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RADIO DEPARTMENT

TECHNICAL NOTE

Nº RAD. 232

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Technical Note No. Rad. 232

Technical Note No. Rad. 232
November 1944

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH

German Ground Radar Equipment

Master Oscillator Unit Type ZP100 of the Seetakt and Freya Installations

by

D.I.W. Orchin

Summary

The unit described in this Note is, in general, a 500 cycle oscillator with associated output circuits and power supplies. Its purpose is to generate a 500 c/s sine wave voltage which is used to produce the Main and I.F.F. modulating pulses and the wave forms for the fast time bases. It also provides a lock for the slow time base.

Contents

1. Introduction

The Master Oscillator Unit Type ZP100 (illustrated in Figs. 1 to 4) is one of a number of pieces of captured enemy equipment from which a SEETAKT and FREYA installation were built up.

The Unit was originally housed in a metal box measuring 24" high by 9" wide by 18" deep but since most of the equipment was received in damaged condition this box could not be used.

According to captured documents the sine wave voltage generated by this unit is stable in both frequency and amplitude to within 0.2% with a distortion factor of the same order, but a check on this has not so far been possible. However in view of the damaged state in which the unit was found it is unlikely that this is still true. This high degree of stability appears to rely entirely upon a very stable H.T. supply, this being controlled both before and after rectification.

Five separate outputs are provided, two being preceded by phase shifters for setting up purposes. All the outputs, except the one feeding the Precise Range Unit (ref.5.4) have buffer output stages to prevent variations in load affecting the oscillator circuit. Variations in the load taken by the Precise Range Unit are presumably so small as to be negligible.

2. Mechanical Construction

The Master Oscillator consists of individual units mounted on a metal frame (see Figs. 3 and 4). Most of these are contained in thin sheet metal boxes of poor design, which are screwed to the frame, the units being held in position by means of metal lugs attached to the sides of the boxes which makes the interior of the units most inaccessible. It would appear therefore, that on the occurrence of a fault unit replacement is adopted. Each valve has its own separate box which contains all associated components, except where this is not possible. because of shape or size.

At the top of the frame are situated four banks of metal rectifiers used in the power supply circuits and in front of these, just above the top of the control panel, is a moving coil voltmeter for monitoring the regulated A.C. mains. On either side of this voltmeter are the two mains fuses for the unit, (see Fig.1). On the control panel are the control knobs and switches for setting up purposes, two test points marked "GENERATOR - AUSGANG" for measuring the output from the oscillator valve and also a microammeter for checking the valve currents. It can be seen from figures 3 and 4 that the whole of the inside of the frame has been pushed bodily downwards, thus throwing the control knobs out of alignment with the shafts to which they are connected. Most of the German couplings broke as soon as attempts were made to turn them and have been replaced by British flexible couplings. The bushes, through which the shafts pass, have been taken out and replaced at such an angle as to be as nearly as possible in line with the shafts. The two ten-pin plugs, fixed to the back of the frame, were originally intended to plug into two rows of sockets at the back of the metal box in which the unit was housed, but since this box was damaged beyond repair a British twelve-pin plug was fitted and used in place of the German plugs (see Fig.2). The paper labels on some of the control knobs seen in Fig.1 have been affixed with the object of helping the operator to distinguish between the various controls. Originally only two controls were accessible from the outside of the box, the TX PHASE ROUGH and TX PHASE FINE. As only a few RL 12 P10's were available at the time of

reconstruction it was decided to replace this valve with a DDR2 (CV173) and this meant replacing the German valve holder with a British 9-pin holder. The heater voltage required for the CV173 is only 6.3 as compared with 12.6 for the RL12P10, but fortunately the secondary of the heater transformer was centre tapped to earth so that 6.3 volts could be obtained between one side of the secondary winding and earth. Resistances 128/52 and 128/53 (both 7.250 ohms) were found to be damaged and were replaced by 61 and 62 from unit 122 (see Fig.5) as no other replacements were available. Condenser 108 was also damaged and was replaced by 110, and the latter replaced by a spare condenser 112 from another ZP100.

3. Circuits

The Unit consists essentially of an oscillator stage and voltage amplifier; an input transformer and attenuator pad for feeding in 500 cycles ffom an external course; two phase shifters, one for the Main Transmitter (ref. 5.5) and the other for the I.F.F. Transmitter (ref. 5.8); various buffer amplifiers and output stages; a power supply unit; a microammeter for checking valve currents and also oscillator valve output; and a mains voltmeter for monitoring the regulated A.C. mains.

The numbering system on this unit is so complicated that it was found necessary to simplify the Complete Circuit Diagram shown in Fig.5 to the Basic Circuit Diagram shown in Fig.6, at the same time adopting a more convenient system of numbering the components.

3.1 500 cycle (see Figs. 5, 6 and 7)

The oscillator stage and voltage amplifier comprise units 120, 121, 123 and part of 119 (Fig.5). The oscillator is a particular form of a Hartley circuit, known sometimes as a divided circuit oscillator. In order to make it more recognisable this part of the circuit has been simplified still further, first to that shown in Fig.7A and then as in 7B, again renumbering the components. The frequency of the oscillator is determined by the transformer L_1 (Fig.6) and the "variable condenser" circuit R_1 C_1, R_2 C_2, R_3 C_3, C_4, C_5 and R_8. The value of this "condenser" can be adjusted by means of the control marked "FREQUENZ" to give five different frequencies varying in steps of 3 c/s. The values given for these frequencies in a captured booklet are 494, 497, 500, 503 and 506 c/s, but owing to the fact that the effective inductance of the transformer (L_1 + L_2 + 2M (Fig.7B)) is only 427 mH instead of 477 mH, which is the value given in the German Parts List, the mean frequency is now 550 c/s. This discrepancy may be due to cracks in the dust core sustained when the unit was damaged. The amplitude of the oscillation is limited to about 11 volts R.M.S. by the resistance R_9 and the condenser C_6 (Fig.6) in the grid circuit. The output can be adjusted by means of the variable condenser C_8 which is coupled to the control marked "EIGENGENERATOR" (self excited oscillator) and gives a variation of 2:1. From the oscillator stage the sine wave voltage is fed, through the switch S_1 marked "EIGENGEN" and "FREMDGEN" (internal oscillator and external oscillator) to the voltage amplifier V_2 in the anode circuit of which is the inductance L_2 tuned to about 500 c/s by means of two 0.1uF condensers. The purpose of this is presumably to improve the waveform. About one tenth of the voltage developed across this tuned circuit is fed to the distribution chain R_{16} to R_{24} and from here it is fed through condensers to the various buffer amplifiers and output stages. The input transformer and attenuator

for use with external excitation comprise units 103, 113 and 122 (Fig.5). The primary of the input transformer is provided with three pairs of tapping points, giving input impedances of 600, 800 and 1600 ohm respectively, for the purpose of matching three types of feeder lines. It was found correctly matched for a 600 ohm line. The attenuator pad, which is connected across the secondary of the transformer, is so designed that its effective impedance as presented to the transformer secondary is always 10,000 ohm. By means of this pad the A.C. voltage fed to the grid of V2 can be adjusted to compensate for attenuation in the feeder lines. The inclusion of this adjustable attenuator together with the special efforts to maintain good matching under all conditions is of particular interest. The attenuation of all normal cables at this low frequency is very small and correct terminal matching for relatively short lengths is of little consequence. It follows, therefore, that the designers must have had in mind the use of long lengths of cable (of the order of many miles) and this suggests that the master locking of a chain of Freya or Seetakt stations was used or at least seriously contemplated. The unit 122 forms the rough adjustment and the potentiometer 113 the fine adjustment, the control for the latter being marked "TRIMGENERATOR". Originally the rough and fine adjustment together give a regulation range of 13:1, but since some of the resistances in the attenuator pad were damaged and could not be replaced this is no longer true.

The output to the Main Transmitter is preceded by the rough phase shifter 130, the buffer amplifier V5, the fine phase shifter R39 and C26 and finally the output valve V6. The rough phase shifter consists of resistance and capacity elements connected together to form a pi network (see Fig.5), the sections of which are switched in or out by means of the control marked "TX PHASE ROUGH". With all six sections in circuit a shift corresponding to 6 x 4.2 Km (i.e. 25.2 Km) can be obtained. The buffer stage is a straight forward amplifier working in class A and providing a gain of about 12. The fine phase shifter is simply a resistance in series with a variable condenser, the output being taken from across the condenser. The control for this phase shifter is marked "TX PHASE FINE", 4½ complete rotations of this producing a linear shift corresponding to 5.5 Km. The output valve was originally an RL12P10 but since only three of these valves were available at the time of reconstruction it was decided to replace it with a DDR2 (CV173), a British valve with similar characteristics. This valve is matched to the low input impedance of the modulator by means of the transformer L3, which gives a power output of about 2 watts at 17 volts, when terminated with the correct impedance of 150 ohms.

The output to the I.F.F. Transmitter is preceded by the rough phase shifter 126, similar to 130, the buffer amplifier V7, similar to V5, the fine phase shifter R47 and C25 similar to R39 and C26 and finally the output valve V8. The output from this valve is about 30 volts when terminated with an impedance of 50,000 ohms. The control knob for the rough phase shifter is marked "NULLPHASE II GROβ" (zero phase setting II, rough adjustment) and that for the fine phase shifter "NULLPHASE II FEIN" (zero phase setting II, fine adjustment).

The buffer amplifiers V3 and V4 are similar in every detail, both being fed direct from the distribution chain and both giving an output of about 1 volt R.M.S. (when terminated with an impedance of 100,000 ohms) with approximately unity gain. V4 supplies the output to the Main Presentation Unit (ref 5.3) and V3 to a special monitoring presentation which has not yet come to hand.

The output to the Precise Range Unit is supplied direct from the distribution chain, the value of this output being about 1.3 volts R.M.S.

