

“HIS MASTER'S VOICE”

*Service Manual*

8 VALVE ALL-WORLD RADIO TABLE MODEL  
AND RADIOPHONIC, MODELS 469 & 479

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## MODELS 469 & 479

### SPECIFICATION

#### VOLTAGE RANGE.

195 to 255 volts A.C.  
50 to 100 cycles (table model).  
50 to 60 cycles (radiogram).

#### POWER CONSUMPTION.

Approximately 127 watts (radio).  
" 150 watts (gramophone).

#### FUSES.

It is recommended that these instruments are connected only to supply points protected with 2-ampere fuses.

#### SPEECH OUTPUT.

Approximately 5 watts undistorted.  
Anode dissipation of KT66 output valve 17 watts.

#### WAVELENGTH RANGE.

LW .. .. ..	725 to 2,000 metres.
MW .. .. ..	195 " 580 "
SW1 .. .. ..	35 " 100 "
SW2 .. .. ..	11 " 35 "

#### DIMENSIONS.

Model 469.	Height. 21 inches.	Width. 18 $\frac{1}{2}$ inches.	Depth. 12 $\frac{1}{4}$ inches.
Model 479.	Height. 30 $\frac{1}{2}$ inches.	Width. 31 inches.	Depth. 21 $\frac{1}{4}$ inches.

#### WEIGHT.

Model 469.	56 lb. net.	68 lb. gross.
Model 479.	120 lb. net.	204 lb. gross.

#### VALVES.

Marconi W63 .. ..	H.F. Amplifier.
.. X64 .. ..	Mixer.
.. Z63 or KTZ63 ..	Oscillator.
.. W63 .. ..	I.F. Amplifier.
.. D63 .. ..	Detector and A.V.C. diodes.
.. Z63 or KTZ63 ..	L.F. Amplifier.
.. KT66 .. ..	Output Valve.
.. U50 .. ..	H.T. Rectifier.
.. 6G5 .. ..	Tuning Indicator.

#### LOUDSPEAKER.

##### No. 24460 S.

The elliptical cone loudspeaker has an energised field coil, and the chassis incorporates three high capacity electrolytic smoothing condensers (C39, C40, C41). The field is connected in the positive H.T. lead where it acts as a smoothing choke.

D.C. resistance of speech coil ..	4 ohms.
Impedance at 800 cycles .. ..	5 "
D.C. resistance of field coil .. ..	400 "

#### PICK-UP (Radiogram).

##### No. 28060 C.

D.C. resistance .. .. .. 850 ohms.

For full service data see separate manual already issued.

#### MOTOR (Radiogram).

##### No. 24 S.

Induction disc motor is wired across the 195 to 223 tapping of the mains transformer. This ensures a consistent voltage across the motor, no other voltage adjustment being necessary.

#### AUTO. BRAKE.

No. 230E. Standard friction-feed type. For full service particulars, see Models 445, 545, Service Manual.

#### CONNECTING A PICK-UP (Table Model).

A high resistance pick-up, such as "His Master's Voice" No. 11, may be permanently connected to the sockets provided.

#### EXTRA LOUDSPEAKERS.

These models will operate up to four extra loudspeakers without greatly reducing the volume from the built-in speaker. The total speech coil impedance of extra speakers should be approximately 5 ohms, and "His Master's Voice" Models 172 and 184, are very suitable.

#### ANTI-STATIC AERIAL.

This receiver has, in addition to ordinary aerial and earth sockets, a specially designed input circuit to match the line impedance of the "His Master's Voice" Anti-static Aerial Model 214. This aerial equipment is provided with a special non-reversible plug attached to the transmission line, which fits two special sockets on the receiver. The link-plug included in the aerial equipment must be inserted between aerial and earth sockets when using the anti-static aerial.

## CIRCUIT DESCRIPTION

### AERIAL CIRCUIT.

- For standard aerial the input circuit consists of a separate aerial transformer for each of the four wavebands. Connexion to the transmission line socket for the anti-static aerial is made through a bank of switch contacts (S2) to an impedance matching tap on the tuned secondaries of these transformers.

### H.F. AMPLIFIER.

The secondaries tune the grid circuit of an H.F. amplifier (W63) with AVC bias control. This valve has a tuned anode circuit, the anode lead being tapped into the medium and long wave inductances. A small condenser couples this circuit to the grid of the heptode mixer.

### MIXER AND OSCILLATOR.

The two-valve frequency changer has been chosen because of the extremely high frequency stability required for low wavelengths. The oscillator valve V3 (Z63) incorporates a Hartley type circuit with centre tapped inductances, and individual padding for each waveband. An additional reaction coil L17 is included on the shortest wave range to ensure consistent oscillation. The oscillator voltage is injected from the cathode of the oscillator valve via C11 into the heptode mixer V2 (X64) which has in its anode circuit the primary of a variable coupling I.F. transformer.

### I.F. AMPLIFIER.

A variable mu I.F. amplifier valve V4 (W63) is A.V.C. controlled and is coupled by the second I.F. transformer to the diode detector V5. The coupling of both I.F. transformers is varied by switch S12 (ganged to the treble tone control) and its operation is to short-circuit tertiary coils (L22, L24) placed between the primary

and secondary of the transformers. Eddy current losses introduced when these coils are shorted reduce the coupling and so give higher selectivity. A compensating coil (L23) is included in IFT1 to balance the inductance and preserve a good band-pass effect in the fidelity position.

### DETECTOR AND A.V.C. CIRCUITS.

The double diode (D63) has one diode fed direct from the tapped secondary of IFT2 for signal rectification (load R13, filter C23, R14, C49, R40), and the A.V.C. diode fed from the same tapping via C24. Delay is obtained by connecting the A.V.C. diode cathode to a tapping on the self-bias circuit (R20, R21) of V6, whilst the A.V.C. diode load (R16, R41) is connected down to chassis. It will be noted that V1, V2 and the tuning indicator take full A.V.C. voltage, whilst V4 takes half voltage.

### L.F. AMPLIFIER AND TONE CONTROL.

The valve V6 (Z63) connected as a triode L.F. amplifier is fed from the volume control, VR1 and is parallel fed (R23, C35) transformer coupled to the next valve. The bass tone control circuit is in series with the primary of this transformer, whilst the treble control VR3 shunts a condenser across the secondary.

### OUTPUT STAGE AND SUPPLY.

The output valve V7 (KT66) has a negative feed-back circuit (C37, R29) which ensures a very level frequency response and low harmonic distortion. Bias is obtained by means of the cathode resistance R28.

The full-wave rectifier V8 (U50) supplies current for all valves and a two-stage smoothing filter in which the loudspeaker field is the second smoothing choke is employed. The high capacity electrolytic smoothing condensers C39, C40 and C41 are mounted on the loudspeaker chassis.

## PRELIMINARY TESTS

This receiver employs the new "International" type valves with eight pin (octal) bases. With these valves the grid connexion is made to the top cap, and therefore it is more difficult to check individual H.T. voltages. On the table model checking is facilitated by the removable cabinet bottom; on all models the following tests can be made without disturbing the chassis.

