Bruce Carpenter And A. (8888111)
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INSTRUCTION BOOK NO. 54800R
500W. H.F. COMMUNICATION INSTALLATION
A.W.A. TYPE J54800

47 York Street, Sydney

SYDNEY (MINISTER ADDING ADDING

INSTRUCTION BOOK NO. 54800R

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Amalgarated Wiroloss (A'sia) Limited

47 York Street

SYDNEY

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•	Elect	ronic Keyer B54810		
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	Monit	or J54811		
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SYDNEY (KINGSFORD SMITH) AIRPORT
RADIO EQUIPMENT ROOM
ARTICLE IN USE

1. BRIEF SPECIFICATION

1.1 Classification

The A.W.A. Communication Installation J54800 is a medium power transmitting equipment suitable for telegraphy or telephony service (Al, A2, or A3 emission) on high frequencies, and is provided with facilities for remote control.

1.2 Composition and Type Numbers

The installation consists of a high frequency R.F. Unit, and a Power Unit for supplying power to it.

The Type numbers of the various units are shown here:

Installation:

J54800

R.F. Unit:

J54804 incorporating:-

Electronic Keyer B54810 Monitor J54811

Power Unit:

P54805 incorporating:-

Sub-Modulator G54806

1.3 Frequency Coverage

2 - 20 Mc. spot frequency.

1.4 Frequency Control

Crystal controlled oscillator with provision for two temporature controlled crystals having a frequency separation of 0.5% so that a small change of carrier frequency may be made without the necessity for retuning.

1.5 Crystal Types

R52398; Frequency between 2 and 5 Mc. Frequency tolorance + 0.0005%

1.6 Types of Emission

Al --- Continuous wave telography (C.W.)

A2 --- Modulated continuous wave telegraphy (M.C.W.)

A3 --- Radio Telophony (R.T.)

1.7 Audio Frequency Characteristics

The output of the Modulated Amplifier may be anode-modulated to 100% between 200 cycles and 2,600 cycles.

Harmonic Distortion is less than 10% at 400 cycles. Frequency Response is within ± 2 db. from 200 to 2,600 cycles.

1.8 <u>Carrier Noise</u>

Measured at 2 Mc. with 40% modulation -- -40 db.

1.9 Power Output

The unmodulated power output to the aerial circuit is:-

500 watts from 2 Mc. to 15 Mc., and not loss than 450 watts at 20 Mc.

1.10 Output Coupling Circuit

The aerial circuit of the R.F. unit will couple into unbalanced lines of from 70 to 80 ohms and 100 to 1,000 ohms. Yand balanced lines between 100 and 1,000 ohms at the operating afrequency.

1.11 Power Supply

Operation is from 240V., 50 cycle, A.C. mains. The total load may be connected across either a single 240V. circuit, or may be divided between two 240V. supplies each comprising active and neutral feeders.

1.12 Remote Control

Remote control is available for the following functions:-

Filament Switching H.T. Switching Crystal Changeover Emission type Keying Modulation

1.13 Valve Complement

<u>Ci</u>	rcuit Function	<u>Circuit</u> <u>Reference</u>	Туре
Power Uni	t P54805		
	as Rectifier nor H.T. Rectifier	4V5 4V6 4V7 4V8 (S pare)	574-G 544 G 866A/866 866A/866 866A/866
Ma.	in H.T. Rectifior	4Vl (S pare) 4V2 4V3	872A/872 872A/872 872A/872
Мо	dulators	4V10 4V11	810 810
Vo	ltage Regulators	4V4 4V9	0G3/VR105

Valve Complement (Cont *d)

Sub-Modulator	G54806
---------------	--------

		•
Tone Oscillator	5V1	6A U6
A.F. Amplifier 1	5V2	6BA 6
• • • • • • • • • • • • • • • • • • • •	5 V 3	6BA 6
A.F. Amplifier 2	5 V 4	6 SN7 -GT
A.F. Rectifier	575	6A L5
Clipper	5V6	6A L5
A.F. Amplifior 3	5V7	6SN7-GT
A.F. Amplifier 4	578	807
	5V9	807
R.F. Unit J54804		
Crystal Oscillator	178	6A.U6
Amplifier 1	177	807
Amplifier 2	1V6	807
Amplifier 3	IVI	807
Amplifier 4	IV2	807
	173	807
Modulated Amplifier	1V4	81.0
111 Comme Com The state of the Comme of the	1V5	810
	± V, O	02.0
Monitor J54811		
Rectifier	2V1	6AL5
Amplifier	2V 2	6SN7-GT
Electronic Keyer		
Amplifier	3Vl	6A U6
Limiter Amplifier	3V2	6A U6
Rectifier	373	6A.L5
Koyer Valve	3V4	6V6-GT
,		

Total Complement of Valves in Transmitter:-

Typo	544G 5446	1	off
Туре	866A/866	2	off
Туре	872A/872	2	off
Туре	810	4	off
Туре	807	8	off
Туре	C3/VR105	1	off
Туре	6A U6	4	off
Турс	6BA 6		off
Туре	6 S N7GT	3	off*
Type	6A L5		off
	6V6GT	1	off

1.14 Mechanical Construction

The R.F. Unit and Power Unit are of similar construction and dimensions. In each unit all components except larger transformers and blowers are mounted on a vertical panel. Access to the interior of the unit is provided by the hinged side panels, and a door is fitted to the front for protection of the control knobs.

The cubicles normally stand on a folded steel base, and inter-wiring is provided by a cable form in a flexible metal shoath from each unit to the base assembly. This mothod of construction enables either unit to be withdrawn from the base assembly for servicing and adjustment while the equipment remains onergised, and is connected to the Artificial Aerial.

1.15 Dimensions

Dimensions of Cubicles:-

Height 6 ft. Width 20 ins. Depth 28 ins.

Plus approximately 2 ins. at front and 7 ins. at rear for projection of handles and locking catches.

Dimensions of Base:-

Width 3ft. 2 ins. Depth 2ft. 11 ins.

Overall Dimonsions:-

Height 6 ft. Width 3 ft. 5 ins. Dopth 3 ft. 7 ins.

Crated Weights:-

R.F. Unit 1170 lb.

Power Unit
(less 4T2 & 4L1) 1480 lb.

Baso 274 lb.

Miscellaneous 139 lb.

1.16 <u>Vontilation</u>

Forced convection cooling by means of a blower mounted in the base of each unit. Each blower draws air through a dry, wire-mosh filter.

1.17 Power Control and Switching

The transmittor is switched "on" and "off" by filament and H.T. pushbuttons on the power unit, or by corresponding switches at the remote end.

The Radio Frequency circuit inductor taps are pre-set, and fine tuning adjustment is by means of controls on the front panel of the R.F. Unit.

1.18 Personnel Protection

Two safety switches are provided on each unit, and operate to break the circuit of the high-voltage rectifiers when any side door is opened. They may be rendered inoperative during tuning and maintenance, a warning lamp then lighting on each side of the vertical panel in each unit.

2. TECHNICAL DESCRIPTION

2.1 High Frequency R.F. Unit Type J54804 Fig. 2 (Drg. 54804A1)

2.1.1 Crystal Oscillator

The crystal oscillator employs a type 6AU6 in a "Pierce" circuit, with the crystal connected between the grid and anode. Either of two crystals may be selected to provide an output of between 2 and 5 megacycles, but the crystal frequencies must be within 0.5% of each other in order that the transmitter may be switched from one crystal to the other without the necessity of retuning. The circuit is arranged so that either the A.W.A. type R52398 thermostatically temperature stabilized crystal maintaining frequency to within 0.0005% after an initial warming up period may be used, or an ordinary 2-pin plug-in crystal with 0.01% frequency tolerance. The temperature controlled crystals have inbuilt thermostats and heating elements, and heater voltage is provided from the transmitter supplies. Pilot lights on the front panel indicate the operation of the heating element.

Crystals to be used in this oscillator should be made to operate into a capacitance of 30 µµF. The oscillator has an adjustable trimmer capacitor 1C52 which allows the frequency to be set as close as can be measured to the desired frequency. Both crystals should be in position when this adjustment is made as the stray capacitance of the unused crystal effects the setting if very close adjustment is required. The same setting of 1C52 should held for all crystals.

Keying is carried out in the cathode circuit of the crystal oscillator and the succeeding amplifier stages 1 and 2.

2.1.2 Amplifier Stages 1. 2 and 3

- (i) Amplifier 1 is an 807 valve (1V7) with untuned input and output circuits. It operates at the crystal frequency and provides a buffer amplifier stage between the crystal oscillator and the first tuned circuit, which otherwise might have some effect on the crystal frequency.
- (ii) Amplifier 2 is also an 807 (1V6) valve which operates at fundamental frequencies (2 5 Mc.) and as a doubler to provide frequencies between 5 and 10 Mc. in its anode circuit. The anode tank circuit consists of the tapped inductor 1L1 and the tuning capacitor 1C6. 1V6 and 1V7 have their screens tied together and are connected to a tap on the H.T. voltage divider 1R6. This voltage must be adjusted with frequency so that the required drive to the following stage is obtained.

- The cathode circuits of 1V6 and 1V7 are connected to the crystal oscillator and are completed via the keying relay.
- (iii) Amplifier 3 is an 807 (1V1) which operates as a doubler to provide frequencies between 10 and 20 Mc. in its anode circuit. This anode circuit contains a tapped inductor 1L3 and a tuning capacitor 1C16. Screen voltage is obtained from a tap on the H.T. voltage divider 1R6, and must be adjusted with frequency so that the correct drive is provided to the succeeding stage.

This amplifier stage is not used for operation botween 2 and 10 Mc., and flexible links are provided to onable Amp. 2 output to be connected to Amp. 4.

2.1.3 Amplifior Stage 4

This stage uses two 807 valves (1V2 and 1V3) connected in parallel and operating as a fundamental frequency amplifier from 2 to 20 Mc. Metering is provided for the total grid and the individual screen and cathode currents. The anode circuit is shunt fed and amploys one of three inductors: 114 for frequencies from 2-to 3.7 Mc.; 1L19 for frequencies from 3.7 to 10 Mc.; and 1L5 covering 10 to 20 Mc. The unused capacitors are to be stored in a safe place. The tuning capacitor is 1C22, and is of split stator construction so that an out-of-phase driving voltage may be obtained to feed the M.A. neutralising capacitor 1030. Capacitor 1023 is a balancing capacitor used to balance the two halves of this circuit for stray capacitance, and to allow the setting of the M.A. neutralising capacitor to hold for any setting of 1022. The balancing capacitor is adjusted during factory testing, and its correct position is approx. 300 out of full mesh. IT MUST NOT be altered during tuning.

Screen voltage is obtained from a tap on the H.T. voltage divider 1R6, and this voltage must be adjusted with frequency so that the required drive is obtained for the following stage.

2.1.4 Modulated Amplifier

In this stage two type 810 triodes are operated in parallel. The R.F. grid driving voltage applied to these valves is that developed across one section of the split-stator capacitor 1C22. The neutralising capacitor 1C30 is connected from the anodes to the other section of 1C22 so that apotential of opposite polarity to the grid voltage is obtained.

The anode circuit consists of a tapped inductor 1L6 (2-10 Mc.) or 1L20 (10-20 Mc.), which is tuned by one or both sections of 1C31 (M.A. ANODE control) according to the frequency of operation. An additional fixed capacitor is provided so that the circuit may be turned down to 2 Mc. This stago always operates as a fundamental frequency amplifier to cover the complete frequency range.

The output coupling circuit incorporates a tapped inductor 1L7 (2-10 Mc.) or 1L21 (10-20 Mc.), inductively coupled to the M.A. Anode inductor. The degree of coupling is adjustable by sliding the inductor in slots provided in the mounting base, havin first loosened the clamping screws. The coupling inductor is parallel tuned by 1034 (ABRIAL TUNING), and 1035 (ABRIAL PHASING) is connected in series with the "hot" aerial lead. The circuit therefore combines series and parallel tuning which enables the transmitter to be matched into acrials or feeder lines having wide ranges of resistance and reactance.

Bias, Screen and Anode Supplies Figs. 9 & 11. 2.1.5

(i) Crystal Oscillator

Cathode bias from IR46; grid bias from IR1 Tied to anode Screen:-From Minor Rectifier (600V.) via regulator Anode:circuit. Maintained at 105V.

(ii) Amplifier Stage 1

Cathode bias from 1R37; grid leak bias Bias:from 1R35 Tied to Amp. 2 screen. From minor Screen:rectifier via divider IR6. Voltage depending on frequency of operation. Direct from minor rectifier

(iii) Amplifier Stage 2

Anode:-

Cathode bias from IR2; grid leak bias Bias:from 1R39. Tied to Amp. 1 screen. From minor Screen:rectifier via divider IR6. Voltage depending on frequency of operation. Direct from minor rectifier Anodes-

Amplifier Stage 3 (iv)

Cathode bias from IRll; grid leak bias from IR8; cut-off bias (common to Amp. 4) Bias:from divider in bias rectifier.

Screen:- From minor rectifier via divider 1R6.
Voltage depending on frequency of operation.

Anode: Direct from minor rectifier

(v) Amplifier Stage 4

Bias:- Grid leak bias from IR15; cut-off bias from the bias rectifier. (common to Amp.3)

Screen:- From a tap on voltage divider IR6 fed from minor rectifier.

Anode:- Direct from minor rectifier.

(vi) Modulated Amplifier

Bias:- Grid bias from 1R22; cut-off bias from bias rectifier.

Anode: - 1750V. from main rectifier.

2.1.6 Metering

(i) Meter A (1M1) is switched by the METER A selector 1S4 and the METER A NCRM. - NEUT. switch 1S6 to provide, in conjunction with the appropriate metering resistor, metering facilities in the following circuits:-

Switch Position	Metering Resistor	Rango
OFF	hands design dense sprang	apper lends
OSC. CATH,	1R42	0-10 mA.
AMP. 1 CATH.	1R 3 8	0-50 mA.
AMP. 2 CATH.	lr3	0-50 mA.
AMP. 3 CATH.	lRlO	0-100 mA.
AMP. 4 GRID	LR16	0-25 mA.
AMP. 4 V2 SCREEN	lR29	0-25 mA.
AMP. 4 V3 SCREEN	1R30	0-25 mA.
AMP. 4 V3 CATH.	1R31	0-100 mA.
AMP. 4 V3 CATH.	lR 3 2	0-100 mA.
CARRIER	we see any and	Arbitary
% MOD.	Ottob Goods Goods now	0-100%
NEUT. (1S6)	Annie west, date, gives	Arbitary

(ii) Meter B 1M2 is switched by the METER B selector 1S5 to provide, in conjunction with the associated metering resistors metering facilities of the following circuits.

Switch Position	Metering Resistor	Range
OFF	formit locals speak straigh	0/7 GLP
MOD. AMP. GRID	IR2l	0-250 mA.
MOD. AMP. CATH. V4	1R23	0-500 mA.
MOD AWP CATH V5	1R24	∩~500 mA .

(Cont'd).

Switch Position		Metering Resistor		Range	
	MOD. AMP. TOTAL	CATH.	1R25	0-1000 mA.	
	MONITOR		2R.8	0-10 mA.	
	BIAS H.T.		IR33	0-500 V.	
	MINOR H.T.		1R9	0-1000 V.	
	MAIN H.T.		4R4	0-2500 V.	
	KEYER V1-V2		3R3	0-25 mA.	
	KEYER V4	•	3R10	0-50 mA.	

(iii) The R.F. line ammeter 1M3 (LINE) is a single range thermoanmeter reading aerial (or line) current in conjunction with a current transformer 1T3. This transformer assembly includes a thermocouple for the meter, and a filter circuit.

2.1.7 Electronic Keyer type B54810 Fig. 3 (Drg. 5481001)

When provided with an input signal of keyed audio tone, this unit provides an output of keyed D.C. in accordance with the keying of the input signal.

The circuit provides an amplifier 3V1 (6AU6) resistance coupled to a limiter stage 3V2 (6AU6). The output from the limiter is fed via transformer 3T2 to a duodiode 3V3 (6AL5), and this is coupled to the keying valve 3V4 (6V6GT) which is normally biased just to cut-off.

The input circuit is provided with a GAIN control 3R1, and the unit will operate with a range of input levels of from -25 dbm. to +15 dbm. The frequency of the tone input may range from 200 cycles to 2,600 cycles, and the unit will handle keying speeds of up to 60 bauds. The input impedance is 600 ohms.

Amplifier 3V1 provides sufficient gain to operate the limiter 3V2. The output of the limiter is fed to the full-wave rectifier circuit containing 3V3 so that a double positive pulse is applied to the grid of 3V4 for every cycle of input signal. These pulses release 3V4 from cut-off, and the voltage developed across its load resistor 3R16 during conduction operates the keying relay and keys the transmitter in accordance with the keying of the input signal.

The GAIN control may be set past the point where the keying relay operates, provided it is not advanced past the point where line noise provides keying interference. The keyer limiter will take care of all reasonable variations of input level which might otherwise produce erratic operation of the unit.

2.1.8 Monitor type J54811 Fig. 4 (Drg. 54811C1)

The monitor unit provides several facilities; and it may be used for the following functions:-

(a) As a neutralising meter.

(b) As a percentage modulation indicator.

(c) As an audio monitor on R.T. (A3) supplying speech frequencies to line.

(d) As an audio monitor on M.C.W. (A2), supplying tone frequency to the line.

(e) As a C.W. monitor providing a 1000 cycle keyed tone to line.

(f) It provides a high impedance audio outlet on the R.F. unit front panel for checking audio output or connecting to a C.R.O. or a Distortion Meter.

The circuit consists of a diode 2V1 (6AL5) that rectifies the R.F. input to the unit, and is fed from the modulated amplifier stage via the coupling inductor 1L16 (2-10 Mc.) or 1L22 (10-20 Mc.) The coupling and turns of this inductor are adjusted to give exactly full scale reading on Meter A when the selector is set to the CARRIER position. 2Rl is the diode load across which the meter is connected.

When modulation is applied to the carrier the de-modulated output of 2Vl is applied via transformer 2T2 to the germanium rectifier (2Wl) circuit, where the audio component is rectified so that with the METER A selector in % MOD. the meter will read the resultant D.C. current in the circuit as a direct indication of modulation percentage in the modulated amplifier.

An alternative diode load circuit is provided for the neutralising meter. This load is the variable resistor 2R2, and sensitivity increases as the value of resistance in circuit becomes less.

Changeover of the above functions is performed by 186 and 184 in the R.F. unit.

Valve 2V2 (6\$N7GT) is a twin-triode, one section operating as a Class A amplifier to provide audio output to line, and, if no R.F. carrier is present, is biased beyond cut-off by the other section of 2V2. This second section is not provided with fixed grid bias (grid leak 2R4 returns direct to the cathode), and draws anode current that is limited by 2R6. As this current passes through the common cathode resistor 2R7 it produces bias in excess of the cut-off value for the first amplifier section. When R.F. carrier is present, the voltage developed across the load (2R1) of the diode 2V1 is applied to the grid network of the biasing triode unit of 2V2. This voltage is negative in its

application to the grid, and is of sufficient magnitude to drive the triode to cut-off, thus removing the excess bias from the amplifier section of 2V2, which then operates as a Class A amplifier.

Audio modulation on the carrier is applied to the grid circuit of the amplifier contion of 2V2 via 2R13, 2R5, 2C4 and 2R9, is amplified and fod to the monitoring line via the transformer 2T1. The impedance of the output line is 600 ohms. The lovel of the output signal is controlled by 2R9 (LINE OUTPUT) and is adjusted to give a signal of approximately 6 mW. into 600 ohms.

A high impedance outlet is provided from the grid circuit, via 2C5, to a coaxial connector on the front panel of the R.F. unit. This may be used to check audio output, or may be connected to a Distortion Meter or to a C.R.O.

A second input circuit is connected via 2C8 to the grid of the amplifier section of 2V2. This circuit couples a tone frequency of approximately 1000 cycles from the tone oscillator which is included in the submodulator in the Power Unit. The tone input level is adjusted to give the same input from 2V2 to line as is obtained from M.C.W. or R.T. with the setting of 2R9. This 1000 cycle tone provides menitoring facility for C.W. operation. When the key is open the carrier is off, the amplifier section of 2V2 is biased beyond cutoff and no tone signal is applied to the menitoring line. When the key is closed carrier signal comes on, and removes the bias from 2V2 allowing tone signal to be heard across the menitor line.

2.1.9 Connection of Cathode Ray Oscilloscopo

One of the ci-axial connectors on the front of the R.F. unit is marked R.F. to C.R.O., and terminates in a small inductor 1L17 (2-10 Mc.) or 1L23 (10-20 Mc.) inductively coupled to the anode soil of the modulated amplifier. The number of turns in circuit (or the number of end turns shorted or open) and the amount of coupling must be adjusted, after the transmitter is adjusted, to give the required deflection on the C.R.O for the carrier.

To obtain the modulation pattern the C.R.O. internal time base may be used in the normal manner without the necessity for additional connections to the transmitter, but if a trapezoid pattern is required a connection must be made to the A.F. TO C.R.O. connector, and the C.R.O. set up accordingly.

The cathode of the modulated amplifier is bypassed for R.F., and thus audio voltage is developed across resistor 1R45 and fed to the co-axial connector A.F. TO C.R.O. via a blocking capacitor 1C54.

The AUDIO MONITOR co-axial connector may be used instead of the A.F. TO C.R.O. connector, but some phase shift is noticeable in the pattern so obtained and the original connections mentioned will give the most satisfactory service.

Either A.F. or the R.F. outlet may be connected to a Distortion Meter.

2.2 Power Unit Type P54805 Fig. 5 (Drg. 54805H2)

Refer also to Drgs. 5480CCl Fig. 1 (Interwiring)
5480CC2) Fig. 9
5480CG1) Fig. 10 (Simplified
5480CG2) Fig. 11 Schematics)

2.2.1 Low Tonsion Switching

When the A.C. mains supply is connected to the Power Unit and switched on, the blower will commence to run if connected directly across the mains at the terminal blocks (Drg. 5480CCl). If the mercury vapour rectifiers require preliminary heating then the AIR HEATER switch 457 may be switched ON and warn air will be directed against the bases of these valves. If ambient temperature is sufficiently high then 457 need not be switched ON.

