K-801
L-800	L-5016-C14	Choke, A.F. - smoothing, 15 henries, 600 ma, 200 ohms DC resistance, insulation test 10,000 volts.
L-801		Choke A.F. - Same as L-800
L-802	L-5017-C14	Choke, A.F. - smoothing, 8 henries, 250 ma, 100 ohms, DC resistance, insulation test 2000 volts.
L-803		Choke, A.F. - Same as L-802
L-804		Choke, A.F. - Same as L-802
L-805		Choke, A.F. - Same as L-802
L-806		Lines, R.F. - final amplifier plate circuit
L-807		Output coupling link
L-808		Lines, R.F. - final amplifier grid circuit

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
L-809		Input coupling link
L-810		Choke, R.F. - plate
L-811	L-5066-E9	Choke, R.F. - 3 microhenries, 25%
L-812		Choke, R.F. - Same as L-811
L-813		Not used
L-814		Monitor coupling link
M-800	M-5009-W2	Meter, AC volts - 0-7.5 volts, 60 cycles, 2%
M-801	M-5010-W2	Meter, DC milliammeter - 0-50 ma, 2%
M-802	M-5011-W2	Meter, DC milliammeter - 0-600 ma, 2%
M-803	M-5012-S2	Meter, DC volts - 0-1 milliamper movement fitted with 0-5000 volt scale, 2%, used with external multiplier
M-804	M-5013-W2 or M-5054-W2	Meter, DC milliammeter - 0-1 ma, 2% Meter, DC milliammeter - 0-1 ma, 2% with special scale
M-805	M-5007-W2	Meter, DC milliammeter - 0-100 ma, 2%
P-800	P-5002-A5	Plug - coaxial, single male contact
P-801	P-5009-A5	Plug - twin male contacts
P-802	P-5011-A5	Plug - coaxial, 90° elbow, single male contact
P-803		Plug - Same as P-802
P-804		Plug - Same as P-802
P-805		Plug - Same as P-802
R-800	R-5104-I2 or R-5273-C6	Resistor - fixed, wire wound, 200,000 ohms, 120 watts, 5% Resistor - fixed, wire wound, 200,000 ohms, 160 watts, 10%
R-801	R-5105-I2	Resistor - fixed, wire wound, 5 meg ohms, max. current 1.0 milliamper 0.5%

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
R-802	R-5089-A11	Resistor - fixed, composition, 10,000 ohms, 2 watts, 10%
R-803	R-5097-I2 or R-5269-C6	Resistor - fixed, wire wound, 500 ohms, 120 watts, 5% Resistor - fixed, wire wound, 500 ohms, 160 watts, 10%
R-804	R-5098-S7	Resistor - fixed, wire wound, 50,000 ohms, 10 watts, 10%
R-805	R-5109-I2 or R-5271-C6	Resistor - fixed, wire wound, 250 ohms, 40 watts, 5%, fe- rules for 60 ampere fuse clips Resistor - fixed, wire wound, 250 ohms, 40 watts, 10%, fe- rules for 30 ampere fuse clips
R-806		Resistor - Same as R-805
R-807	R-5321-C6	Resistor, fixed, wire wound, 500 ohms, 20 watts, 10%
R-808		Resistor - Same as R-805
R-809		Resistor - Same as R-805
R-810		Resistor - Same as R-807
R-811	R-5269-C6	Resistor - fixed, wire wound, 500 ohms, 160 watts, 10%
R-812		Resistor - Same as R-811
R-813	R-5270-C6	Resistor - fixed, wire wound, 2500 ohms, 10 watts, 10%
R-814		Resistor - Same as R-813
R-815		Resistor - Same as R-813
R-816	R-5334-I2	Resistor - fixed, composition, 5.1 ohms, 1 watt, 10%
R-817		Resistor - Same as R-813
R-818	R-5336-S7	Resistor - fixed, wire wound, 1250 ohms, 50 watts, 10%
R-819	R-5337-S7	Resistor - fixed, wire wound, 2000 ohms, 50 watt, 10%
R-820		Resistor - Same as R-807
R-821	R-5331-C6	Resistor - variable, wire wound, 5000 ohms
S-800	S-5010-H8	Switch toggle - SPST, rated 20 amperes, 250 volts