3.2 Valve checking (see Fig.5)

The valve checking circuits comprise units 141 and 117. Unit 141 contains the switch for switching the meter 117 into the anode circuits of the various valves, together with associated shunting resistances which are always in circuit. The unit also contains a small metal rectifier which enables the output of the oscillator valve to be measured when necessary. As the meter 117 is very sensitive it does not affect the operation of the unit when in circuit. The eight positions of the control knob marked "ROHREN KONTROLLE" correspond to the anode current of valves 127/51, 129/51, 131/51, 133/51, 134/51, 135/51, 123/51 and the output of the oscillator valve in this order. With the control knob in position 0 the meter is removed from circuit.

The mains voltmeter 118 is actually a microammeter with a linear deflection. It is used as a suppressed zero instrument and is presumably used in some form of bridge circuit external to the apparatus whereby only difference in potential over a narrow range is indicated. The instrument is calibrated from 213V to 227V (Fig.1) and provides a very sensitive monitor of the mains voltage.

3.3 Power Supply (see Fig.5)

The power unit comprises the following subsidiary units:- 100 to 102, 105 to 112, 136 to 140 and 142.

The heater voltage for the oscillator valve 121/51 and the amplifier 123/51 is supplied by transformer 100, the heater voltages for the remainder of the valves being supplied from the transformer 102. Transformer 100 also provides the H.T. for 121/51 and 123/51 via the selenium rectifiers 136 and 137 and the smoothing circuit 109, 142, 105 and 112. To maintain the H.T. to 121/51 as constant as possible, a stabilovolt is used in parallel with a fairly low resistance potential divider consisting of 138/54 and 119/52-55, which divides down the voltage in the ratio 7:4. The H.T. for the remainder of the valves is provided by transformer 101, via the selenium rectifiers 139 and 140 and the smoothing circuit 111, 106 and 112, this being divided down by the potential divider 141/61 and 141/62.

4. Conclusions

The mechanical design of the unit is bad from the point of view of maintenance, but this would not matter provided there were plenty of sub-units available.

Extreme importance seems to have been attached to stabilising the H.T. to the oscillator valve. To start with the mains voltage is regulated at 220 $\pm$ 0.5 V, after rectification the H.T. is stabilised by means of a stabilovolt and finally the oscillator valve is shunted with the swamping resistances R_4 to R_7 (Fig.6). The design of the oscillator is rather unusual, but it fulfills the necessary requirements and produces quite a good sine wave. The attenuator pad is also of interest since it provides a means of adjusting the input to V2 over quite a wide range, while at the same time keeping the effective impedance across the secondary of the input transformer constant. The remainder of the circuit follows more or less standard practice, except for the 200K in the grid circuit of V6. There seems to be no apparent reason for having such a large resistance for a grid stopper, but since it makes very little difference to the operation of the circuit it is of little consequence.

The performance of the unit is on the whole reasonably satisfactory considering the state in which it was originally received.

5. References

5.1	Recognition of German Ground Radar	A.D.I.Sc.Report No.24 R.A.E.Tech.Note No.
5.2	Transmitter type T 106 (Freya)	Rad. 156
5.3	Main Display Unit type NB110 of Coast Watcher and Freya Installations	" 204
5.4	The Precise Range Measuring Unit type OK 106 of the Coast Watcher and Freya Installations	" 209
5.5	Transmitter of G.E.M.A. Coast Watcher Installation	" 210
5.6	Description of the Receivers used in Freya and Coast Watcher Stations	" 223
5.7	Display Unit type OB 110 of the Seetakt and Freya Installations	" 224
5.8	I.F.F. Systems used with Freya and Seetakt Installations. (Tech. Note in preparation).	

6. Parts List

Unit	Component	Description
100	Mains transformer	21VA; 220/100-275V; 2x6.3V
101	" "	25VA; 220/100-300V; 90 mA
102	" "	10VA; 220/2 x 6.3V; 0.8A
103	Input transformer	10K/600/800/1600 ohm
104	Output transformer	7000 ohm/150 ohm
105	Choke	40H; 0mA; 18H; 70 mA
106	Choke	40H; 0mA; 18H; 70 mA
107	Condenser	4 μF ± 10%; 550V D.C.
108 (now 112)*	"	"
109	"	"
110	"	"
111	"	"
112	"	"
113	Potentiometer	5K ± 20%; 2.5 watt
114	Key, locking	2 way change over
115	Fuse	1A; 500V
116	Fuse	1A; 500V
117	Micro-ammeter	200 μA. 800 ohm
118	Micro-ammeter (used as voltmeter)	400 μA

Unit	Component	Description
119	51 Torroidal dust core transformer	477 mH; ± 2%
	52 Special wire wound resistance	1K ± 5%; 0.1 watt
	53 "	"
	54 "	"
	55 "	"
120	51 Condenser	2500 pF ± 5% 500V D.C.
	52 "	5000 pF ± 5%; 500V D.C.
	53 "	7500 pF ± 5%; 500V D.C.
	54 "	10,000 pF ± 5%; 500V D.C.
	55 "	208,300 pF ± 0.1%; 175V
	56 Selector switch	Single pole, 8 way
	57 Resistance	1M ± 5%; 0.25 watt
	58 "	600K ± 5%; 0.25 watt
	59 "	400K ± 5%; 0.25 watt
	60 "	300K ± 5%; 0.25 watt
121	51 Valve	RV 12 P 2000
	52 Condenser	50 pF ± 10%; 500V
	53 "	10,000 pF ± 20%; 500V D.C.
	54 Trimmer Condenser	250 pF ± 10%; 175V
	55 Resistance	1M ± 5%; 0.25 watt
	56 "	3K ± 5%; 0.25 watt
	57 "	1.5M ± 5%; 0.25 watt
122	51 Special wire wound resistance	0.7K ± 5% 0.1 watt
	52 "	1K ± 5% 0.1 watt
	53 "	1.5K ± 5% 0.1 watt
	54 "	2.2K ± 5% 0.1 watt
	55 "	3.3K ± 5% 0.1 watt
	56 "	5K ± 5%; 0.1 watt
	57 "	1.57K ± 5%; 0.1 watt
	58 "	0.98K ± 5%; 0.1 watt
	59 "	1.75K ± 5%; 0.1 watt
	60 "	3.85K ± 5%; 0.1 watt
	61 "	5K ± 5%; 0.1 watt
	62 "	7.25K ± 5%; 0.1 watt
123	51 Valve	RV 12 P 2000
	52 Block condenser	2 + 0.2 + 0.5 µF ± 10%; 15V D.C.; 500V D.C.
	53 Resistance	1.5M ± 5%; 0.25 watt
	54 "	800 ohm ± 5%; 0.5 watt
	55 "	20K ± 5%; 0.5 watt
	56 "	25K ± 5%; 0.5 watt
124	51 Torroidal dust core auto transformer	495 mH ± 2%
	52 Condenser	0.1 µF ± 10%; 500V D.C.
	53 "	0.1 µF ± 10%; 500V D.C.
	54 "	20,000 pF ± 20%; 500V D.C.
125	51 Condenser	5000 pF ± 5%; 500V D.C.
	52 "	5000 pF ± 5%; 500V D.C.
	53 "	0.45 µF ± 5%; 500V D.C.
	54 "	0.45 µF ± 5%; 500V D.C.
	55 Special wire wound resistance	180 ohm ± 1%; 0.1 watt
	56 "	25 ohm ± 1%; 0.1 watt
	57 "	25 ohm ± 1%; 0.1 watt
	58 "	25 ohm ± 1%; 0.1 watt

Unit		Component	Description
125 (Contd.)	59	Special wire wound resistance	25 ohm ± 1%; 0.1 watt
	60	"	25 ohm ± 1%; 0.1 watt
	61	"	25 ohm ± 1%; 0.1 watt
	62	"	25 ohm ± 1%; 0.1 watt
	63	"	645 ohm ± 1%; 0.1 watt
126	51	Condenser	5000 pF ± 5%; 175V
	52	"	"
	53	"	"
	54	"	"
	55	"	"
	56	"	2500 pF ± 5%; 175V
	57	"	30000 pF ± 5%; 175V
	58	Special wire wound resistance	1K ± 5%; 0.1 watt
	59	"	"
	60	"	"
	61	"	"
	62	"	"
	63	"	"
	64	"	"
	65	"	5K ± 5%; 0.1 watt
	66	"	"
	67	"	"
	68	Resistance	100K ± 5%; 0.25 watt
	69	"	200K ± 5%; 0.25 watt
	70	"	300K ± 5%; 0.25 watt
	71	"	400K ± 5%; 0.25 watt
	72	"	500K ± 5%; 0.25 watt
	73	"	600K ± 5%; 0.25 watt
	74	Selector Switch	Single pole, 8 way
127	51	Valve	RV 12 P 2000
	52	Block Condenser	2 + 0.2 + 0.5 µF ± 10% 15V D.C.; 500V D.C.
	53	Resistance	1M ± 5%; 0.25 watt
	54	"	800 ohm ± 5%; 0.25 watt
	55	"	40K ± 5%; 0.5 watt
	56	"	10K ± 5%; 0.25 watt
128	51	Variable condenser	60-1000 pF; 50V
	61*	Special wire wound resistance	5K ± 5%; 0.1 watt
	62*	"	7.25K ± 5%; 0.1 watt
	54	"	"
	55	"	"
	56	"	"
	57	"	"
129	51	Valve	RV 12 P 2000
	52	Block Condensers	2 + 0.2 + 0.5 µF + 10%; 15V D.C.; 500V D.C.
	53	Resistance	800K ± 5%; 0.5 watt
	54	"	1K ± 5%; 0.25 watt
	55	"	25K ± 5%; 0.5 watt
	56	"	3K ± 5%; 0.25 watt
	57	"	200K ± 5%; 0.25 watt
130	51	Condenser	5000 pF ± 5%; 17V
	52	"	"
	53	"	"
	54	"	"
	55	"	"