Internal cabinet heating elements (4R35 and 1R44) are available, and may be switched on by means of the CABINET DRIER switch 4S9. These elements are energised from the mains supply, are protected by the fuse 4F6, and it should be noted that they may be energised only when the transmitter L.T. (FILS) is switched CFF as the circuit is completed via a break contact on the filament relay 4REL13.

The autovolt transformer 4Tll and the control transformer 4Tl0 are both connected directly to the mains, and both become energised upon application of power. The control transformer 4Tl0 provides 10V. A.C. for pilot lamps and thermal delay relays, and 5CV. A.C. for the power relays and input to the full-wave rectifier 4W2. This latter is the only item energised by 4Tl0 until the next step in the switching sequence takes place.

Pressing the FIL. ON pushbutton 4510 completes the 50V. circuit to 4RELL3 via the LOCAL contacts of 4510. If this switch is set to REMOTE the application of 48V. D.C. to the FIL line will close 4RELL6, which in turn operates 4RELL3. Removal of the 48V. D.C.

from the line opens 4RELI6 and releases 4RELI3. 4RELI3: ;pcls in via a make contact on the relay, the OFF button on 4S10 and the LOCAL contacts of 4S13.

When closed 4REL13 disconnects all air hoating elements, and energises the filament transformers in both units via the L.T. fuse 4F4 and the air blower in the R.F. Unit. (Also the air blower in the Power Unit if connected into this circuit. Refer Drg. 5480001) The LOV. A.C. supply is connected to the DELAY pilot 4Pl and to the element of the thormal rolay 4REL10 via a break contact on the dolay relay 4RELII. This supply is also connected to the gate-switches on both units, and if any gate-switch is manually operated the red warning lights 4P5 and 4P6 in the Power Unit and/or 1P1 and 1P5 in the R.F. Unit will light. The 240V. mains supply is also connected to the Elapsed Time Indicator 4M4, to the 24V. bias rectifier 4W1 via transformer 4T7, and to the 200V. bias rectifier 4VIL via the power transformer 4T6.

If normal output is obtained from the bias rectifier then the interlock relay 4REL4 will close.

Approximately 35 seconds after the FIL. push-button has been operated the thermal delay relay 4RELIO will operate to close the onergising circuit of 4RELII which locks in via one of its make contacts and a make contact on 4RELII3. The operation of 4RELIII extinguishes the DEIAY pilot 4P1, lights the FIL. pilot 4P2, disconnects the low. A.C. from the heater element of 4RELIIO, which then coels and opens the microswitch contacts, and connects the 240V. A.C. circuit to a make contact set on the minor H.T. relay 4RELI2 via fuse 4F5.

2.2.2 High Tension Switching

With the MAIN H.T. STEP 1 and STEP 2 switches (4S1 and 4S3) set to CFF, operation of the H.T. ON pushbutton (4S2) closes the energising circuit of the minor H.T. relay 4REL12 via the LCCAL/REMOTE switch 4S13, the CFF button 4S2, a break contact on the overload relay 4REL5, the bias interlock relay 4REL4, the safety switches and the air flow switches in both units. The held in circuit of 4REL12 is completed via a make contact on the relay and the remainder of the above circuit.

The operation of 4REIJ2 connects 240V. A.C. from 4REIJ1 to the primary winding of the minor H.T. anode transformer 4T5, and lOV. A.C. to the H.T. pilot 4P3. This relay also connects 50V. A.C. to the MAIN H.T. STEP 1 switch via the main H.T. interlock circuit to the METER NORM./NEUT. switch (1S6) in the R.F. unit.

If the LOCAL/REMOTE switch is set to REMOTE, then the application of 48V. D.C. to the H.T. remote control line will operate 4REL15 which in turn will energise 4REL12 in a similar manner to that described above. Removal of the 48V. D.C. supply will de-energise 4REL15 and release 4REL12.

The main H.T. is applied in two stages that are controlled by the MAIN H.T. STEP laand STEP 2 switches. The STEP 1 switch brings the main rectifiers into operation at reduced voltage suitable for application to the final stages of the transmitter during tuning, and the STEP 2 switch then increases the main rectifier output to full value for normal operation.

Operation of the MAIN H.T. STEP 1 switch will complete the 50V. A.C. circuit via a break contact on the overload relay 4REL5 to the coil of the main H.T. step 1 relay 4REL9. This relay operates to connect 10V. A.C. to the MAIN H.T. STEP 2 switch for application to the heating element of the thermal overload interlock relay 4REL6. It also connects 240V. A.C. from the main H.T. fuse 4F7 via the limiting resistor 4R29 to the primary of the main H.T. rectifier anode transformer 4T2. The limiting resistor reduces the main H.T. voltage to a low value suitable for use during tuning operations. 4REL9 also connects 240V. A.C. to the MAIN H.T. STEP 2 switch 453 for application to the coil of the H.T. delay relay 4REL8. Note that one of the make contacts of 4REL9 is connected in the interlock circuit of the coil of the main H.T. stop 2 relay 4REL7.

Setting the MAIN H.T. STEP 2 switch 4S3 to ON completes, via a break contact on 4REL7, the coil circuit of the H.T. delay relay 4REL8. It also connects 10V. A.C. to the heating element of the H.T. overload interlock relay 4REL6 via a break contact on 4REL7.

Three seconds after energisation 4REL8 will operate, while nine seconds are required for the operation of 4REL6. When 4REL8 closes it completes the 5CV. A.C. circuit to the coil of the main H.T. step 2 relay 4REL7 via break contacts on the main H.T. overload relay 4REL1.

4REL7 operates, and a break contact set releases 4REL8 which resets. A second break contact disconnects the 10V. A.C. from the heater element of 4REL6 which commences to cool. A make contact set locks in 4REL7 via a contact on the main H.T. step 1 relay 4REL9. The remaining make contact short circuits the limiting resistor 2R29 to raise the main rectifier output to full voltage.

2.2.3 Operation of Overload Protection Circuits

The overload relay in the minor rectifier circuit is 4REL3, and has its coil connected in series with the negative return to the rectifier. The coil is shunted by the adjustable resistor 4R6 which may be pre-set to allow adjustment of the overload current. The contacts of this relay are connected in parallel with the contact of the overload interlock relay 4REL6 which is the controlling relay in the main H.T. overload tripping circuit. Any overload on the output of the minor rectirior will immediately close the overload relay 4REL5 which will then hold in and operate as detailed below for a main H.T. overload. Resetting is also accomplished as detailed below.

The overload relay for the main rectifier circuit is 4RELL, and has its coil connected in series with tho negative return to the main rectifiers. The coil is shunted by a resistor 4R3 that is adjustable to allow the relay to be set to any desired value of overload current. The contacts of the relay are connected in the 50V. A.C. circuit to the coil of the main H.T. step 2 relay 4REIT so that when an overload occurs in the output of the main rectifier 4REL7 is tripped to reduce the main H.T. to the low level voltage. If the overload is removed then 4REL1 will release to connect the H.T. delay relay 4REL8 and the overload thormal delay interlock relay 4REL6 into thoir energising circuits. 4REL8 will be the first to operate, closing 4REL7, and if the overload has been removed the circuit will return to normal. If however, the overload persists then the 4REL1 will again open and repeat the sequence outlined above. After the third switching sequence the element of 4REL6 will have heated sufficiently to operato the microswitch and complete the 50V. A.C. circuit to the coil of the overload relay 4REL5. This relay will lock in via the O/L RESET button 4S12 and the LOCAL/REMOTE SWITCH or the H.T. remote control-relay 4REL15, 4REL5 connects 10V. A.C. to the O'LOAD pilot 4P4, and open the interlock circuits of both the minor and main H.T. relays 4REI12 and 4REL9 to close down the H.T. rectifiers. To re-set the circuit (after a delay of approximately 20 seconds to allow the element of 4REL6 to cool) when operating on LOCAL control press the O/L RESET button and if on REMOTE remove the 48V. D.C. from the H.T. remote control line to trip 4REL15.

After resetting the overload circuits as detailed above the H.T. supplies may be restored by operating 4S2 or 4REL15 in the normal manner.

2.2.4 Rectifiers

All rectifiors are of orthodox design. The bias rectifier uses a type 5V4-G (4V5) in a single 5UL-G-phase full-wave circuit and feeds into a single section cheke-input filter 4L6, 4C10, 4C11. The bias interlock relay 4REL4 is shunted across the output of the filter, in series with potential dividers 4R17, 4R18 and 4R19 by which the bias voltages supplies to the various stages are adjusted.

The minor rectifier is also a single-phase full-wave arrangement with a double section choke-input filter 4LA, 4L5, 4C5, 4C6, 4C7 and 4C8 terminated by a bleed resistor 4R5. It uses two type 866A/866 mercury-vapour rectifiers 4V6 and 4V7. A tap on 4R5 supplies D.C. H.T. voltage to the tone oscillator valve in the sub-modulator

A voltage regulator circuit is connected to the output of the minor rectifier consisting of a type 807 valvo (4V9) and a type 0C3/VR104 (4V4) in series. The 807 regulates a D.C. supply at approximately 380V. for the valvos in the sub-modulator unit. This voltage is adjusted primarily by variation of the grid bias on 4V9, taken from the bleed assembly (4R7-4R12 inclusivo) that is connected across the minor rectifier output. The gaseous regulator 4V4 supplies H.T. voltage at 105V. to the R.F. crystal oscillator. Note that 4V4 is connected in series with 4R14 in the cathode circuit of the 807, and that the 105V. D.C. is taken as a tapped voltage from the 380V. regulated supply.

The main rectifier employs two type 872A/872 morcury vapour valves, 4V2 and 3V3 in a single-phase full wave circuit. A two-stage choke-input filter 4L1, 4L2, 4C1, 4C2, 4C3 provides adequate filtering and is terminated by "bleed" resistor 4R1.

Spare valve sockets are provided on both tho Minor and Main Rectifiers and have only filament voltage connected so that they may be used for "running-in" and storing a spare 866A/866 and 872A/872.

2.2.5 Sub-Modulator and Modulator (See Fig. 6) (Drg. 51806G1)

The sub-modulator is provided with an in-built tone oscillator to generate a tone frequency of approximately 1000 cycles per second, which may be used to modulate the carrier for M.C.W. (A2) emission, or to supply a tone, keyed by the carrier signal, to the monitor unit for monitoring C.W. (A1) emission. The tone oscillator uses a type 6AU6 pentede in a resistance-capacitance feedback circuit. A phase shifting network 5C4, 5R4 is connected across the valve from

anode to cathode, a similar network 502, being connected across 5R4, and again another network 5C1, 5R1, 5R2 is connected across 5R3. In each network the values of R and C are so selected to give a phase shift of approximataly 60°. Thus, the grid voltage, which is taken from the third network, is approximately 180° out of phase with the anode voltage, giving the conditions for the valve to oscillato. The magnitude of the feed-back voltage to the grid can be varied by the potentiometer 5R2. The output of the tone oscillator is transformer coupled to the input transformer (5T2) of the sub-modulator section via contacts of the M.C.W./R.T. rolay 5RELL. The input impedance of the sub-modulator is 600 ohms. The modulator section has four stages, each push-pull and is controlled by limiting and clipping circuits that prevent overmodulation, and maintain the modulation level of the carrier within + 1 db. for variations of + 10 db. to the audio input level. (Refer to Fig. 7) (Drg. 54806D1).

The input stage, which functions as a limiter amplifier, has two type 6BA6 pentodes (5V2, 5V3) in pushpull, resistance coupled to the second stage which employs a twin triodo (5V4) typo 6SN7-GT. A BALANCE control 5R25 is provided to balance the gain of the two halves of the limitor stages and provent instability. Refer to Section 4.5.1 (vii) for adjustment procedure.) 5V4 is transformer coupled by means of separate secondary windings of 5T3 to two twin diodes. One of these diodes, 5V5 (6AL5), operates as a half-wave rectifier with a delay bias applied to its cathode circuit, and the resultant output voltage appearing across the load resistor 5R14 is then applied to the grids of 5V2 and 5V3 to control the gain of the amplifier. The delay bias applied to 5V5 is set by the LIMITER potentiometer 5R21, in a potential dividing network across the 600 volt supply, so that 5V5 becomes conductive, to apply controlling bias to the limiter stages, when the audio level output of Λ .F. Amp. 2 is in excess of that required for the modulator to produce 85% modulation of the carrier.

A variable resistor in series with the anode supply to 5V2 and 5V3 has a meter designated COMPRESSION shunted across it. When the limiter rectifier 5V5 begins to operate, the anode current of 5V2 and 5V3 will fall due to the increased bias voltage applied to the grids, and so the reading of the compression meter will fall. Thus an indication of the amount of limiting (compression) taking place is given by the reading of this meter. The meter is initially (no audio input) adjusted to full scale deflection by the COMP. METER central 5R35, and will give the amount of compression as a direct reading in db. with an accuracy of better than 5%.

An INPUT LEVEL control (40 db. rangé) attenuator is provided in the power unit to allow adjustment of speech input for levels ranging from -25 to +15 dbm. The limiter will take care of normal variations in level when set up as described in sub-section 4.5.1.

The twin diode 5V6 connected to the other secondary winding of 5T3 operates on both positive and negative peaks as a clipping device, and the bias applied to each section is adjusted by the POS. and NEG. CLIPPER BIAS controls 5R30 and 5R31 so that each diode becomes conductive when the audio level output from A.F. Amp. 2 is more than that required for the modulator to produce 98% modulation of the carrier. This prevents overmodulation of the carrier and sidoband splatter that would be caused by sudden peaks of audio signal.

The clippor is followed by a low-pass audio filter which cuts off at approximately 3,000 cycles to prevent higher order harmonics from the clipper passing through and so restricting the range of audio froquencies that modulate the carrier.

The filter is transformer coupled to the twin triode 5V7 (6SN7-GT) of the Amp. 3 stage, which is in turn transformer coupled to the sub-modulator valves 5V8 and 5V9. These are triede connected 807's, and are cathode coupled to the modulator stage, which employs two type 810 valves 4V10 and 4V11. When operating on M.C.W. (A2) or R.T. (A3), the secondary of the modulation transformer is connected in series with the H.T. supply to the Modulated Power Amplifier stage of the R.F. unit.

Bias, Screen and Anode Supplies 2.2.6

Tono Oscillator (6AU6)

Cathode bias from 5R6. Grid Bias:-

From anode supply via bleeders 5R8 Scroon:-

and 5R9.

From tap of minor rectifier bleed Anodo:-

resistor 4R5 in sories with 5R11.

Limiter Amplifier (2 x 6BA6)

Fixed bias from 5R24 plus automatic Grid Bias:-

limiting bias from 5R14.

From 380V. rogulated supply via tap Scroen:-

on network 5R19-5R24 inclusive.

From 380V, regulated supply. Anode:-

(6SN7GT) Amplifier 2

Cathodo fixed blas from 5R19-5R24 networl Bias:-From 380V. regulated supply via 5R27.

Clipper Diode (6AL5)

Delay bias:- 5R30 and 5R31 across full-wave rectifier 4W1.

Limiter Diode (6AL5)

Delay bias:- 5R21 in potential dividing network across 600 volt supply from minor rectifier.

Amplifier 3 (6SN7GT)

Bias:- Cathode bias from 5R34.
Anode:- From 380V, regulated supply via 5R37.

Amplifier 4 (sub-modulator) (2 x 807)

Grid Bins:- From Bins rectifier via 4R19.
Screen:- From 380V. regulated supply.
Anode:- From 380V. regulated supply

Modulators (2 x 810)

Grid Bias:- From bias rectifier via 4R19
Anode:- From main rectifier (approximately 1750V.)

2.2.7 Metering and Miscellaneous

- (i) The MAINS meter 4Ml is connected directly across the output of the auto-transformer 4Tll, and gives a continuous reading of the supply voltage to all filament transformers.
- (ii) The GOMPRESSION meter 4M2 gives a continuous reading of the amount of limiting taking place in the audio channel (refer Section 4.2.5).
- (iii) Meter A, 4M3, is a general purpose multimeter used in conjunction with the METER A A.F. CIRCUITS selector switch 4Sll and various metering resistors to read current as listed below:-

<u>Gircuit</u>	Metering Resistor	Rango
OFF	under times almost better	Card was Total Card
TONE OSC. CATH.	4R33	0-10 mA.
AMP. 1 V2 CATH.	4R31	0-10 mA.
AMP. 1 V3 CATH.	4R32	0-10 mA.
AMP 2 ANODE	4R30	0-25 mA.
AMP. 3 ANODE	4R28	0-25 mA.
AMP. 4 V8 ANODE	4R 26	0-50 mA.
at the contract of the contrac	er der jug 1∰	

(Cont*d)	<u>Circuit</u>	Metering Resistor	Range
	AMP. 4 V9 ANODE MOD. VIO CATH.	4R27 4R21	0-50 mA.
	MOD. VIL CATH. MOD. TOTAL CATH.	4R20 4R22	0-500 mA. 0-1000 mA.

(A) (A) (A)

3. INSTALLATION

3.1 Assembly and Location of Equipment

The base assembly will be normally dismantled for conservation of space in shipping, and should be the first unit unpacked and assembled. The base plate itself should be secured to the floor by five 3/8" B.S.W. bolts, checking that the floor is level so that the framework will not be strained, and the cubicles will slide freely in and out. Note that the full extension of either truck is about 30 inches, and to withdraw it completely clear, a space of approximately 3 ft. is required in front of the base plate. The upright frame members may now be belted in position with six 3/8" B.S.W. belts supplied, and after these have been drawn up tight, the two flexible conduits that run down each side member of the frame should be secured in position to the rear flange of the base by two 2BA belts through the mounting plate at the end of each conduit.

The R.F. and Power Units may now be rolled into position in the base with the R.F. Unit on the left hand side of the base when viewed from the front, and the Power Unit adjacent to it in the base.

Check that the locating pins at the top of the frame have positioned the units correctly, and that the spring loaded contacts at the rear of the R.F. Unit have mated correctly to the line terminals of the frame.

Note that the main H.T. transformer 4T2, and the first choke (4LL) of the main rectifier filter are not fitted in the Power Unit when crated, but are packed separately. Both should be placed in position on the floor of the Power Unit, the transformer in front with its H.T. terminals on the left when viewed from the front, and the choke behind this. Both are secured by four 3/8" B.S.W. round head screws passing through mounting straps fitted to their tanks, and into tapped holes in the bottem plates of the unit.

The transformer and choke should be wired into the circuits as indicated by the designations on the individual wires.

The flexible conduits carrying the interwiring forms from the frame should be secured to the rear of their respective cubicles by two 2BA, screws through the mounting plate at the end of each conduit to the tapped rivet blocks in the cubicles.

Slip the spade terminals of the form wiring under the screws of the terminal blocks as indicated by the designation strips attached to each set of wires. Also secure the H.T. wiring from the form to the stand-off insulator adjacent to the terminal blocks in each cubicle and the earth wires to the frame earthing belts that are also adjacent.

3.2 Extornal Connections (See Fig. 1) (Drg. 54800C1)

Drg. 54800Cl shows the necessary external connections to the base. The wiring should be run in cable forms, and be protected by the flexible conduits supplied as part of the base assemble. These conduits, one to take the required power wiring, and the other for the control cables, run down the two upright frame members to either side of the rear flange of the base. From this point the wiring may be run above floor level (suitably protected) or through the floor as required at the particular installation. All wiring should be carried out in accordance with any relevant regulations.

The frame earth should be as short as possible, and connected to a low resistance earthing point.

3.3 <u>Insertion of Valves</u>

After ensuring that the 240V. mains supply is switched off, the various valves should be placed in their sockets by reference to the list given in sub-section 1.13 and the valve type numbers stencilled near the sockets. Make sure that the anode connectors for the type 807 valves, and the grid and anode connectors for the type 810 valves, are securely attached. The anode clips for the 866A/866 and 872A/872 mercury vapour rectifiers should be left off temperarily until preliminary tests of the Installation are made, but should be carefully tied back on themselves so that they cannot short to frame or to one another.

Note that for frequencies between 2 and 10 Mc., 1V1 is not required.

3.4 Proliminary Tost of Installation

The following tests are intended merely to check the correctness of the interwiring between the Power Unit and the R.F. Unit, the wiring of the A.C. supply and the operation of the various control switches and relays. The overload thermal delay relays have been adjusted during factory testing and should not require any attention.

- (i) Open the side doors. The safety switches will now be in the normal position rendering H.T. switching inoperative.
- (ii) Set the MAIN H.T. STEP 1 and STEP 2 switches to OFF and the LOCAL REMOTE switch to LOCAL.
- (iii) Switch on the A.C. supply to the transmitter and press the FIL. ON push-button. The L.T. relay 4REL13 should close and the heaters or filaments of all valves should light up. The DELAY pilot should also light. The 866A/866 and 872A/872 mercury vapour valves may not show any appreciable glow, but should become slightly warm after a few minutes. Check the reading of the MAINS meter, if it varies by more than 5 volts from a reading of

240 volts, it should be adjusted by means of the MAINS tap on the autovolt transformer 4Tll. Note the final tap selected, and by reference to the circuit diagram Fig. 5 54804H2 set the transformers 4T2 and 4T5 to the same position. Check that both blowers are running. The bias rectifier should also have come into operation and closed the bias interlock relay 4REL4. If necessary check that the bias voltage on METER B of the R.F. Unit shows 200 volts. About 30 seconds after 4REL13 closes, the thermal relay 4REL10 should close and operate the delay relay 4REL11. The DELAY pilot will extinguish and the FIL. pilot will light, indicating that the H.T. control circuits are prepared for operation and that the H.T. ON pushbutton may be operated.

