Private and Confidential ***For Trade Use Only***

"His Master's Voice"

SERVICE MANUAL

for

FIVE - VALVE MEDIUM - WAVE

BATTERY / A.C. MAINS - OPERATED PORTABLE CHASSIS

TYPE 22

•

THE GRAMOPHONE COMPANY LIMITED
(Incorporated in England)
HOMEBUSH - - - N.S.W.

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PART No. 682-2941

TECHNICAL SPECIFICATION

POWER SUPPLY:
- A.C. Mains—
  - 200-210 volts—40-50 c.p.s.
  - 230-240 volts—40-50 c.p.s.
  - 245-255 volts—40-50 c.p.s.
- Batteries—
  - Eveready Type 765—9.0 volts.
  - Eveready Type 490P—90.0 volts.

CONSUMPTION:
- Mains—
  - Reception — 19 watts.
  - Reactivation — 9 watts.
- Battery—
  - L.T. — 50 mA.
  - H.T. — 11 mA.

TUNING RANGE:
- 535—1600 kc/s.

I.F. FREQUENCY:
- 457.5 kc/s.

VALVE COMPLEMENT:
- 1T4—R.F. Amp.
- 1R5—Frequency Changer
- 1T4—I.F. Amp.
- 1S5—Demod. A.V.C.—A.F. Amp.
- 3V4—Power
- 6V4—Rectifier.

SPEAKER:
- 7in. x 5in. Permagnetic, 4 ohms impedance at 400 c.p.s.

CIRCUIT DESCRIPTION

This chassis type is a 5-valve battery/A.C. mains-operated superheterodyne receiver for medium-wave reception, in which provision for battery reactivation is incorporated.

R.F. AMPLIFIER

A tuned loop aerial, mounted in the cabinet back, is connected to the R.F. amplifier grid; a coupling winding is provided for the use of an external aerial and earth. The R.F. amplifier is coupled to the frequency changer by a tuned R.F. transformer. This transformer is matched by means of an iron dust core, the setting of which should not be disturbed.

FREQUENCY CHANGER

A pentagrid valve is employed as the frequency changer. The oscillator circuit incorporates a tickler coil (L5) fed by the screen grid. A fixed padding capacitor is used and padding adjustment is carried out by means of a variable iron-dust core. A small neutralising capacitor is connected between signal and oscillator grids.

I.F. AMPLIFIER

The output of the frequency changer is transformer coupled to the I.F. Amplifier grid. This stage is neutralised by capacitor C10. The amplifier output is in turn transformer coupled to the diode of the following valve. Both I.F. transformers employ permeability tuning.

DEMOD.—AVC—A.F. AMPLIFIER

The I.F. signal is demodulated in the diode circuit of a diode-pentode valve, the audio signal being developed across the volume control which constitutes the diode load.

A.V.C. voltage is derived from the same source and is applied to the Frequency Changer and R.F. stages through a resistor network comprising R3—R1—R4. This network, in series with the volume control, is shunted across the low tension source. With this arrangement, the grids of the controlled stages are brought slightly negative with respect to the negative side of their filaments under no-signal conditions.

The demodulated signal is picked off the volume control and applied to the grid of the A.F. amplifier which is grid-leak biassed. The plate circuit is resistance-capacitance coupled to the grid of the output valve.

POWER

This stage incorporates a power pentode valve; its grid is biassed by the voltage drop across the remaining valve filaments. The output of this stage is transformer coupled to the speaker voice coil.

Variable inverse feedback is applied over both A.F. stages. Feedback voltage is taken from the centre tap of the output transformer and fed into the bottom of the volume control.

VALVE FILAMENT CIRCUIT

All valve filaments are connected in series and the voltage drops across them are equalised by shunt resistors.