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
S-801		Switch - Same as S-800
S-802	S-5052-A18	Switch - cabinet light interlock, 1 pole, N.C., 5 amps, 250 volts, AC
S-803		Switch - Same as S-802
S-804	S-5031-A18	Switch - door interlock, 1 pole, N.O., 5 amps, 250 volts AC
S-805		Switch - Same as S-800
S-806		Switch - Same as S-804
S-807		Special air switch - sail type, with mercury switch rated 5 amps, 250 volts
S-808	S-5013-H8	Switch, toggle - DPST, 20 amperes, 250 volts, AC
S-809		Switch - Same as S-804
S-810		Switch - Same as S-804
S-811		Switch - Same as S-804
S-812		Switch - Same as S-804
S-813		Switch - Same as S-804
S-814		Switch - Same as S-804
S-815		Switch - Same as S-802
S-816	S-5057-A17	Switch - rotary, snap, 3 position, one pole, contacts rated 30 amps, 550 volts, AC
S-817	S-5045-A17	Switch - rotary, snap, 3 position, 2 pole, with 1 section having shorting contacts, rated 10 amperes, 250 volts AC
T-800	T-5028-C14	Transformer, rectifier filament - Pri. 208V, 60 cy. single phase - Sec. #1, 5.0V, 3.0A - Sec. #2, 5.0V, 3.0A - Insulation test 2000 volts
T-801	T-5029-C14	Transformer, filament - Pri. 208V, 60 cy. single phase - Sec. 5.0V 24.5A CT - Insulation test 1000 volts

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
T-802	T-5030-C14	Transformer, plate - Pri. 208 volts, 60 cycles, single phase - Sec. 290-0-290 volts AC RMS; 250 M.A. Insulation test 2000 volts
T-803	T-5031-C14	Transformer, plate - Pri. nominal 208V, 60 cy. single phase, tapped so that Sec. #1 will deliver 3000,3600,4200 volts AC RMS. Sec. #1 to deliver voltages at .60 amps, choke input filter - Sec. #2, 490-0-490 volts AC RMS, 200 M.A. when pri. is connected to highest tap - Insulation test 10,000 volts
T-804	T-5032-C14	Transformer, rectifier filament - Pri. 208V, 60 cy. single phase Sec. 5.0V, 15 amps CT - Insulation test 10,000 V
T-805	T-5033-C14	Transformer, rectifier filament - Pri. 208V, 60 cy. single phase Sec. 5.0V, 7.5A CT - Insulation test 10,000V
T-806		Transmormer - Same as T-805
V-800		Tube - Rectifier type 872A
V-801		Tube - Same as V-800
V-802		Tube - Same as V-800
V-803		Tube - Same as V-800
V-804		Tube - rectifier type 5U4G
V-805		Tube - Same as V-804
V-806		Tube - tetrode, type 4-400A
V-807		Tube - Same as V-806
V-800 X-800	X-5009-J4	Socket - ceramic, 4 contact
X-801		Socket - Same as X-800
X-802		Socket - Same as X-800
X-803		Socket - Same as X-800
X-804	X-5006-U5 or X-5060-A5	Socket - octal, ceramic Socket - octal, mica filled bakelite

PARTS LIST FOR MODEL 518
1000 WATT FM TRANSMITTER

SYMBOL NO.	REL STOCK NO.	DESCRIPTION
X-805		Socket - Same as X-804
X-806	X-5012-G7	Socket - pilot light assembly, candelabra base, 1" green indicator jewel
X-807	X-5013-G7	Socket - pilot light assembly, candelabra base, 1" clear indicator jewel
X-808	X-5014-G7	Socket - pilot light assembly, candelabra base, 1" red indicator jewel
X-809	X-5061-G7	Socket - pilot light assembly, 2 prong bayonet base, 1" amber indicator jewel
X-810	X-5017-G7	Socket - pilot light assembly, candelabra base, 1" blue indicator jewel
X-811	X-5021-H8	Socket - meter and illuminating lights, lumiline lamp holder fitted with bakelite cap
X-812		Socket - Same as X-811
X-813		Socket - Same as X-811
X-814		Socket - Same as X-811
X-815		Socket - Same as X-811
X-816		Socket - Same as X-811
X-817		Socket - Same as X-811
X-818		Socket - Same as X-811
X-819		Socket - Same as X-811
X-820		Socket - Same as X-811
Y-800		Crystal - germanium, rectifier, type 1N34
YR-800	YR-5000-G3	Voltage regulator - variable, 2.0 KVA, Input 230 volts, 60 cycles, output 0-270 volts, 60 cycles

SECTION VIII

MAINTENANCE OF EQUIPMENT - ORDERING SPARE OR REPLACEMENT PARTS - PRO- CEDURE FOR RETURN OF MATERIAL.