- Note:- Provision is made at the terminal blocks on the base assembly so that the Power Unit blower may be connected directly across the mains if continuous operation is required, or normally for operation with the filaments. The blower should be checked for correct operation for whichever conditions apply.
- (iv) Close all four safety switches by pulling the operating lever right back to its locking position. The red warning lamps in each cubicle should light.
- (v) Press the MINCR H.T. ON push-button. The minor H.T. relay 4REL12 should close and light the H.T. pilot. If it does not, verify that the bias interlock relay 4REL4 has closed, and check that both air-flow switches have closed.
- (vi) Check the safety switches on both units by pushing any lever back to the free central position. 4REL12 should drop out and the red warning lamps on the cubiclo concerned should stay alight, and after the second safety switch on the cubiclo concerned is operated as above the lamps will extinguish. After these safety switches have been checked, pull both levers back to the locking position and press the H.T. ON button to energise 4REL12 before checking the switches in the other unit.
- (vii) Close down by pressing the FIL. OFF button. After completing the tests, attach the anode connections to the 866A/866 and 872A/872 mercury-vapour rectifiers. Before anode voltage is applied to these valves they should be "run-in" by operating for at least 30 minutes with only filament voltage applied.
- (viii) With the transmitter filaments off, check that the two cabinet drier elements do not become energised until the CABINET DRIER switch is closed. Then check that they are switched off automatically when the FIL. ON button is operated and 4REL13 closes.

- (ix) Sot the AIR HEATER switch to ON, and check that a stream of warm air is directed by the ducting at the mercury vapour rectifiers. Insert a thermometer into the rear top hele of the air duct and adjust the thermostat to operate when air temperature reaches 40°C. After a period of operation of approximately one hour, the temperature should stabilize at 40 45°C. Note that the thermostat is mounted in the air duct near the blower outlet, and the adjusting screw projects through the duct behind the modulation transformer 4T3 and below the filter capacitor 4C8.
- (x) Check that the elapsed time indicator is operating.

4. ADJUSTING AND TUNING

4.1 Precaution

The following precautions should be observed when tuning, adjusting and servicing the transmitter.

- (i) Always set the LOCAL REMOTE switch to LOCAL.
- (ii) Unless absolutely essential during fault finding, nevor operate the transmitter with any side door open.
- (iii) Always tune the Radio Frequency stages under C.W. (Al) condition.
- (iv) Never apply audic input to the modulated amplifier unless this is properly tuned and fully loaded. If setting up initially, or after the circuits have been disturbed, return as described in sub-section 4,3.5.
- (v) Tune as rapidly as consistent with accuracy so that amplifiers 3, 4 and the modulated amplifier valves do not draw high "off-tune" cathode currents for a lengthy period. When tuning the modulated amplifier use the STEP 1("Tune") position of the MAIN H.T. switching until the anode circuit is in resonance. This reduces the H.T. voltage applied to the anode circuits, and so reduces the risk of overloading due to high "off-tune" cathode current. STEP 2 ("Transmit") position is then used during actual transmission.
- (vi) When servicing, switch off the 240V. A.C. supply to the transmitter whonever practicable.
- (vii) When initially tuning the transmitter, or retuning to a frequency that differs by more than 10% from the previous tuned frequency, the Main H.T. must NOT be switched on until the C.R.O. connector and Monitor pick-up coils have been set for minimum coupling to the Modulated Amplifier anode inductor.
- (viii) When operating the METER A NORM-NEUT switch, turn the switch ELCTLY when leaving the NORM. position.

4.2 Checking and Adjustments of Bias Voltages

Before commencing to tune the Radio Frequency stages the fixed bias voltages for the amplifier 3 and 4, and the modulated amplifier valves, and for the sub-modulator and modulator should be checked and adjusted if necessary to the values given below. In addition to ensuring that the amplifiers 3 and 4 and the modulated amplifier are set to cathode current cut-off with no R.F. drive applied, this procedure will make certain that the sub-modulator and modulator do not draw excessive cathode current, while adjustments are proceeding in the R.F. stages. These bias voltages have all been set correctly during factory testing but the adjustments may become disturbed while the equipment is in transport.

Switch on the transmitter by pressing the FIL. ON button. This will also switch on the Bias Rectifier. Do not switch on the H.T. supplies.

4.3 Tuning Procedure

The following tuning instructions apply equally to any frequency within the band (2-20 Mc.) covered by the unit. The lowest frequency crystal would most conveniently be located in No. 1 position and the others in the No. 2 position. The frequency coverage of the transmitter is split into two bands, 2-10 Mc. and 10-20 Mc., and for which separate inductors are supplied for amplifier 4 and the modulated amplifier. Note that for Amp. 4 two coil assemblies are used to cover the 2-10 Mc. band, 2-3.7 and 3.7-10 Mc. respectively. The inductors should be selected, (rof. 4.3.1 below), mounted in the transmitter (rof. 4.3.2 below), and wired into the circuit. All other taps should be adjusted as indicated in sub-section 4.3.3 below.

Two sets of chokes, L10-L11 and L24-L25 are provided, one set for each of the Amp. 4 anode and Med. Amp. grid circuits. The chokes of each set are identical, and the set used depends on the transmitter frequency. For frequencies up to 7 Mc., LL10 and LL11 are used, and frequencies above 7 Mc., use 1L24 and 1L25.

Note: For frequencies up to 10 Mc., Amp. 3 stago is not required, and flexible links are used to enable the output of Amp. 2 to drive Amp. 4.

The crystal frequency is selected between 2 and 5 Mc., and if the output frequency of the transmitter is to be within these limits, all stages tune to fundamental frequency. For frequencies of from 5 to 10 Mc., Amp. 2 operates as a doubler and subsequent stages tune to the second harmonic of the crystal frequency.

For frequencies between 10 and 20 Mc., Amp. 2 and 3 each operate as doublers, subsequent stages tuning to the fourth harmonic of the crystal frequency.

Amplifiers 3 and 4 Bias:- -75V.

Moasure between terminal 4TSE7 (neg.) and terminal 4TSE8 (pos.) on Power Unit.

Adjust by the appropriate clip on 4R18 in the Power Unit.

M.A. Bias: - -85V.

Measure between terminal 4TSE6 (neg.) and terminal 4TSE8 (pos.) on Power Unit. Adjust by appropriate clip on 4R17 in Power Unit.

<u>Sub-Modulator Bias:- -105V.</u>

Measure between terminal 5TSA19 in the sub-modulator unit and frame (pos.). Adjust by appropriate clip on 4R19 in Power Unit.

Wodulator Biss. - 40V

Measure between centre tap of 4L3 (neg.) in Power Unit and frame (pos.). Adjust by appropriate clip on 4R19 on the Power Unit. It should be noted that, since the Sub-modulator is cathode coupled to the modulator, there is a direct connection between the cathode of each sub-modulator valve and the grid of the corresponding modul-

ator. Therefore the actual grid bias of the sub-modulator valves equals their grid-to-ground voltage minus the grid-to-ground voltage of the modulators. That is, the clip for sub-modulator bias on 4R19 must always be more negative than the clip for the modulator bias.

4.3.1 Coil Identification

Circuit	Circ. Rof. No.	Frequency Mc.	Marking
Amp. 3	1L3	10 = 20	V75
Amp. 4	11.4 11.19 11.5 11.10 11.24	2 - 3.7 3.7 - 10 10 - 20 2 - 7 7 - 20	V76 V85 V77 V86 V87
Mod. Amp.	1L6) 1L7) 1L16) 1L17)	2 - 10	V548 12
	1L20) 1L21) 1L22) 1L23)	10 - 20	1V54812
	11.11 11.25	2 - 7 7 - 20	V86 V87

4.3.2 Coil Mounting

Coil 113 is provided with three mounting feet, and are secured to the components panel by three 5BA screws.

Two spacers are used to mount the coil assembly associated with Amp. 4 and the coil is secured by means of two 2BA screws.

The selected coil assembly for the modulated amplifier stage is secured to the components panel by three 2BA screws fitting rivet blocks in the panel.

4.3.3 Coil Tapping

Amp. 2

111

<u>ps</u> Nil
l and 2
l and 3
l and 4
l and 5

			#ELONS LITTLE CO
Amp. 3	e de la companya de l		
113 Freq. Range	10-14 Mc. 14-20 Mc.	Link Taps	Nil l and 2
Amp. 4 1L4 Freq. Range	2.0 - 2.7 Mc. 2.7 - 3.7 Mc.	<u>Link Taps</u>	Nil (1 and 2 (3 and 4
	7.0 - 10 Mc.	·	(1 and 3 (4 and 6
<u>1L5</u> Freg. Range	10 - 14 Mc. 14 - 20 Mc.	AMANDA CONTRACTOR DE LA	Nil (1 and 2 (3 and 4
Mod. Amp.			

The following is intended only as a guide in preliminary setting up procedure, the final adjustments of the coupling coils varying with line impedance.

<u>1L6</u> ·				
Freq. Range	2.0	Mc.	Turns in Circuit	14
•	3.0	Mc .		11
		Mc.		10
		Mc.	•	8
		Mc.		6
	10.0			4
				_
1L20				
Freq. Range	•			
	10.0	Mc -	Turns in	4.0
			Circuit	- •
	15.0	Mc -	STATE OF THE PERSON NAMED OF THE PERSON	2.5
	20.0			1.5
•		2	* * * * * * * * * * * * * * * * * * * *	
erial Coupling			•	•
and the beautiful and a second of the second				
<u>117</u>				
Freq. Range				
	2.0	Mc.	<u>Turns in</u>	12
•			Circuit	
والمعاصفان والمعاصفات	3.0	Mc.		10
	4.0	Mc.	The second second	8
	~5.0	Mo		6
	7.0	Mc.		4
* * * * * * * * * * * * * * * * * * *	700	Ma		2

1L21

Freq. Range

10.0 Mc. Turns in 4
15.0 Mc. Circuit 2.5
20.0 Mc. 1.5

Notes: In the frequency range of 2.0 to 3.0 Mc. both sections of 1031 are used, and 1032 is to be connected into circuit as shown on circuit diagram.

From 3.0 to 6.0 Mc. 1C32 is disconnected, both sections of 1C31 remaining in circuit. For frequencies above 6.0 Mc. only one section of 1C31 is used and 1C32 is disconnected.

4.3.4 Tuning Amplifier Stages 2. 3 and 4

If during tuning procedure an overload occurs in the minor H.T. circuit, these rectifiers will be switched off automatically. To restore supplies press the O/LOAD RESET and then the H.T. ON pushbutton.

Procedure

- (i) Withdraw the R.F. unit from the base assembly, open both side doors and connect the artificial aerial across the line terminals by means of the two link switches provided at the rear of the unit. Note that the ARTIFICIAL ARRIAL pilot will then light.
- (ii) Loosen the screws in the adjusting slots of the modulated amplifier coil assembly, and set these inductors (1116 and 1117 or 1122 and 1123) for minimum coupling.
- (iii) Check that the MAIN H.T. STEP 1 and STEP 2 switches to CFF, the C.V./M.C.W./R.T. switch to C.W., the LCCAL/REMOTE switch to LCCAL and the crystal selector to the required position.
- (iv) Press the FIL. ON pushbutton. The DELAY pilot should light immediately, and after a delay of approximately 30 seconds should be replaced by the FILS. pilot.
- (v) Where the side doors have been left open for subsequent adjustment of the Modulated Amplifier stages, the safety switches associated with these doors should be rendered inoperative by pulling their operating levers to the locking position.
- (vi) Press the H.T. ON pushbutton, and observe that the H.T. pilot should light.

- (vii) Sot the METER A NORM.-NEUT. switch to NORM. and the METER A selector to OSC. CATH. Check that on pressing momentarily the TEST KEY (or the local handkey if fitted and the KEYING switch is in the D.C. position) a reading of approximately 3 mA. is obtained in Meter A.
- (viii) Check that readings are obtained in each of the AMP. 1 CATH., and AMP. 2 CATH. positions of the METER A selector when the TEST KEY is operated momentarily.
- (ix) With METER A selector set to AMP. 3 CATH. (10-20 Mc.) or AMP. 4 ANODE (2-10 Mc.), tune for a maximum metor reading.

If the transmitter is operating in the 10-20 Mc. band, then tune AMP. 3 ANODE for a minimum, indicating anode circuit resonance. If the transmitter is operating in the 2-10 Mc. range, or having completed the above adjustments, proceed as in (x) below.

- (x) With METER A selector set to AMP. 4 GRID, and immediately a reading has been obtained reset the selector to either of the AMP. 4 CATH. positions and tune AMP. 4 ANODE for resonance as indicated by a minimum moter reading.
- (xi) Reset METER A selector to AMF. 4 GRID and check that for frequencies between 2 and 10 Mc. the drive current is 2 to 3 mA., and for frequencies above 10 Mc., the drive is between 5 and 6 mA., under no circumstances must the latter figure be exceeded. If necessary, adjustment of the screen voltages on the first four emplificiation stages by means of the taps on 1R6, while keeping amp. 2 and amp. 3 ande circuits tuned to resonance, provides variation of amp. 4 grid drive current.
- (xii) Set METER B selector to MOD. AMP. GRID, and check that the grid drive current is between 80 and 100 mA. depending on frequency. Further adjustment of screen voltages as indicated in (viii) above may be necessary, and a guide to the correct values may be obtained from the maintenance section of this book.

4.3.5 Tuning and Loading Modulated Amplifier

WARNING

When initially tuning the transmitter, or retuning to a frequency that differs by more than 10% from the previous tuned frequency, the Main H.T. must NOT be switched on until the C.R.O. connector and Monitor pick-up coils have been set for minimum coupling to the modulated amplifier anode inductor.

- (i) Set the AERIAL PHASING control to full scale, AERIAL TUNING to zero, and the METER B selector to MOD. AMP. TOTAL CATH.
- (ii) Close the MAIN H.T. STEP 1 switch and adjust M.A. ANODE tuning for a minimum meter reading which should be between 100 and 200 mA. depending on frequency. Note the position of the M.A. ANODE tuning control.
- Note: It is now necessary to neutralise the modulated amplifier stage and the procedure is outlined in Section 44.
- (iii) Vary the AERIAL TUNING control over the entire range to find a setting where the MOD. AMP. TOTAL CATH. current rises to a well defined peak. If no satisfactory setting can be obtained, increase the degree of coupling between LL16 and LL17 (or 1L22 and 1L23) and repeat the procedure. If it is still impossible to obtain a satisfactory peak vary the number of coupling coil turns in circuit. Finally it may be necessary to reduce the setting of the AERIAL PHASING capacitor, but do not use a lower value than is absolutely necessary, especially on the lower frequencies.
- (iv) After completing step (iii), note the setting of the M.A. ANODE tuning control, and re-adjust for a minimum MOD. AMP. TOTAL CATH. current. If the new setting differs from the old, slight re-adjustment of AERIAL TUNING control should enable the MOD. AMP. ANODE to be retuned for a minimum cathode current at the original setting. Such retuning of the M.A. anode circuit to the original setting for minimum cathode current is important because it keeps the valve dissipation to a minimum, increases the useful output to the aerial and minimises "de-tuning" of the anode circuit when the coupling to the aerial is increased.

After the above adjustments, the MOD. AMP. TOTAL CATH. current should be slightly less than 250 mA. If greater, reduce by decreasing the degree of coupling between inductors 1116 and 1117 (or 1122 and 1123).

(v) Switch ON the MAIN H.T. STEP 2, and check the AERIAL TUNING and the M.A. ANODE tuning controls to bring the MOD. AMP. TOTAL CATH. current to the full lead figure of 500 mA. (for 750 watts anode input with main H.T. at 1800V. and M.A. grid current at 80 mA.). If this current cannot be obtained with the input coupling very tight (the

inductors must NOT be closer than 3/8" at the nearest point) try reducing the setting of the AERIAL PHASING control or adding an extra turn to the coupling inductor and repeating the adjustments given in this section.

Notes

- (1) Any alteration to the AERIAL PHASING will necessitate readjustment of one or more of AERIAL TUNING and M.A. ANODE controls, and the output coupling.
- (2) Should correct loading necessitate operating with AERIAL TUNING de-tuned, and M.A. ANODE adjusted for minimum cathode current at a setting different from that found in (ii), then the latter should be constantly re-adjusted for minimum cathode current while the loading is being obtained by varying the degree of aerial coupling.
- (3) Keep AERIAL PHASING at as high a setting as possible during loading in order to minimise the possibility of corona between its plates when modulation is applied.
- (4) Re-check all tuning adjustments and moter readings noting especially that AMP. 4 GRID current must be between 2 and 3 mA. and MOD. AMP. GRID current botween 70 and 80 mA.

4.4 Neutralising Modulated Amplifier

The Modulated Amplifier neutralising and the balancing capacitor 1023 will have been adjusted during factory testing, however the adjustment may have been disturbed during transport and installation and/or the setting of the balancing capacitor 1023 may have been altered. The orthodox method of neutralisation employing a thermomilliameter (or voltmeter) loosely coupled to the anode inductor may be used if desired, but the procedure outlined below utilises the in-built neutralising meter. The neutralising capacitor 1032 is adjusted by a knob on the front panel of the R.F. Unit, and the balancing capacitor is located at approximately the same height on the left hand side of the internal vertical panel near the front.

Procedure:-

1. If the Balancing Capacitor 1023 is out of adjustment.

The modulated amplifier may be neutralised by adjustment of 1030 while the balancing capacitor 1023 is set to any position. However difficulty may be experienced in tuning Amp. 4 anode circuit at either extreme of the frequency range, and the modulated amplifier stage would definitely have to be re-neutralised if the operating frequency were changed. For spot frequency operation the setting of 1C23 is not critical and it may be set by hand to approximately 30° out of full mesh for satisfactory operation. Adjustment of the neutralising capacitor may then be carried out as indicated in step 2 following. If however it is necessary to accurately adjust 1C23 then the following procedure should be adopted:-

- (i) Tune the transmitter to 2.0 Mc. in the normal mannor as detailed above, and with the balancing capacitor 1023 set at approximately 30° out of full mesh.
- (ii) outralise the modulated amplifier as detailed in (2) of this section and note the setting of the NEUTRALISING control.
- (iii) Without alteration to the taps on the tuning inductors in the amplifier stages 2 and 4, tune the transmitter to 2.7 Mc. in the normal manner. Repeat the neutralising process as detailed in (2) of this section and note carefully whether more or less capacitance is required to fulfil neutralising conditions. If more capacitance is required then the balancing capacitor 1C23 is too large and must be reduced accordingly. Similarly if less capacitance is required in the neutralising capacitor, then 1C23 is too small and must be increased.
- (iv) Return to 2 Mc., tune through and adjust 1030 as before. If 1023 has been altered in the correct direction 1030 will now only require a small variation.
- (v) Make a further slight adjustment to 1023 in the correct direction and then repeat the check at 2.7 Mc. The object is to obtain such a setting for 1023 that for complete neutralisation 1030 does not vary from 2-2.7 Mc. Finally tighten the locknut on 1023 and seal.

2. Adjustment of Neutralising Capacitor 1030

- (i) Bring the transmitter into operation at full power as described earlier in this section, and with METER A selector set to CARRIER adjust the number of turns in circuit (or shorted), and the coupling of the small pick-up inductor lll6(or 1122), for a full scale meter deflection. When set to the CARRIER position, the meter gives direct indication of carrier level, and may be used to monitor power cutput. Setting the meter for full scale reading ensures correct input to the Monitor.
- (ii) Set the NEUT. SENSITIVITY ADJ. control on the monitor unit to its extreme anti-clockwise position to protect the meter, and bring the transmitter to

full power operation. Set the METER A NORM. NEUT. switch to NEUT. and check that this has switched off the main H.T. rectifiers. The sensitivity of METER A as a neutralising meter is now set by means of the NEUT. SENSITIVITY ADJ. control. This is adjusted for a peak meter reading or a deflection of 20 divisions, whichever occurs first.

- (iii)Adjust the NEUTRALISING control on the R.F. Unit front panel to give a minimum reading of Meter A when set to NEUT. As the deflection of this meter approaches the minimum it may be necessary to increase the sensitivity of the meter by increasing the setting of the NEUT. SENSITIVITY control. Should the meter go to zero, continue to adjust the NEUTRAL-ISING control in the same direction until the meter begins to rise again. Reverse the direction of retation and set the control to a position midway between the two positions where the meter reading fell to zero, and then rose from zero. If 1030 was substantially out of adjustment it will be necessary to return the transmitter to normal full power operation, as in (vi) below, re-check AMP. 4 ANODE and M.A. ANODE tuning control settings, then repeat (ii) and (iii) above.
- (iv) The above procedure for adjusting 1030 is satisfactory so far as checking the setting of the balancing capacitor 1023 is concorned but, in order to obtain correct neutralising of the Mod. Amp., and to prevent instability when keyed and with 'bff-tune" settings of the tuning controls with very low drive to the Mod. Amp. stage, it is necessary to slightly re-adjust 1030 as follows:-
- (v) Having determined the setting of 1030 giving minimum reading on Meter A when set to NEUT., rotate the NEUTRALISING control knob $\frac{1}{2}$ to $\frac{3}{4}$ turn in a clockwise direction.
- (vi) Restore the transmitter to normal operation (main H.T. applied) by setting the METER A NCRM. NEUT. switch to the NCRM. position.
- (vii)On the frequency range 16 to 20 Mc. more critical adjustments are necessary to obtain complete stability. For this frequency range neutralise as in (i), (ii), (iii), (iv) (v) above, restore the transmitter to normal operation as in (vi), and then proceed as below.
- (viii) Set METER B selector to MOD. AMP. GRID, and carefully tune AMP 4 ANODE control for maximum grid current. Set the metering selector to MOD. AMP. TOTAL CATH. and then tune M.A. ANODE control to give a minimum cathode current.
- (ix) Return METER B selector to MCD. AMP. GRID, and swing the AERIAL TUNING control through the tuning point noting the variation of grid current. Now, while swinging the AERIAL TUNING about the tuning point, adjust the MEUTRAL-ISING control for a minimum variation of grid current.

= 200

tive in the

- (x) Now tune and lead the medulated amplifier as described in 4.3.5 (iii), (iv), and (v) and again carefully check M.A. GRID and M.A. CATH. currents for maximum and minimum respectively.
- (xi) Repeat step (ix) above. Note that as the exact neutralising point is very sharply defined it will be necessary to adjust the NEUTRALISING control very slowly.
- (xii) Finally check for stability by connecting a C.R.O. to the R.F. TO C.R.O. socket on the front panel of the R.F. unit, and checking for any signs of instability on the trace by do-tuning all controls. Should instability be apparent, a slight re-adjustment of the NEUTRALISING control should eliminate it or reduce it to a negligible amount.