After valve replacement, check that all filament voltages are within the limits of 1.20 to 1.40 volts with the mains voltage adjusted to the nominal value of the tap used on the power transformer. On battery operation, filament voltages will be somewhat higher with new batteries. It is important that the tap used on the power transformer should correspond with the value of the supply mains to which the instrument is connected. Attention to this will allow the receiver to accept fluctuations of mains voltage without overloading valve filaments. The mains voltage-tap lugs are adjacent to the mains input pins, and opening the cabinet back will provide access to them.

L.T. AND H.T. POWER SUPPLY

This instrument operates either from self-contained dry batteries or from A.C. power mains.

Separate H.T. and L.T. batteries are used with this chassis type. For A.C. mains operation

and battery reactivation, a power pack unit is used; this pack is built on a separate chassis which is housed in the bottom right-hand corner of the cabinet. It incorporates a power transformer, valve rectifier and associate filters, together with a power control switch.

This switch has four positions, the functions of which are as follows:

"OFF": Receiver switched off irrespective of the form of power supply employed.

"A.C.": With the power cord connected, the receiver operates from mains power supply.

"BATT": The receiver operates from self-contained dry batteries. In the interests of battery economy, it is recommended that "AC" operation be used whenever possible.

"REACT": The receiver is inoperative and, with the power cord connected, the dry batteries receive a reactivating charge from the mains power supply unit.

An indirectly-heated rectifier is employed in a full wave circuit; its output is taken to two separate resistance-capacitance filters, which feed L.T. and H.T. receiver circuits respectively.

Note: Should the rectifier be replaced, check that the current supplied to the filament chain lies between the limits of 45 to 47 mA. with mains voltage adjusted to the nominal value of the tap used on the power transformer.

BATTERY RE-ACTIVATION

This chassis incorporates battery reactivation facilities. This feature enables extra life to be obtained from the dry batteries employed.

This is accomplished by sending a reverse current—obtained from the mains power supply unit—through the batteries for a period of time whilst the receiver is not being used. The reactivation system employed in these models ensures that, irrespective of subnormal mains voltage or power "black-outs," the batteries cannot discharge during the reactivation cycle.

After the receiver has been operated on its internal batteries the Power Switch should be set to the "Re-act" position, and the mains supply to the instrument switched on.

The period of reactivation should be approximately six hours for each hour of use on dry batteries. As an example, a receiver operated for two hours on dry batteries would require twelve hours reactivation, and this could conveniently be done overnight.

Although the time of reactivation is not critical within an hour or so, it is important not to exceed the recommended period by any considerable margin.

The ratio of reactivation to battery usage time applies only to the last daily period used. For example, should the receiver be used on batteries for a total of two hours daily for three days without reactivating, then the reactivating period would be twelve hours, based on the last period of two hours total daily usage.

Reactivation should preferably be carried out within a few hours of operating the receiver on batteries.

The cost of power taken from the electric supply mains for reactivation is very low. On the basis of power costing 3d. per unit, the cost of a reactivating charge of twelve hours would approximately be one-third of a penny.

DISMANTLING

CABINET BACK

(1) With the receiver in an upright position, unscrew the two top screws securing cabinet back.

(2) Remove back by first pulling top section away from the main cabinet, then lifting upwards slightly and withdrawing.

(3) Disconnect the two leads connecting the loop aerial to the receiver by disengaging their terminal pins from the loop terminal sockets.

RECEIVER CHASSIS

Remove two nuts which secure the base of the chassis to the cabinet front. Slight upward pressure on the cabinet top will then allow the receiver chassis, complete with knobs, to be withdrawn.

Note: Power and speaker leads are sufficiently long to enable the receiver to be withdrawn from the cabinet for servicing.

POWER UNIT

(1) Unsolder the following leads from the receiver which terminate at the power unit tag panel:
   (a) L.T. + Yellow;
   (b) Neg. — Black;
   (c) H.T. + Red.

(2) Remove power switch knob by easing it off the shaft.

(3) Remove three screws securing unit to the cabinet base.

(4) Remove receiver chassis from the cabinet.

(5) Withdraw the power unit.