1. *Maximum H.T. Voltage.*—Measure voltage between tag 5 on L.S. panel and chassis. This should be approximately 330 volts. High values indicate low H.T. current, and possibly faulty CK1, loudspeaker field, output valve, etc. Low voltage indicates high H.T. current, possibly faulty electrolytic condensers or an "earth" on the H.T. wiring or smoothing chokes.
2. *Smoothed H.T. Voltage.*—Tag 6 L.S. panel to chassis

approximately 310 volts. Tag 7 L.S. panel to chassis, approximately 250 volts.

3. *L.F. Test.*—Operation of the L.F. end of the receiver can be tested by removing the earth lead and touching the left-hand pick-up socket, and then the top grid of V6. A loud hum will be heard if the L.F. and output stages are in good order.
4. *H.F. Test.*—The earlier stages of the receiver can be systematically eliminated by contacting the aerial lead on to fixed vanes VC1, then fixed vanes VC2. Medium wave results should be obtained, and if at some point signals appear the fault will be found in one of the earlier stages. See continuity checks page 7, valve sockets tests and valve table, page 10.

## DISMANTLING INSTRUCTIONS

### MODEL 469

#### REMOVAL OF CHASSIS.

1. Remove back and knobs.
2. Unsolder leads from loudspeaker and remove fixing cleat.
3. Remove four fixing bolts from underside of cabinet. The chassis may now be withdrawn.

(Note.—By removing the outer three woodscrews fixing the three steel strips from the underside of the cabinet, the cabinet bottom may be removed for inspection of the chassis without withdrawing the latter from the cabinet.)

#### ACCESS TO UndERSIDE OF CHASSIS.

Remove two woodscrews on right-hand side of radio control panel and remove volume control knob. The right-hand side panel may now be withdrawn.

#### REMOVAL OF RADIO CHASSIS.

1. Remove side panel as detailed above.
2. Remove knobs and four wood-screws securing control panel and remove panel.
3. Disconnect from chassis aerial, earth, pickup, motor and motor earth leads and leads on loudspeaker panel.
4. Remove four bolts securing radio chassis.

The chassis may now be withdrawn.

#### REMOVAL OF LOUDSPEAKER.

1. Disconnect leads to speaker panel.
2. Remove four fixing screws and withdraw speaker.

#### CONNEXIONS TO L.S. PANEL.

Tag No.	Lead Colour.
1	Yellow.
3	Black.
5	Yellow/black.
6	Red.
7	Red/Yellow.
L.S. frame	Black V.I.R.

### MODEL 479

#### REMOVAL OF LOUDSPEAKER.

1. Disconnect leads from radio chassis and extra L.S. panel at loudspeaker panel.
2. Remove four fixing screws and withdraw speaker.

#### CONNEXIONS TO LOUDSPEAKER.

Tag. No.	Lead colour.	
2	Yellow	
3	Black	
5	Yellow/Black	To Radio Chassis.
6	Red	
7	Red/Black	
L.S. frame	Black V.I.R.	
1	Yellow	
2	Yellow/Black	To ext. L.S. Panel.
3	Black	

## H.F. TESTS AND ADJUSTMENTS

The alignment of this receiver should not be attempted unless adequate apparatus is available, and must be done with great care. A shielded oscillator or signal generator tuning from 11 to 2,000 metres fitted with an attenuator, and an output meter, or an 0-2 A.C. voltmeter are required. The E.M.I. Service equipment is recommended. The receiver, and the oscillator if mains driven, should be switched on at least a quarter of an hour before commencing ganging operations.

#### SEQUENCE OF ALIGNMENT.

Be very careful not to bend or alter the position of leads in the vicinity of the wavechange switch and tuning coils. The shortest wave-range is provided with a form of inductance trimming for the oscillator coil in addition to the usual trimming condensers. Generally speaking the alignment of the different wave-bands is

not interdependant, but it is suggested that if work has been done on a given band when re-aligning this band the other should be touched up or alternatively carefully checked with a tuning wand (see page 6). In cases where re-alignment of the I.F. circuits is necessary it is essential to follow this with the entire H.F. alignment procedure.

#### CONNEXION OF OUTPUT METER.

If an E.M.I. Service Output Meter is used it should be connected between the anode of the output valve (KT66) and chassis. If the A.C. voltmeter is used it must be connected to the extra L.S. sockets (see that the L.S. switch is in the central position). During all ganging operations the input to the receiver from the oscillator should be progressively reduced as the circuits are brought into line, so that the reading on the output meter does not exceed 500mW or 1.6 volts.

## I.F. ALIGNMENT.

IMPORTANT.—A signal modulation of not more than 30 per cent. must be used for I.F. ganging.

Set receiver to SW2 band, gang condenser to maximum, volume control to maximum, bass tone control fully anti-clockwise, and top tone control as far anti-clockwise as possible without switching to high fidelity.

1. Connect oscillator to top grid V2 (X64) via an 0.1 mfd. condenser and chassis; and tune oscillator exactly to 465 kc.
2. Adjust TC15, TC16, TC17 and TC18 for maximum deflection on output meter.
3. Check these adjustments in the same, and in the reverse order until no further increase can be obtained.

## LONG WAVES.

Set tone and volume controls as for I.F. alignment, but switch to LW and gang to minimum. Connect oscillator to aerial and earth sockets.

1. Note the indication of the vernier dial. Now turn the gang condenser 10 degrees (on the vernier scale) in. The wavescale pointer should now register accurately on 725 metres. If it does not do so, slacken the pointer fixing screws and adjust.
2. Tune oscillator to 725 metres and adjust TC9 for maximum output.  $413.8 \text{ KC}$ .
3. Set oscillator to 850 metres, tune-in signal on receiver and adjust TC1 and TC5 for maximum.  $157.9 \text{ KC}$ .
4. Set oscillator to 1,900 metres, tune in signal and adjust TC13 for maximum, at the same time "rocking" the gang condenser.

IMPORTANT.—Unless the latter adjustment is done with a hard fibre or other entirely non-metallic screwdriver, the screwdriver must be withdrawn from the trimmer hole to ascertain if the correct setting has been obtained. Bear in mind that the presence of the screwdriver adds to the trimmer capacity, and allow for this.

5. Return oscillator and receiver to 725 metres and check the setting of TC9.  $413.8 \text{ KC}$
6. Repeat operations 3, 4 and 5.

## MEDIUM WAVES.

Connect oscillator and set tone and volume controls as for LW. Unless you have already checked the correctness of the wave-scale pointer, do so as detailed under LW.

$1.639 \text{ KC}$ .

1. Set oscillator to 195 metres and receiver to the same wavelength by the wave-scale.
2. Adjust TC10 carefully for maximum output.

$1429 \text{ KC}$ .

3. Set oscillator to 210 metres, tune in on receiver and adjust TC2 and TC6 for maximum.
4. Tune oscillator to 530 metres and adjust TC14 for maximum at the same time "rocking" the gang condenser.

IMPORTANT.—This trimmer screw is not at earth potential and consequently any metal in the screwdriver will affect the adjustment. See important note under operation 4 in the L.W. ganging.