4.5 Sotting up Sub-modulator (Soo Fig. 7) (Drg. 54806Dl)

4.5.1 General Notes on Limiting, Clipping and Power Lovels

The audio sub-modulator section of this transmitter incorporates limiting and audio clipping circuits that, when correctly adjusted, maintain the output level, and hence the modulation percentage, constant to within + 1 db for variations of input level up to + 10 db., and also prevent overmodulation of both positive and negative peaks by transient peaks at the input terminals.

The maximum modulation depth selected for this equipment is 97%, and setting the clipping circuit to commence operation at this figure ensures that the actual 100% point will not be exceeded due to variations in test equipment, methods of measurement, or transmitter performance.

checked. The clipper and limiter circuits have been factory adjusted, but must be checked and adjusted to the required operating conditions before being placed in service on any frequency, and whenever the frequency or operating conditions are changed.

The limiting circuits may be set to operate about any required modulation percentage for the particular input level at the installation. It is important to note that the maximum allowable modulation depth for normal audio input level should not exceed 87%, to ensure that clipping will not commonce until the input has risen by more than 10 db. above normal line level, and thus above that necessary for a 1 db. rise in modulation

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percentage (i.e. 97%). A <u>docrease</u> of 10 db. in line level will reduce modulation dopth by 1 db. to 77%. Note that these figures are based on maximum ratings only, and the sub-modulator may be set for lower modulation levels than the figures given above if required.

10 BE USED

The audic frequency level available at the line input terminals for the transmitter will be the sending power level from the remete centrel point less lesses due to line attenuation, equalisers, etc. This level must be determined, by measurement, in db. above or below a reference level of 1 mW. (i.e. in dbm.), before adjustments are made to the sub-medulator circuits. This level should be between -25 and +15 dbm. for stable conditions of the line, and preferably 10 db. inside these limits.

Setting up the sub-modulator is carried out with the transmitter set for R.T. (A3) emission, and using an external audio oscillator to provide the modulating signal level (as previously determined in the last sub-paragraph) at the input terminals. Then, using an audio input level as determined above, calculate the level of this input above the allowable minimum of - 25 dbm, and set the INPUT LEVEL attenuator accordingly. (For example, if the level measured at the transmitter input terminals is - 7 abm, the attenuator in the transmitter should be set at 18 db in order to provide an input level of - 25 dbm at the terminals of the sub-modulator chassis. Such an input is capable of modulating the transmitter to a depth of 100% with the limiter and clipper circuits disconnected).

The input signal is then decreased by 9 - 10 db, either by means of the INPUT LEVEL control, or by an external attenuator across the output of the audio oscillator. With the clipping circuits disconnected, the limiting circuit is now set to the verge of compression for an output modulation level approximately 1 db below that at which the transmitter till be normally operating. Thus, if it is desired to operate normally at 85% modulation, adjust the verge of compression at 75%. An increase of imput level by + 20 db should now produce not more than a 2 db rise in modulation percentage and, using the above example again, the modulation should not exceed 97%. The limiter is then set approximately to the middle of the compression range by decreasing the input

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The clipping stage is then set to prevent the positive and negative peaks of modulation exceeding 97%

- PAGE 32. (iii) * 1L6 & iL7, not 1L16 & 1L17.
 - 33. Note 4.4 capacitor 1C32 should read 1C30
 - 35. margin. Adj Neut Cond for min effect on Ig P.A. as the AE tuning is swung.
 - 36. 4.5.1 <u>Limiting</u> +/- 10db input; +g= 1 db output Clipping (888) Set to 97% Mod.
 - 36a. Note 77% to 87% modulation is an increase of very very nearly 1 db and also ditto 87% to 97% Modulation.

 (-5 +/- 10 dbm optimum); * At the "Tx" input terminals.
 - 37b. A.F. Adj J54800. (R.T. operation)
 1. Determine the "tone equivelant" of the speach level arriving at the TX audio terminals (6TSA7 & 8)
 This will be the max voice peak minus 8 db.
 - 2. Subtruct "-25 dbm" from this figure. Set the Tx attenuator (4ATT1) to the setting which is closest to this figure.
 - 3. Remove the two Clipper links.
 - 4. With no A.F. input set Comp. Meter (5R35) pot. to give F.S.D. on the Comp Meter (4M2)
 - 5. Connect a 1000 cps BFO to 6TSA7 & 8 set to a level down 10 db on the "tone equivelant" refer (1 above).
 - 6. Set the Lim Bias (5R21) pot so that is just gives the merest back deflection on the Comp Meter (4M2)
 - 7. Increase the BFO 10 db to the "tone equivelant". Set the Output (5R28) pot to give 87% modulation as measured on a CRO or Mod Mon.
 - 8. It should be now possible to swing the BFO +/- 10 db for a modulation percentage change of from 77% (-10db on BFO) to 97% (+10db on BFO)
 - 9. Remove the Lim Link and set the BFO to give 100% modulation as read on the CRO or the Mod. Mon. Insert the POS CLIP LINK and adj Pos Clip Bias (5R30) pot to clip the pos. peaks to 97%
 - 10. Remove the Pos Clip Link. Insert the NEG CLIP LINK adj the Neg Clip Bias (5R31) pot to clip the neg peaks to 97%. Nullify any interaction between 9 & 10 above.
 - 11. Insert the other 2 links. The Tx is now aligned.
 - 37 4.5.1 (i) (-5 +/- 20 dbm)

4.5.2 Setting Up Procedure

- (i) Determine at 1000 cycles the line level. This should be measured in db. above or below a reference level of 1 mW. (i.e. in + dbm.), and will be the level normally fed to the transmitter input terminals. It should, if possible, be within the range of -25 to +15 dbm.
- (ii) Tune and adjust the transmitter on C.W., and then set the C.W./M.C.W./R.T. switch to R.T. or M.C.W. as desired. Set the LIMITER BIAS, CLIPPER POS. and CLIPPER NEG. controls to their off or minimum gain positions, and remove the LIMITER and CLIPPER POS. and NEG. links from the sub-modulator chassis, thus rendering both limiting and clipping circuits inoperative.
- (iii) Connect an external modulation monitor to the R.F. TO C.R.O. co-axial connector on the front panel of the R.F. unit. Where a modulation monitor is not available a C.R.O. may be used by connecting for a trapazoid pattern with the vertical plates connected to the R.F. TO C.R.O. connector, and the A.F. TO C.R.O., connector wired to the horizontal plates.
- (iv) With the transmitter operating unmodulated at full power, adjust the reading of the COMPRESSION meter to 0 db. by means of the COMP. METER control, 5R35 on the sub-modulator chassis.
- (v) Set the OUTPUT control, 5R28 on the sub-modulator chassis to the minimum gain position (fully anti-clockwise), and connect an audio oscillator, set to 1000 cyclos, to the line input terminals, 6TSA7 and 6TSA8 on the mounting base. Adjust the output of this oscillator to normal line level as determined in (i) above.
- (vi) Set the INPUT LEVEL control to the position designated with the nearest db. calibration corresponding to the level in db. of line input level above -25 dbm. The line level has been determined in (i) above.

- (vii) Decrease the input level by 9 db. either by shifting the INPUT LEVEL control 2 steps anti-clockwise or increasing the attenuation in the output of the audio oscillator by 9 to 10 db.
- Insert the LIMITER link in the sub-modulator chassis, (viii) and with the press-to-talk circuit closed (link 4TSB1 and 4TSA6), adjust the LIMITER BIAS control, 5R21, for the verge of compression as indicated by a slight fall in the reading shown on the COMPRESSION meter 4M2. This setting will be found to be fairly broad; and to check the final adjustment, decrease the input signal from the audio oscillator and then increase it until the verge of compression is indicated as before. Check that the output of the audio oscillator has been restored to the level set up in (vii) above. If the COMPRESSION meter shows any tendency to oscillate as ocmpression takes place, a slight re-adjustment of the BAIANCE control, 5R26 inside the sub-modulator chassis, in the direction that gives lowest dip of the COMPRESSION moter reading should stabilize the circuit.
- (ix) Carefully increase the setting of the OUTPUT control, 5R28, until 75 80% modulation is indicated on the modulation menitor or the C.R.O. Increase the input level from the audio oscillator by 20 db. bearing in mind the limits of input signal given in (i) above, and check that the modulation porcentage does not rise by more than 2 db., i.o., to not greater than 97%.
- (x) Restore the output of the audio oscillator to normal line level as determined in (i) above, and set INPUT LEVEL to the conditions set out in (vi) above. If additional line attenuation has been inserted in (vii), this should be removed. The modulation level should now rise to the required operating point (85%), and the limiting circuits will be operating at the mid-point of their range. Variation of +10 db. about normal line level will produce corresponding modulation level changes of within +1 db.
- (xi) Where a C.R.O. is being used instead of a modulation monitor, set it to obtain a modulation envolope pattern by connecting the vertical plates to the R.F. TO C.R.O. connector on the front panel of the R.F. unit, and using the internal time base.

- (xii) Remove the LIMITER link, and increase the output of the audio oscillator sufficiently to produce 100% modulation of the carrier as indicated either on the C.R.O. or the modulation monitor. Now fit the CLIPPER PCS. link into position.
- (xiii) Adjust the CLIPFER BIAS PCS. control 5R30, to reduce positive modulation peaks of 97% as indicated either on the C.R.O. or the modulated monitor.
- (xiv) Remove the CLIPPER POS. link, and insert the CLIPPER NEG. link, and adjust the CLIPPER BIAS NEG. control, 5R31, until the negative modulation peaks are clipped to 97%, as for (xiii) above.
- (xv) Where using a modulation monitor, re-insort the CLIPFER BIAS POS. Link, and re-adjust the CLIPFER BIAS POS. control for 97% clipping, as its setting will have been altered when the negative clipping circuit was adjusted. Then re-set the CLIPFER NEG. control and repeat this procedure until clipping of both peaks starts at 97%.
- (xvi) The clipping circuits have new been adjusted to prevent the modulation level exceeding 97% on either positive or negative peaks.
- (xvii) Re-insert the LIMITER link and return input conditions to those set out in (i) and (vi) above. Check that the modulation level is approximately 85%, with the COMPRESSION meter showing 10 db. compression. Remove the LIMITER link, and check that increases of line level will not produce modulation over 97%. Replace LIMITER link, restore input conditions (i) and (vi) above, and vary input level by ± 10 db. Note that modulation levels should not change by more than ± 1 db. either 97% to 77%.
- (xviii) Open the press-to-talk circuit and set the transmitter to M.C.W. Turn the SUB. MOD. TONE IN control, 5RlO on the sub-medulater chassis, to its position of minimum gain (fully anti-clockwise), and then close the TEST KEY.
- (xix) Advance the SUB. MOD. TONE IN control, 5R20, until the modulation level as seen on the modulation monitor or the C.R.O. is 85%. Note that at this point the COMPRESSION meter should indicate 10 db. compression.

4.6 Setting up the Monitor Unit

It is assumed that this unit has been set up as detailed in section 4.4 (2) to check neutralising, and that the number of turns and position of the coupling coil have been set to give full scalp deflection of Meter A when its selector is set to CARRIER.

Set METER A solector to % MOD., and adjust carrier modulation to 50% as described in section 4.5.1 above. Check by means of an external C.R.O. and/or a Modulation Monitor. Then set the % MOD. SENSITIVITY ADJ. control (2R11) on the Monitor unit for a reading of 50 on METER A. Lock 2R11 at this setting. This adjustment should then held for all R.F. frequencies provided the turns and coupling of the pick-up ceil are adjusted to give full scale deflection on Motor A while set to the CARRIER position.

Note that when the METER A NCRM.-NEUT. switch is set to NEUT., the main H.T. supply is switched off and METER A is connected (regardless of the setting of its selector) to the neutralising circuit of the monitor. The NEUT. SENSITIVITY ADJ. control (2R2) should have been proviously set and locked in position (section 4.4 (2). Returning METER A NCRM.-NEUT. switch to NCRM. restores main H.T. supplies and connects Motor A into the circuit determined by its selector.

The LINE OUTPUT control is adjusted to provide the required level to the monitoring line (maximum 6 mW. in 600 chms using an audic voltmeter) when the transmitter is operating normally at 80-85% modulation. Lock the control in position and check on both A2 and A3 emission. Switch over to C.W. (A1), and check that when the key is closed a signal of 1000 cycles is applied to the line. Adjust the level of this signal as A2 and A3 emission by means of the MONITOR TONE IN control 5R7 on the Sub-modulator unit.

4.7 Local Control

4.7.1 Preliminary Connections

The hand key should be connected across terminals 6TSC2 and 6TSC1 (Drg. 5480CC1) for D.C. keying, and where keyed audio tone is used in conjunction with the electronic keyer, the hand key should be connected in series with the audio supply across terminals 6TSB3 and 6TSB4. The frequency of the audio keying tone may vary between 200 and 2,600 cycles, and its level from - 25 to + 15 dbm.

The speech frequency input should be connected across terminals 6TSB7 and 6TSB8, and the local pressto-talk switch across 6TSCl and 6TSC2.

A monitoring circuit may be connected to terminals 6TSB1 and 6TSB2.

4.7.2 C.W. Operation

- (i) Set the LCCAL/REMOTE switch to LCCAL, the C.W./M.C.W./R.T. switch to C.W., and the KEYING switch to D.C. or TONE as required.
- (ii) It is assumed that the R.F. Unit has been correctly tuned to the operating frequency of the installation. Set the MAIN H.T. STEP 1 and STEP 2 switches to ON, press the FIL. push-button, and after the FIL. pilot lights, press the H.T. ON button. The transmitter should now come into operation at full power.
- (iii) The transmitter may now be keyed by the keying relay 4REL17 from the local transmitting key or the presste-talk switch. The TEST KEY may also be used, but this operates directly in the R.F. cathodo circuit and does not operate the keying relay.

If the KEYING switch is set to TONE, the transmitter may be keyed, again by 4REL17, by means of the electronic keyer.

(iv) In all cases the monitoring circuit may be used.

4.7.3 M.C.W. Operation

- (i) Set the C.W./M.C.W./R.T. switch to M.C.W. and the KEYING switch to D.C.
- (ii) Bring the transmitter into operation as described in the first two paragraphs of Section 4.7.2.
- (iii) The tone escillator in the sub-modulator provides an M.C.W. tone of approximately 1000 cycles. Both the tone and the carrier signal may be keyed by the keying relay 4REL17 from the transmitting key provided the TEST KEY is left open.
- (iv) If desired the modulating signal only may be keyed by locking the TEST KEY in its operative position to bring on the carrier, and then applying the keyed tone by using the transmitting key as before.
- (v) The TEST KEY must be returned to its inoperative position before switching to C.W. or R.T.
- (vi) Note that the Electronic Keyer may be used with audio keying as for C.W. operation.
- (vii) M.C.W. operation may be obtained by keying an audio input to the speech input circuit of the sub-modulator while operating the transmitter under R.T. conditions (see below).
- (viii)In all cases the monitoring circuits may be used.

4.7.4 R.T. Operation

- (i) With the C.W./M.C.W./R.T. switch set to R.T. and the KEYING switch on D.C., the equipment is brought into operation as in the two previous sections.
- (ii) Close the press-to-talk switch, and apply speech frequencies to the modulator input circuit.
- (iii) If the press-to-talk facility is not required the transmitting key may be permanently closed to maintain carrier emission.
- (iv) M.C.W. emission may be obtained while set up for R.T. operation by keying the required tone frequency (200-2600 cycles) and the carrier together. The carrier is keyed via the press-to-talk circuit, and the audio tone must be keyed simultaneously by external means.

4.8 Remote Control

4.8.1 General Precautions

- (i) The C.W./M.C.W./R.T. switch on the Transmitter must be left set to R.T. when operating under remete control so that the remete control relay 4REL14 will provide changeover from C.W., to R.T.
- (ii) Changeover from D.C. to TONE keying must be carried out at the transmitter, and then the same circuit used at the remote control point for C.W., M.C.W. and Press-to-talk keying unless the transmitter can be manually switched over each time the emission type is changed.

4.8.2 Setting Up

Remote control of the equipment is carried out via a set of twelve lines, and these should be connected to the terminals 6TSB1 to 6TSB4 inclusive, and 6TSA1 to 6TSA8 inclusive as shown on the interwiring diagram 5480CC1.

The actual equipment used for control at the remote point is unimportant provided the switching functions are correct. Six of the lines are used in conjunction with the controlling relays of the transmitter, and the remaining three pairs are used to connect audio or speech signals to the sub-modulator, provide a monitoring line from the transmitter, and connect keyed audio tone to the electronic keying unit.

4.8.3 Rolay Control

The six lines associated with the controlling relays provide five control circuits, one of the lines being a common return circuit for all. The relays are then controlled by the application and removal of 48V. D.C. to the controlling lines as indicated below.

paperson and the second	a marina de la marina marina de caração de marigines es de cara de caração de caração de caração de de caração de caraç	
Line	48V. D.C. ON	48V. D.C. OFF
Fil. (6TSA1)	Fils. D.C. ON	Fils. OFF
H.T. (6TSA2)	H.T. ON	H.T. OFF and O/LOAD RESET
Emission (6TSA3)	M.C.V. or R.T. chission depending on setting of C.W./M.C.W./R.T. switch on R.F. unit. Note that both M.C.W. and R.T. may be obtained by setting to R.T., and keying a tone signal on the sub-mod. input line.	
Crystal	CRYSTAL 2	CRYSTAL 1
D.C. Keying	D.C. KEYING and Press-to-talk	Key or P.T.T. Open

5. MAINTENANCE

5.1 Radio Frequency Unit

Very little maintenance should be needed, at frequent intervals the readings of all meters should be noted and compared with the typical figures given in sub-section 5.7, or on the Test Report supplied. This will give early warning of deterioration. Suspected valves are best tested by substitution of a good spare. At longer intervals a complete visual examination of each unit should be made to detect any over-heating in components.

Control shafts and gearing should receive an occasional application of light oil, taking care that it does not reach leads or switch contacts. Squeaks in Oak type switches can be eliminated by lightly oiling the clicker plate.

Switch contacts may be cleaned and lubricated by brushing them with a solution consisting of one part of Lancline by volume to twolve parts of carbon-tetrachloride. Adjustment to Cak switch contacts is not recommended, and if a faulty contact develops, the whole wafer should be replaced.

5.2 Power Unit

In this Unit, maintenance will largely consist of routino examination of relays for contact wear and looseness, and the replacement of pilot lamps, which should be done as soon as a lamp burns out, in order to prevent incorrect interpretation of the lamp signals.

The valves in the various rectifiers will normally be checked by the periodical rating of current readings mentioned in 5.1 above. Spare 866A/866 and 872A/872 mercury vapour rectifiers may be "run-in" by operating for at least 30 minutes with only the filaments alight. They may then be carefully stored in a vertical position ready for immediate use as a replacement. One spare of each type should be kept in the spare sockets in the Power Unit, ready for immediate use.

Adjustment of the thermal delay relay is described in sub-section 5.3.

Dirty contacts on any rolay should be cleaned with a suitable solvent or burnishing tool. Contacts which are burnt or pitted may be trimmed with a magneto file, but othorwise, files or coarse abrasives must not be used. Where possible, badly pitted contacts should be replaced. Relays should also be checked for loose contacts or connections and in the A.C. operated types the pole faces and armature must be kept clean and square to each other to prevent chattering.

Coil Replacement on Series B8365 Relay

- (i) Take off the cover, and remove the flash screens from between the contacts.
- (ii) Remove the serew joining the areature to the bar carrying the contact fingers.
- (iii) Romove the return spring from the armature, which can then be swung back to clear the coil.
- (iv) Remove the coil clamping fingers after taking off the nuts securing them.
- (v) Unsolder the connections to the coil and remove the coil from the pole pieces.
- (vi) Fit the new coil and re-assemble by reversing these operations.

Coil Replacement on Series B50686 Relays

- (i) Romove the return spring from the heel of the armature taking care not to distort the spring or spring hooks.
- (ii) Unsolder the coil leads from the terminal tags.
- (iii) Remove the large screw holding the core to the relay base.
- (iv) Lift the armature from location and remove the core and coil as one unit.
- (v) Remove the core from the coil.
- (vi) When the new coil is fitted to the core, re-assemble by reversing these operations.

5.3 Adjustment of Thermal Dolay Relay 4REL10

On this relay, 4REL10, the adjusting scrow projects from one side so that it is unnocessary to remove the cover to time the relay. The delay time is REDUCED by tuning the adjusting scrow CLOCKWISE, and INCREASED by turning it ANTI-CLOCKWISE. If the timing has been completely upset, the following will give an average delay time of about 30 seconds which can then be more closely adjusted by timing against a watch.

- (i) Withdraw the Power Unit from its base, open the right hand side door and swing out the hinged relay panel. Do NOT switch on the H.T. supplies.
- (ii) Slacken the lock-nut on the adjusting screw and turn the screw slowly CLOCKWISE until a distinct click is heard. The contacts are now just closed and there is no delay period.

- (iii) Turn the screw slowly ANTI-CLCCKWISE until the click is again heard. The contacts are new just opened, but the delay period is very short.
- (iv) Turn the scrow a further half-turn ANTI-CLOCKWISE and tighten the lock-nut. This should give an operating time of approximately 30 seconds.

To check the timing, press the FIL. ON butten and measure the time that elapses until 4RELIL closes. Thus should be approximately 30 seconds. If substantially greater or less, say plus or minus 10 seconds, switch off and turn the adjusting screw a very small amount CLOCKWISE or ANTI-CLOCKWISE respectively. Recheck the timing, and if necessary, make further small adjustments until the correct timing is obtained. The element must be allowed time to cool after each adjustment, otherwise false operating times will be obtained.

5.4 Adjustment of Thornal Rocurrent Cverload relay 4REL6

This relay is of the same type as 4PEL10 described in Section 5.3, and is adjusted to operate and switch off the H.T. rectifiors in the Power Unit after three successive everloads in the Main H.T. circuit.