RECEIVER ALIGNMENT

In any case where a component replacement has been made in either the tuned I.F. or R.F. circuits of the receiver, all circuits should be re-aligned and, even if only one coil has been serviced, the whole of the re-alignment should be undertaken in the order given.

An output meter should always be connected across the speaker voice coil terminals to indicate when the circuits are tuned to resonance.

In carrying out the following operations, it is important that the input to the receiver from the signal generator should be kept low, and progressively reduced as the circuits are brought into line, so that the output meter reading does not exceed 0.5 volt.

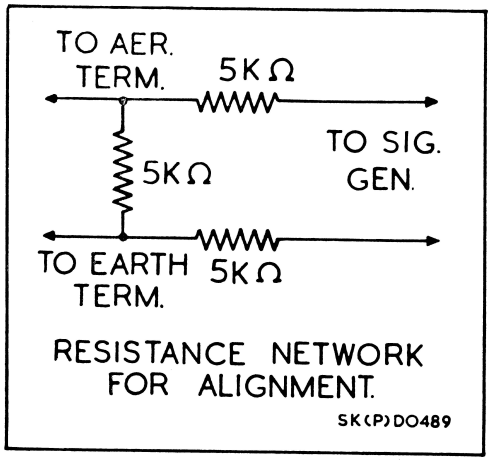
I.F. ALIGNMENT

(1) (a) Set volume control to maximum.
(b) Fully enmesh tuning capacitor plates.
(c) Connect output leads of a signal generator through a 0.1 uF capacitor to the stator plates terminal of the centre section of the 3-gang capacitor; this point is connected to the frequency changer grid.
(2) Tune signal generator to 457.5 kc/s.
(3) Adjust I.F. transformer trimmer screws for maximum reading on the output meter, commencing with the second I.F. transformer and following with the first.
(4) Continue this alignment on both transformers in turn until no greater output can be obtained.

Note: If trimmer screws are screwed too far in, it may be possible to obtain a false peak. Start alignment of each transformer by first screwing its core well out, and then advancing the core into the coil until resonance is obtained.

R.F. ALIGNMENT

(1) (a) Replace chassis base plate and check that, when the 3-gang capacitor is fully enmeshed, the pointer coincides with the setting point on the extreme left-hand side of the dial back plate.
(b) Instal receiver in the cabinet; the pointer should now coincide with the setting mark at the bottom left-hand side of the dial scale.
(c) Set volume control to maximum and re-connect loop aerial to receiver (top lead to top terminal).
(d) Connect signal generator through a special resistance network — illustrated below — to *A* and *E* loop terminals.



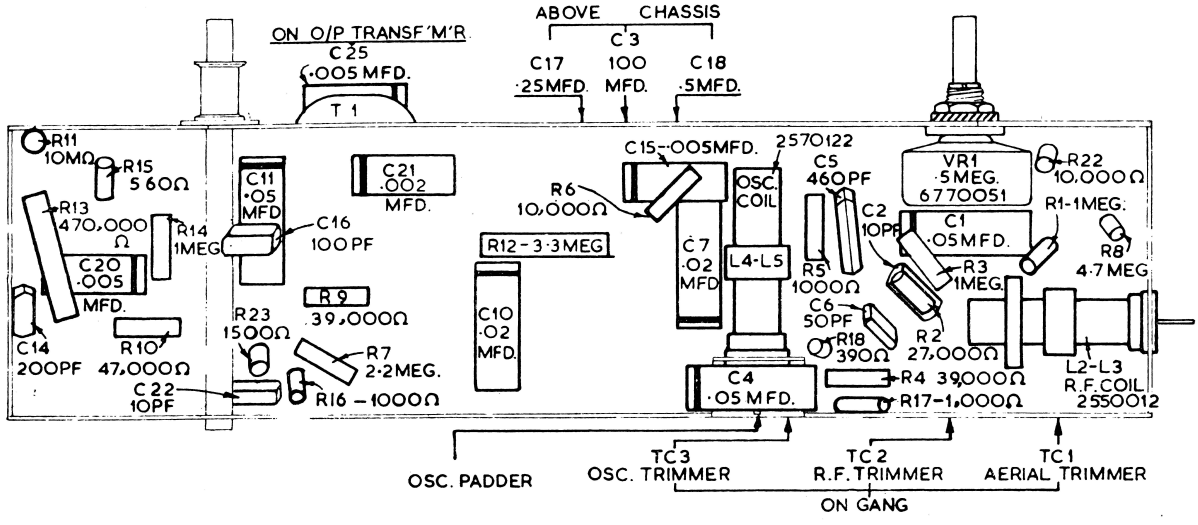
Note: Non-inductive resistors should be used in the above network. Sensitivity figures obtained will not represent the true sensitivity of the instrument; purpose of the network is to obtain optimum alignment of the loop when used without an external aerial.
(2) Tune the signal generator to 600 kc/s.
(3) Rotate tuning knob until pointer is exactly under the 600 kc/s calibration point on the dial scale; this point may be found directly under 7ZL.
(4) Adjust the oscillator padder screw for maximum response.
(5) Set signal generator to 1500 kc/s.
(6) Rotate tuning knob until pointer coincides with the 1500 kc/s calibration point, which is located to the right of 7DY on the dial scale.
(7) Adjust oscillator trimmer for maximum response.
(8) Repeat operations (2) to (7) inclusive until correct calibration is achieved.
(9) Close cabinet back and adjust R.F. and Aerial trimmers in turn at 1500 kc/s for maxium response; access to these trimmers is provided by two holes in cabinet back.