Unit		Component	Description
130 (Contd.)	56	Condenser	2500 pF ± 5%; 175V
	57	"	30000 pF ± 5%; 175V D.C.
	58	Special wire wound resistance	1K ± 5%; 0.1 watt
	59	"	"
	60	"	"
	61	"	"
	62	"	"
	63	"	"
	64	"	"
	65	"	5K ± 5%; 0.1 watt
	66	"	"
	67	"	"
	68	Resistance	100K ± 5%; 0.25 watt
	69	"	200K ± 5%; 0.25 watt
	70	"	300K ± 5%; 0.25 watt
	71	"	400K ± 5%; 0.25 watt
	72	"	500K ± 5%; 0.25 watt
	73	"	600K ± 5%; 0.25 watt
	74	Selector switch	Single pole, 8-way
131	51	Valve	RV 12 P 2000
	52	Block Condenser	2 + 0.2 + 0.5 µF + 10%; 15V D.C.; 500V D.C.
	53	Resistance	1M ± 5%; 0.25 watt
	54	"	800 ohm ± 5%; 0.25 watt
	55	"	40K ± 5%; 0.5 watt
	56	"	10K ± 5%; 0.25 watt
132	51	Variable Condenser	60-1000 pF; 50V
	52	Special wire wound resistance	7.25K ± 5%; 0.1 watt
	53	"	"
	54	"	"
	55	"	"
	56	"	"
	57	"	"
133	51	Valve	D.D.R.2. (CV173)
	52	Resistance	2K ± 5%; 0.25 watt
	53	"	1M ± 5%; 0.5 watt
	54	"	150 ohm ± 5%; 0.5 watt
134 & 135	51	Valve	RV 12 P 2000
	52	Block Condenser	2 + 0.2 + 0.5 µF ± 10%; 15V D.C.; 500V D.C.
	53	Resistance	200K ± 5%; 0.25 watt
	54	"	1K ± 5%; 0.25 watt
	55	"	5K ± 5%; 0.25 watt
	56	"	30K ± 5%; 0.5 watt
	57	"	3K ± 5%; 0.25 watt
135 (see 134)			
136 & 137	51	Selenium Rectifier	75V D.C.; 17 mA.
	52	"	"
	53	"	"
	54	"	"
137 (see 136)			

Unit		Component	Description
138	51	Stabilovolt	STV 150/20
	52	Condenser	20000 pF ± 20%; 500V D.C.
	53	Resistance	7.5K ± 10%; 12 watt
	54	Resistance	3K ± 5%; 1 watt
139 & 140	51	Selenium Rectifier	75V D.C.; 36 mA
	52	"	"
	53	"	"
	54	"	"
140 (see 139)			
141	51	Selenium Rectifier	2V D.C.; 30 mA
	52	Special wire wound resistance	49 ohm ± 1%; 0.1 watt
	53	"	39.4 ohm ± 1%; 0.1 watt
	54	"	49 ohm ± 1%; 0.1 watt
	55	"	2.8 ohm ± 1%; 0.1 watt
	56	"	49 ohm ± 1%; 0.1 watt
	57	"	49 ohm ± 1%; 0.1 watt
	58	"	31.2 ohm ± 1%; 0.1 watt
	59	Selector switch	2 pole - 23-way
	60	Special wire wound resistance	3K ± 5%; 0.1 watt
	61	Resistance	2.5K ± 10%; 12 watt
	62	Resistance	12K ± 10%; 12 watt
142		Resistance	1K ± 5%; 2 watt

* Replacements

Distribution:

A.D.I.Sc. - 120
D.D.C.D.2.
R.D.C.7
R.D.C.13
T.R.E. - 3

APPENDIX 1 - Operating Data

The following H.T. voltages were measured between the indicated connection tags and earth:-

Connection Tag.No.	119/3	123/9	127/9	129/9	131/9	133/5	134/9	135/9
Voltage	39v	270v	188v	188v	188v	260v	188v	188v

Total current taken from the mains: 275 mA.

The following are D.C. voltages to earth:-

Unit	Tag.No.	Voltage	Avo range
121	6	0.7V	0-12V
123	6	2.3V	0-12V
131	6	1.5V	0-12V
133	4	240V	0-480V
134	6	4.6V	0-12V
135	6	4.5V	0-12V

N.B. All the above measurements were made with an AVO Model 40.

The following are 500 c/s voltage measurements taken on an oscilloscope:-

Unit	Tag.No.	RMS Voltage	Unit	Tag.No.	RMS Voltage
121	3	2.8V	129	3	5.0V
	4	11V		5	32V
	5	1.5V	131	3	0.5V
123	3	1.5V		5	6.5V
	5	12V	133	3	5.0V
125	3	1.3V		4	140V
	4 & 5	0.9V	104	f, i	17V
	6	0.8V			
	9	0.7V	134	3	0.9V
127	3	0.5V		5	0.9V
	4	5.0V	135	3	0.9V
				5	0.9V

The above are maximum values with no visible distortion of any of the outputs.

Mains voltage 220V.

APPENDIX 2 - Note on the Special Wire Wound Resistances

The resistances marked with asterisks in figures 5 and 6 are made of manganin wire, which has a negligible temperature coefficient, non-inductively wound on wooden formers about $\frac{1}{2}$" in diameter and $\frac{3}{8}$" high. They have a very low wattage rating, less than 0.1 watt. This means that where the wattage to be dissipated is more than 0.1 watt a bank of such resistances must be used. They are used in parts of the circuit where it is important that the value of the resistance shall remain constant.

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DATE	14-8-44.

FIG. 1.

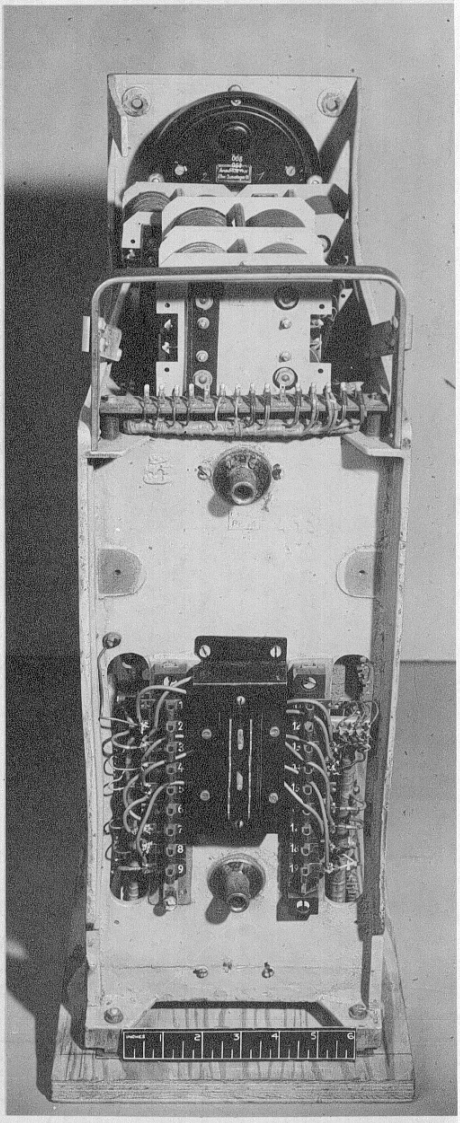

FIG. 2.

MASTER OSCILLATOR TYPE ZP100

FRONT AND REAR VIEWS.

FIGS. 1 & 2.

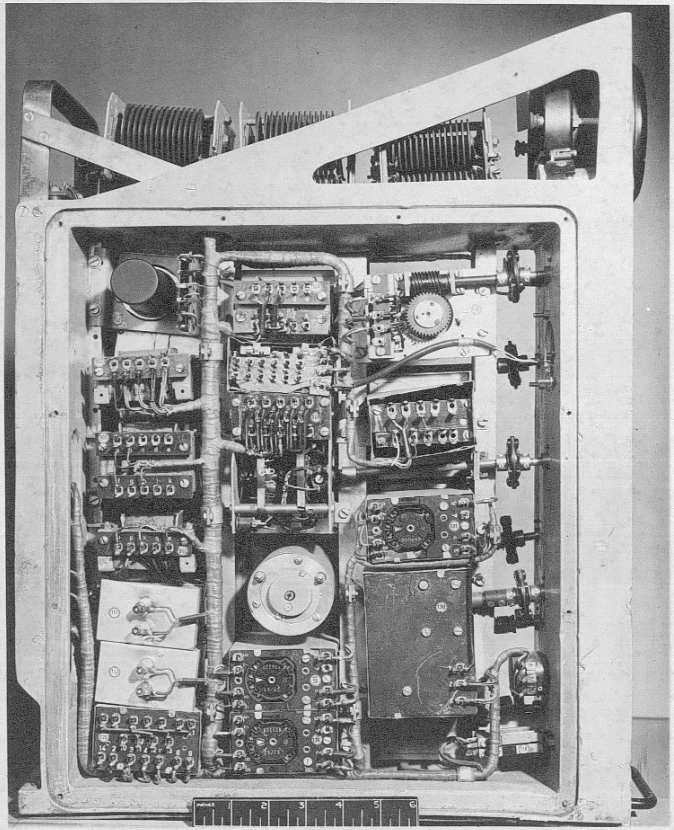

FIG. 3.