1. MAINTENANCE OF EQUIPMENT

Normal maintenance requires periodic inspection of equipment with careful scrutinizing of the various components to detect signs of overload or imminent failure.

Components which require periodic maintenance are tabulated below. Where applicable to this equipment, instructions given should be followed.

MOTORS, PUMPS AND BLOWERS - rotating machinery of this type may require periodic lubrication if not of the sealed roller bearing type. Follow lubrication instructions attached to machine.

MECHANICAL DRIVE SYSTEMS - Panel bearings, shafting, belt pulley and chain drive arrangements require occasional lubrication with a few drops of light machine oil. Do not apply oil to sliding contacts found in Radio Frequency "Line" assemblies.

MECHANICAL CONNECTIONS - Terminal strips should be inspected occasionally for loose lugs, broken or badly frayed wires. Chuck or clamp type plate and grid lead connectors should be tried for secure fit. Coaxial cables may break loose from plug assemblies if subject to repeated handling or flexing.

RELAYS-CONTACTORS - Relays and contactors with enclosed contacts do not require servicing for the life of equipment. Telephone type relays and other exposed contact relays may require occasional cleansing or burnishing of contact surfaces. Bond paper strips saturated in pure ethyl alcohol may be drawn between contacts while holding relay closed normally.

Electro-pneumatic and oil-dashpot type timing relays should be checked for maintenance of correct timing interval. Adjustment instructions for these items are found in Section V of this manual.

RESISTORS-- Low voltage resistors should be examined for discoloration of paint indicating overloaded operating conditions. Large size plug-in sticks should be checked for loose ferrules and clean contact surfaces.

CLEANSING - The necessity for maintaining equipment in clean condition should be obvious. Dust and dirt will definitely have a deleterious effect on the operation of most electronic components. The necessity and frequency of cleaning operations will vary with the type and location of equipment. Equipment in pressurized cabinets with air filters on intake and exhaust ducts will require less service than a rack mounted receiver.

Air filters may be cleaned by immersing in gasoline to wash out dust and old oil. When clean stand up to drain then reimmerse in SAE 30 motor oil. Again stand to drain. Wipe off excess and reinstall.

Special attention should be paid to wiping dust off of insulators in high voltage circuits and also glass envelopes on vacuum tubes having plate and grid caps.

When cleaning vacuum tube envelopes an excellent opportunity presents itself for an examination and check for loose or corroded tube or tube socket pins.

The more carefully "Preventive Maintenance" is performed, the less service and trouble shooting will be encountered.

2. ORDERING SPARE OR REPLACEMENT PARTS

All components used in R.E.L. equipment have been assigned REL Stock Numbers, and are designated as such either on the component itself, or if impracticable, on the Tabular List of Parts of this Instruction Manual. When ordering spare or replacement parts, please state quantity and REL Stock Number to insure exact duplication.

Another method of ordering components when the above is impracticable is as follows:

All components used in REL equipment are designated on the Tabular List of Parts and Wiring Diagrams as a circuit symbol i.e. R-100, C-500, C-300, etc. This symbol may be used in ordering spare or replacement parts, however, the catalogue number of the equipment must be stated.