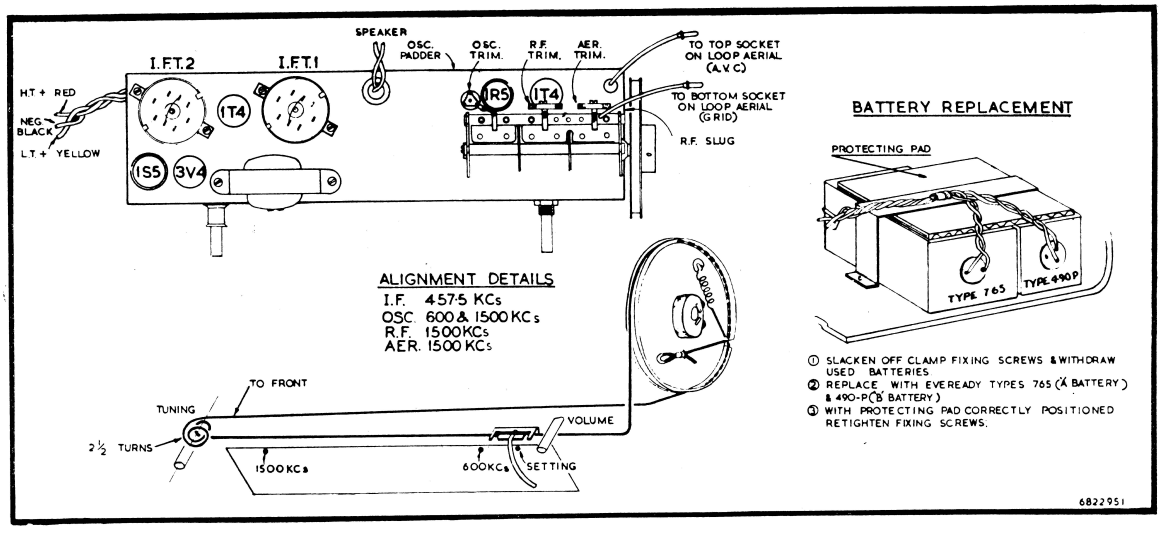
Note: For operation (9) it is essential that batteries be in position in the cabinet.

ADDITIONAL DATA

Any further service information may be obtained by addressing an enquiry to the "Service Division, The Gramophone Company Limited, 575-577 Parramatta Road, Leichhardt, N.S.W." (Telephone LM1491).