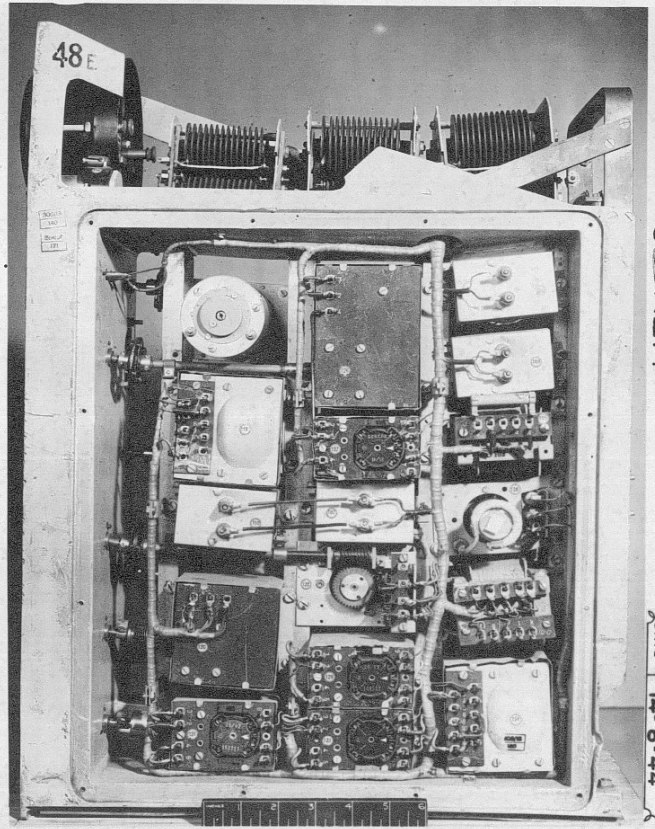

FIG 4.

MASTER OSCILLATOR TYPE ZP100, SIDE VIEWS.

FIGS. 3 & 4.

Unclassified
SECRET.

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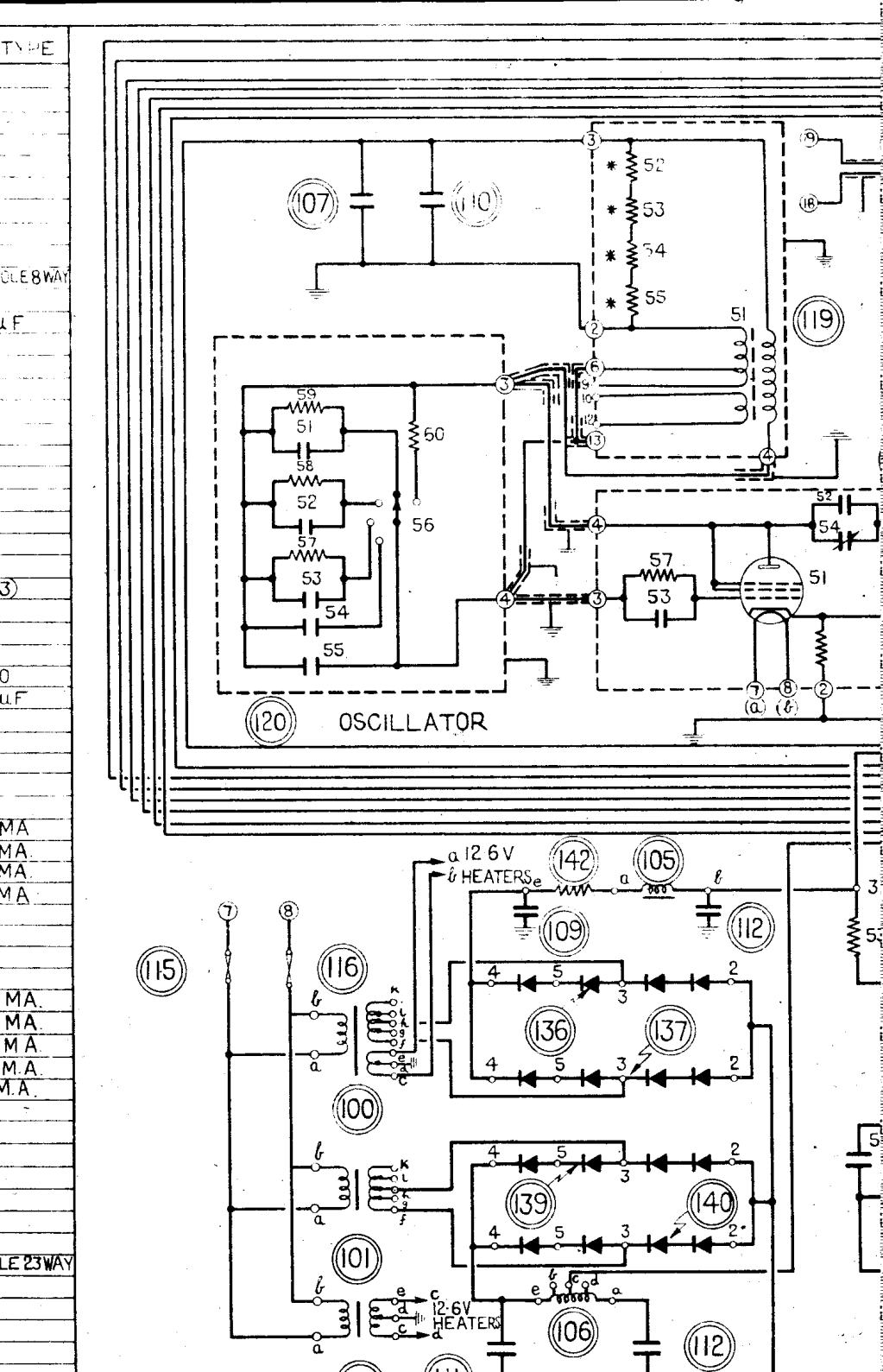
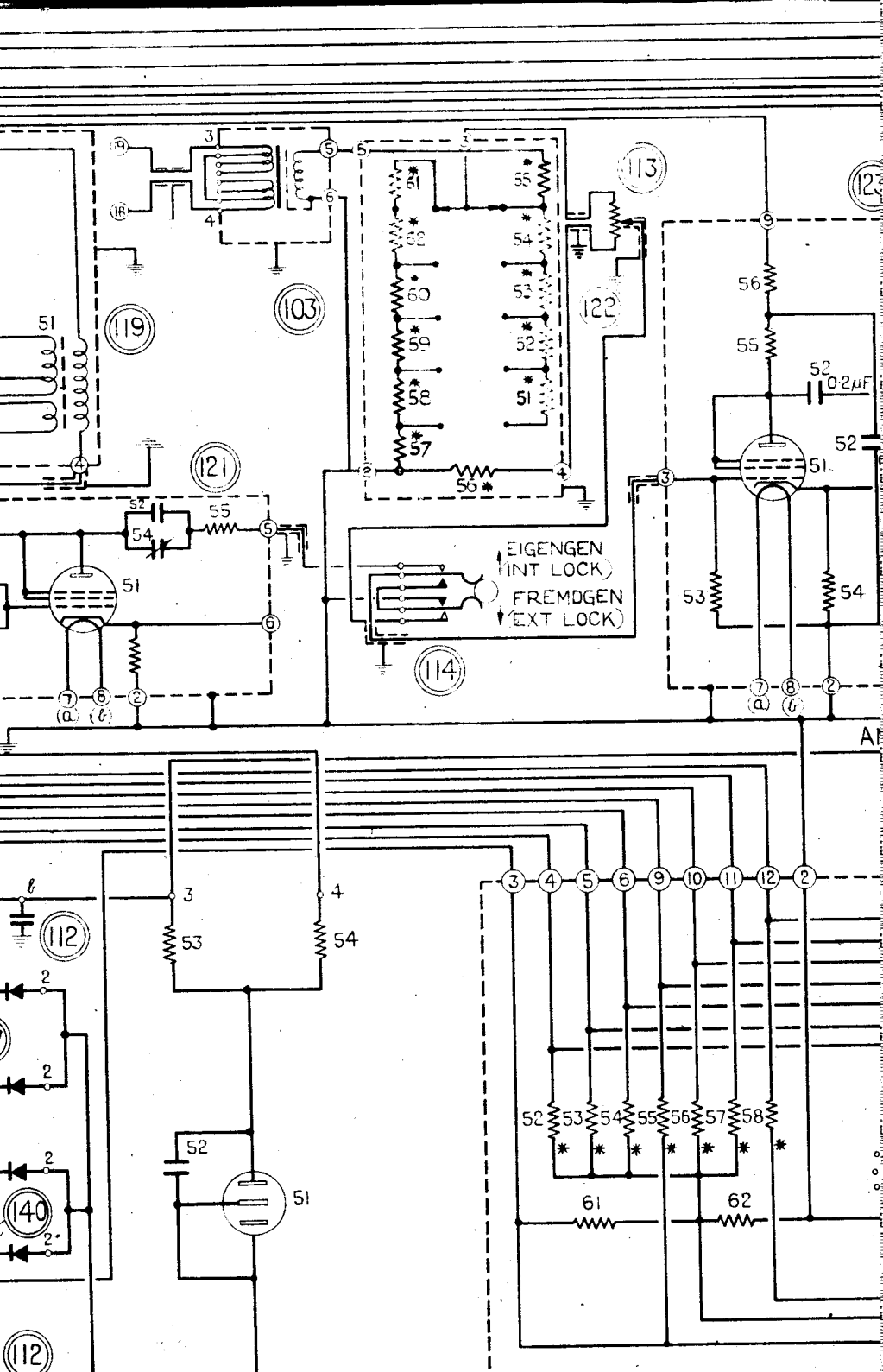
PHOTOGRAPHIC DIVISION
NEG. No. 56104.
DATE 14-8-44