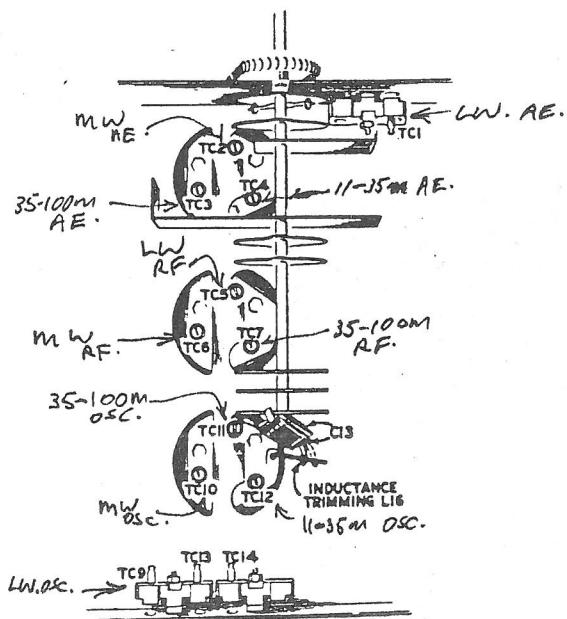
## SHORT WAVES.

See that all trimmers are accessible before commencing adjustments and do not bend any leads after trimming is completed. Unless you have not already done so, check the correctness of the wave-scale pointer as detailed under "Long Waves."

Band 35 to 100 metres.

Set volume and tone controls as for I.F. alignment, and switch to 35 to 100 metre band.

1. Adjust tuning control so that the pointer reads 725 metres on the L.W. scale. ~~725~~.
2. Tune oscillator to 35.2 metres and adjust TC11 for maximum output.  $8.52 \text{ MHz}$ .
3. Adjust oscillator to 37.5 metres and tune in signal on receiver.  $8 \text{ MHz}$ .
4. Adjust TC3 and TC7 for maximum output, at the same time "rocking" the gang condenser.
5. Repeat operations 1 to 4 to verify settings of trimmers.



Band 11 to 35 metres.

1. Set receiver waveband switch to 11 to 35 metres range, and fully unscrew TC4.
2. Tune oscillator to 11.3 metres, tune in signal on receiver and adjust TC12 for maximum output at the same time "rocking" the gang condenser.
3. Adjust TC4 for maximum.
4. Inductance adjustment of the oscillator circuit should only be done if the tuning coils of this wave range have been seriously disturbed. If this is not the case, conclude the ganging of this band by repeating operations 2 and 3. Otherwise continue on the following lines.
5. Set oscillator to 30 metres and tune signal in on receiver. Insert the ferrocarril end of a tuning wand into can containing L12. If the output reading rises the inductance of L16 must be decreased by unsoldering the junction between C13 and its connecting wire and sliding the condenser tag down towards the coil base until the insertion of either end of the wand into L12 produces a fall in output.
6. If the insertion of the ferrocarril end of the wand produces a fall in output but the insertion of the brass end raises the output, then the inductance of L16 must be increased by sliding the tag of C13 upwards until the condition outlined at the end of paragraph 5 above is achieved.

NOTE.—If two condensers in parallel are used for C13 it is very important to ensure that when resoldering the tags to the wire good connexion is made *between* the tags of the two condensers as far up to the moulded cases as possible.

7. Repeat operations 1, 2 and 3.

#### GENERAL NOTES.

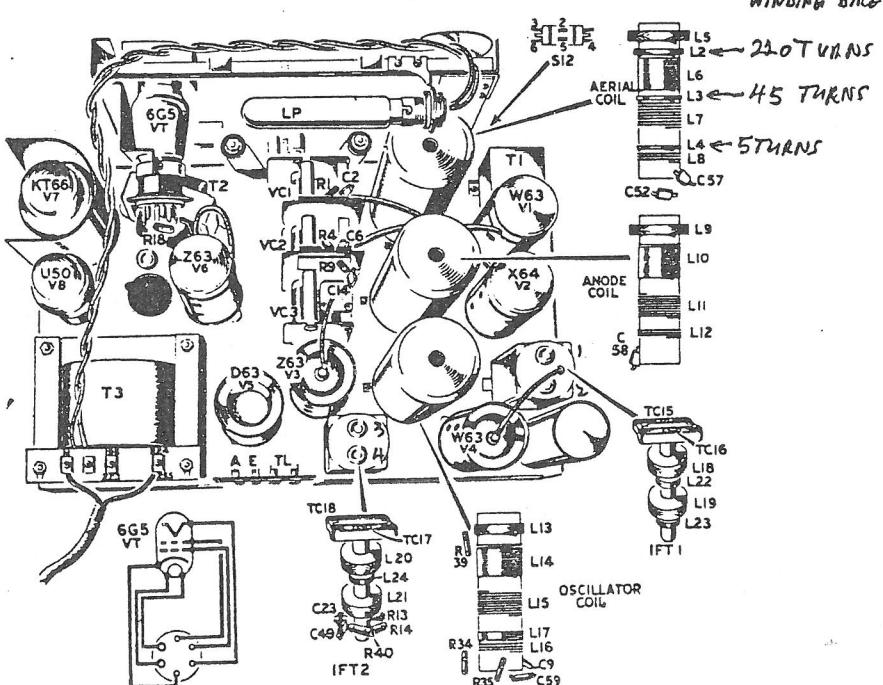
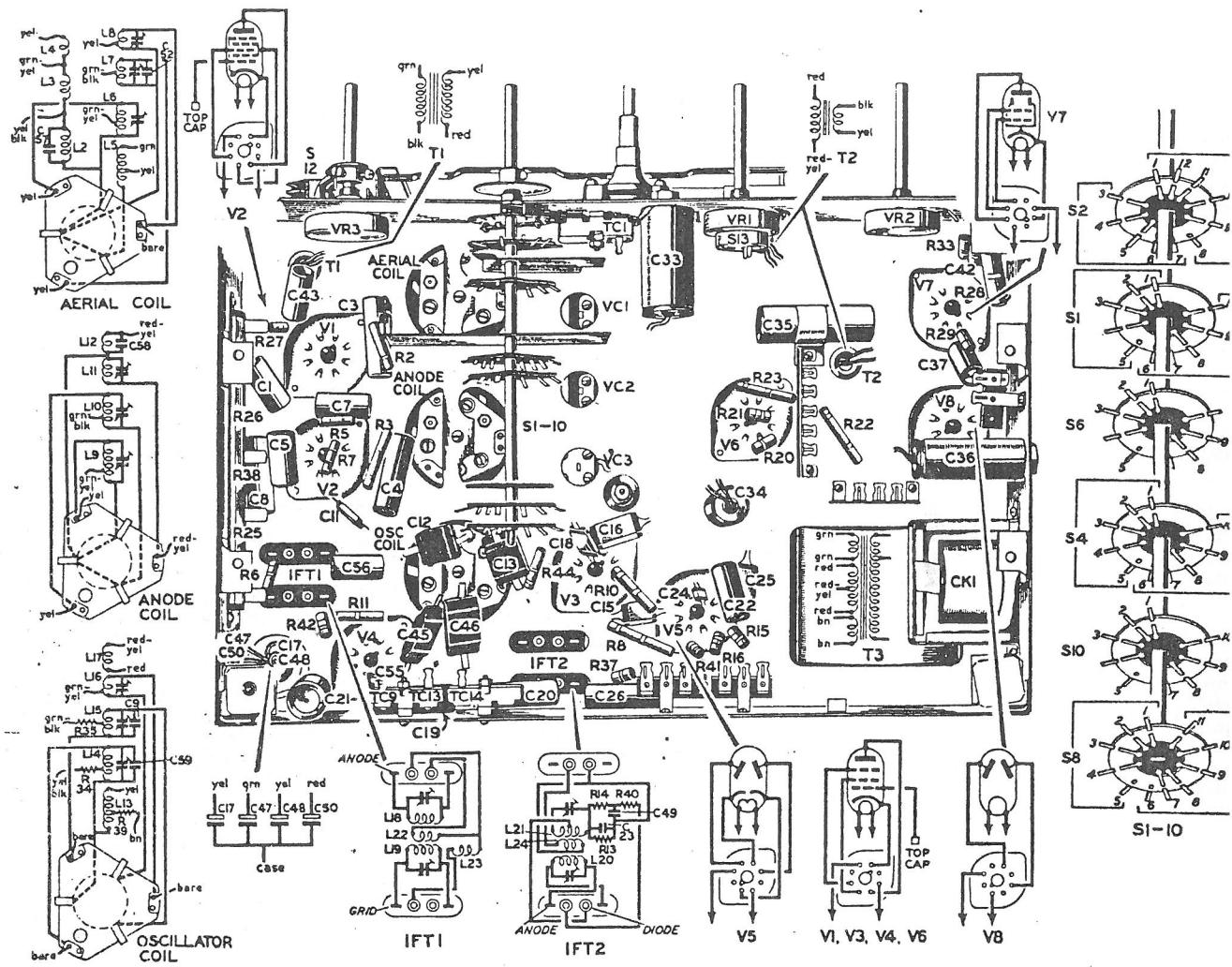
1. Do not unnecessarily disturb or bend leads.
2. Use a screwdriver with an absolute minimum of metal in the blade (such as the E.M.I. Service trimming tool).
3. Apart from the inductance trimming of L16 for which one is essential, the use of a "tuning wand" (obtainable from E.M.I. Service) will facilitate all ganging operations. The wand should be used as follows :—
  - (a) Insert the ferrocarril end of the wand into the can containing the coil of the circuit being aligned. If output reading falls, leave trimmer set and if reading increases, increase capacity by screwing down trimmer until peak reading is obtained.
  - (b) Insert brass end of wand, and if reading falls leave trimmer set, but if output reading increases decrease trimmer capacity until a peak reading is obtained.