During the course of production of this receiver the Company reserves the right, without notice, to make any modifications or improvements in design which may be necessary to meet prevailing conditions. Information concerning changes, which is likely to be of benefit to retailers and servicemen, will be notified as far as possible, by issuing a Technical Data Sheet.


ON O/P TRANSF'M'R
C25
·005 MFD.
T1
ABOVE CHASSIS
C3
100 MFD.
C17
·25MFD.
C18
·5MFD.
R11
10MΩ
R15
560Ω
R13
470,000Ω
R14
1MEG
C20
·005 MFD.
C14
200PF
R10
47,000Ω
C22
10PF
C11
·05 MFD
C16
100PF
C21
·002 MFD.
R23
15000Ω
R9
39,000Ω
R7
2·2MEG.
R16 – 1000Ω
R12 – 3·3MEG
C10
·02 MFD.
R6
10,000Ω
C15 – 005MFD.
2570122
OSC. COIL
C7
·02 MFD
L4-L5
C5
460PF
R5
1000Ω
C2
10PF
C6
50PF
R18
390Ω
C4
·05 MFD.
R2
27,000Ω
R4 39,000Ω
R17 – 1,000Ω
VR1
·5MEG.
6770051
C1
·05MFD.
R3
1MEG.
R22
10,000Ω
R1-1MEG.
R8
4·7MEG
L2-L3
R.F. COIL
2550012
OSC. PADDER
TC3
OSC. TRIMMER
TC2
R.F. TRIMMER
TC1
AERIAL TRIMMER
ON GANG


SPEAKER
OSC. PADDER
OSC. TRIM.
R.F. TRIM.
AER. TRIM.
I.F.T.2
I.F.T.1
HT + RED
NEG. BLACK
L.T. + YELLOW
1T4
1S5
3V4
1R5
1T4
TO TOP SOCKET ON LOOP AERIAL (A.V.C)
TO BOTTOM SOCKET ON LOOP AERIAL (GRID)
R.F. SLUG
ALIGNMENT DETAILS
I.F. 457·5 KCs
OSC. 600 & 1500 KCs
R.F. 1500 KCs
AER. 1500 KCs
TO FRONT
TUNING
2½ TURNS
1500 KCs
600 KCs
VOLUME
SETTING
BATTERY REPLACEMENT
PROTECTING PAD
TYPE 765
TYPE 490P
① SLACKEN OFF CLAMP FIXING SCREWS & WITHDRAW USED BATTERIES.
② REPLACE WITH EVEREADY TYPES 765 (A BATTERY) & 490-P (B BATTERY)
③ WITH PROTECTING PAD CORRECTLY POSITIONED RETIGHTEN FIXING SCREWS.
6822951