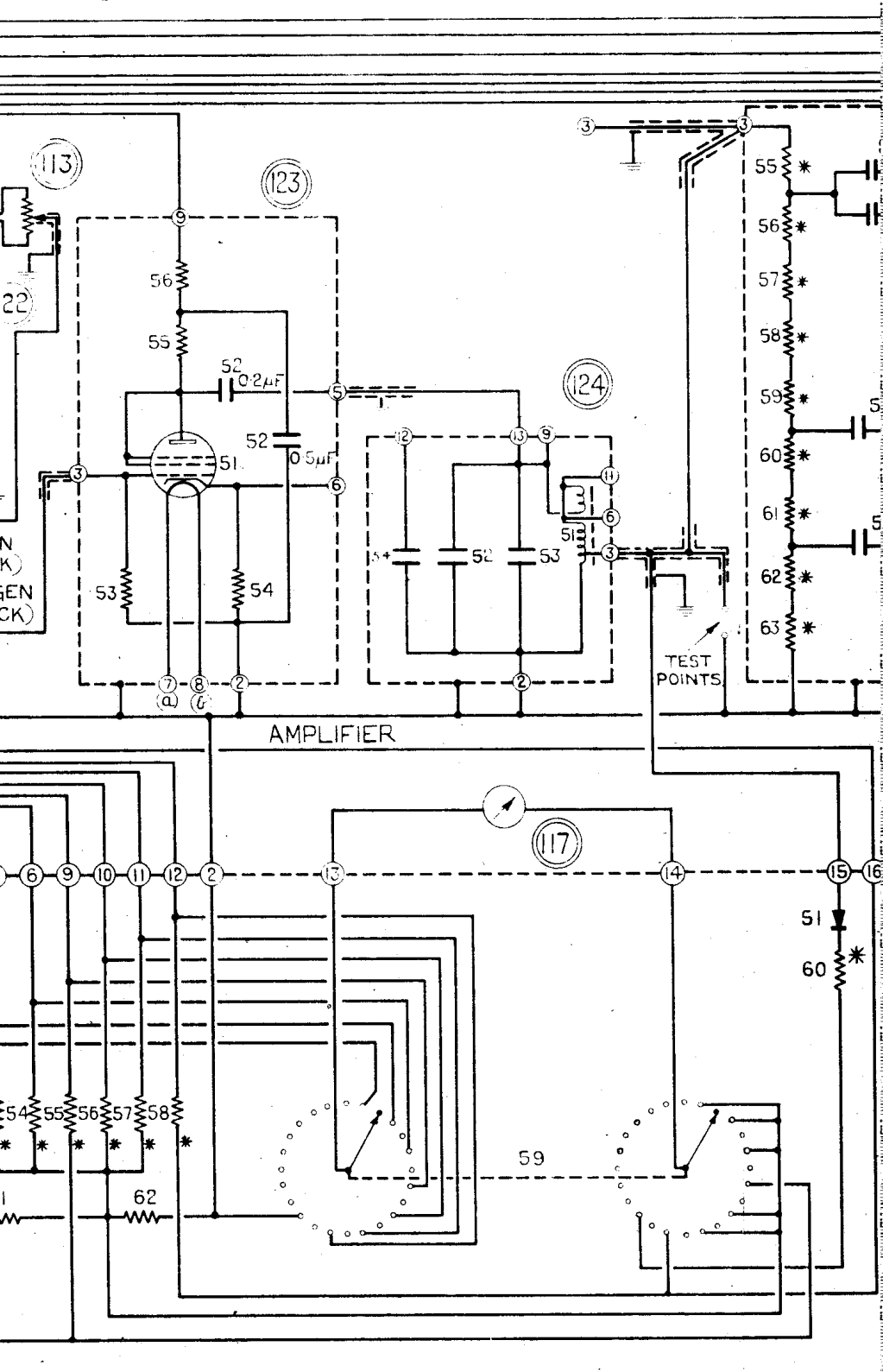
UNIT No	ITEM No	VALUE OR TYPE
100	—	2IVA,220/100-275V 2x63V
101	—	25VA,220/100-300V 90MA
102	—	10VA,220/ x6·3V 0·8A
103	—	10K/600 [illegible] 1600Ω
104	—	7000Ω [illegible] Ω
105	—	18H 70M A
106	—	18H 70 A
107	—	4μF
108	—	4μF (NOW 112)
109	—	4μF
110	—	4μF
111	—	4μF
112	—	4μF
113	—	5K
114	—	KEY 2 WAY CHANGEOVER
115	—	1A 500
116	—	1A 250
117	—	0 MA 800Ω
118	—	0·4 MA
119	51	4·77MH
	52	1K
	53	1K
	54	1K
	55	1K
120	51	2500PF
	52	5000PF
	53	7500PF
	54	10000PF
	55	208300PF
	56	SWITCH SINGLE POLE 8WAY
	57	1M
	58	600K
	59	400K
	60	300K
121	51	RV12 P2000
	52	50 PF
	53	10000PF
	54	250PF
	55	1M
	56	3K
	57	1·5M
122	55	3·3K
	56	5K
	57	1·57K
	58	0·98K
	59	1·75K
	60	3·85K
123	51	RV12 P2000
	52	2+0·2+0·5μF
	53	1·5M
	54	800Ω
	55	20K
	56	25K
124	51	495 MH
	52	0·1μF
	53	0·1μF
	54	20000 PF
125	51	5000 PF

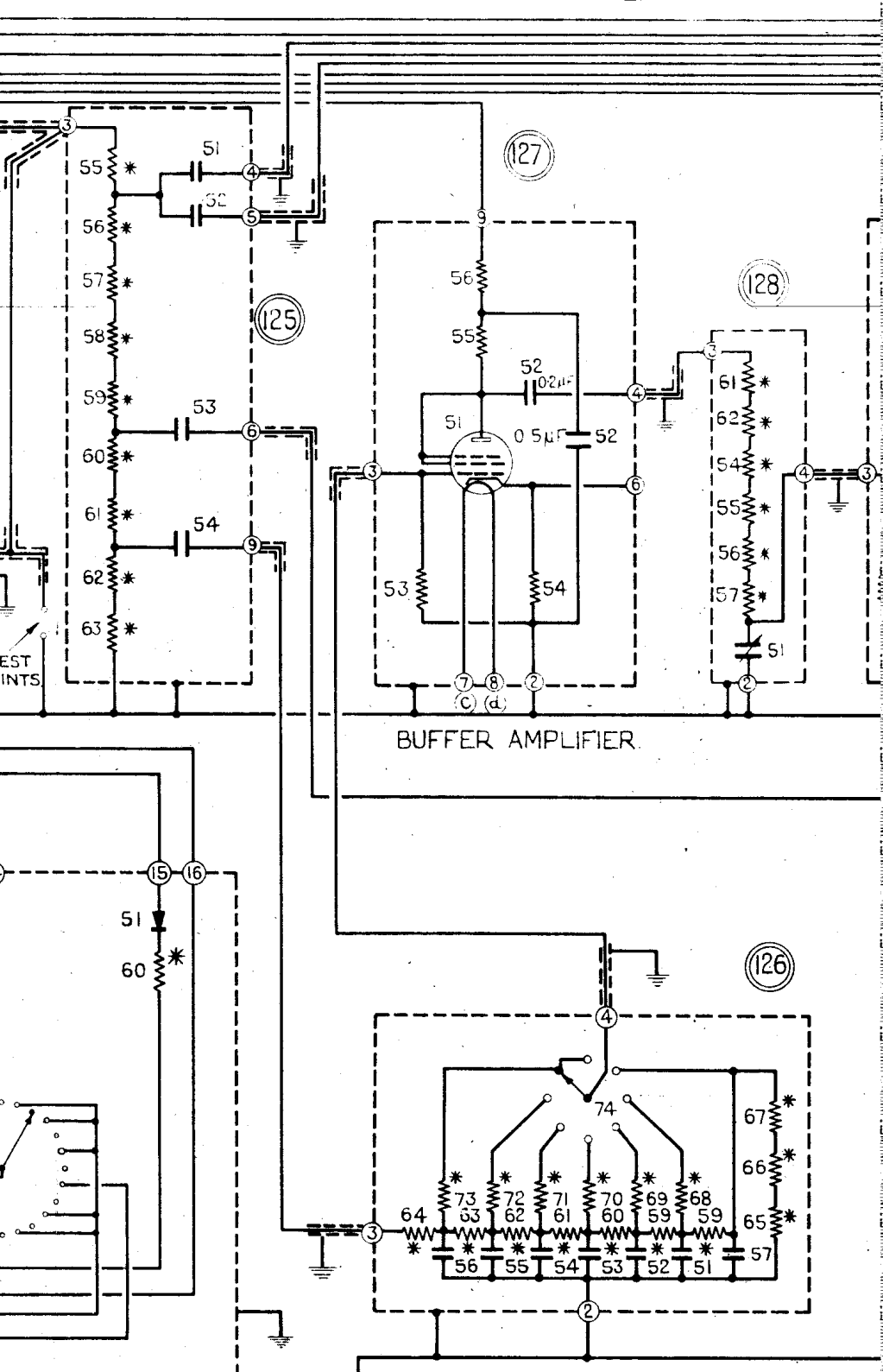
UNIT No	ITEM No	VALUE OR TYPE
125	5	25Ω
CONT	[illegible]	[illegible]Ω
	59	25Ω
	60	25Ω
	61	[illegible]Ω
	62	[illegible]Ω
	5	[illegible]
126	6	[illegible]0 PF
	5	[illegible]0 PF
	6	[illegible]00 PF
	4	[illegible] PF
	[illegible]	3000 PF
	6	2500 PF
	[illegible]	10000 PF
	8	K
	59	K
	60	K
	6	1K
	62	1K
	63	1K
	64	1K
	65	5K
	66	5K
	67	5K
127	51	RV12 P 2000
	52	2+0 2+0·5μF
	53	1M
	54	800Ω
	55	40K
	56	10K
128	51	60-1000 PF
	61	5K (REPLACEMENT)
	62	7·25K (REPLACEMENT)
	54	7·25K
	55	7·25K
	56	7·25K
	57	7·25K
129	51	RV12 P2000
	52	2+0 2+0·5μF
	53	800K
	54	1K
	55	25K
	56	3K
	57	200K
130	51	5000PF
	52	5000PF
	53	5000PF
	54	5000PF
	55	5000PF
	56	2500PF
	57	30000PF
	58	1K
	59	1K

