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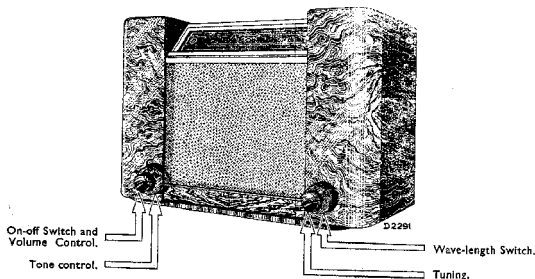
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FOR PHILIPS SERVICE  
DEALERS ONLY

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# PHILIPS SERVICE MANUAL

FOR RECEIVER  
TYPES 747A and 747AX



## GENERAL.

The receivers type 747A and 747AX operate on the super-heterodyne principle and cover the following wavelengths:—

Long waves : 725—2,000 m.

Medium waves : 200—585 m.

Short waves : 16.7—51 m.

The receivers are suitable for use on Alternating Current and can be adjusted for voltages of 110 v., 125 v., 145 v., 200 v., 220 v. and 245 v., 50 to 100 cycles. (See note page 2 re operation on D.C. supplies).

## FEATURES.

1. Visual tuning with cathode ray indicator.
2. Automatic volume control.
3. Mains aerial with switch.
4. Audio-frequency quality correction (feed-back).
5. Connection for gramophone pick-up.
6. Connection for extension loudspeaker having an impedance of 5.5 ohms.
7. Continuously variable tone control.

**Weight.**—Nett 34 lb.

## Dimensions.

Width : 19½ in.

Height : 14½ in.

Depth : 11½ in.

## DESCRIPTION OF CIRCUIT: RADIO-FREQUENCY SECTION.

### Short Waves.

Tuning circuit : S13, C10 and aerial coupling condenser C41.

Oscillator grid circuit : S19, C30, C11.

Oscillator anode coil : S18.

C40 is the grid condenser, R9 the grid leak.

### Medium Waves.

Aerial circuit : S7, coupled inductively and capacitively (C23) with the first band filter circuit S9, C25, C14, C9.

Second band filter circuit : S11, C23, C15, C10.

Oscillator grid circuit : S14, C29, C16, C11. C29 serves also as grid condenser.

## A 2

Oscillator anode coil : S16.

### Long Waves.

Aerial circuit : S7, S8, coupled inductively and capacitively (C23) with the first bandfilter circuit, S9, S10, C24, C25, C14, C9.

Second bandfilter circuit : S11, S12, C24, C25, C15, C10.

Oscillator grid circuit : S14, S15, C28, C29, C16, C17, C11. C28 and C29 in series serve as grid condenser. Oscillator anode coils : S16, S17.

### Intermediate Frequency Circuits.

1st I.F. bandfilter : S20, C18 and S21, C19.

2nd I.F. bandfilter : S22, C20 and S23, S24, C21.

The voltage for the detector is derived from a section of the second circuit, in order to reduce circuit damping.

### Detector and Audio-frequency Section.

Detector circuit : diode-anode L4, cathode L4 (747AX) or diode-anode L3 (747A), R13, R12, S24.

The A.F. voltage across R13 is applied to the control grid of L3 via C33 (and on short waves C47), C34 (747A), R30 and R37, R28 (747A).

R23, R30, R37, C34, C38 and C45 are for tone control. R30, C42 (747A). The A.F. voltage is amplified by L3 and is fed to the output valve L4 via C39 and R24.

### Automatic Volume Control. (747AX).

The automatic volume control on valve L2 is not delayed, but is delayed in the case of L1 (on medium and long waves only).

This is effected in the following manner :—

The I.F. voltage across S22 is applied via C36 to one anode of diode L3. Rectification produces a negative voltage across R28, and this voltage is applied to the control grid of L2 via R34 and S21, being smoothed by C48.

The negative voltage across R28 is also fed to one diode-anode of L4 by way of R33, but this diode also receives a positive voltage across R21, so that when no signal is received the voltage across R28 is zero and the diode will pass a current due to the positive voltage.