CHASSIS TYPE 22 PARTS LIST

RESISTORS

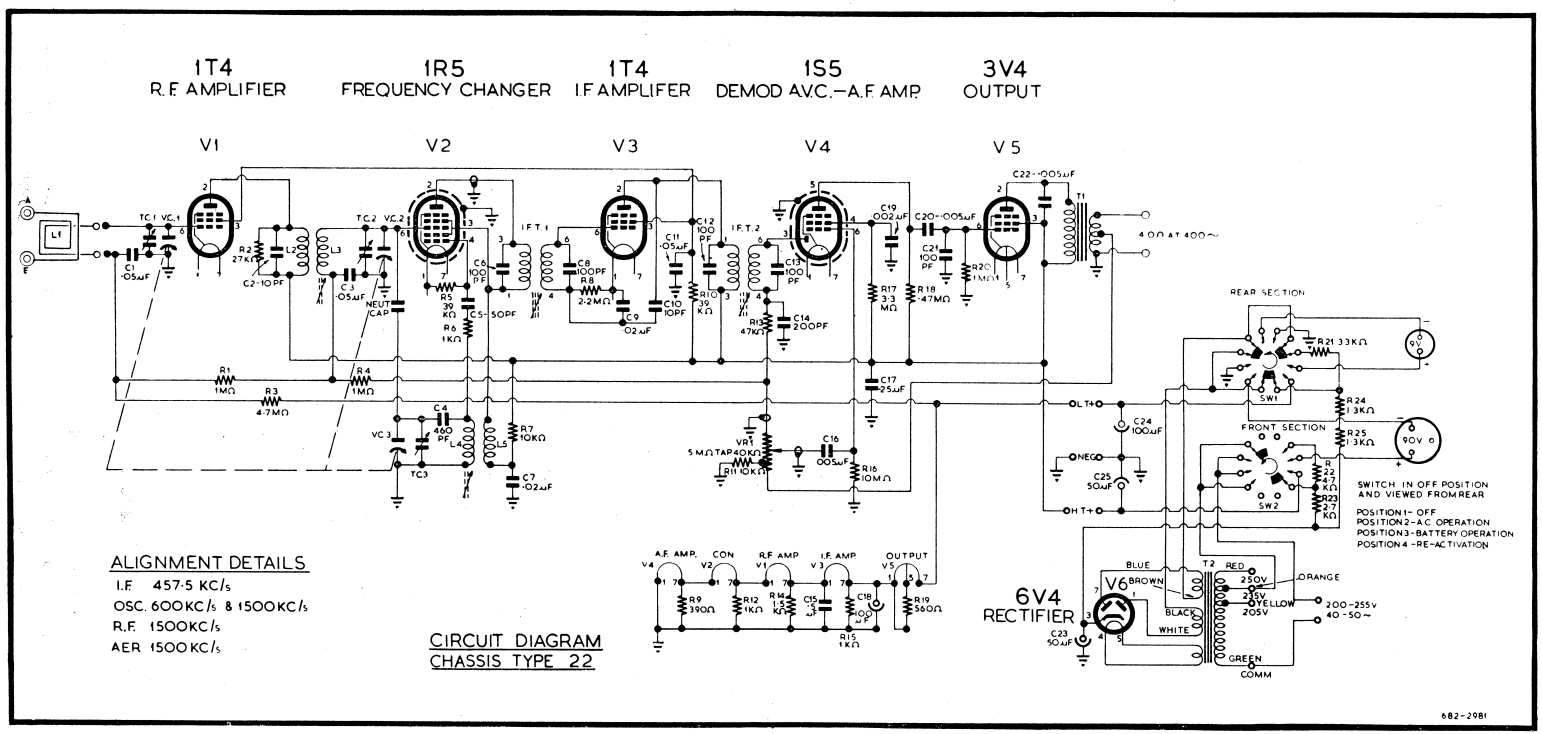
REF.	PART No.	DESCRIPTION	REF	PART No.	DESCRIPTION
R1	7400192	1 Megohm ± 10% ½ Watt	R14	7400252	1,500 ohms ± 10% ½ Watt
R2	7400112	27,000 ohms ± 10% ½ Watt	R15	7400022	1,000 ohms ± 10% ½ Watt
R3	7420222	4.7 Megohms ± 10% 1 Watt	R16	7420232	10 Megohms ± 10% 1 Watt
R4	7400192	1 Megohm ± 10% ½ Watt	R17	7420212	3.3 Megohms ± 10% 1 Watt
R5	7400232	39,000 ohms ± 10% ½ Watt	R18	7420172	470,000 ohms ± 10% 1 Watt
R6	7400022	1,000 ohms ± 10% ½ Watt	R19	7400262	560 ohms ± 10% ½ Watt
R7	7400082	10,000 ohms ± 10% ½ Watt	R20	7400192	1 Megohm ± 10% ½ Watt
R8	7400202	2.2 Megohms ± 10% ½ Watt	R21	7420292	3,300 ohms ± 10% 1 Watt
R9	7400002	390 ohms ± 10% ½ Watt	R22	7420022	4,700 ohms ± 10% 1 Watt
R10	7400232	39,000 ohms ± 10% ½ Watt	R23	7420262	2,700 ohms ± 10% 1 Watt
R11	7400082	10,000 ohms ± 10% ½ Watt	R24	7500021	1,300 ohms ± 5% 5 Watt
R12	7400022	1,000 ohms ± 10% ½ Watt	R25	7500021	1,300 ohms ± 5% 5 Watt
R13	7400122	47,000 ohms ± 10% ½ Watt			