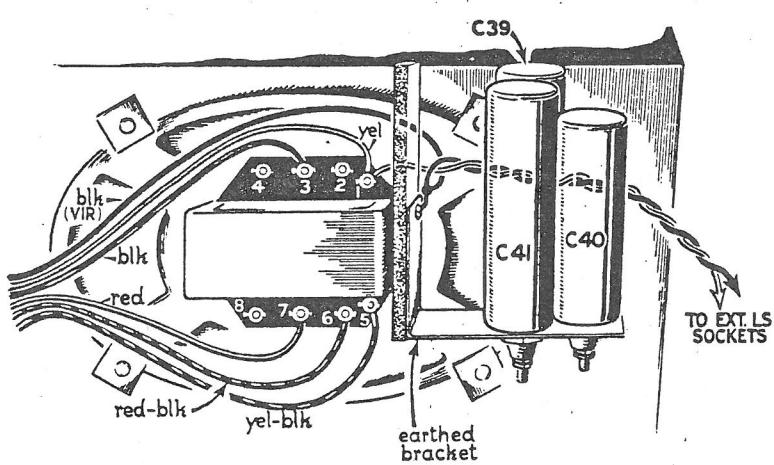
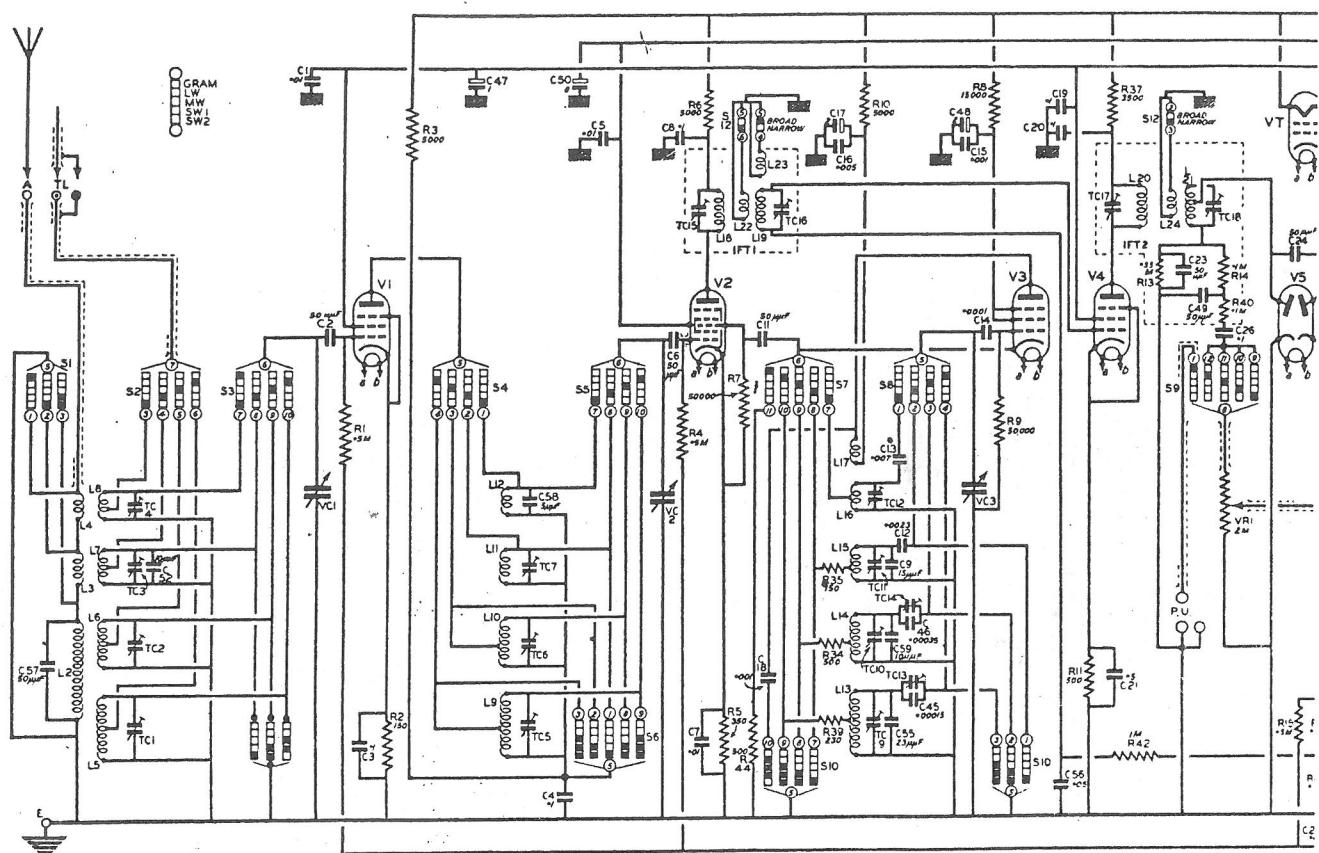
## CONTINUITY CHECKS

Remove valves and pilot lamp; values  $\pm 15$  per cent.