This current causes a voltage drop in the diode, but only a small drop, seeing that the internal resistance is very small as compared with R21. When a signal is received the negative voltage across R28 is shorted by the diode, via R33 until the negative voltage exceeds the voltage drop in the diode. The current flowing through the latter then ceases, and the negative voltage is passed to L1 via R5. R7 and R8 provide a fixed negative bias on the grid of L1.

In the type 747A, A.V.C. is applied via R20 to L2 and via R5 to L1.

### Visual Tuning Indicator.

A part of the negative voltage from the rectifier across R16, R13 (747AX), R12, R13, R14 (747A), is applied to the control grid of L5. This causes the anode current of L5 to decrease and the anode voltage thus

increases on account of the smaller potential difference across R11. The screening effect of the control plates is reduced and the light on the screen increases in size. Correct tuning is indicated by the largest possible amount of light.

### SPECIAL CIRCUIT DETAILS.

#### Audio-frequency Improvement.

The voltage across S26 is fed back via C46, S32, R39 and R26 to R17, and R26, S32, S31, R17 (747A) in the cathode circuit of L3, so as to produce feed-back. This ensures considerable reduction of the distortion percentage for a given output.

#### I.F. Frequency.

The tuning of the oscillator circuits on medium and long waves is in each case 128 K.C. above the tuning of the R.F. circuits.

This is obtained by means of parallel and series padding condensers, C14, C15, C16 and C17, being the parallel and C28, C29 series padding condensers.

On short waves the tuning of the oscillator circuit is 128 K.C. below that of the R.F. circuits.

On medium and long waves the R.F. circuits are arranged as a bandfilter. Coupling between the bandfilter circuits on medium waves is provided by C25 and S29, S30, while on long waves the coupling condenser C24 is included.

#### Supply.

L6 supplies direct voltage to C1.

S5 (R25, 747AX) and C2 form the smoothing filter. Anode voltage for L1, L2, L4 and L5, is taken direct from C2 for 747AX.

L2 through R3 and L3 through R4 (747A).

Anode voltage for L3, as well as the screen grid voltages, is tapped from potentiometer R1/R36.

The anode voltage for L3 and screen grid voltage on L2 are decoupled by C6.

The voltage for grids 2, 3 and 5 of L1 is decoupled by C5.

Grid bias for L1 is provided by the potential difference across R7, decoupled by C27, and on pick-up L1 is quenched by the potential difference across R7+R8. R10 decoupled by C32 supplies the grid bias for L2, and the bias for L3 is obtained from R18 (R17, S31), decoupled by C3. The potential difference across R25, decoupled by R2 and C43, provides the necessary bias for L4.

#### Mains Aerial.

Operation of the mains aerial switch couples the aerial socket via C44 to the mains. At the same time the aerial socket is closed, so that the outdoor aerial must be removed from the receiver before the latter can be switched over to work on mains aerial.

#### Extension Speaker.

The extension speaker sockets are in parallel with the speech coil of the built-in speaker.

The impedance of the extra speaker should be about 5.5 ohms.

*NOTE:—The type 747AX is suitable for D.C. supplies when fitted with a Philips Converter Unit.*

## TRIMMING THE RECEIVER.

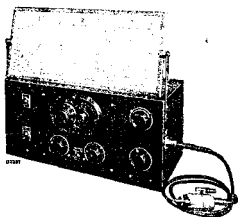


Fig. 1.

It is not necessary to remove the chassis from the receiver for trimming purposes. All the necessary trimming points are easily accessible by placing the receiver on its left-hand side on a piece of felt and removing the bottom and back plates.

When the damping resistances are applied, care should be taken that no short circuit occurs between the anodes of L1 or L2 and the chassis, as this would place the full anode voltage across the I.F. transformers, which would become overheated.

## The Set should be re-trimmed—

1. After changing coils or condensers in the I.F. or H.F. sections.
2. If the receiver is not sufficiently sensitive or selective (see page 6).