CAPACITORS

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
C1	2790121	.05 mF ± 20% 200v.	C14	2730081	200 pF ± 20%
C2	2730011	10 pF ± 10%	C15	2790201	.5 mF ± 20% 200v.
C3	2790121	.05 mF ± 20% 200v.	C16	2790031	.005 mF ± 20% 600v.
C4	2730301	460 pF ± 5 pF	C17	2790231	.25 mF ± 20% 200v.
C5	2730041	50 pF ± 10%	C18	2690251	100 mF 10v. wkg.
C6	2750041	100 pF ± 5%	C19	2790001	.0O2 mF ± 20% 600v.
C7	2790091	.02 mF ± 20% 400v.	C20	2790031	.055 mF ± 20% 600v.
C8	2750041	100 pF. ± 5%	C21	2730051	100 pF ± 10%
C9	2790091	.02 mF ± 20% 400v.	C22	2790031	.005 mF ± 20% 600v.
C10	2730011	10 pF ± 10%	C23	2690241	50 mF 200v. wkg.
C11	2790121	.05 mF ± 20% 200v.	C24	2690251	100 mF 10v. wkg.
C12	2750041	100 pF ± 5%	C25	2690241	50 mF 200v. wkg.
C13	2750041	100 pF ± 5%	Neut Cap	5260921	Capacitor Neutralising

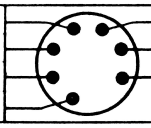
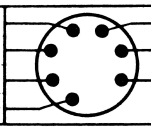
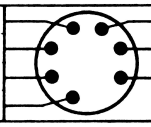
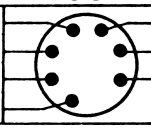
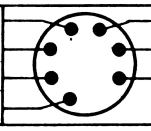
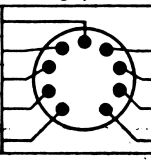
MISCELLANEOUS

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
VC1-2-3	2810092	Capacitor, 3-gang, Variable		2970011	Cord, Dial Drive, White (3ft. 3in.)
L1	2530131	Loop Aerial		3810061	Drum Dial
L2-L3	2550014	Coil—M/W R.F.		6710061	Pointer
L4-L5	2570134	Coil—M/W Oscillator		8400091	Spring, Dial Cord
TC1-TC2	2810082	Capacitor Trimmer		6680181	Plug, 3-pin (B Battery 490P)
TC3	2810031	Capacitor Trimmer		6680191	Plug, 2-pin (A Battery 765)
IFT1	9060005	Transformer, 1st I.F.	Mains inlet plug	1370011	Body
IFT2	9060024	Transformer, 2nd I.F.		2910051	Contact, 2 each
T1	9050005	Transformer, Output		2940241	Back
T2	9040062	Transformer, Mains Unit		8140331	Screws, 2 each
VR1	6770051	Volume Control, .5 megohm, tapped 40,000 ohms Potentiometer		5170071	Knob Control
				2440081	Clip, Knob
SW1 SW2	8550171	Switch, 5-pole, 4 position			


1T4
R.F. AMPLIFIER
1R5
FREQUENCY CHANGER
1T4
I.F. AMPLIFER
1S5
DEMOD A.V.C.—A.F. AMP.
3V4
OUTPUT
V1
V2
V3
V4
V5
ALIGNMENT DETAILS
I.F. 457·5 KC/s
OSC. 600KC/s & 1500KC/s
R.F. 1500KC/s
AER 1500KC/s
CIRCUIT DIAGRAM
CHASSIS TYPE 22
6V4
RECTIFIER
V6
REAR SECTION
FRONT SECTION
SW1
SW2
SWITCH IN OFF POSITION AND VIEWED FROM REAR
POSITION 1- OFF
POSITION 2- A.C. OPERATION
POSITION 3- BATTERY OPERATION
POSITION 4 -RE-ACTIVATION
400 AT 400~
200-255v
40-50~
BLUE
BROWN
BLACK
WHITE
GREEN
COMM
RED
ORANGE
YELLOW
250V
235V
205V
682-2981