Procedures

- (i) Withdraw the Power Unit from the base, and with both side doors open bring the transmitter into operation at full power.
- (ii) Momentarily depress the armature of the 3,000 type H.T. overload relay 4RELL to stimulate everload conditions, and note that the transmitter will imediately reduce to low power for a period of 3 seconds and then return to normal high power operation.
- (iii) Again operate 4REL1 and check that the same sequence takes place.
- (iv) Operation of 4REL1 after full power has been restored for the third time should operate 4REL6 to switch off all H.T. rectifiers in the Fower Unit.
- (v) If the number of overleads that are allowed before 4REL6 operates is more or less than the required three, then 4REL6 should be adjusted by means of the knurled screw projecting from the case, and then locked in position by the lock-nut provided.
- Note: After 4REL6 has operated and the H.T. rectifiers have been switched off, the transmitter cannot be again switched ON until after the thermal element of 4REL6 has cooled, and the O/L RESET button operated.

5.5 Adjustment of 3000 type Relays

The adjustment of all these relays is normal as required by the relevant P.M.G. specifications, but NOTE the following with reference to those relays operating micro-switches.

Rosidual Air-gap - Nominal 12 mils., + 2 mils.

Armature travel - Nominal 31 mils., ± 2 mils.

Micro-switch Lever Prossure

Pointer of tension gauge placed on side of operating lever adjacent to the point where it rests on the armature bush. Pressure required to lift lever and operate micro-switch should be between 145 and 250 grammes.

Armature Operating and Roleasing Clearance -

There should be a minimum of 4 mils movement of the armature after the micro-switch operates (measure between core face and tip of residual scrow or stud) and a minimum of 4 mils movement of the armature after the micro-switch resets (measure between armature backstop and yoke of relay). Adjust by bending leaf spring operating micro-switch, but note that this spring shall be bent in such a way as not to distort the normal appearance.

Rolay 4REL1 (Main H.T. Overload relay)

Additional adjustment may be necessary to the residual air-gap of this relay to make it function correctly under operating conditions. It is necessary to increase the loading on the main H.T. rectifier output to assimulate an overload in order to operate 4RELL. Check the operation of the triple tripping action, and note the operation of 4RELL. If 4RELL sticks in, increase the residual air-gap by adjustment to the residual air-gap serow until the relay operates correctly. Note that if the air-gap is made too great 4RELL will chatter, the final setting being intermediate between the "chattering" and the "sticking in" positions of the screw. Generally the gap will increase from a nominal 12 mils. to approximately 20 mils.

5.6 Adjustment Procedure for Keying Relay Type B50089

(i) Slacken off the armature mounting bracket and contact adjusting screws.

- (ii) Tighten the spring tensioning nut to the maximum possible, and then slacken off one complete turn. Lock this setting with the locking nut provided.
- (iii) Insert a ,002" fooler gauge between the armature and both pole faces. Press the armature firmly against the feeler gauge, and adjust the mounting bracket until it bears against the armature. Firmly tighten the holding screws.
- (iv) With the feeler gauge still inserted, scrow the make contact in until the armsture just bends with the pressure; tighten the locking scrow.
- (v) Adjust the contact spacing to .003" by inserting a .003" feeler gauge between the armature contact and the "make" contact, and then screwing in the space contact until the feeler gaugesis just held. Lock the helding screw.

5.7 Typical Operating Currents and Voltages

The following are typical figures intended mainly as a guide to correct operation. For exact details refer to the Test Report supplied with each transmitter.

5.7.1 R.F. Unit

CARRIER FREQUENCY

METER A 2	<u>Mc</u> . <u>10</u>	<u>Mc</u> . <u>10</u>	<u>Mc</u> . <u>20</u>	Mc.
OSC. CATH. 3 AMP. 1 CATH. 4 AMP. 2 CATH. 8 AMP. 3 CATH. AMP. 4 GRID 2.5 AMP. V2 SCREEN 4 AMP. 4 V3 SCREEN 4 AMP. 4 V2 CATH. 55 AMP. 4 V3 CATH. 55	mA. 26 mA. 38 mA. 2.5 mA. 4 mA. 4 mA. 55	nA. 20 30 mA. 2.5 nA 4 mA. 4	mA . 40 mA . 45 mA . 5 mA . 5 mA . 5 mA . 70	
METER B	Mc. 10	<u>Mc</u> . <u>2</u>	O Mc.	•
MOD. AMP. GRID MOD. AMP. CATH V4 2 MOD. AMP. CATH V5 2 MOD. AMP. TOTAL	.50 mA. 25	0 mA. 2	75 mA. 50 mA. 50 mA.	
CATH. 5 MONTTOR 2 BIAS H.T. 2 MINOR. H.T. 6 MAIN H.T. 15	2.2 mA. 2. 205V. 20 33 OV. 62	.1 mA. 2 05V. 2 00V. 6	.0 mA. :00V. :10V.	*
KEYER VI V2 KEYER V4	3.0 mA. 3.	OmA. 3	O mA.	· · · · · · · · · · · · · · · · · · ·

5.7.2 Power Unit

METER A	OW. Oww. Mod.	RT. 90% Mod.
TONE OSC. CATH. AMP. 1 (5V2) GATH. AMP. 1 (5V3) CATH. AMP. 2 ANODE AMP. 3 ANODE AMP. 4 (5V8) ANODE AMP. 4 (5V9) ANODE MOD. (4V10) CATH. MOD. (4V11) CATH. MOD. CATH. TOTAL.	2.0 mA. 4.0 mA. 4.0 mA. 11 mA. 11 mA. 8 mA. 8 mA. 20 mA. 20 mA. 40 mA.	0 mA. 4.1 mA. 4.1 mA. 11 mA. 11 mA. 14 mA. 150 mA. 150 mA.

5.7.3 Bias Voltagos

The figures given are for static condition i.e., those measured between earth and the appropriate taps on the dividers 4R17, 4R18, 4R19 of the Bias Rectifier.

Sub-modulator	-	1.05V.
Modulator	two.	40V.
R.F. Amp. 3 & 4	906	75V.
Mod. Amp.	****	80V.
Koyor	P-6	46V.

5.7.4 Screen Voltagos

Those Voltages are measured with a high resistance (1000 ohms / V) voltmeter between earth and the appropriate clips on divider 1R6 in the R_*F_* unit.

Carrier Frequency

<u>Valve</u>	2 Mc.	<u>5 Mc</u> .	10 Mc.	10 Mc.	<u>15 Mc</u> .	20 Mc.
AMP. 1 & 2	20V.	70V.	150V.	9 OV .	130V.	165V.
AMP. 3	man men	test enne	ent tod	150V.	25 OV .	280V.
AMP. 4	795V.	220V.	240V -	190V.	220V.	24 OV .

5.7.5 Miscellaneous H.T. Supplies

These voltages are measured with a high resistance (1,000 chms / V) voltmeter between earth and the appropriate terminals.

Electronic Keyer H.T.	tess	280V.
Monitor Control H.T.	wa	80V.
Monitor line Amp. H.T.	mo	1200.
Tone Oscillator H.T.	***	380V.
Regulator 807 Anode	606	66CV.
Regulator 807 Cathode	Date	39 OV 。
Metal Rectifier 4V1 H.T.	500	5 OV 。
Metal Rectifier 4W2 H.T.	em)	5 OV .

5.8 Complete Typical Voltage Analysis

Note: These readings are typical only, and where possible reference should be made to the Test Report Shoet for the particular transmitter. The readings given below have been taken in a 1,000 Ω/V meter, set to the highest convenient range.

All screen and grid voltages are as measured at their by-pass points.

5.8.1 Power Unit

(a) Sub-Modulator

 5V1
 Anode 225V.

 Sot to M.C.W.,
 Screen 114V.

 85% Mod.
 Cathode 1.5V.

. 5V4
C.T. of T2 transwinding 235V.
Cathodos 9.2V.

<u>575</u>

10 db. compression Cathode Bias at C.T. of (t2) of 7500 Ω winding of 5T3. 39.4V. at electrodes 38.8V.

5V6 Cathodo (5) 14.6V.
Anodo (7) 14.4V.
Bias Supply 5TSA13 +28.5V.
5TSA14 -28.5V.

Anodes 273V.
H.T. at pri. C.T. 274V.
(t2) of 5T6
Cathodes 10.6V.

APP ATTEMPT	And the second	5 <u>V8</u> 5 <u>V9</u> (as for 5 <u>V7</u>)	Grid Bias at sec. C.T. (T2) of 5T6 Anodes Cathodes	-105V. 368V. -43.4V.
(b)	Modulator	•		
		<u>5V10</u> <u>4V11</u> (as 5V7)	Anodes Br at C.T. of 4T3 Bias C.T. Grid	1800V. 1810V. -44.3V. -43.5V.
(c)	Rectifier	9		
	М	ain Rectifie	r	•
•	M.C.W. Key down mod. 85%	4V2) 4V3)	H.T. filter input (C.T. of 4T1) Anodes H.T. filter output	1980 2000V. A.G. 1790
	<u>N</u>	linor Rectifi	er ·	
		<u>4V6</u>) <u>4V7</u>)	H.T. filter input (C.T. of 4T4) Anodes H.T. filter output	624 725V. A.G. 610
	Ŗ	egulators		
		<u>4V9</u>	Anode Screen Cathode (with 4R14 set to 16.0 mA.)	610 600 310
		- 474 **********************************	Anode	111
	Ī	Bias Rectifie	<u>ir</u>	
		<u>4V5</u>	H.T. filter in (cathode of 4V5) Anodes H.T. filter output	5.5 275V. A.G. -210
	·	4R17, tap 4R18,tap 1 tap 2 4R19, tap tap	1	-130 -55 -103 -50 -105

5.8.2 R.F. Unit					
(a) R.F. Applifie	rs	2 Mc.	<u>lO-Mc</u> .	LO MC	20 Mc.
1V8 C.W. key down	Anode Cathode (across 1R46)	105	105	105 0.7	105
1V7	Anodo Screen Cathode	620 35 2,2	615 152 13,7	615 87 6.0	600 162 15.0
IV6	Anode Screen Cathode	625 29 _• 0 4 _• 6	625 135 20	620 88 14 , 5	620 150 21.5
171	Anode Screen Cathode			615 120 14,25	620 260 26.75
1V2 1V3	Anodes Screens Grids	615 175 -83	612 220 -83	610 175 - 91	600 200 90
1V4 1V5	Anodes Control Grids	2110	2100 -186	2100 -193	2100 . - 193
(b) Electronic Ke	ey er				
3V1	Anode Screen Cathode	70 61 1.3			
3V2	Anode Screen Cathode	205 33.0 0.4			,
	Unkeyed	& Keyed	60 bauds	<u>Unkeyed</u>	<u>Keyed</u>
3V3	Anode Cathode			=45 =0.8	-49 -2 ₅
3V4	Anode Screen Cathode			280 280	175 175 0,2
(c) Monitor				•	
2V2	Anode (! Anode (: Cathode		•	125 85 5.0	

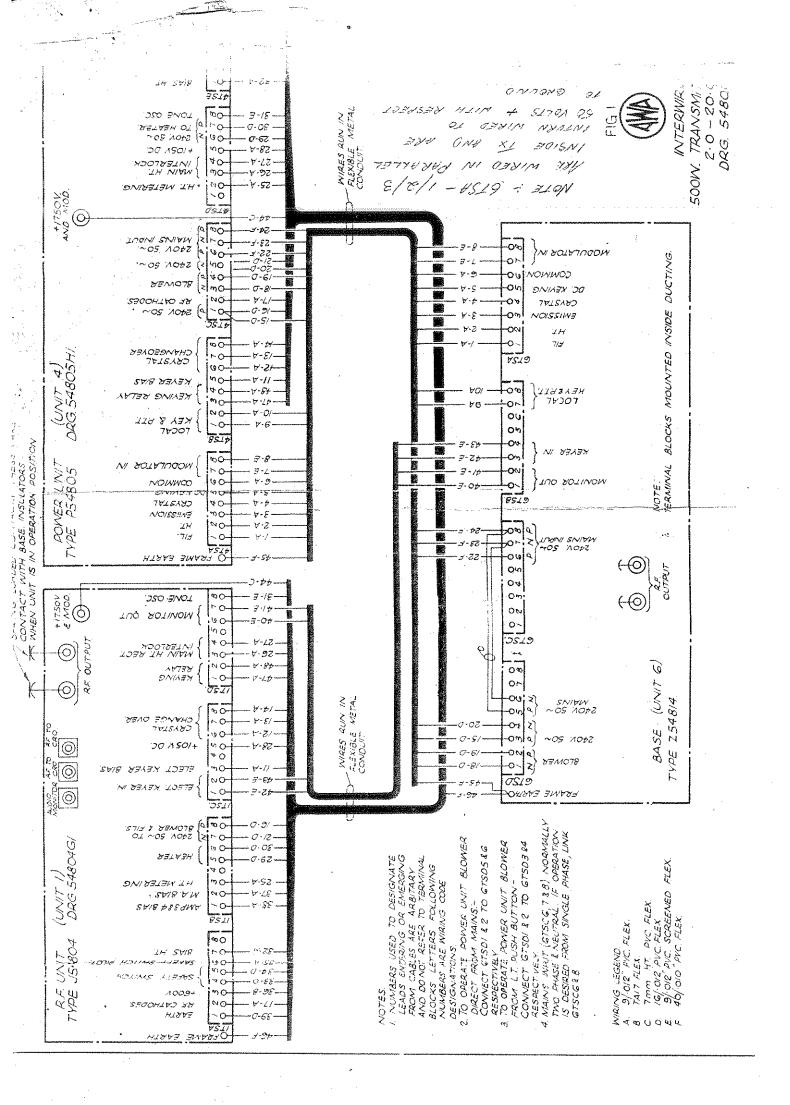
6. COMPONENT SCHEDULE

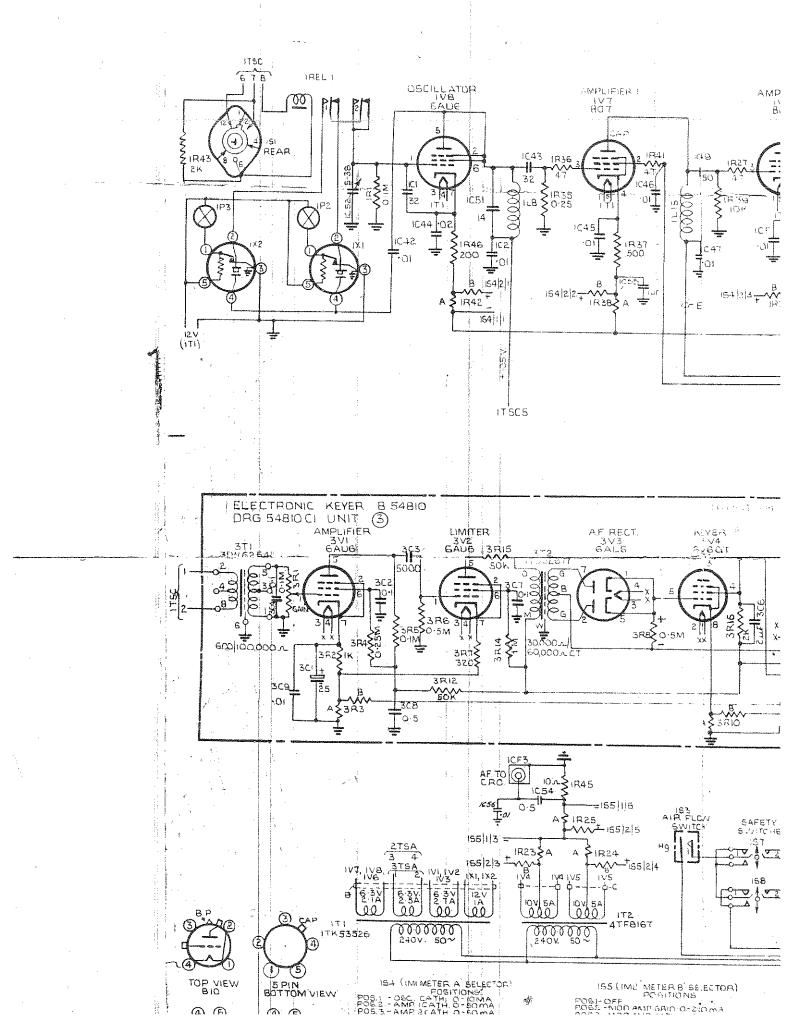
6.1 <u>Introduction</u>

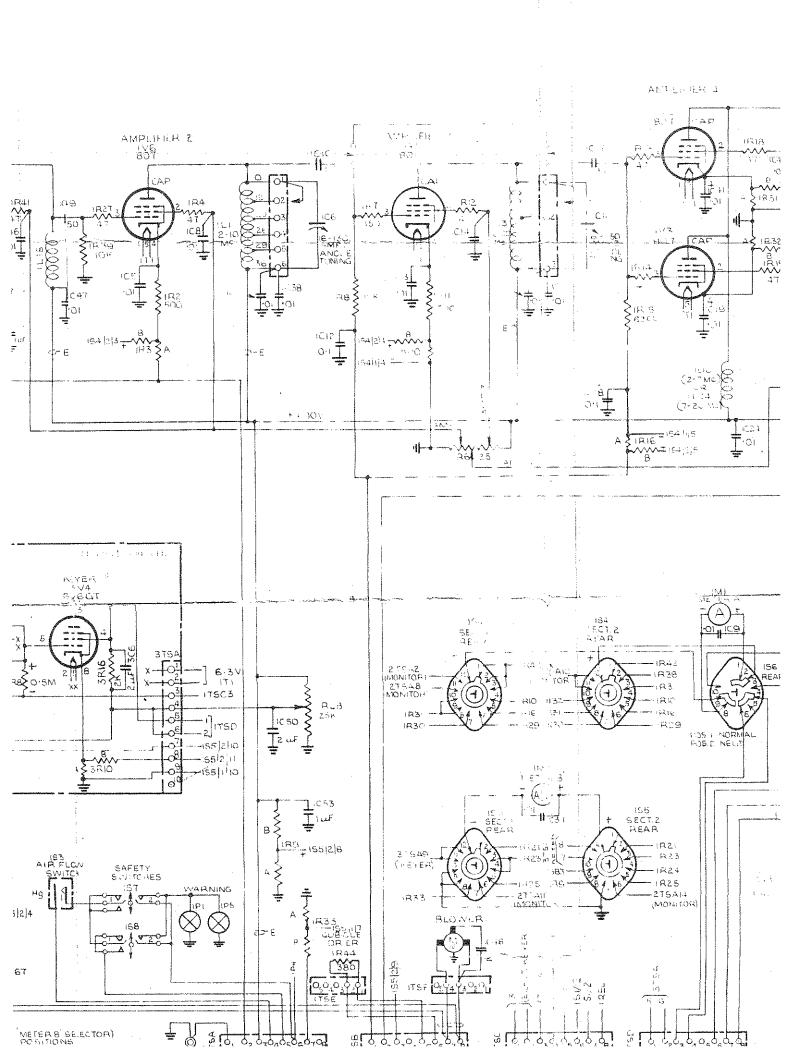
The following schedule gives all electrical components in Installation J54800.

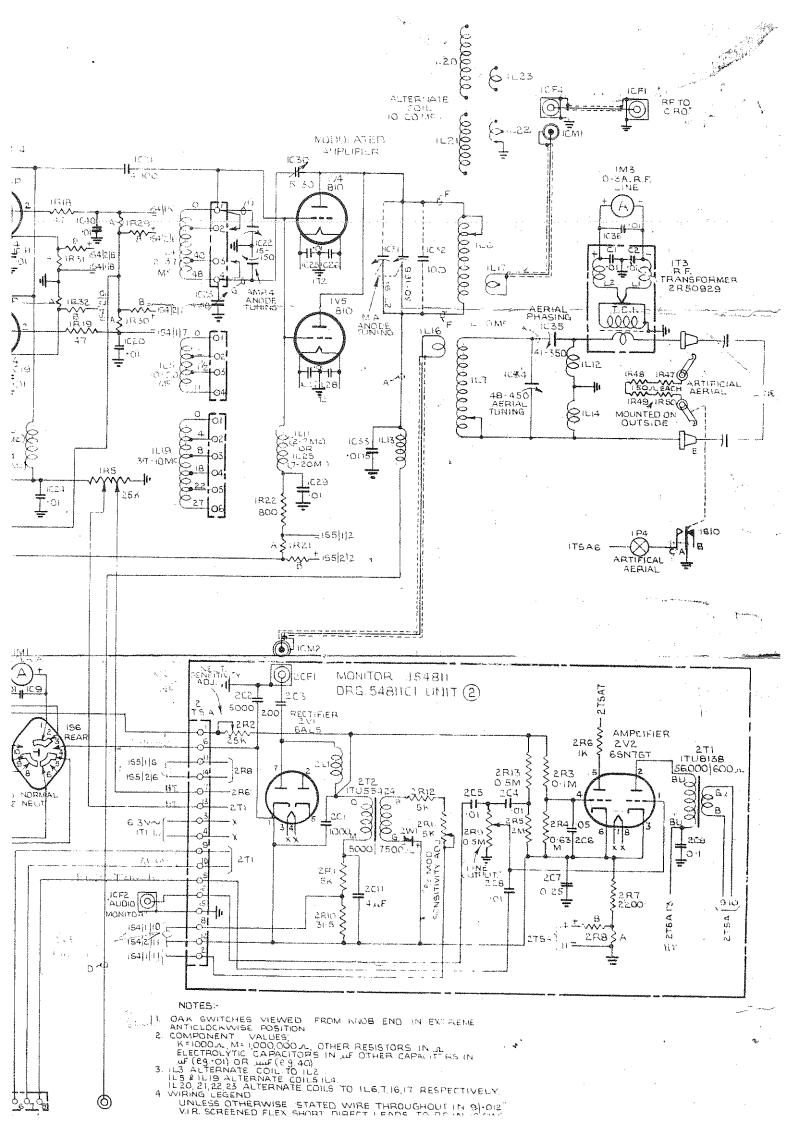
Since the circuit reference number of each component incorporates a prefix number, the Panel or section of the equipment to which it belongs can be easily determined. Therefore, in the schedule, all basic types of components are listed in alphabetical order and the individual components are grouped in numerical order of prefix and circuit reference number. The following tabulation gives the significance of the prefixes.