## In trimming use is made of the following—

1. Service oscillator GM2880F (fig. 1).
2. Output indicator; universal testboard 4256 or 7629.
3. 15° jig.
4. Insulated trimming key: 6 mm.
5. Insulated trimming key: 8 mm.
6. Insulated trimming screwdriver.
7. Wax for locking trimmers.
8. 25,000 ohms resistance.

## Artificial Aerials—

- |   |                                   |
|---|-----------------------------------|
| <ol style="list-style-type: none"> <li>1. I.F.: a condenser of 32,000 <math>\mu\text{F}</math>.</li> <li>2. Medium and long waves: standard artificial aerial.</li> <li>3. Short waves: short wave artificial aerial (standard artificial aerial with red spot).</li> </ol> | } Supplied with Oscillator GM2880 |
|---|-----------------------------------|

Always use Customer's Valves for Trimming. If the octode valve becomes defective during trimming, the set must be re-trimmed (new valve to be heated).

## A. THE I.F. CIRCUITS.

Earth the receiver.

1. Switch receiver to long waves.
2. Volume control at maximum.
3. Tuning condenser at maximum.

4. Connect output indicator to external speaker sockets across a trimming transformer with 0.1  $\mu\text{F}$  condenser across the high impedance side.
5. Apply modulated signal of 128 K.C. via 32,000  $\mu\text{F}$  to the fourth grid of L1 (fig. 2).
6. Damp the second circuit by coupling a 25,000 ohms resistance with 0.1  $\mu\text{F}$  in series between the top connection of L2 and the chassis (see fig. 3).

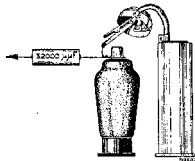


Fig. 2

7. Trim C18 for maximum output.

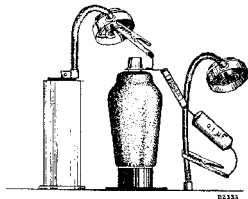


Fig. 3

8. Transfer damping resistance to between anode of L1 and chassis (fig. 4).
9. Trim C19 for maximum output.
10. Remove damping resistance and connect across S23 + S24 (fig. 4).
11. Trim C20 for maximum output.
12. Remove damping resistance and connect from anode of L2 to chassis (fig. 4).

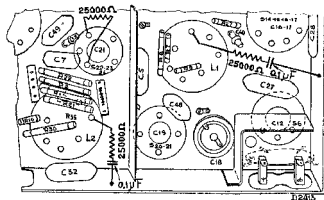


Fig. 4

13. Trim C21 for maximum output.
14. Lock trimmers with wax, remove damping resistance and artificial aerial.

## C 2

### B. THE R.F. AND OSCILLATOR CIRCUITS.

#### I. Medium Waves.

1. Switch receiver to medium waves.
2. Volume control at maximum.
3. Fit 15° jig. (See fig. 6.)
4. Set variable condenser to the jig (minimum capacity).
5. Apply modulated signal of 1,442 K.C. via standard artificial aerial to aerial and earth sockets.
6. Couple damping resistance of 25,000 ohms + 0.1  $\mu$ F between top of L2 and chassis.

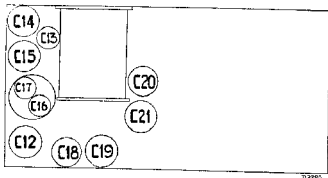


Fig. 5

7. Trim C16, C15, C14, C15, C16, in that order for maximum output (fig. 5).
8. Lock C16, C15, C14 with wax.

#### II. Long Waves.

1. Switch receiver to long waves.
2. Volume control at maximum.
3. Apply modulated signal of 395 K.C. via standard artificial aerial to aerial and earth sockets.

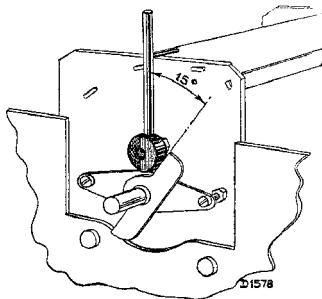


Fig. 6

4. Tune receiver for maximum output.
5. Couple damping resistance 25,000 ohms + 0.1  $\mu$ F between the top of L2 and the chassis (fig. 3).
6. Trim C17 for maximum output.
7. Lock C17 with wax and remove damping resistance.