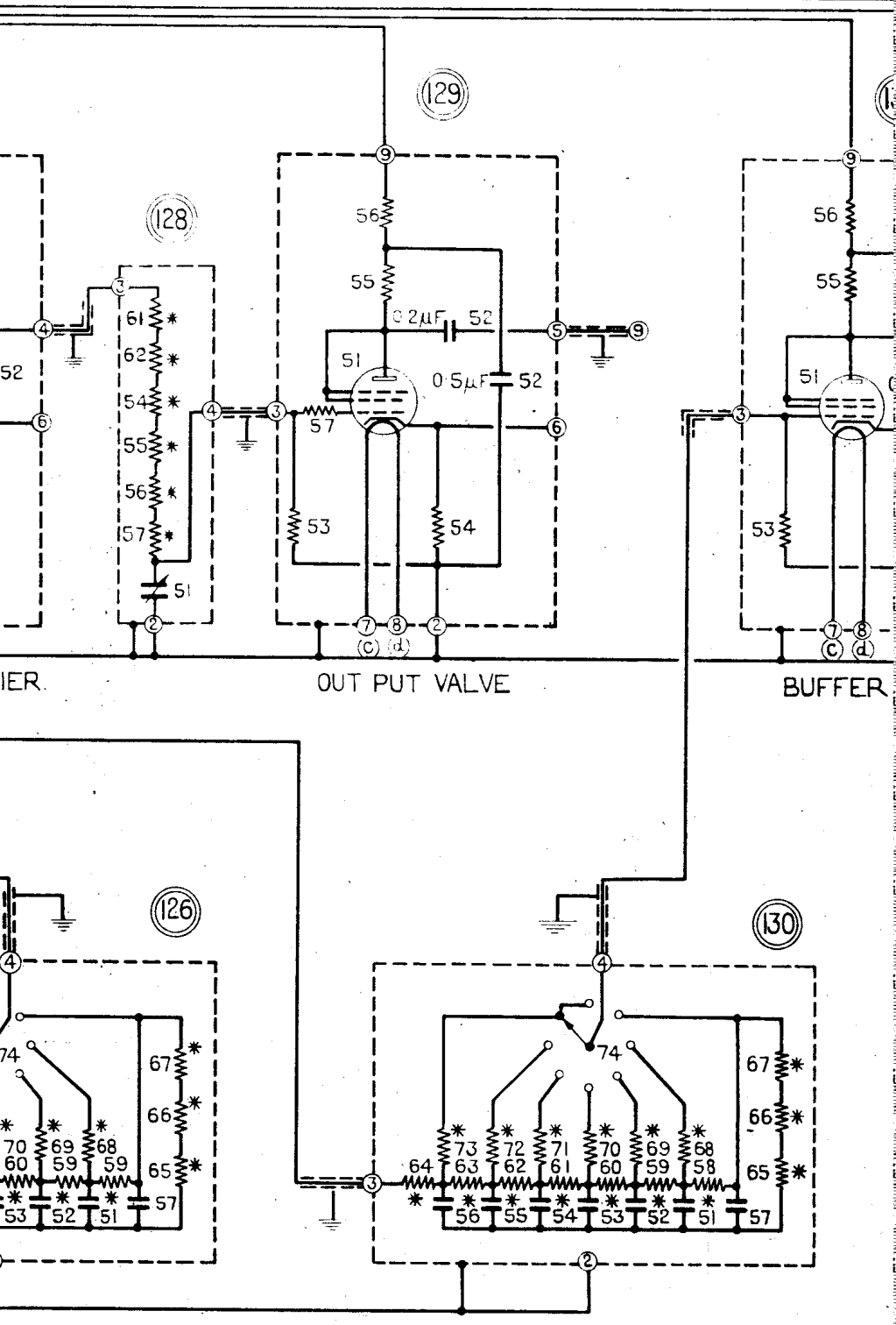
UNIT No	ITEM No	VALUE OR TYPE
130	60	5K
CONT	61	5K
	62	5K
	68	100K
	69	200K
	70	300K
	71	400K
	72	500K
	73	600K
	74	SWITCH SINGLE POLE 8WAY
PT	51	RV12 P2000
	52	2+0·2+0·5μF
	53	1M
	54	800Ω
	55	40K
	56	10K
132	51	60-1000PF
	52	7·25K
	53	7·25K
	54	7·25K
	55	7·25K
	56	7·25K
	57	7·25K
133	51	DDR2 (CV173)
	52	2K
	53	1M
	54	150Ω
134 & 135	51	RV12 P2000
	52	2+0 2+0·5μF
	53	200K
	54	1K
	55	5K
	56	30K
	57	3K
136 & 137	51	75V D.C. 18 MA
	52	75 V.D.C. 18 MA
	53	75 V.D.C. 18 MA
	54	75 V.D.C. 18 MA
138	51	STV 150/20
	52	20000 PF
	53	75K
	54	3K
139 & 140	51	75 V.D.C. 36 MA.
	52	75 V.D.C. 36 MA.
	53	75 V.D.C. 36 M.A.
	54	75 V.D.C. 36 M.A.
141	51	2 V.D.C. 30 M.A.
	52	49Ω
	53	39·4Ω
	54	49Ω
	55	2·8Ω
	56	49Ω
	57	49Ω
	58	31·2Ω
	59	SWITCH 2 POLE 23WAY
	60	3K
	61	2·5K
	62	12K
142	—	1K

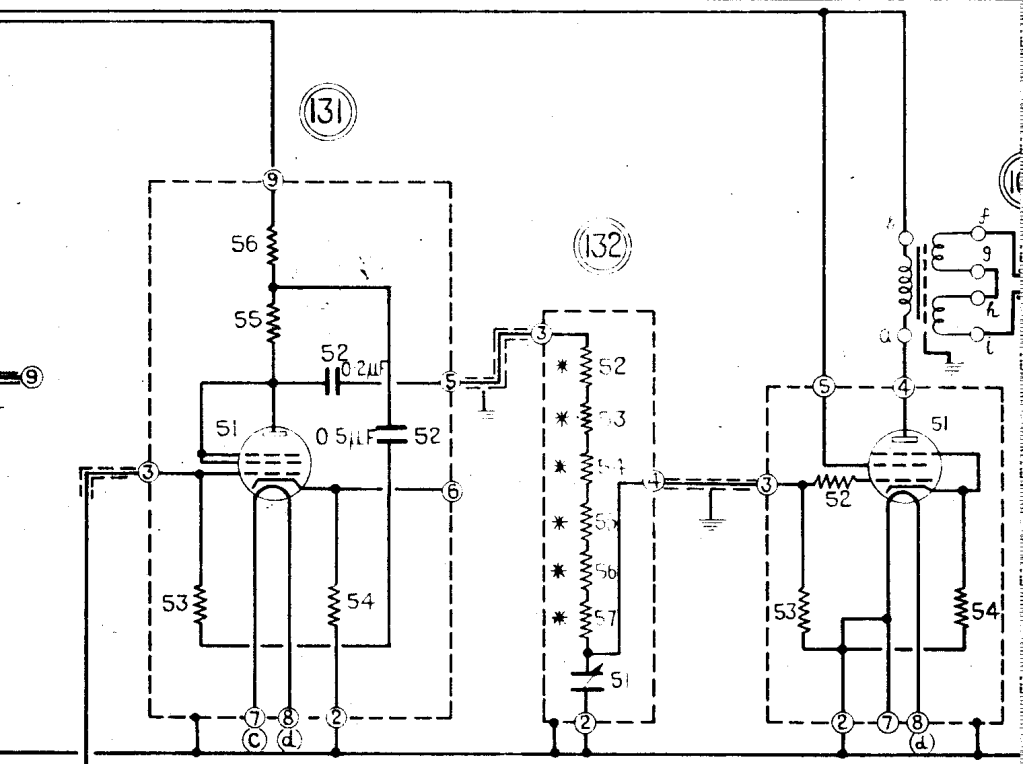

107
110
52
53
54
55
51
119
59
51
58
52
57
53
54
55
60
56
51
54
57
53
51
120
OSCILLATOR
a 12.6 V
b HEATERS
142
105
109
112
115
116
136
137
100
139
140
101
12.6V
HEATERS
106
112

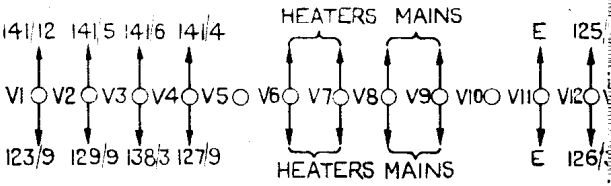

119
103
121
113
122
123
114
112
140
EIGENGEN (INT LOCK)
FREMDGEN (EXT LOCK)
0·2μF
51
52
53
54
55
56
57
58
59
60
61
62


113
123
124
117
56
55
52
0·2μF
52
0·5μF
51
53
54
52
53
51
55
56
57
58
59
60
61
62
63
TEST POINTS
AMPLIFIER
51
60
59
62
54
55
56
57
58

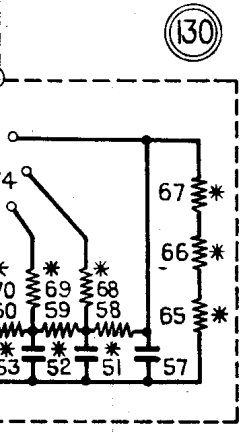

127
125
128
126
BUFFER AMPLIFIER
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
0·5μF
0·2μF
EST
INTS