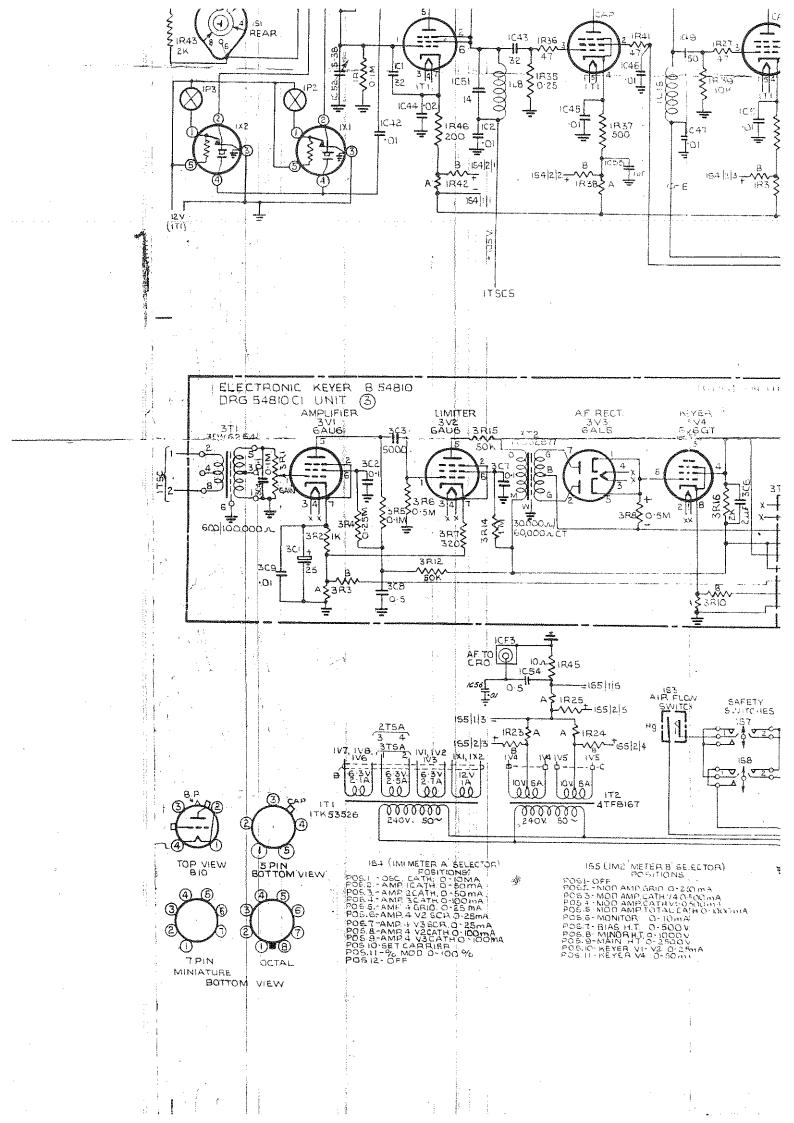
PREFIX	PANEL OR SECTION OF EQUIPMENT
***	3 Kc. Low Pass Filter Mtd. in Sub-modulator.
1	R.F. Unit J54804
2	Monitor Unit J54811
3	Electronic Keyer B54810
4	Power Unit P54805
5	Sub-Modulator G54806

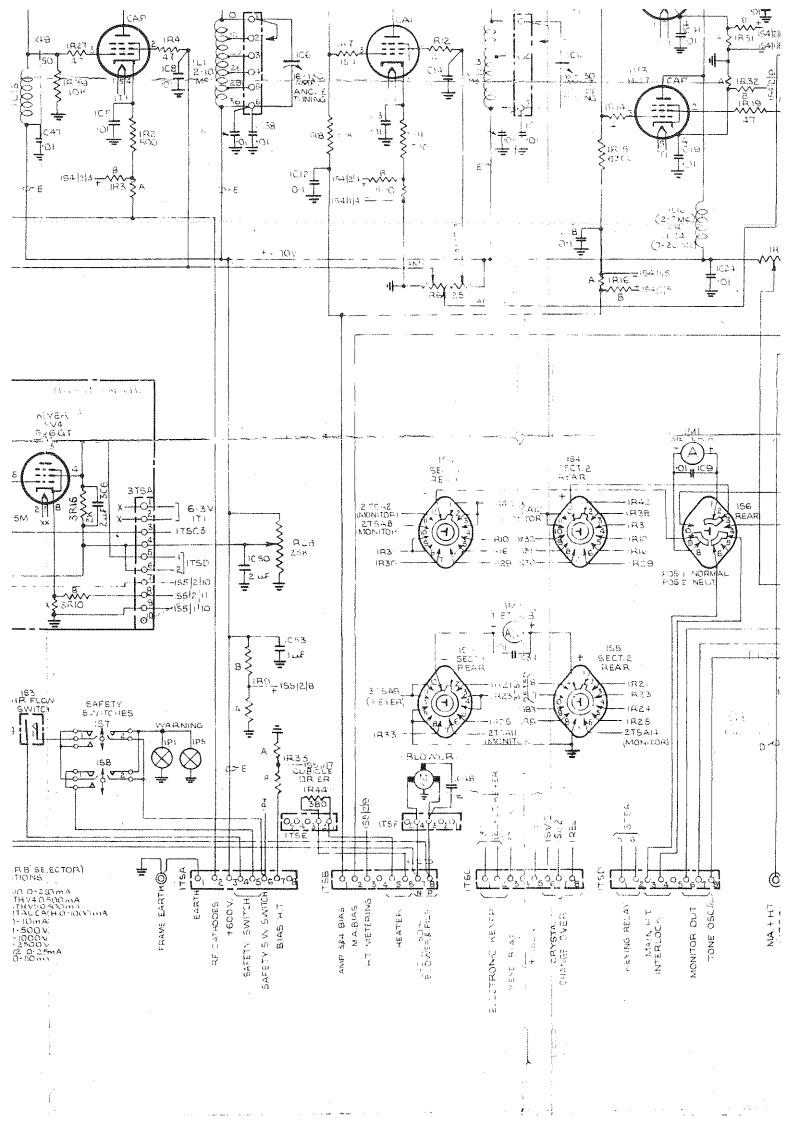


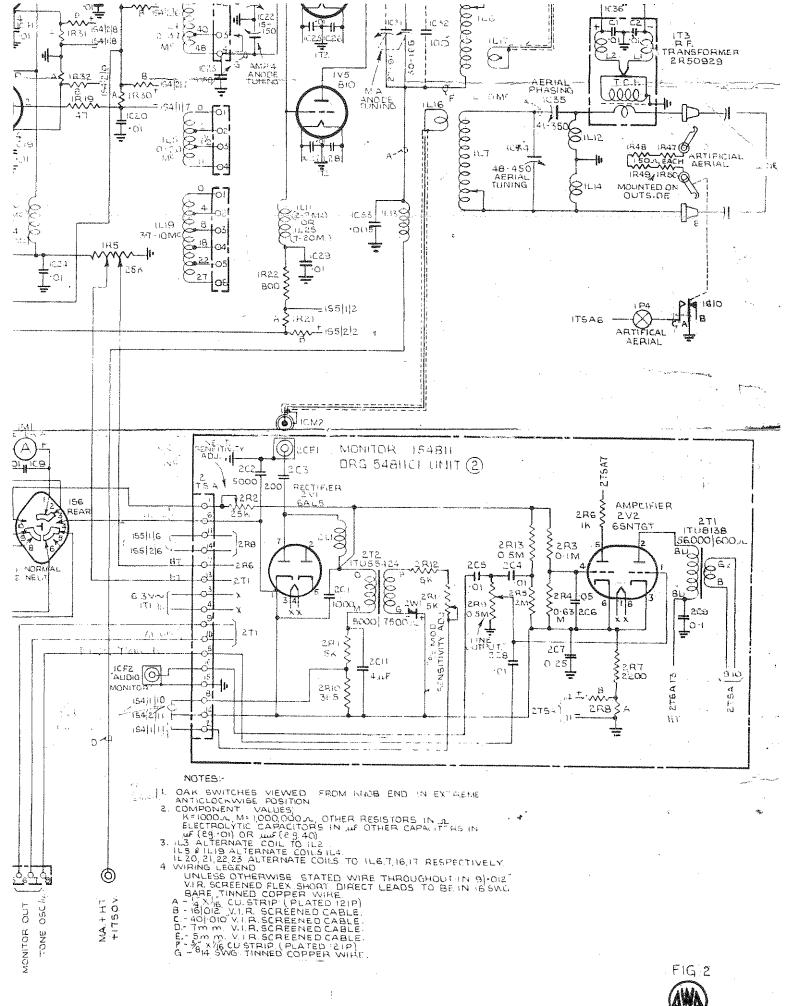




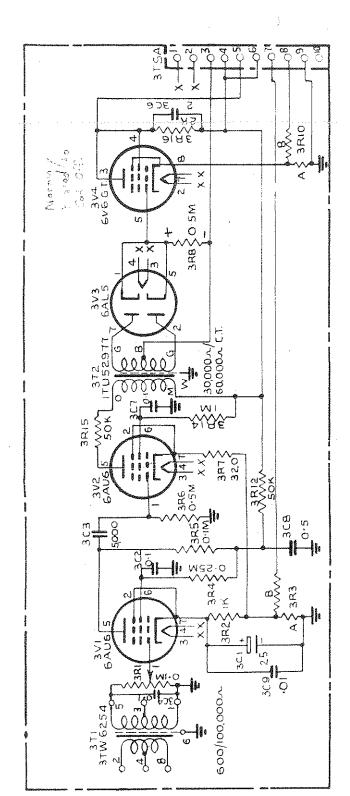


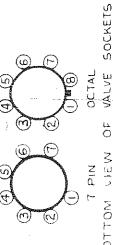






CIRCUIT RF. UNIT J54804 DRG 54804 AI

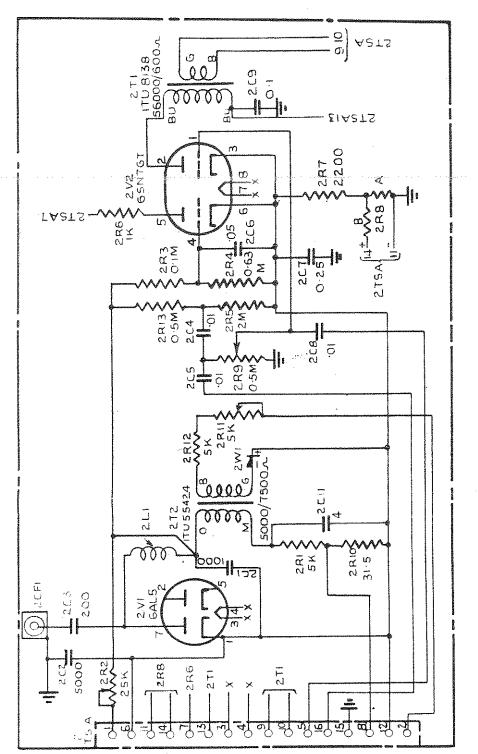


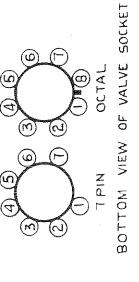


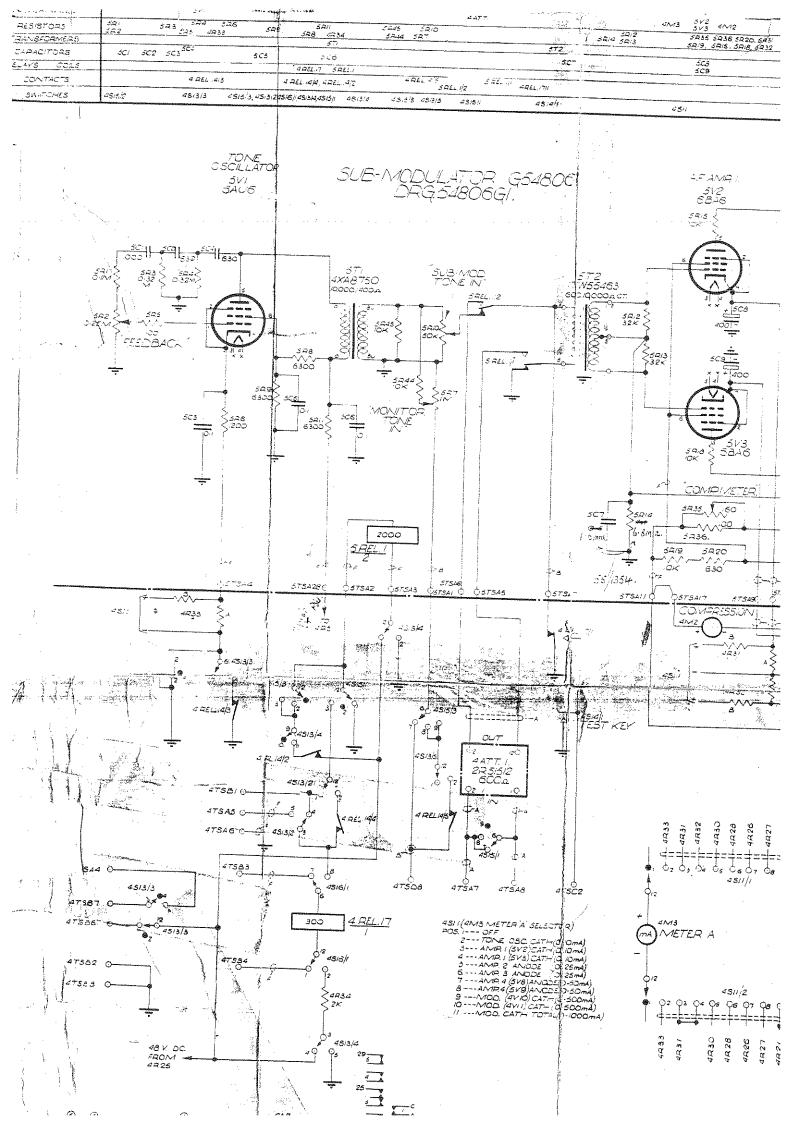
BOTTOM VIEW OF K = 1000 A M = 1000,000 A OTHER RESISTORS IN A CAPACITORS IN MF (89.01) OR LUMF (89.5000.)