### C. TRIMMING IMAGE SUPPRESSION CIRCUIT.

1. Switch receiver to short waves.
2. Set service oscillator to 1,000 K.C.
3. Greatly increase signal strength.
4. Tune receiver to 403 m.
5. Trim C13 for minimum output.
6. Lock C13.

#### D. I.F. AERIAL FILTER.

1. Switch receiver to long waves.
2. Adjust service oscillator for 128 K.C. (large input signal).
3. Set variable condenser to maximum.
4. Trim C12 for minimum output.
5. Lock C12.

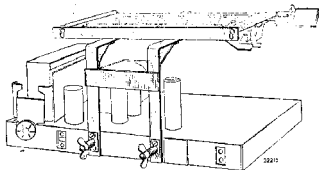


Fig. 7.

### E. CALIBRATION.

Re-calibration if necessary, is carried out in the following manner :-

Apply a signal of 208 m. (1,442 K.C.) via standard artificial aerial, and tune the receiver to this wavelength.

Adjust pointer to 208 m. and fix.

Apply signal of 350 m. (857 K.C.) and tune receiver to this.

Note discrepancy.

Apply signal of 549.5 m. (546 K.C.) and tune to this.

Note discrepancy.

Adjust the driving bracket with variable condenser spindle, (loosen screws A and B) in accordance with fig. 8.

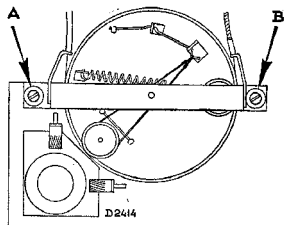


Fig. 8

350 metres		549.5 metres		
Correct	...	Too high	...	↑ or ↖
Correct	...	Too low	...	↙
Too high	...	Too high	...	←
Too low	...	Too low	...	→
Too high	...	Too low	...	↓
Too high	...	Correct	...	↓
Too low	...	Too high	...	↑
Too low	...	Correct	...	↑

Tune to 208 m. after each adjustment and if necessary re-set the pointer.

The use of a special bracket for fixing the scale is recommended (see fig. 7).

In many cases it will be sufficient to correct the position of the pointer without removing the receiver from the cabinet.

## FAULT-FINDING.

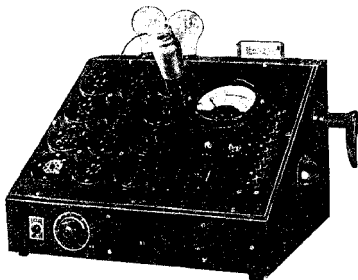


Fig. 9.

The tracing of faults is greatly facilitated by the use of a universal testboard type 4256 or 7629, fig. 9. Particulars and prices can be had upon application to the Service Department.

The more usual faults are short circuits in the wiring and open circuited solder joints, these being indicated by C....., R..... shorted or open.

Before removing the chassis from the cabinet or loosening components, endeavour to localise the fault in accordance with the point to point system (see page 7).

When a receiver requires examination and the point to point system is not adopted, the best procedure is as follows :—

- I. Place in the receiver a set of valves taken from a receiver which works normally and try out, if necessary, with another loudspeaker.
- II. Test for gramophone reproduction ; if in order see § V, if not in order see § III.
- III. Test the voltage across C2. If this is abnormal, the following faults may be looked for :—
  1. Bad contact in the mains switch or safety contact.
  2. Open or short circuit in the mains transformer.
  3. C1, C2 short.
  4. R25, S5 open.
  5. Open or short circuit in the heater wiring.
  6. Short circuit in the speaker transformer.
  7. One of the valveholders making bad contact.
- IV. **Voltage across C2 more or less normal but no gramophone reproduction.**
  - (a) L4 showing abnormal currents and voltages.
    1. No anode current : S25 open.
    2. Anode current too high : C39, C43 short.
    3. R24, R29, R31, R32 open.
  - (b) L3 showing abnormal currents and voltages.
    1. No anode current : R1, R17, R18, R22 open ; C6, C7 short.
    2. Anode current too high : C3 short.
    3. R23, R30, R37 open.