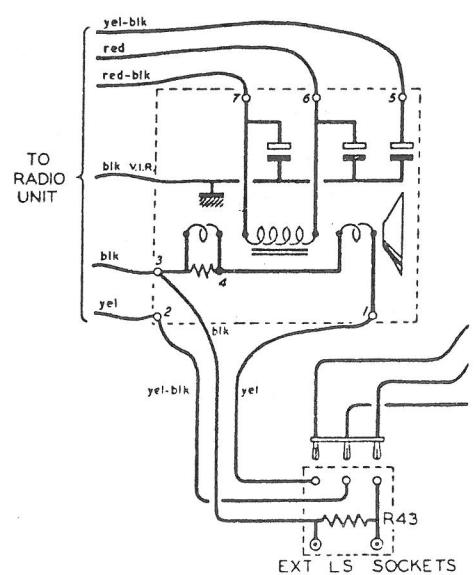
Component.	Measured.	Switch.	Resistance.
L2, L3, L4 ...	Aerial and earth sockets ...	Gram. LW MW SW1 SW2	Short. (L2, L3, L4) 48 ohms. (L2, L3, L4) 48 ohms. (L3, L4) 9 ohms. (L4) 1 ohm.
L5, L6, L7, L8 ...	(a) Fixed vanes VC1 and chassis .. (b) Smaller TL socket and chassis ..	Gram. LW MW SW1 SW2	(a) 0.1 ohm (L5) 19 ohms. (L6) 6.0 ohms. (L7) 0.2 ohm. (L8) 0.1 ohm. (b) open. 0.4 ohm. 0.3 ohm. 0.1 ohm. 0.1 ohm.
L9, L10, L11, L12 ...	Tag 7, L.S. panel and fixed vanes VC2 ..	SW2	5,000 ohms. (L9) 19 ohms. (L10) 6 ohms. (L11) 0.2 ohm. (L12) 0.1 ohm.
L13, L14, L15, L16, R34, R35, R39	(a) Cathode V3 (Z63) and chassis .. (b) Across ends ..	Gram. LW MW SW1 SW2	(a) 500 ohms. (L13) 5 ohms. (L14) 6 ohms. (L15) 0.1 ohm. (b) 260 ohms. 500 ohms. 150 ohms. Short (L16) 0.1 ohm.
L17, R10 ...	Anode V3 (Z63) and tag 7, L.S. panel ..	—	5,000 ohms. (L17, 8.5 ohms.)
L18, R6 ...	Anode V2 (X64) and tag 7, L.S. panel ..	—	5,000 ohms. (L18, 6.7 ohms.)
L19, R4 ...	Grid V2 (X64) and grid V4 (W63) ..	—	0.5 megohm. (L19, 6.7 ohms.)
L22 ...	Contacts 5 and 6, S12 ..	Broad	4.0 ohms.
L23 ...	Contacts 4 and 5, S12 ..	Narrow	4.5 ohms.
L20, R37 ...	Anode V4 (W63) and tag 7, L.S. panel ..	—	3,500 ohms. (L20, 6.7 ohms.)
L21, R13 ...	Diode V5 (D63) and chassis ..	—	0.35 megohm. (L21, 6.7 ohms.)
L24 ...	Contacts 2 and 3, S12 ..	Broad	4.0 ohms.
R1, R15, R16, R41 ...	Grid V1 (W63) and chassis ..	—	2 megohms.
R4, R42, R41 ...	Grid V2 (X64) and chassis ..	—	2 megohms.
R9 ...	Grid V3 (Z63) and chassis ..	—	50,000 ohms.
VR1 ...	Grid V6 (Z63) and chassis ..	—	6 ohms. to 2 megohms.

For T1, T2, T3, CK1, L.S. See circuit diagram.  
Field, Speech coil.

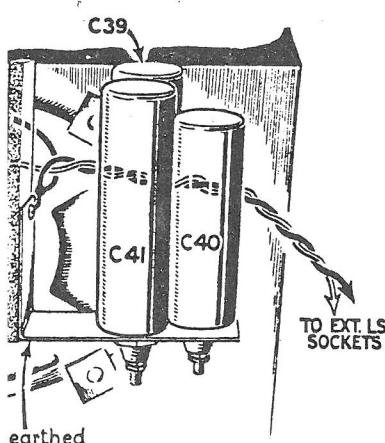
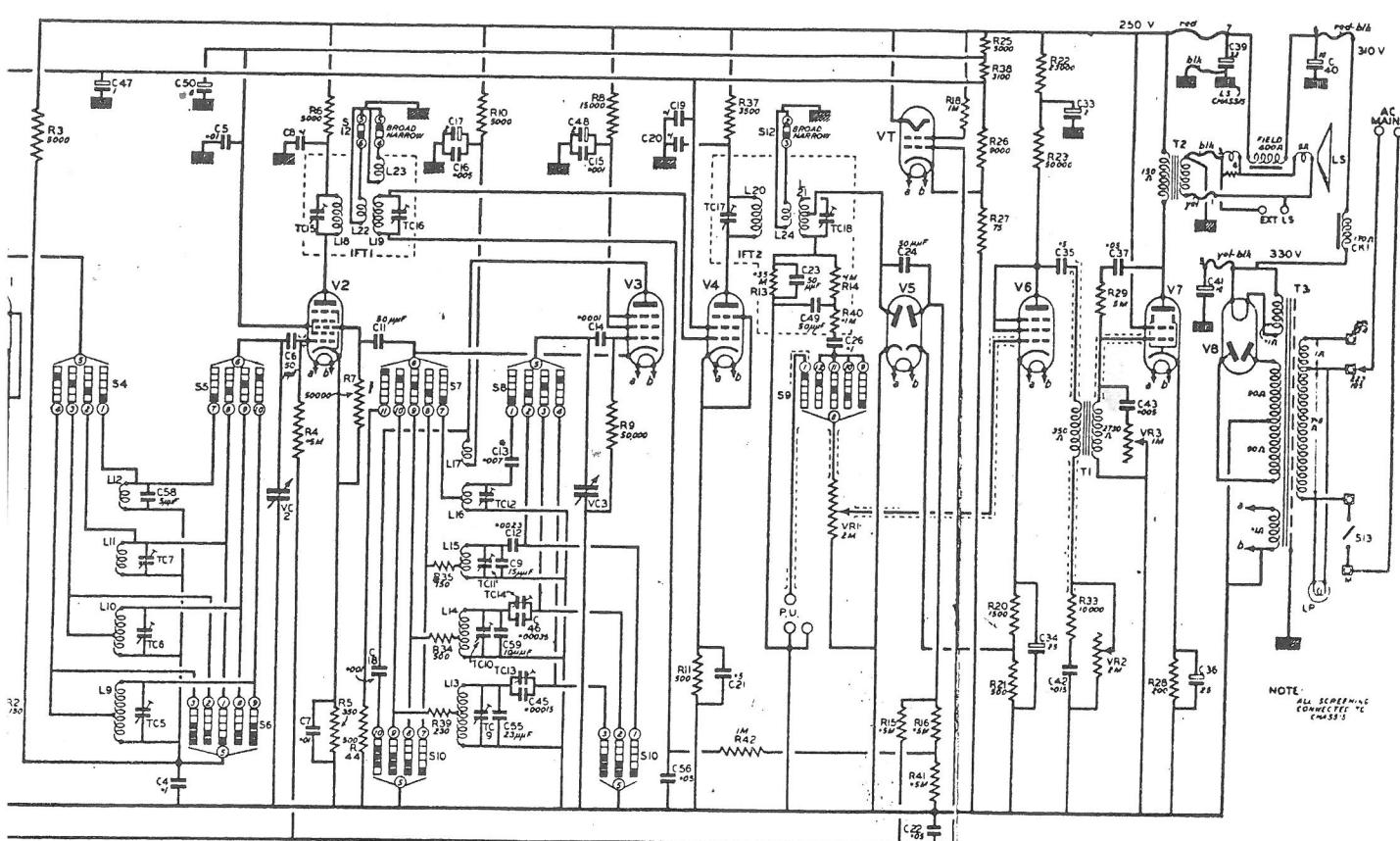