129
128
56
55
0·2μF
52
51
0·5μF
52
57
53
54
61
62
54
55
56
57
51
OUT PUT VALVE
BUFFER
126
130
74
67
66
65
64
73
72
71
70
69
68
63
62
61
60
59
58
53
52
51

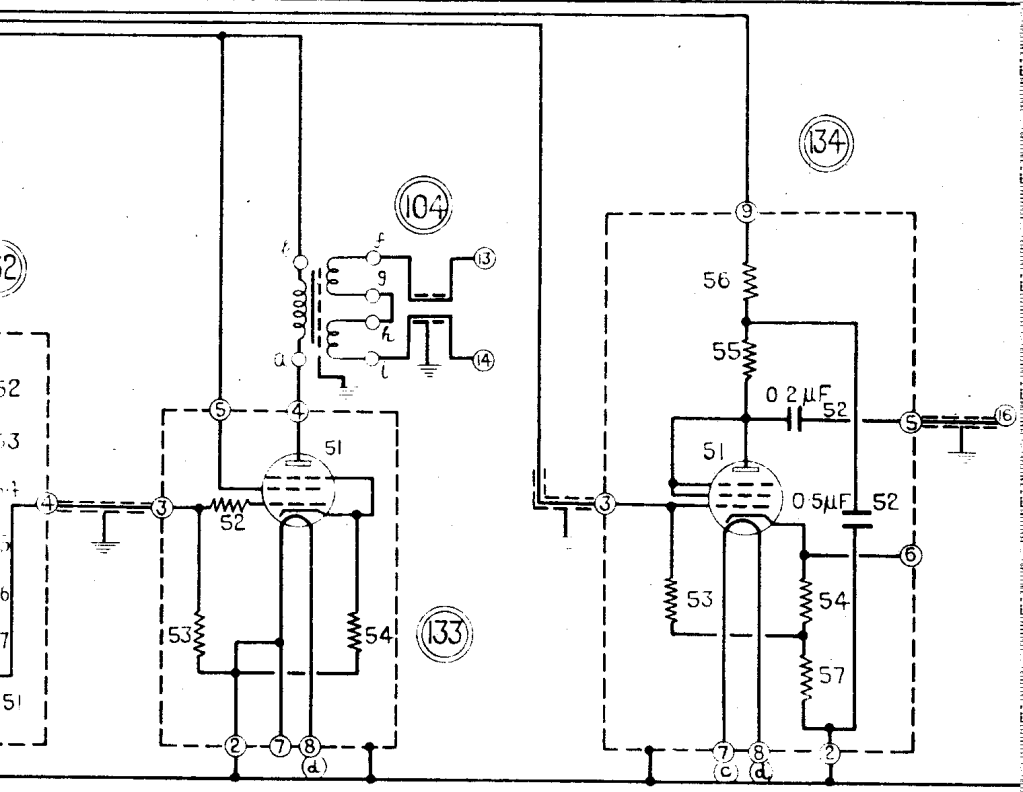


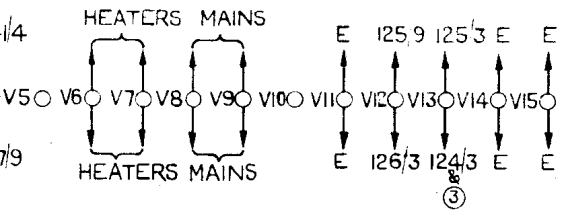


CONNECTIONS ON REAR TAG BOARD.



* SPECIAL
THE FOLLO
REMOVED F
UNIT Nº
122





TIONS ON REAR TAG BOARD.

* SPECIAL WIRE WOUND RESISTANCES

THE FOLLOWING COMPONENTS HAVE BEEN REMOVED FROM THE UNIT :-

UNIT Nº	ITEM Nº	VALUE
122	51	0·7K
	52	1·0K
	53	1·5K
	54	2·2K

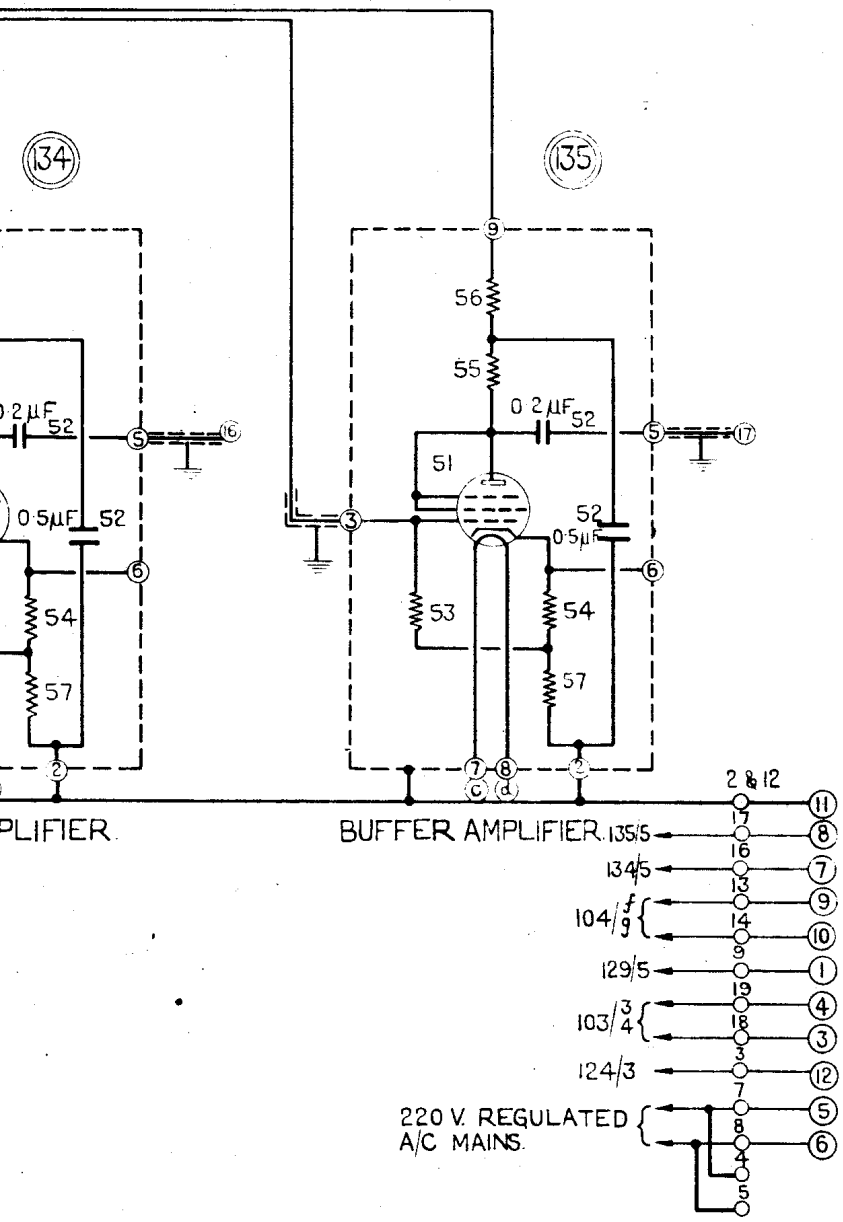
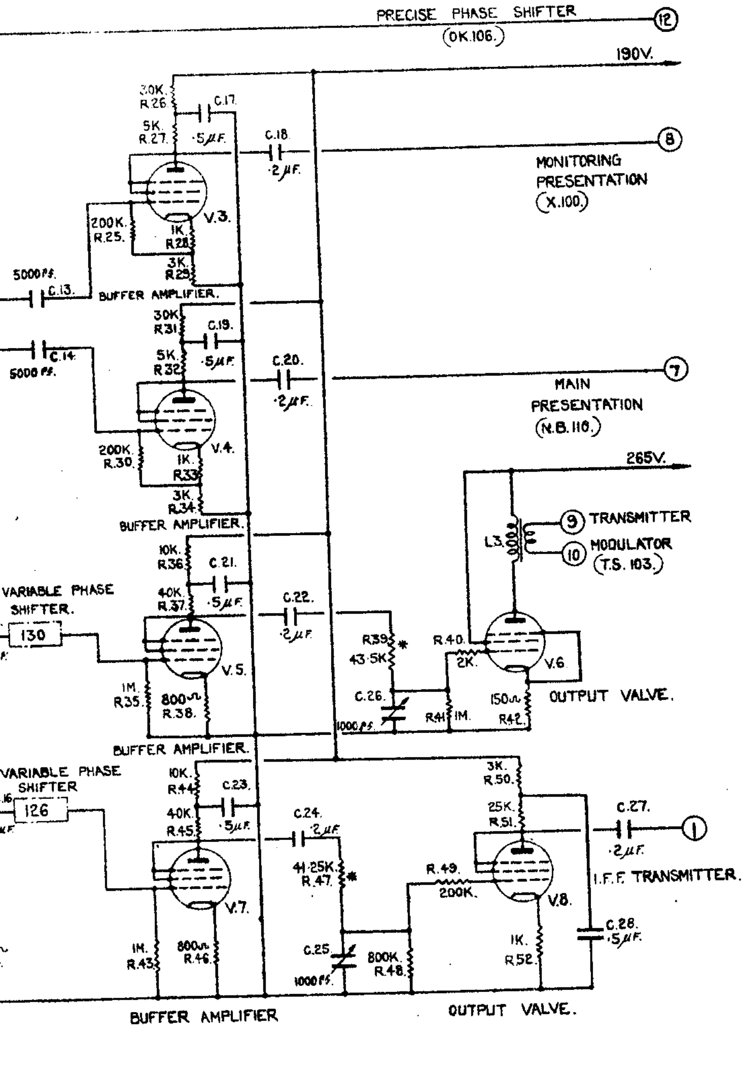

134
135
0·2μF 52
0·5μF 52
54
57
56
55
0·2μF 52
51
52
0·5μF
53
54
57
2 & 12
BUFFER AMPLIFIER
135/5
134/5
104/f g
129/5
103/3 4
124/3
220 V. REGULATED A/C MAINS

FIG. 5.