- (c) L3 and L4 showing normal currents and voltages, but no gramophone reproduction
  1. S25, C34, C38, C42, C45 short.
  2. C33, C39 open.

- V. Gramophone but no radio reproduction.
  - (a) L2 showing abnormal currents and voltages.
    1. No anode current : S22, R10 open.
    2. Anode current too high : C32, C48 short ; R2, R35, R36 open.
    3. R28, R34, S21 open.
  - (b) L1 showing abnormal currents and voltages.
    1. No anode current : R7, R8, S20 open ; C5 short.
    2. Anode current too high : C27 short.
    3. S11, S12, S13, R5, R6, R33 open.

- VI. L1 and L2 showing normal currents and voltages, but no reproduction of a modulated signal of 128 K.C. applied to the control grid of L2 via a condenser of .01  $\mu$ F. Grid connected to chassis via 0.1 megohms resistance.
  - C20, C21, C37, S22, S23, S24 short.

No reproduction of a 128 K.C. signal applied to the fourth grid of L1 ; grid connected to chassis via 0.1 megohms resistance.

  - C18, C19, S20, S21 short.

- VII. Reproduction of a 128 K.C. signal applied to L1, but no reproduction of an R.F. signal fed to the fourth grid of L1.
  - Oscillator not working, or working on wrong frequency.
    1. S14, S15, S16, S17, S18, S19 short or open.
    2. R9, C11, C16, C17, C28, C29, C30, C40 open or short.

- Reproduction of an R.F. signal applied to the fourth grid of L1, but no radio reception.
1. S7, S8, S9, S10, S11, S12, S13, C14, C15, C9, C10 short or open.
  2. C24, C25 open.

- VIII. Gramophone reproduction and radio reception, but both unsatisfactory quality.

- (a) Reproduction weak.
  1. Abnormal currents and voltages.
  2. Receiver requires trimming.
  3. Fault in the speaker or speaker transformer.
  4. C23, S29, S30 open.
- (b) Distorted reproduction.
  1. One of the valves defective.
  2. Loudspeaker defective.
- (c) A.V.C. not working properly.
  - C36, R21, R33 open.
- (d) Receiver oscillating.
  - One of the de-coupling condensers open, e.g., C2, C5, C6, C31, C43, C48.
- (e) Tuning indicator not working.
  1. R11, R14 open.
  2. R15, C35 short.
- (f) Cabinet resonances.

These may be caused by loose parts such as valve caps, springs, etc.  
The vibrating part may be fixed in position with a piece of felt.

- (g) Microphony.
 

Microphony may be caused by omitting to loosen the transport brackets, which are accessible from the underside of the cabinet. For mechanical effects, see pages.

## FAULT-FINDING, USING THE "POINT TO POINT" SYSTEM.

In order to facilitate fault-finding it is desirable to use a good measuring instrument such as the Universal Testboard type 4256 or 7629. It is not necessary to take the chassis from the receiver to localise the fault, as all the components are accessible when the bottom and back plates are removed: the receiver should be placed on its left-hand side on a piece of felt.

As far as possible leads should not be unsoldered until the fault has been localised.

### Sequence of Operations.

- I. Connect the receiver to the correct voltage and try out with its own valves on an outside aerial or service oscillator.
  - (a) If the receiver works normally, leave it running and keep it under observation.
  - (b) If the set does not work properly proceed as follows :—
- II. Provide the receiver with a set of valves taken from a set which works normally, and if necessary test with a different speaker. This excludes or localises faults in the speaker and valves.
- III. Test for gramophone reproduction.
  - (a) If reproduction is obtained the fault will be found in the I.F. or R.F. section, and can be further localised by applying an I.F. or R.F. signal via an 0.1  $\mu$ F condenser to the control grids of the valves, commencing with the last I.F. valve and working backwards to the first R.F. valve.
  - (b) If no reproduction is obtained or if the R.F. test gives negative results, proceed as follows :—
    1. Remove all valves from the receiver, connect Universal Testboard type 4256 or 7629 and adjust the latter for resistance testing (position 12). Extend the test prod so that the various valveholder contacts may be reached easily, and insert the other prod in the earth socket of the receiver.
    2. The contacts of valveholder L6 must be short-circuited; this also protects the meter, as otherwise the electrolytic condenser might charge during testing and the meter might possibly burn out.
    3. The various resistance values between the points given in the accompanying table and the chassis are measured by touching the contacts indicated with the test prod.