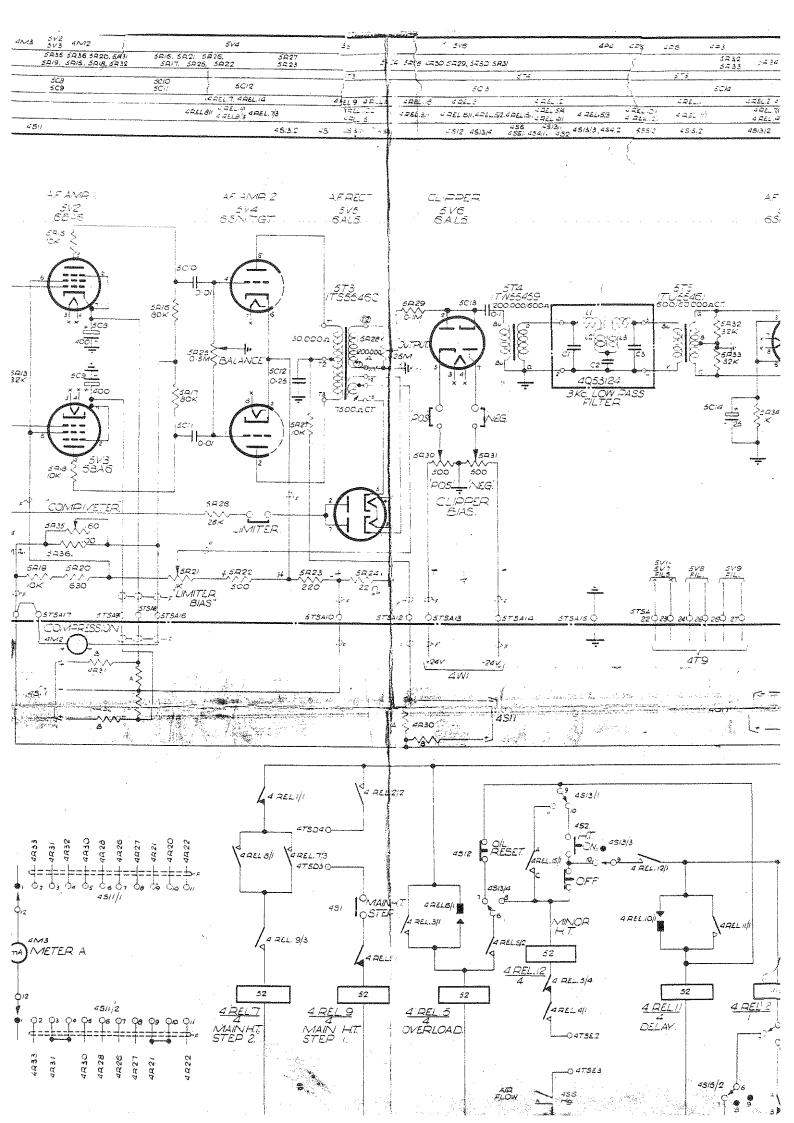
COMPONENT VALUES

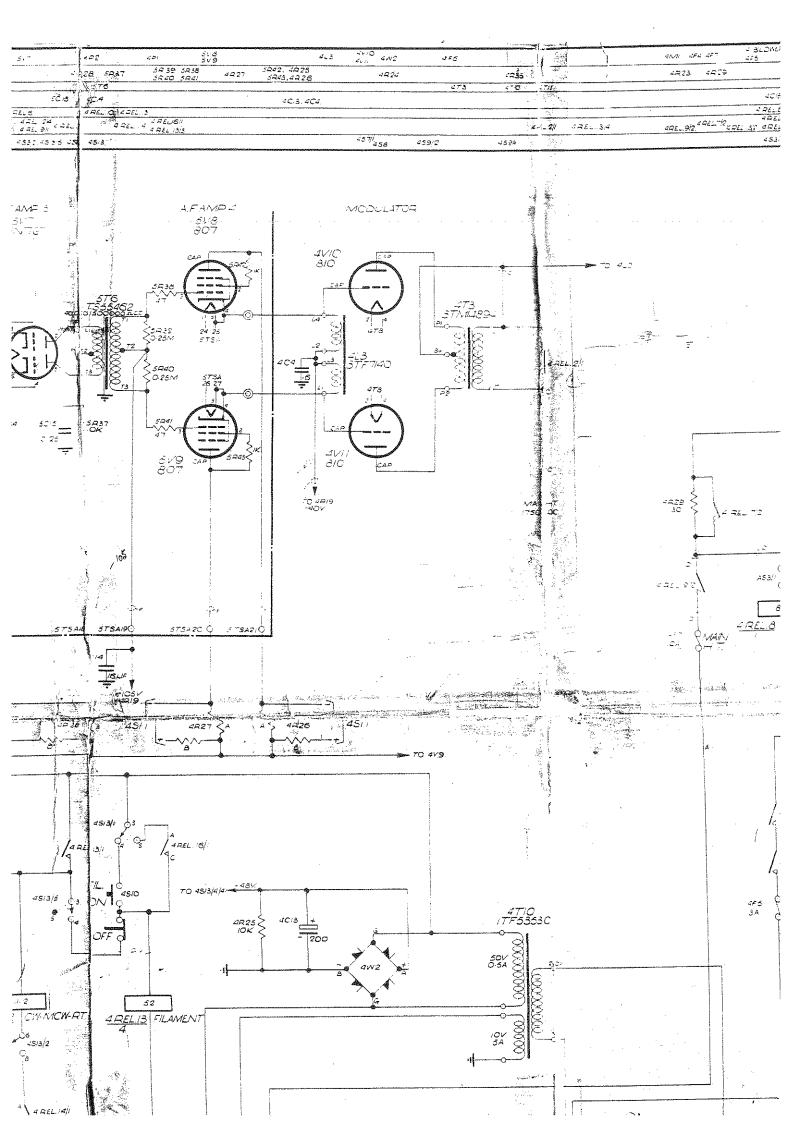


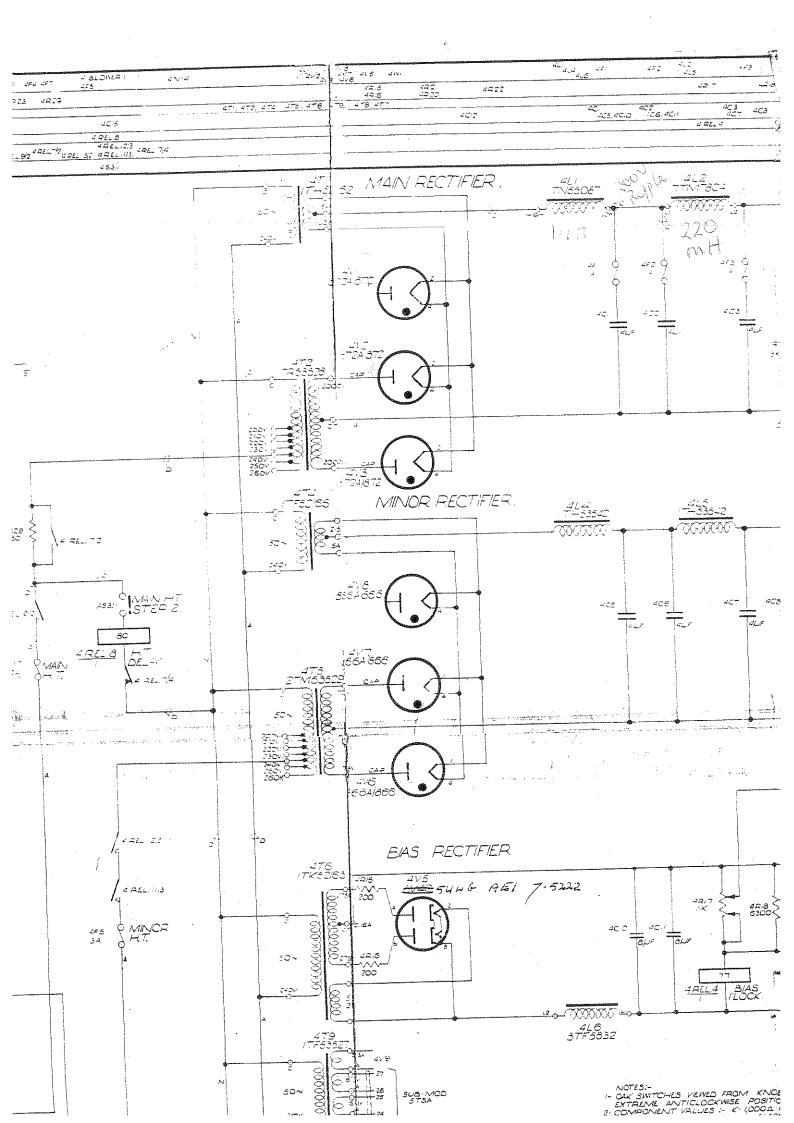


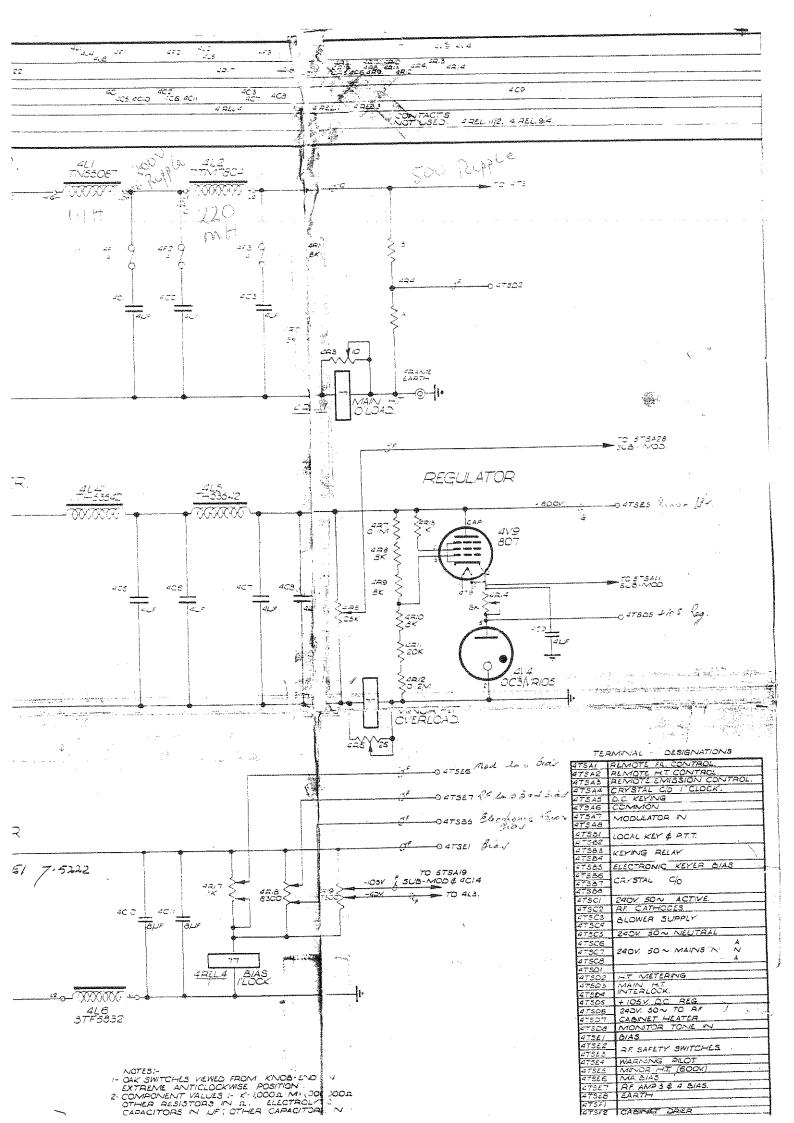


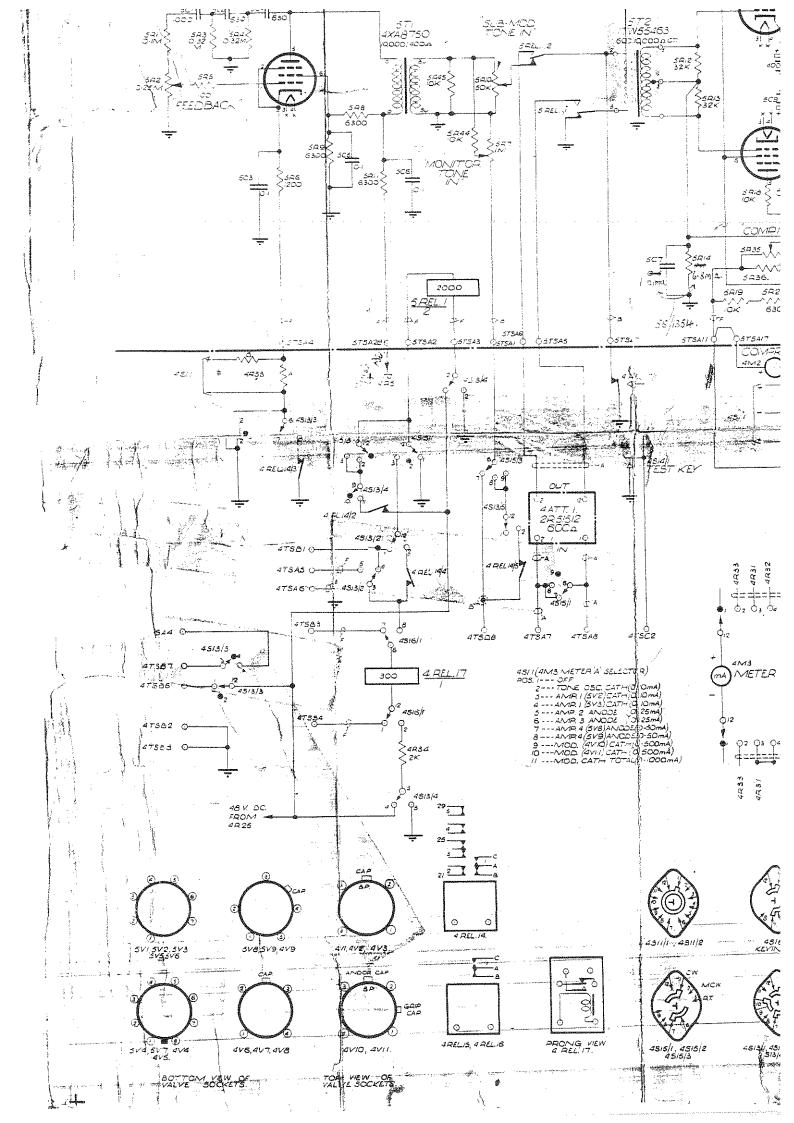


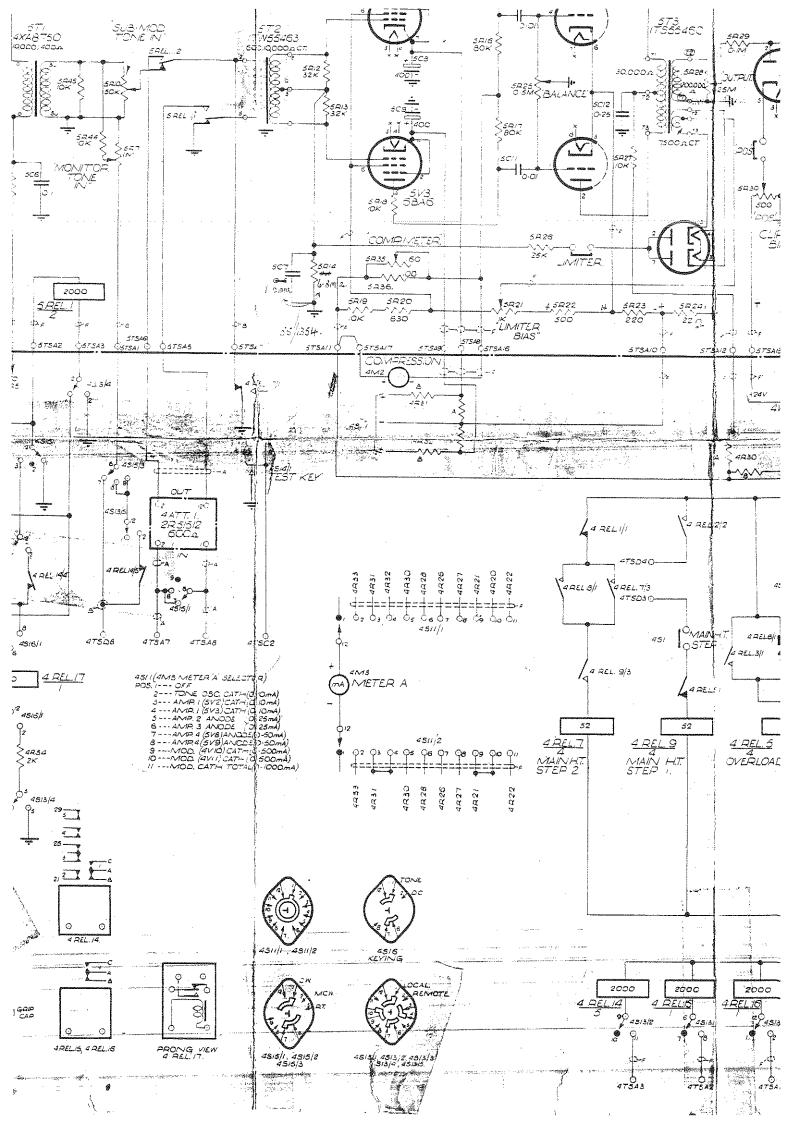


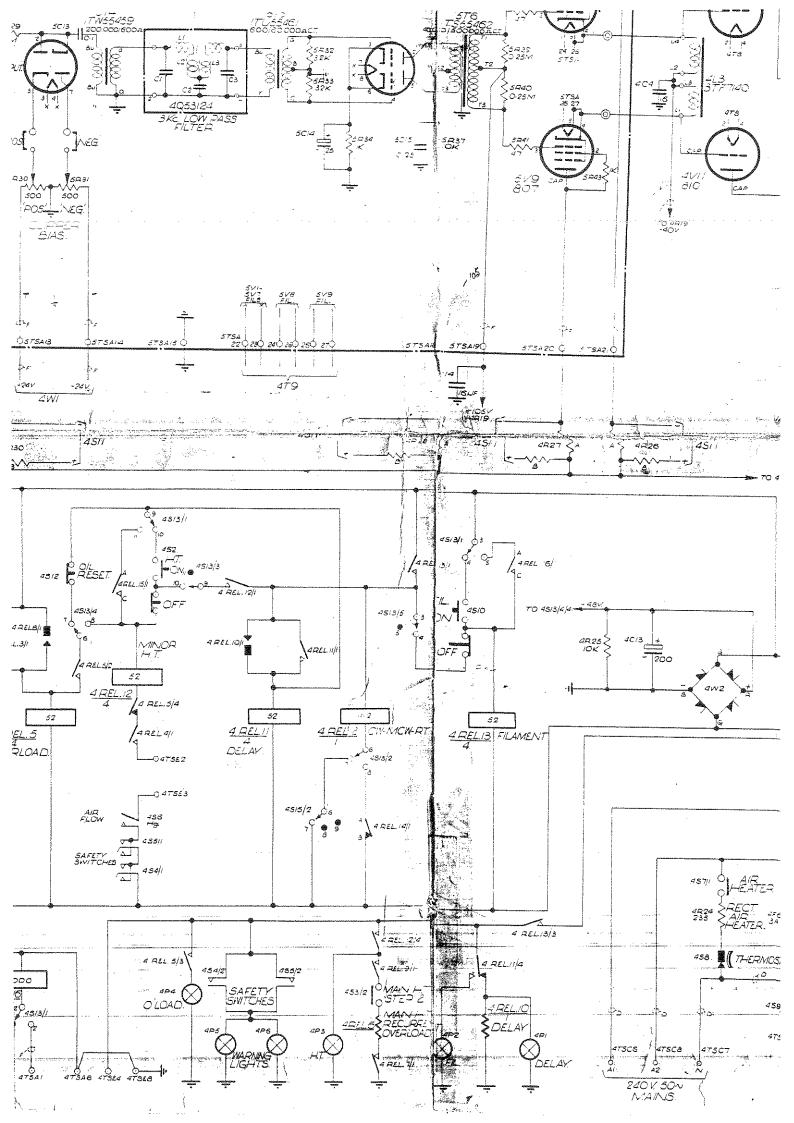


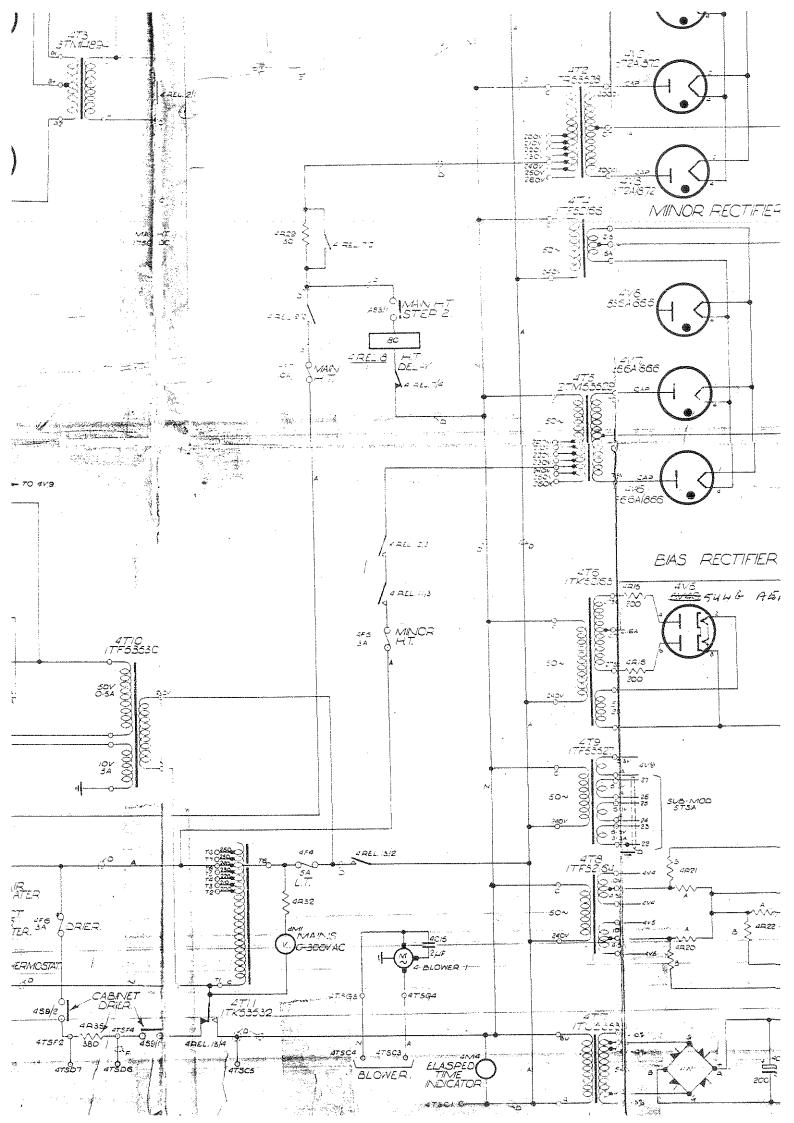


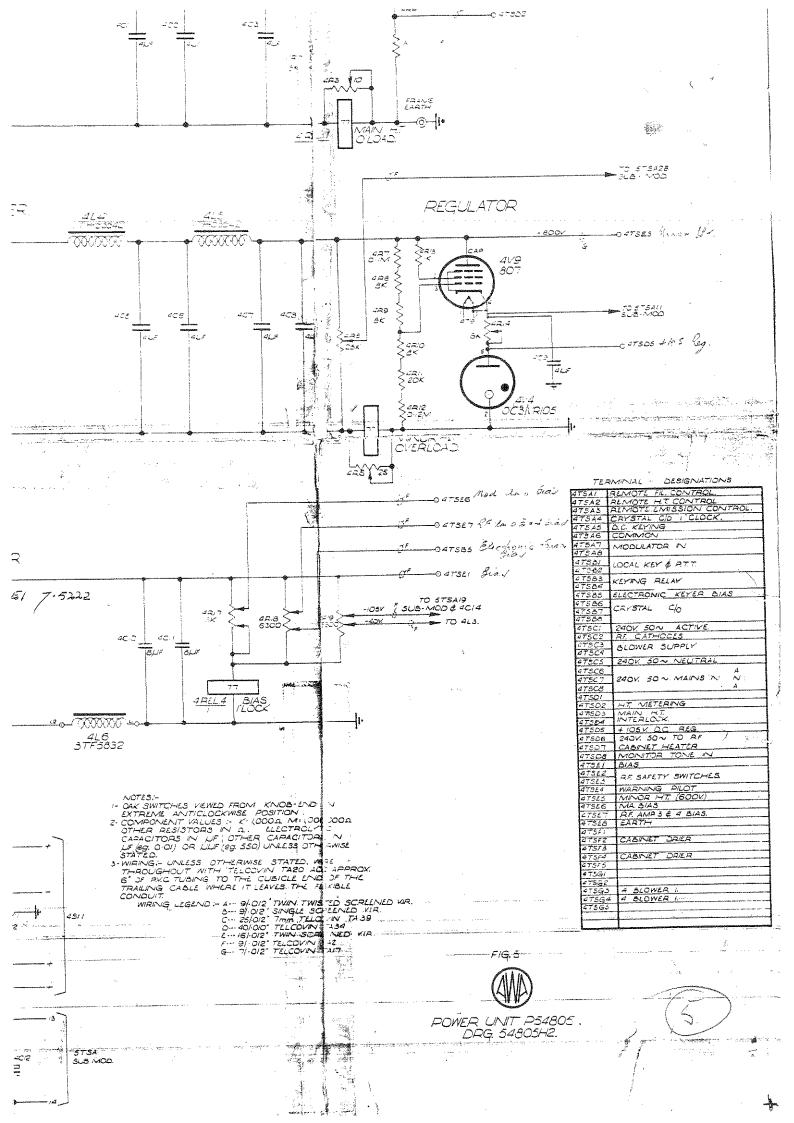


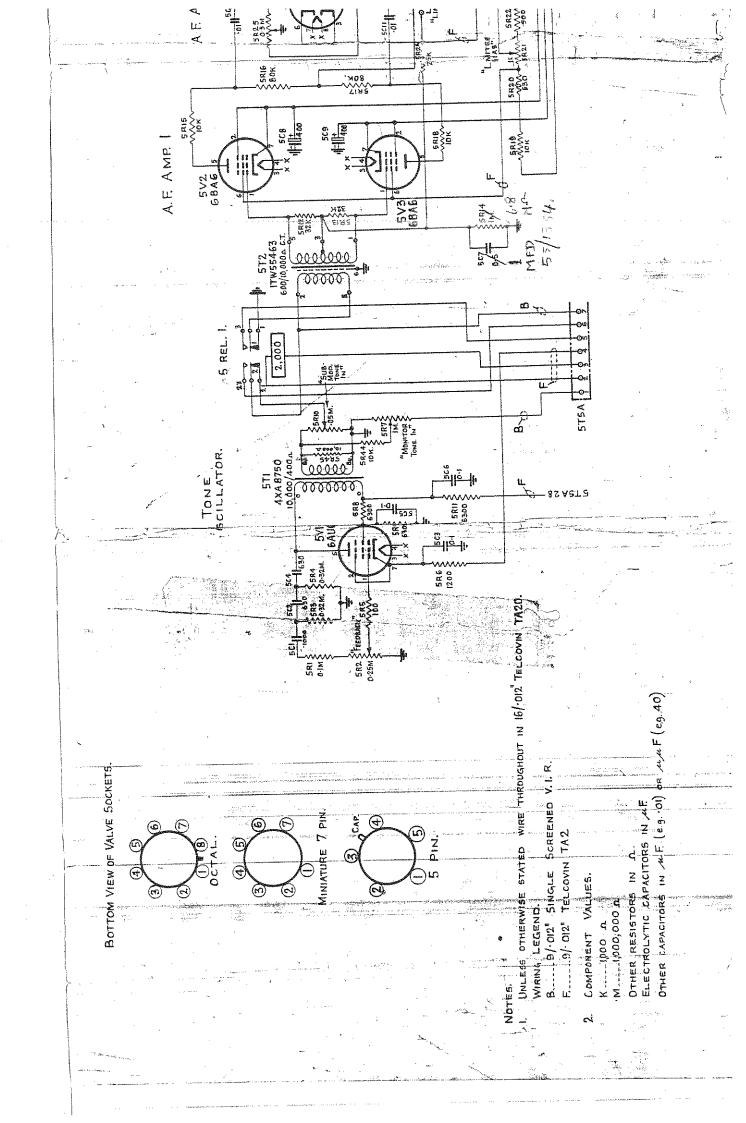


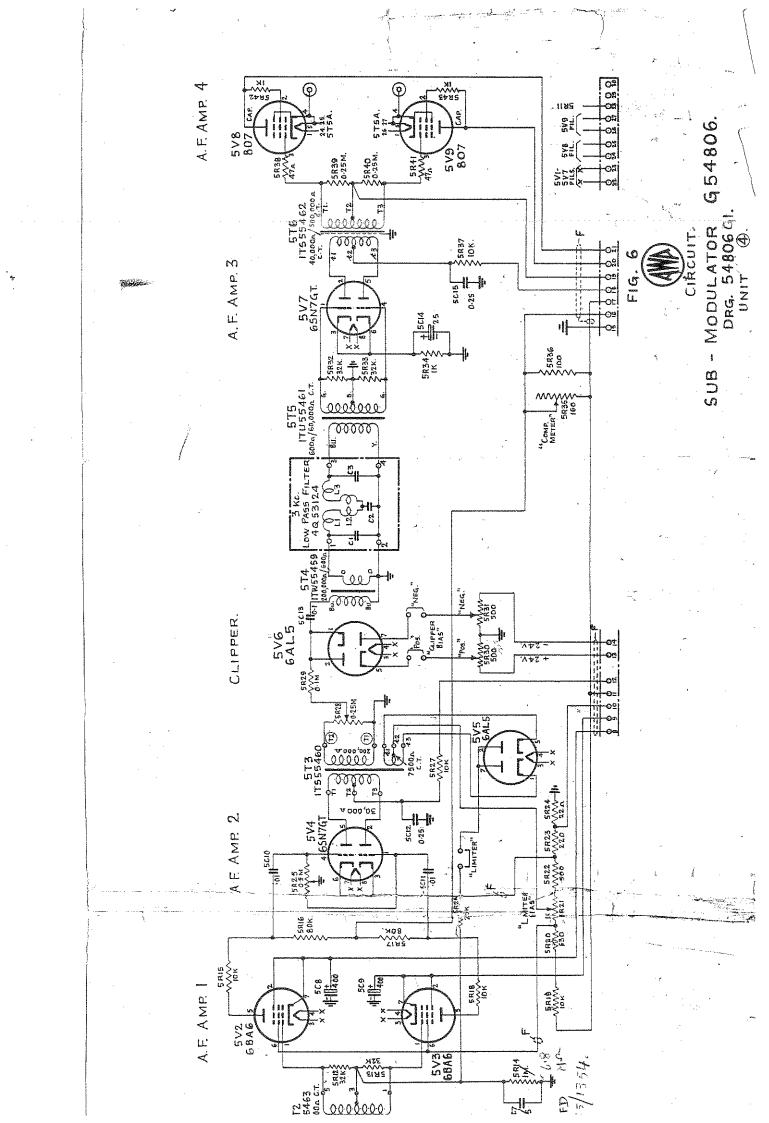


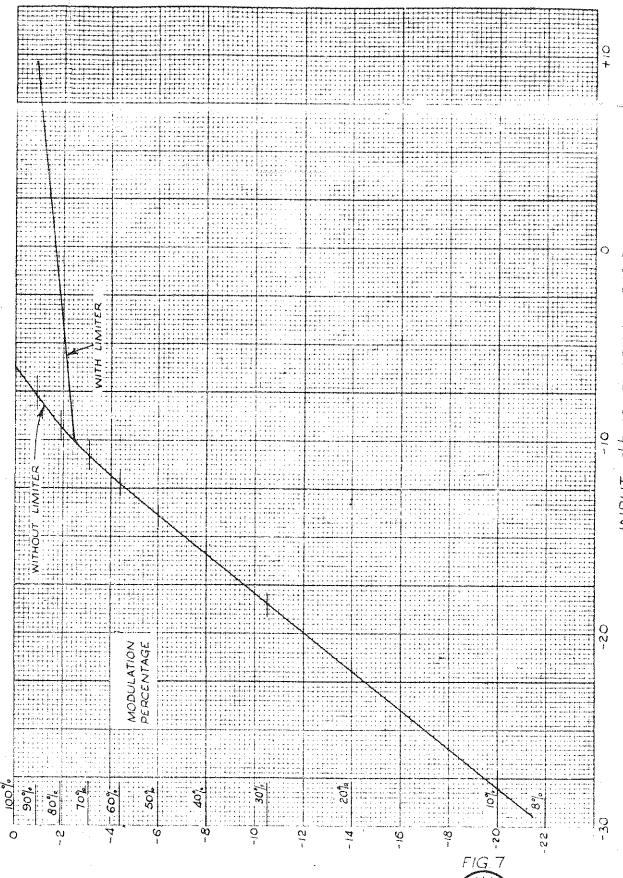










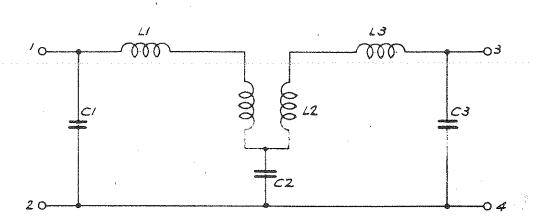


OUTPUT LEVEL Ab



LIMITER SET UP AS DESCRIBED IN INSTRUCTION BOOK

TYPICAL
CHARACTERISTIC CURVE
SUB-MODULATOR
G54806
DRG 54806DI



COŅE			£1	3.0 1	KC F2		Z/	<i>600</i> ೨	Z2	200V
COILS						CONDENSERS.				
DES/G	CODE	TYPE	No.	TEST FREQ.	RES. FREQ KC. P.S	MAUCT	DES/6	AWA. TYPE NO.	MAIN CAP NF.	TOTAL CAP LUF.
4/:		2153/	37	3.0 KC		41 · 7				
42		V5458	12	3:0 KC.		76 • 4			A CONTRACTOR OF THE PARTY OF TH	
43		2/53/3	7	3.0 Kc.		41 · 7	and to the second		1	
		B		\$	 	· · ·	C/		0.088419	0 0884/9
e a' cil may vericomen	MAIN CAP TO ADJUSTED TO BE WITHIN 0.25% OF TOTAL CAP VALUE.						C2	market commence of the second commence of the second	0.3/83/0	0.3/83/0
							C3	and the second s	0.0884/9	0.088419
7,000										1
		L			ΔΤΥΕΝΙΙΑ?	-1/3A/	_			A STATE OF THE STA

ATTENUATION.

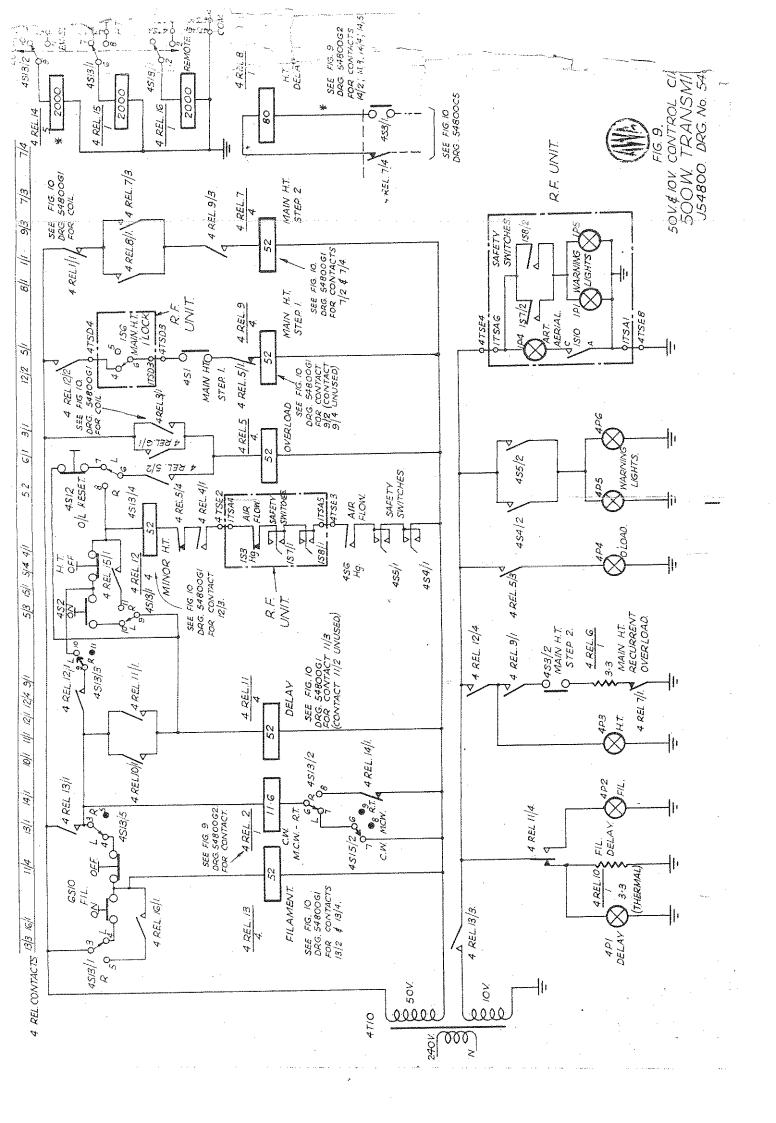