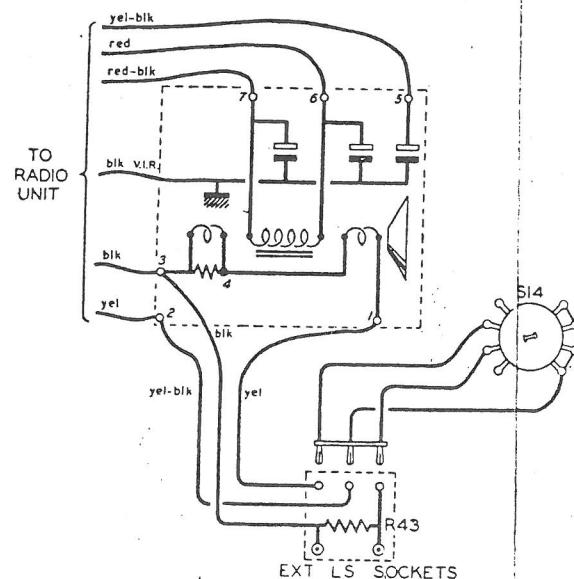
### Wiring to Table model loudspeaker (see adjacent diagram for R.G.)



### Loudspeaker wiring for radiogrammop



odel loudspeaker  
gram for R.G.)



Loudspeaker wiring for radiogramophone.

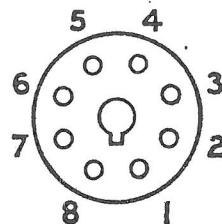
NOTE.—On the wavechange switch the contacts shown without numbers represent switch actions which are purely automatic within the switch, *i.e.*, these contacts have no external wiring to them.

## VALVE SOCKET TESTS

Remove all valves and pilot lamp, switch to M.W. Values  $\pm$  15 per cent. "S" stands for short circuit, "O" for open circuit.

Valve.	Socket Numbers (see diagram).								
	1	2	3	4	5	6	7	8	Top
V1, W63 ...	S	S	22,200	9,100	150	2,700	0·1	150	2M
V2, X64 ...	S	S	22,200	12,200	50,400	S	0·1	350	2M
V3, Z63 ...	S	0·1	22,200	32,200	32,200	22,200	S	500	50,000
V4, W63 ...	S	0·1	20,700	9,100	500	0·5M	S	500	1·5M
V5, D63 ...	S	S	0·35M	S	1M	0·1	0·1	500	—
V6, Z63 ...	S	S	90,000	90,000	90,000	500	0·1	2,000	6 ohms. to 2M(VR1)
V7, KT66 ...	S	S	17,300	17,200	2,700	10,300 to 2M(VR2)	0·1	200	—
V8, U50 ...	O	17,750	O	90	O	90	O	17,750	—

The above are resistance values in ohms measured between the points indicated and chassis.



## VALVE SOCKET SEEN FROM TOP VALVE TABLE

The following table was taken with a receiver operating on 230 volt mains, switched to medium waves (unless otherwise stated) and aerial disconnected. Values  $\pm$  15 per cent.

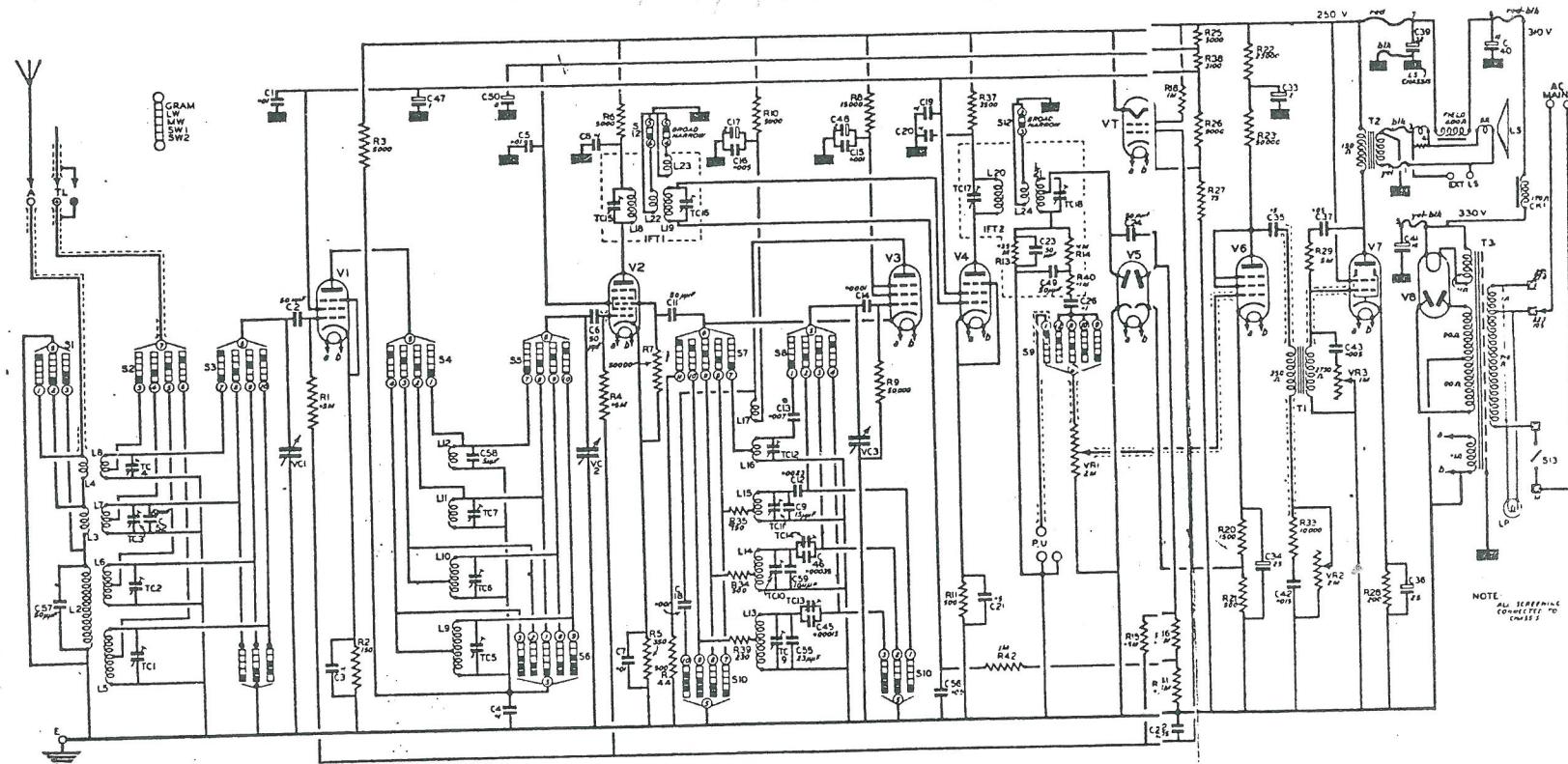
Valves.	V1 (W63) 6K7	V2 (X64) 6L7	V3 (Z63) 6J7	V4 (W63) 6K7	V5 (D63) 6H6	V6 (Z63) 6J7	V7 (KT66) 6L6	V8 (U50) 5Y3	VT (6G5)
Anode-Frame Volts	Radio 200* Gram.: Nil	210	195	215	—	95	230	350 A.C.	240 (Target)
Screen-Frame— Volts ..	95	130	190	95	—	—	240	—	—
Anode Feed mA ..	6·5†	3·5†	8·0*	5·0†	—	1·9	72	—	0·2*
Screen Feed mA ..	2·0†	7·5†	3·0*	1·2†	—	—	5·0*	—	—
Cathode Frame Volts	1·3	4·0	5·5	3·0	1·0 (One cathode is at chassis potential)	3·5	15	320	0·75