ISSUE Nº 1.
DATE:- 10-2-44.
CHANGES.
TRACED & APP.
DATE:- 1-3-44.
ISSUE 2.
·2μF ADDED TO
V127. CIRCUIT
DATE:- 8-3-44.
ISSUE 3.
FIG. Nº ADDED
DATE 18·8·44
ISSUE 4.

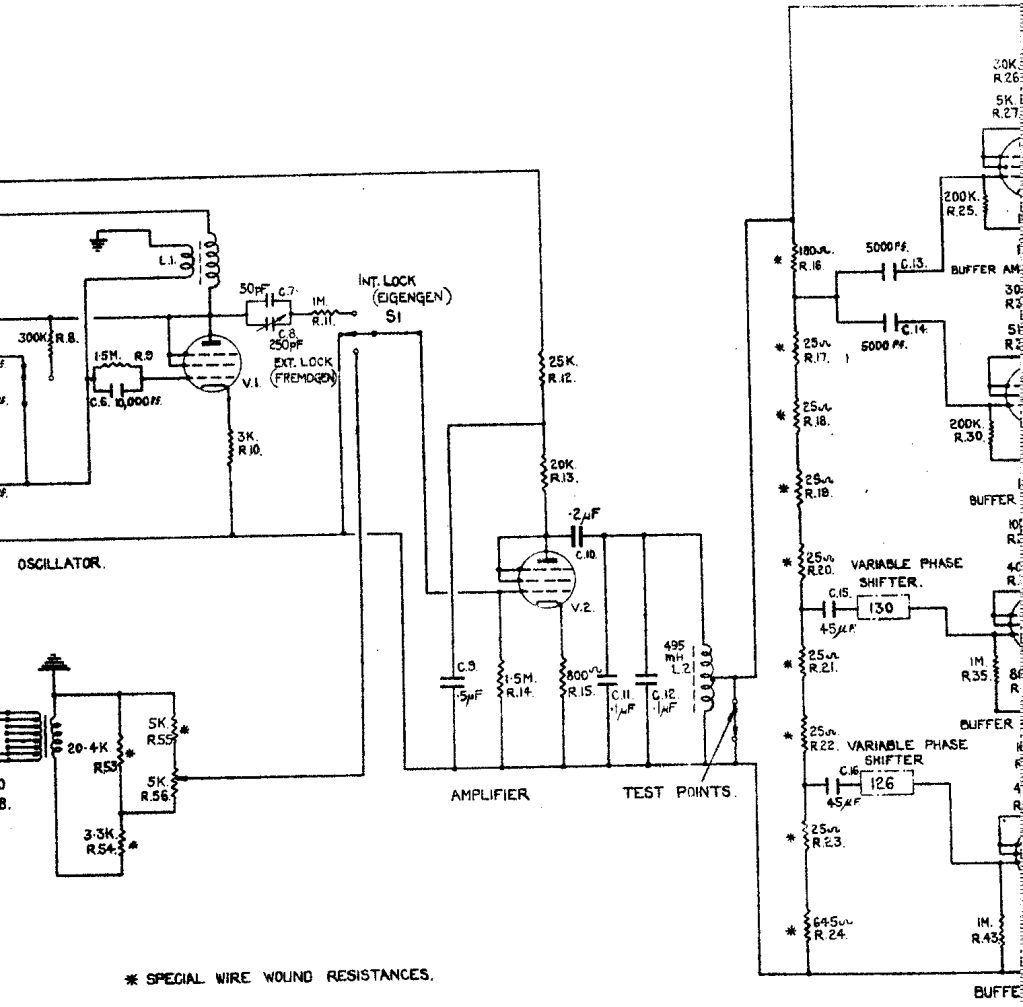
REDRAWN
TRACED & APP
20-9-44
ISSUE 5.

FIG. 6.

TITLE:—MASTER OSCILLATOR UNIT ZP100 BASIC CIRCUIT DIAGRAM.

MATERIAL	ISSUE Nº						
SPEC. Nº (LAT. ISSUE)	ALTS Nº						
USED ON SCHEDULES		DRAWN	TRACED	CHECKED	DATE	APPROVED	

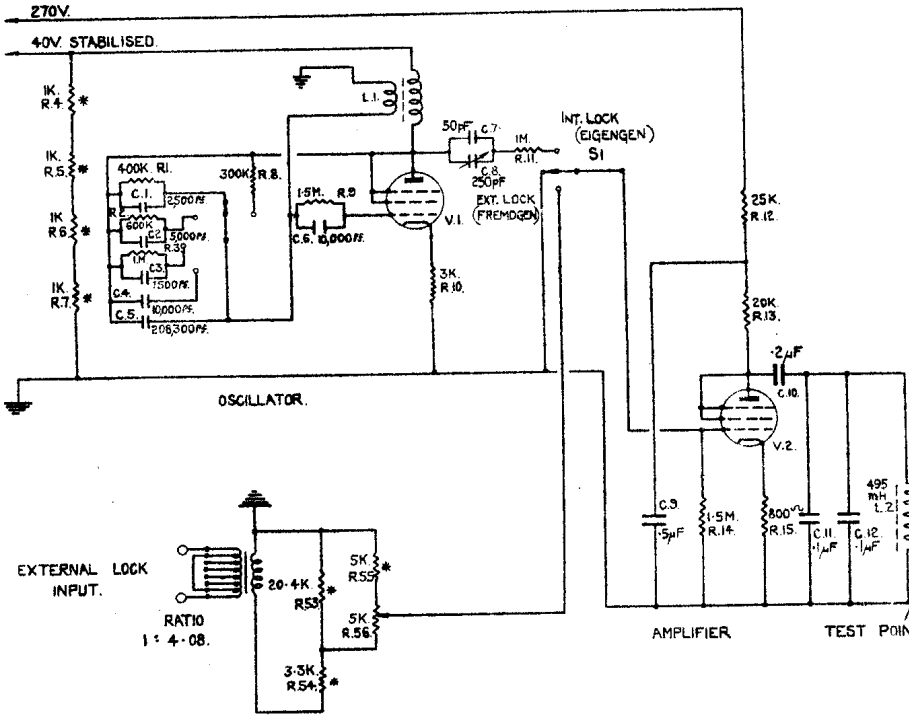
ISSUED BY ROYAL AIRCRAFT ESTABLISHMENT. M.A.P. DIAG. Nº 9709/R



* SPECIAL WIRE WOUND RESISTANCES.

GERMAN GROUND RADAR EQUIPMENT.

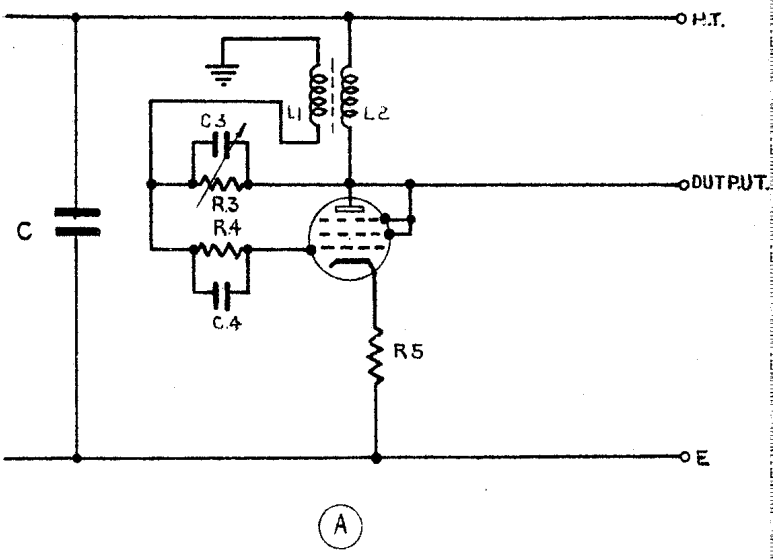
SEETAKT & FREYA.



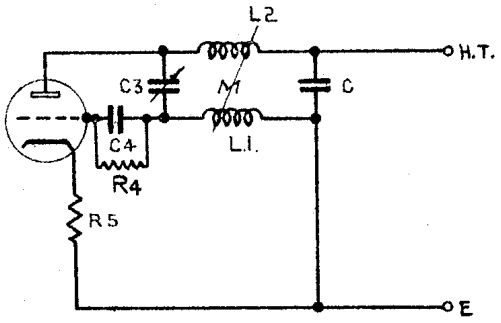
VALVES.	
V1. (121/51)	R.V.12.P. 2000.
V2. (123/51)	R.V.12.P. 2000.
V3. (127/51)	R.V.12.P. 2000.
V4. (129/51)	R.V.12.P. 2000.
V5. (131/51)	R.V.12.P. 2000.
V6. (133/51)	D.D.R.2. CV. 173.
V7. (134/51)	R.V.12.P. 2000.
V8. (135/51)	R.V.12.P. 2000.
N.B. THE NUMBERS IN BKTS ARE THE CORRESPONDING NUMBERS ON FIG. 5.	

* SPECIAL WIRE WOUND RESISTANCES.

GERMAN GROUND RADAR EQUIPMENT.
SEETAKT & FREYA.



A



B

GERMAN GROUND RADAR EQUIPMENT SEETAKT AND FREYA

MASTER OSCILLATOR TYPE ZP100.

THE OSCILLATOR.

FIG. 7.

DIAG Nº 10547-B.

ISSUE 1. 2.
DATE 17-7-44. 18-8-44.