VOLTAGE TABLE

- RECEIVER OPERATING ON MAINS POWER SUPPLY & TUNED TO A POINT OF NO RECEPTION.
- READINGS TAKEN WITH MAINS VOLTAGE ADJUSTED TO THE NOMINAL VALUE OF THE TAP USED ON THE TRANSFORMER.
- VOLTAGE READINGS TAKEN WITH METER RESISTANCE OF 1,000 OHMS PER VOLT

VOLTS TO CHASSIS	CURRENT M.A.	RESISTANCE TO CHASSIS	VALVE ELECTRODE	BOTTOM VIEW OF VALVE SOCKET	VALVE ELECTRODE	VOLTS TO CHASSIS	CURRENT M.A.	RESIST'CE TO CHASSIS
			V1	1T4	R.F. AMPLIFIER			
—	—	—	NO CONN.		FILAMENT−	—	—	—
43	0·6	INFIN.	SCREEN		GRID	—	—	1·6 MΩ
90	1·6	INFIN	PLATE		FILAMENT+	3·9	46	—
2·6	46	—	FILAMENT−					
			V2	1R5	FREQUENCY CHANGER			
—	0·2	39KΩ	OSC. GRID.		FILAMENT−	—	—	—
55	3·5	INFIN.	SCREEN		GRID	—	—	1·2 MΩ
90	1·3	INFIN.	PLATE		FILAMENT+	2·6	46	—
1·3	46	—	FILAMENT−					
			V3	1T4	I.F. AMPLIFIER			
—	—	—	NO CONN.		FILAMENT−	—	—	—
43	0·5	INFIN.	SCREEN		GRID	—	—	2·2 MΩ
90	1·6	INFIN.	PLATE		FILAMENT+	5·2	46	—
3·9	46	—	FILAMENT−					
			V4	1S5	AUDIO AMPLIFIER-DEMOD.			
6	0·02	INFIN.	SCREEN		PLATE	18	0·12	INFIN.
—	—	0·49 MΩ	DIODE		GRID	—	—	10MΩ
—	—	—	NO CONN.		FILAMENT+	1·3	46	—
0	46	—	FILAMENT−					
			V5	3V4	OUTPUT			
—	—	—	NO CONN.		FILAMENT C.T.	6·5	—	—
90	1·0	INFIN.	SCREEN		GRID	—	—	1MΩ
88	4·6	INFIN.	PLATE		FILAMENT+	7·8	46	—
5·2	46	—	FILAMENT−					
			V6	6V4	RECTIFIER			
—	—	INFIN.	HEATER					
—	—	INFIN.	HEATER		NO CONN.	—	—	—
130	62	—	CATHODE		PLATE No. 2	141	—	110Ω
—	—	—	NO CONN.		NO CONN.	—	—	—
141	—	110Ω	PLATE No. 1		NO CONN.	—	—	—

REMARKS.

H T. VOLTAGE = 90VOLTS.

H. T. CURRENT = 15 M.A.

AFTER VALVE REPLACEMENT, CHECK THAT ALL FILAMENT VOLTAGES ARE BETWEEN THE LIMITS OF 1·20 TO 1·40 VOLTS WITH MAINS VOLTAGE ADJUSTED TO THE NOMINAL VALUE OF THE TAP USED ON THE POWER TRANSFORMER. SHOULD THE 6V4 RECTIFIER BE REPLACED, CHECK THAT THE CURRENT SUPPLIED TO THE FILAMENT CHAIN LIES BETWEEN THE LIMITS OF 45·0 TO 47·0 M.A. WITH MAINS VOLTAGE ADJUSTED TO CORRECT VALUE.