The meter deflection is then compared with the corresponding value in the table. "P" or "U" indicates that the measurement is made between the gramophone pickup sockets and earth, etc. 11/12 means that the test is carried out between the points 11 and 12. Discrepancies of 10% may be met with, but this does not necessarily imply that the component is faulty.

4. When the resistances have been tested the Testboard is adjusted for capacity testing, and the values checked in accordance with the table.

By testing all the circuits in this manner the fault will probably be found and the component can then be identified from the theoretical circuit. In the event of the fault not being traced, it is advisable to repeat the tests given in page 6. The valveholder contacts are numbered systematically in the following manner :—

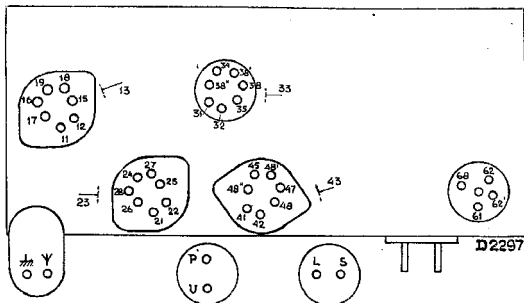
The first figure indicates the valveholder, while the second figure denotes the following :—

- 1 & 2 = heaters.
- 3 = control grid.
- 4 = contact for metalising (if separate).
- 5 = cathode.
- 6 = extra grid (g1).
- 7 = screen grid.
- 8 = anode.
- 9 = extra grid (e.g., for octodes, i.e., g2).

It will be seen from the test table that the numbers are grouped according to the resistance or capacity values, all grid circuits 13, 23, 33, etc., being tested in position 9, while all heater and cathode circuits, the resistance of which is very low, are tested in position 12. In various tests it is necessary to operate the wavelength switch, and this is indicated thus :—

4 X  
13

When testing electrolytic condensers (resistance test) it will be found that the drop in the leak current causes the deflection to fall back to a certain value: This value may prove to be much too high, due to the condenser being defective, but this can also be on account of the receiver having lain idle for a time. When testing electrolytic condensers it is therefore necessary to exercise a certain amount of care and judgment.



## RESISTANCES.

12	4X Aerial				11	21	31	41										
	S 500	M 375	L 470	G 500	5	5	5	5	5	5	5	5	5	5	5	5	5	5
11	47	18	25	28	26	4X 15					4X 13					48	38'	35
	390	405	350	400	350	S 290	M 290	L 290	G 490	S 70	M 500	L 500	G 70	445	475	475	475	475
10	19	16	17	27	38	P on Gram	19 on Gram											
	320	150	330	470	90	100	0											
9	23	38*	33	43	48*	48*												
	75	270	145	170	270	410												

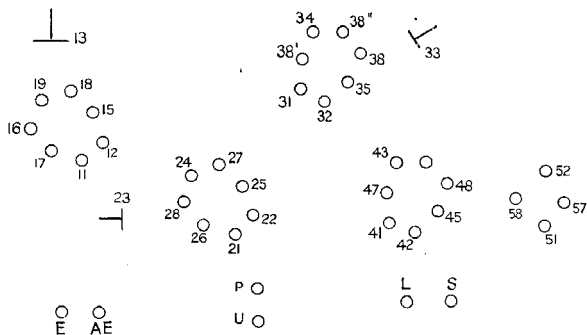
## CAPACITIES.

12	38	38*	48'															
	360	200	120															
11	48'	15	17	16														
	240	310	340	110														
10	26																	
	440																	
9	18	25	35	47														
	340	220	470	410														



TYPE 747A.

F 3



RESISTANCES.