Voltage at tag 6 on L.S. panel .. .. .. .. .. .. .. .. 310 volts.  
 Voltage across L.S. field (measured at tags 6 and 7 on L.S. panel) .. .. .. .. .. .. .. .. 55 volts.  
 Total H.T. feed measured at tag 7 on L.S. panel .. .. .. .. .. .. .. .. 125 mA.  
 Feed in screen potentiometer R25, R26, R27, R38 .. .. .. .. .. .. .. .. 10·5 mA.

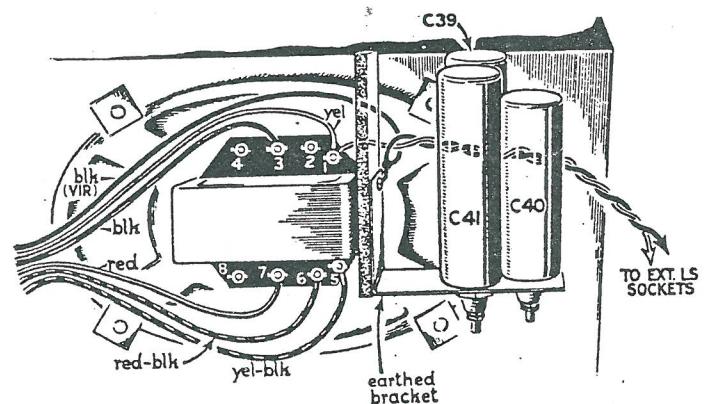
\* Increases with strong signal.

† Decreases with strong signal due to A.V.C. action.

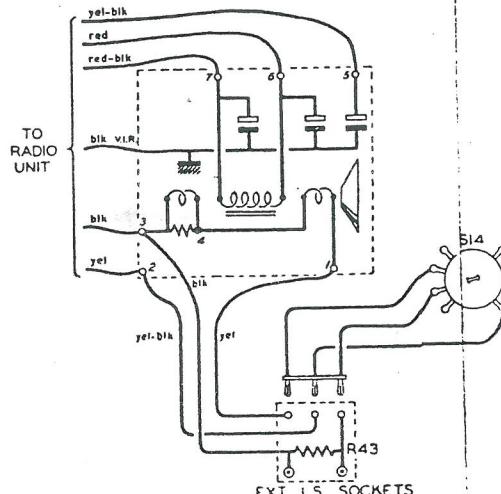
HMV 469, 479



NOTE  
ALL RELEASABLE  
CONNECTORS



Wiring to Table model loudspeaker  
(see adjacent diagram for R.G.)



Loudspeaker wiring for radiogramophone.

NOTE.—On the wavechange switch the contacts shown without numbers represent switch actions which are purely automatic within the switch, i.e., these contacts have no external wiring to them.

## SPARE PART LIST—continued.

MODEL 469

Part No.	Description.	Parts per Inst.	Finish.	Retail List Price.	Per
22624P	CK1—Smoothing choke	1	—	£ 0 6 6	Each.
10606	Screw, PK, securing CK1	2	—	0 0 6	Doz.
26330AH	IFT1—1st I.F. Transformer, complete with L18, L19, L22, L23, TC15 and TC16	1	—	0 7 6	Each.
26330AJ	IFT2—2nd I.F. Transformer complete with L20, L21, L24, R13, R14, R40, C23, C49, TC17 and TC18	1	—	0 12 6	Doz.
12619	Screw, PK, securing I.F. transformers	4	—	0 0 6	Each.
15811J	T1—Intervalve transformer	1	—	0 8 3	Doz.
8777	Screw, PK, securing T1	2	—	0 0 6	Doz.
28024A	T2—Output transformer	1	—	0 7 6	Each.
8777	Screw, PK, securing T2	2	—	0 0 6	Doz.
18511G	T3—Mains transformer	1	—	1 10 0	Each.
28031B	Terminal panel with four tags and three screws	1	—	0 0 6	Doz.
11228	Terminal screw	3	WN	0 0 4	Doz.
14512	Tag	4	—	0 0 5	Each.
14511	Nut	4	—	0 0 4	Doz.
27878	Spacer	2	WN	0 0 1	Each.
3167	Washer, SP	2	WN	0 0 2	Doz.
11627	Nut	2	WN	0 0 6	Each.
17301	Tag	1	—	0 0 4	Doz.
11627	Nut	4	WN	0 0 6	Each.
3167	Washer, S.P.	4	—	0 0 2	Doz.