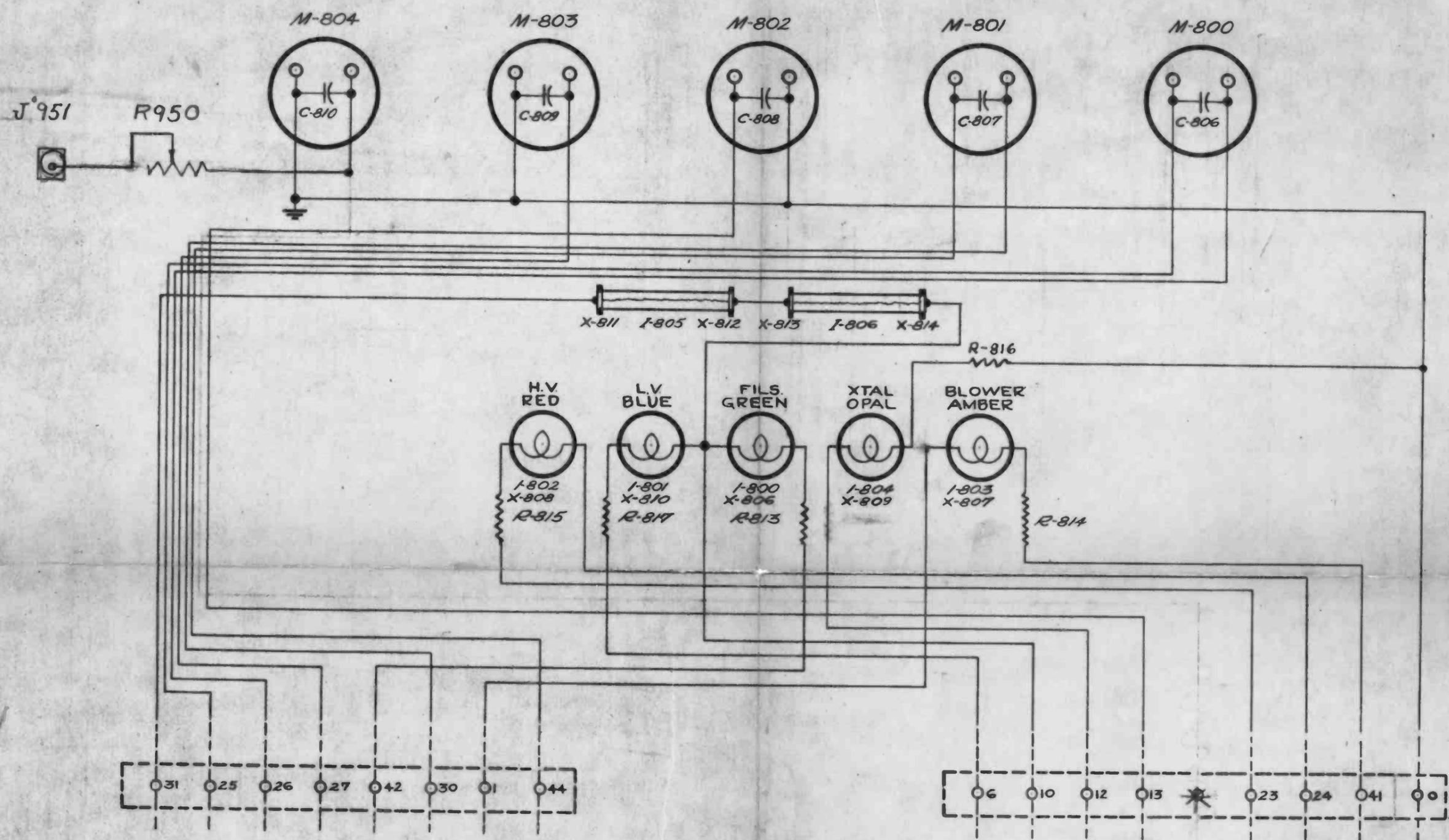
3. PROCEDURE FOR RETURN OF MATERIAL

In the envelope attached to the rear cover, are copies of forms used by REL in dealing with return of defective materials used in our catalogued articles.

If for any reason you have a reject which is due to faulty manufacture or a direct fault of manufacture, please forward this information in the "NOTIFICATION" form letter. Within ten days we will notify you of what disposition is to be made.

NOTE: Do not forward the rejects to us before being notified by our acceptance letter. This will save you cost of shipping in certain cases where a return is not required, and also permits us to keep our records in order.

When you receive our disposition notice requesting that the subject material may be returned, the "RETURN MATERIAL REPORT" is to be forwarded us, packed with material itself, along with your regular packing slip via either Parcel Post or Railway Express Prepaid. In certain cases, additional information may be required in order for us to complete our examination. Forms will be forwarded for compliance.



PARTS LIST ART S

RADIO ENGINEERING LABORATORY
 CONSULTING AND DESIGNING
 35-54 36TH ST. LONG ISLAND CI

CAT. 518 C-DL.
 METER & PILOT LIGHT F

DATE- AUG. 22, 1948
 SCALE-
 DR. BY- J.H.S.
 APP. BY-

B-662

ALT.	A	B	
DATE	10-16-47	12-11-47	
AUTH	M.J.	E.S.	