12	4X					11	21	31	41	24				
	Aerial					12	22	32	42	34	U			
	S	M	L	G	5	5	5	5	5	5				
	500	375	465	500	5	5	5	5	5	5				
11	15	18	25	26	45	48	47	15 on Gram	4X					
	290	390	290	290	230	440	375	500	S	M	L	G		
									100	500	500	100		
10	16	17	27	28	35	S	L	19	19 on Gram					
	140	250	330	425	410	400	400	250	O					
9	P	23	33	38	38'	38'	43							
	210	420	130	360	270	175	160							

CAPACITIES.

12	2X													
	13		38	38"	43									
	M	L	350	180	280									
	410	360												
11	19	17	28	27										
	300	300	420	370										
10	48													
	350													
9	45	47	15											
	460	450	300											

## REPAIRING AND REPLACING COMPONENTS.

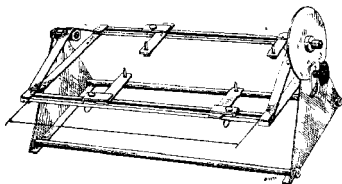


Fig. 10.

When carrying out repairs the following points should always be adhered to:—

1. When completing repairs restore all wiring and screws to their original positions.
2. All leads must be at least 3 mm. apart.
3. Washers, spring washers, and insulating material must be replaced as they were before the repairs.
4. Rivets may be replaced by screws and nuts.
5. Moving parts should be lubricated with a little pure vaseline.
6. Compounded condensers must not be soldered closer than 1 cm. from the compound.
7. Compounded condensers must be suspended free from the other wiring.
8. Resistances must always suspend free on all sides owing to the development of heat.
9. Condensers of which the outer plate is indicated in the theoretical circuit by a thick line, must always be replaced in the same manner. The outer plate is invariably connected to the lead on the left of print, and in the case of mica condensers on the same side as the print. These condensers are marked with a \* in the condenser list.

Most repairs can be effected without uncasing the chassis. The bottom plate can be removed by standing the receiver on its head on a piece of felt and loosening the four screws securing the chassis.

If it is necessary to uncase the chassis for repairs, use should be made of the universal cradle (fig. 10) as well as a bracket (fig. 7) for fixing the scale. It is then possible to fix the chassis in any position.

**NEVER LIFT THE RECEIVER BY THE COILS !**

### CHANGING THE SCALE.

The chassis need not be removed from the cabinet.

1. Loosen the four screws holding the scale to the cabinet.
2. Loosen the four screws by the glass plate.
3. Slide the glass plate to the left and lift out.

### VERNIER UNIT NOT WORKING.

- A. Brake bands too smooth—reverse the bands.
- B. Steel springs weak—carefully straighten out.

### BOWDEN CABLES.

1. Thick cable (type A) for operating potentiometer and coil.
2. Thin cable (B) for operating pointer.

Before cutting the inner cable cut the wire, using acid-free soldering grease, and cut in the centre of the tinned part to prevent unravelling.

Clip the outer cable with cutters and finish with a file, removing all burr from the inside.

The control cables must be handled with great care, as even a slight kink causes heavy running and backlash.

The arrangement of the cables is shown in fig. 11.

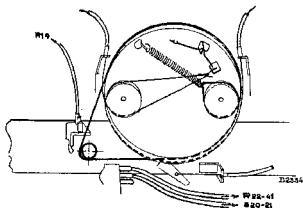


Fig. 11.

### COILS AND TRIMMERS.

These are replaced in the following manner:—

1. Unsolder the leads.
2. Bend up the tags which hold the component to the chassis.
3. Lift the coil from the chassis.
4. Fit new coil.
5. Press down tags with lever.
6. Re-solder electrical connections.

If the fixing tags are broken from the chassis the coil can be mounted by means of repair brackets obtainable from the Service Department.

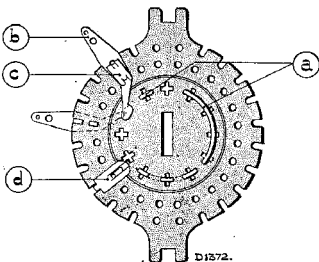


Fig. 12.