## RESISTANCES

24150N	R1—500,000 ohms	1	—	0 0 9	Each.
17140AF	R2—150 ohms	1	—	0 0 9	Doz.
17140F	R3—5,000 ohms	1	—	0 0 9	Each.
24150N	R4—500,000 ohms	1	—	0 0 9	Doz.
24150AD	R5—350 ohms	1	—	0 0 9	Each.
17140F	R6—5,000 ohms	1	—	0 0 9	Doz.
24150J	R7—50,000 ohms	1	—	0 0 9	Each.
17140AG	R8—15,000	1	—	0 0 9	Doz.
24150J	R9—50,000 ohms	1	—	0 0 9	Each.
17140F	R10—5,000 ohms	1	—	0 0 9	Doz.
17140N	R11—500 ohms	1	—	0 0 9	Each.
19202AK	R13—350,000 ohms	1	—	0 0 9	Doz.
19202L	R14—100,000 ohms	1	—	0 0 9	Each.
24150N	R15—500,000 ohms	1	—	0 0 9	Doz.
24150N	R16—500,000 ohms	1	—	0 0 9	Each.
24150P	R18—1 megohm	1	—	0 0 9	Doz.
24150AF	R20—1,500 ohms	1	—	0 0 9	Each.
24150A	R21—500 ohms	1	—	0 0 9	Doz.
17140AA	R22—23,000 ohms	1	—	0 0 9	Each.
17140P	R23—50,000 ohms	1	—	0 0 9	Doz.
24097J	R25—5,000 ohms	1	—	0 2 9	Each.
	R26—9,000 ohms	1	—	0 2 9	Doz.
	R38—3,100 ohms	1	—	0 2 9	Each.
10606	Screw, securing R25, R26 and R28	2	—	0 0 7	Doz.
24150Y	R27—75 ohms	1	—	0 0 9	Each.
19105BM	R28—200 ohms SL	1	—	0 2 3	Doz.
24150CK	R29—5 megohms	1	—	0 0 9	Each.
24150F	R33—10,000 ohms	1	—	0 0 9	Doz.
24150A	R34—500 ohms	1	—	0 0 9	Each.
24150AB	R35—150 ohms	1	—	0 0 9	Doz.
24150AG	R37—3,500 ohms	1	—	0 0 9	Each.
	R38—3,100 ohms with R25 and R26	1	—	0 0 9	Doz.
24150AC	R39—230 ohms	1	—	0 0 9	Each.
19202L	R40—100,000 ohms	1	—	0 0 9	Doz.
24150N	R41—500,000 ohms	1	—	0 0 9	Each.
24150P	R42—1 megohm	1	—	0 0 9	Doz.
19104AA	R43—50 ohms	1	—	0 1 0	Each.
17140N	R44—500 ohms	1	—	0 0 9	Doz.
18300CP	VR1—2 megohm volume control with S13 On/Off switch	1	—	0 5 0	Each.
18300CV	VR2—2 megohm bass control	1	—	0 5 0	Doz.
18300CU	VR3—1 megohm brilliance control	1	—	0 5 0	Each.

## MODEL 469

## SPARE PART LIST—continued.

Part No.	Description.	Parts per Inst.	Finish.	Retail List Price.	Per
<b>CONDENSERS</b>					
24900N	C1—0.01 mfd.	1	—	0 1 0	Each
22164J	C2—50 mmfd.	1	—	0 0 9	"
24900AA	C3—0.1 mfd.	1	—	0 1 4	"
24900AA	C4—0.1 mfd.	1	—	0 1 4	"
24900N	C5—0.01 mfd.	1	—	0 1 0	"
22164J	C6—50 mmfd.	1	—	0 0 9	"
24900N	C7—0.01 mfd.	1	—	0 1 0	"
24900AA	C8—0.1 mfd.	1	—	0 1 4	"
22164D	C9—15 mmfd.	1	—	0 0 9	"
22001A	C11—50 mmfd.	1	—	0 0 9	"
22330BW	C12—0.0023 mfd. SL	1	—	0 2 6	"
*22330CP	C13—0.0035 mfd. SL	1	—	0 0 9	"
22001B	C14—100 mmfd.	1	—	0 0 9	"
22001F	C15—0.001 mfd.	1	—	0 0 9	"
22005A	C16—0.005 mfd.	1	—	0 1 6	"
24019C	C17—2 mfd. electrolytic, with C47, C48 and C50	1	—	0 6 6	"
22001F	C18—0.001 mfd.	1	—	0 0 9	"
24900AA	C19—0.1 mfd.	1	—	0 1 4	"
24900AA	C20—0.1 mfd.	1	—	0 1 4	"
24900AJ	C21—0.5 mfd.	1	—	0 1 6	"
24900W	C22—0.05 mfd.	1	—	0 1 3	"
22164J	C23—50 mmfd.	1	—	0 0 9	"
22164J	C24—50 mmfd.	1	—	0 0 9	"
22005B	C25—0.01 mfd.	1	—	0 2 0	"
24900AA	C26—0.1 mfd.	1	—	0 1 4	"
21553D	C33—2 mfd. electrolytic	1	—	0 2 9	"
21555A	C34—25 mfd. electrolytic	1	—	0 2 6	"
24900AJ	C35—0.5 mfd.	1	—	0 1 6	"
21553B	C36—25 mfd. electrolytic	1	—	0 2 6	"
24900W	C37—0.05 mfd.	1	—	0 1 3	"
22675E	C39—32 mfd. electrolytic	1	—	0 7 6	"
28160A	C40—12 mfd. electrolytic	1	—	0 6 0	"
22675H	C41—16 mfd. electrolytic	1	—	0 7 6	"
24900Q	C42—0.015 mfd.	1	—	0 1 0	"
24900J	C43—0.005 mfd.	1	—	0 1 0	"
22330BG	C45—0.00015 mfd.	1	—	0 2 6	"
22330BL	C46—0.00035 mfd.	1	—	0 2 6	"
—	C47—1 mfd. electrolytic, with C17	—	—	—	
—	C48—2 mfd. electrolytic, with C17	—	—	0 0 9	Each.
22164J	C49—50 mmfd.	1	—	0 0 9	Each.
—	C50—8 mfd. electrolytic, with C17	—	—	—	
22164C	C52—10 mmfd.	1	—	0 0 9	Each.
*22330CP	C53—0.0035 mfd.	1	—	0 2 6	"
22164E	C55—23 mmfd.	1	—	0 0 9	"
24900W	C56—0.05 mfd.	1	—	0 1 3	"
22164J	C57—50 mmfd.	1	—	0 0 9	"
22164M	C58—5 mmfd.	1	—	0 0 9	"
22164C	C59—10 mmfd.	1	—	0 0 9	"
* Note.—On some models C13 may be increased to 0.007 mfd. (Part No. 22005T) and C53 left out.					
26350AH	TC1—Single pre-set condenser	1	—	0 1 0	Each.
23922D	TC2, TC3 and TC4—Triple pre-set condenser	1	—	0 2 0	"
23922D	TC5, TC6 and TC7—Triple pre-set condenser	1	—	0 2 0	"
26350A	TC9 and TC13—Double pre-set condenser	1	—	0 1 3	"
23922B	TC10, TC11 and TC12—Triple pre-set condenser	1	—	0 2 0	"
—	TC13—with TC9	—	—	—	
26350AG	TC14—Single pre-set condenser	1	—	0 1 3	Each.
—	TC15 and TC16—in IFT1	—	—	—	
—	TC17 and TC18—in IFT2	—	—	—	
10710	Screw, 4BA	3	WN	0 0 2	Doz.
3166	Washer, S.P. 4BA	3	—	0 0 2	"
11628	Nut, 4BA	3	WN	0 0 4	"
11231	Screw, 6BA	3	WN	0 0 2	"
3165	Washer S.P. 6BA	3	—	0 0 2	"
19050	Screw	3	WN	0 0 3	"
3166	Washer, S.P.	3	—	0 0 2	"