fkc.	MIN.	, MAX.
1.0	*****	0.3db
26	0.5db	1006
7.5	28 db	AMERICA
	•	

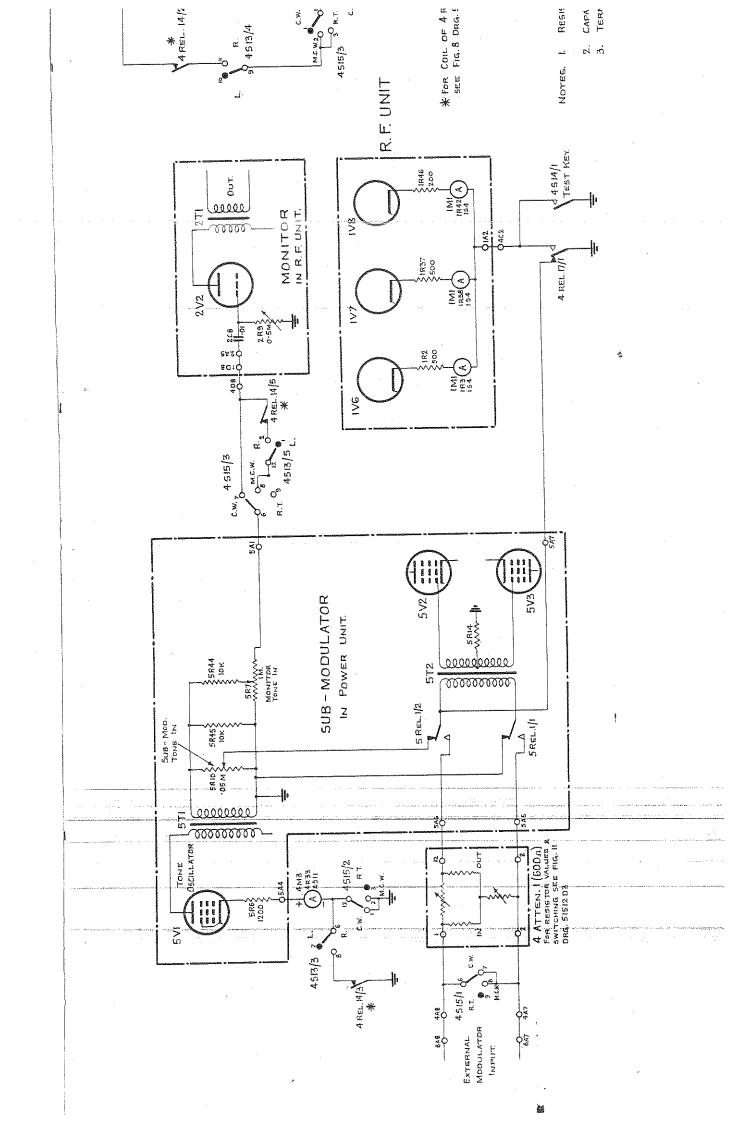
INDUCTANCE TO BE ADJUSTED ON TEST ACCORDING TO 5458201 & 5313201 NOTES:-

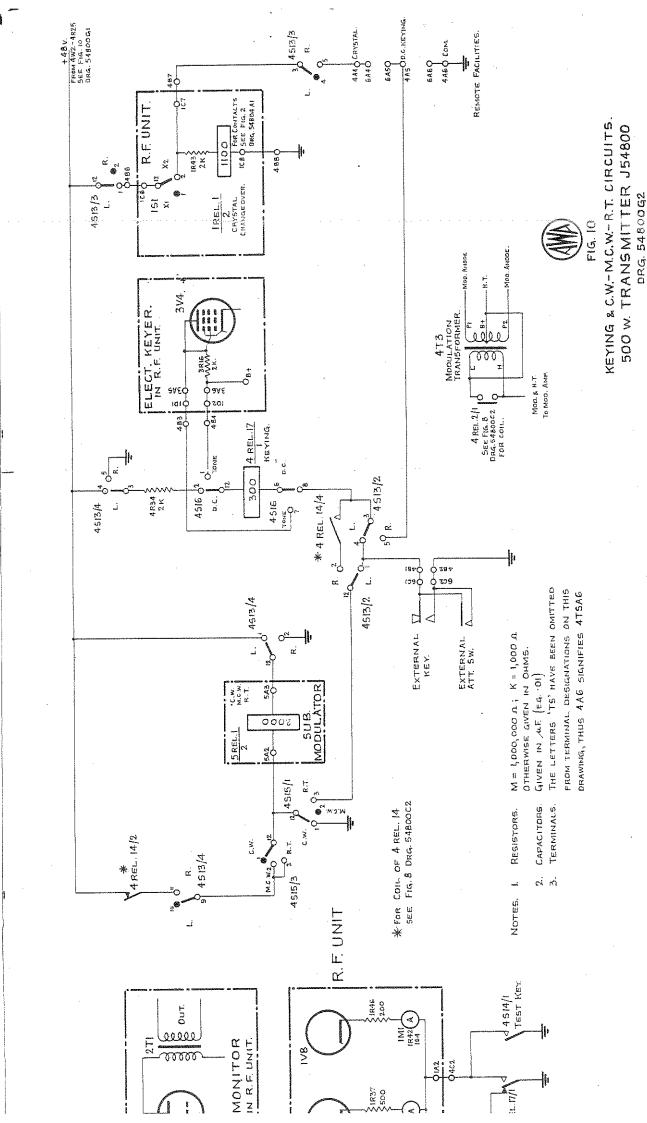
- 1. MAIN CAP CI 2. MAIN CAP C2 CI & C3 SILVER MICA PADDED SM. TO I 0.25%

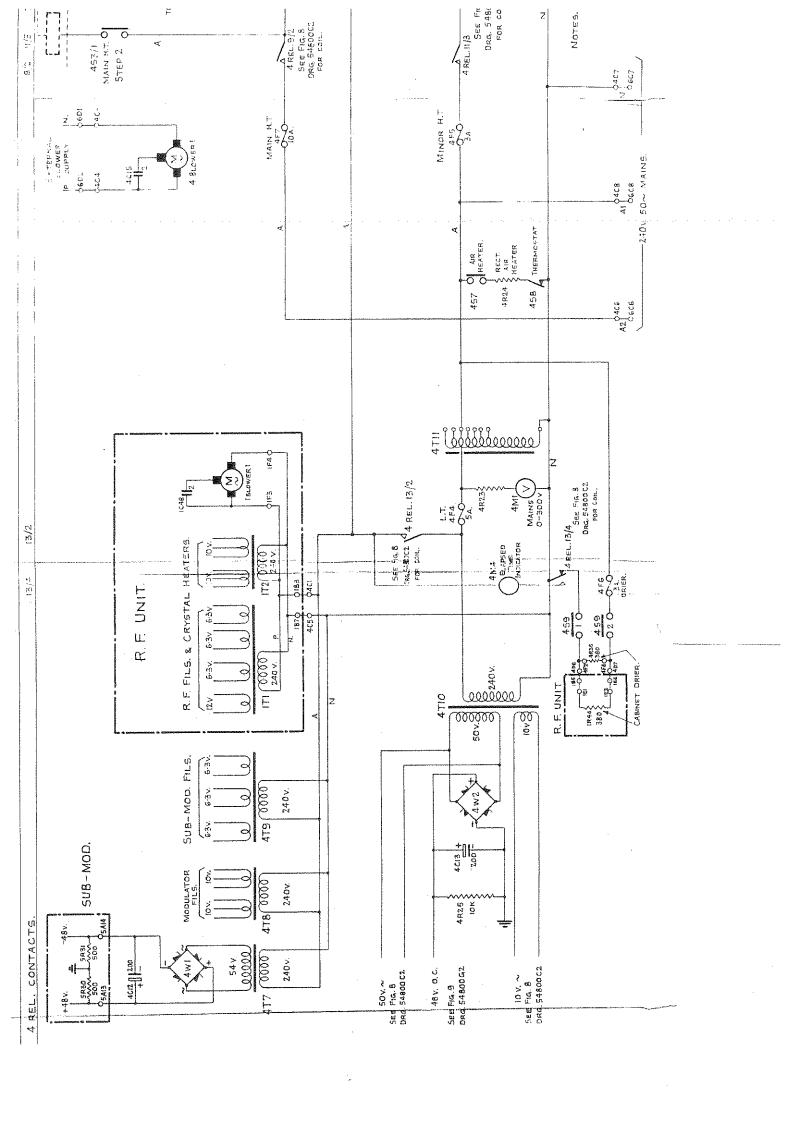
 C2 PAPER PADDED SM. TO I 0.25%
- 3. FOR FILTER ASSEMBLY REFER 53124×39

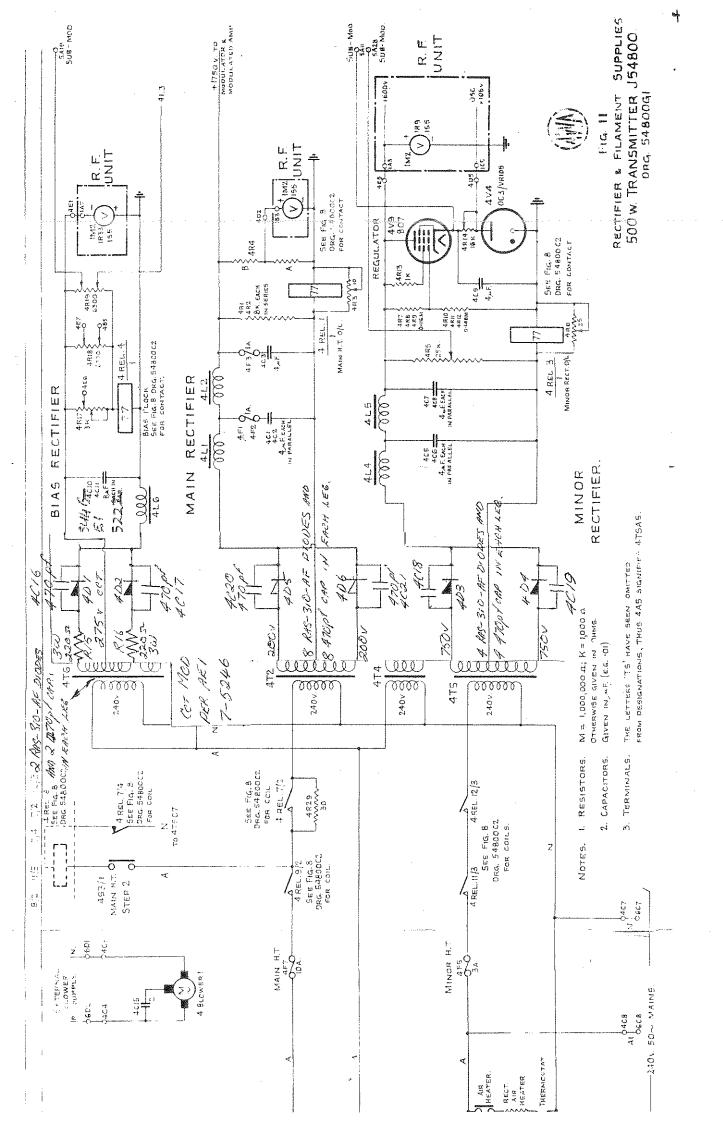
3 KC LOW PASS FILTER DRG 53/08060

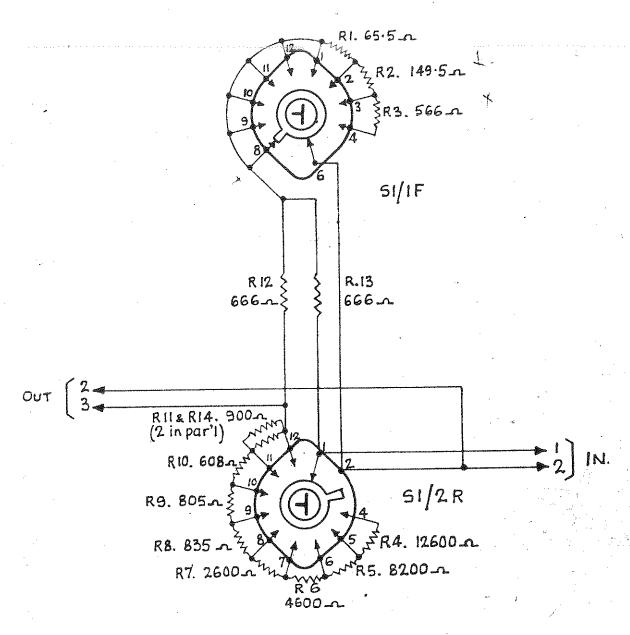












NOTES.

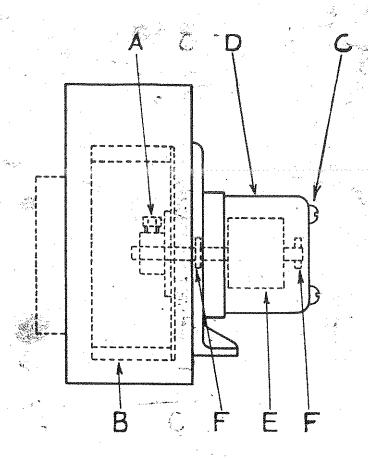
Resistance values shown are calculated.
Resistors used must not vary more than 10%,
(including tolerance on resistor) from values shown.
Oak switch viewed from knob end in extreme

2. anti-clockwise position. FIG. 12



ATTENUATOR 600 A

DRG. 51512 D3 2R51512.



INSTRUCTIONS.

- I. FREMOVE FAN FROM TRANSMITTER.
- 2. REMOVE SET SCREW AT A
- 3. REMOVE WHEEL B. IF WHEEL IS TIGHT ON SHAFT, HOLD FAN VERTICAL BY WHEEL AND TAP SHAFT WITH SHORT COPPER OR BRASS ROD.
- 4. REMOVE 3 SCREWS AT C.
- 5. REMOVE END BELL *D.
- 6. REMOVE ROTOR E, BALL RACES F SHOULD REMAIN ON SHAFT.
- 7. APPLY GREASE TO BALL RACES F.
 PACK WITH VACUUM "INTAVA" OR SIMILAR
 HIGH GRADE 20°C + 95°C. GREASE.
- 8. RE-ASSEMBLE TO DRAWING.

FIG.30 ISSUE No

LUBRICATION CHART
MULTIVANE FAN.
DRG. 55111 DI.