### DESCRIPTION OF WAVELENGTH SWITCH.

The wavelength switch consists of:—

1. One or more switching units.
2. Stop plate for determining positions.
3. Spindles, springs, supports.

The switch units comprise (see fig. 12) :—

Stator.

Rotor.

- (a) Rotor contacts.
- (b) Contact springs.
- (c) Clips for fixing springs to stator.
- (d) Guide brackets.

#### WAVELENGTH SWITCH IN THE CIRCUIT DIAGRAM.

Contact springs are represented by circles and open points on the stator by black dots.

The outside ring of circles indicates the contact springs on the same side as the stop plate, while the inner ring represents the contacts on that side which is remote from the stop plate.

The rotor contacts are indicated by arcs and radial lines, drawn as full lines on the stop plate side—dotted lines on the side remote from the stop plate.

The rotor contacts are provided with tags which fit into the holes in the rotor for the purpose of fixing them, the tags being pinched up flat by means of a pair of pliers with smooth jaws.

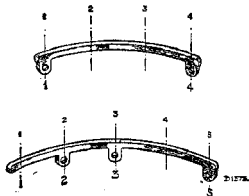


Fig. 13.

#### INDICATION OF ROTOR CONTACTS.

The rotor contacts are indicated by a figure code.

The first figure gives the number of holes covered, while the following figures indicate the holes into which the tags are fitted, as seen from the centre of the arc with the tags downwards reading from left to right.

The two contacts illustrated in fig. 13 are accordingly denoted by 4.1.4 and 5.2.3.5.

#### LOUDSPEAKER.

Before undertaking repairs to the speaker it should be definitely ascertained that the speaker is actually at fault (try out with another speaker or transformer). Rattle and resonances may be due to the following causes :—

1. Loose components in the cabinet.
2. Leads too slack.
3. Leads too taut.

If repairs are to be carried out the following should be borne in mind :—

1. The bench should not be of iron and should be kept quite dust-free.
2. Never remove the front and back plates from the magnet.
3. The defect may be due to :—
  - (a) Dirt in the air gap.
  - (b) Distorted or jamming speech coil.
4. Replace the speaker cover as soon as repairs are completed.

Four feeler gauges, obtainable from the Service Department, are required for centring the speech coil in the air gap.

When replacing the chassis or recentring the core in the air gap, use should be made of a centring jig (fig. 14).



Fig. 14.

When the cone is moved up and down, no sound should be heard with the speaker held close to the ear.

## LIST OF COMPONENTS AND TOOLS.

When ordering any of these spare parts please state :—

1. Code number of spare part.
2. Type and serial number of receiver.
3. Description of spare parts.

Fig.	Item.	Description.	Code No.
15	1	Cabinet ... ..	
15	2	Speaker silk ... ..	28.243.980
15	3	Station dial ... ..	06.600.730
15	4	Pointer with felt ... ..	28.705.451
15	5	Trade mark disc ... ..	25.872.040
15	6	Knob ... ..	28.936.530
15	7	Knob (colour 033) ... ..	23.610.541
16	8	Plug socket plate with switch ... ..	23.610.551
16	9	Knob ... ..	28.871.820
16	10	Pin ... ..	23.610.231
16	11	Valveholder ... ..	28.616.652
16	12	Screening box assembly ... ..	08.515.210
16	13	Screen cap for speaker ... ..	25.872.020
		Service clamping ring for speaker ... ..	28.253.843
		Paper ring for speaker ... ..	28.445.821
16	14	Holder for tuning indicator ... ..	28.445.390
16	15	Back plate ... ..	25.161.921
16	16	Rubber bush for chassis ... ..	28.400.360
16	17	Tapping plate assembly ... ..	28.890.300
16	18	Plug socket plate ... ..	28.871.702
		Flat spring ... ..	28.870.750
		Plate assembly with pin ... ..	28.752.072
		Screw ... ..	25.872.030
		Mains lead ... ..	07.834.060
		Switch assembly ... ..	33.981.080
16	19	Plug socket plate ... ..	08.524.690
16	20	Bottom plate (millboard) ... ..	28.888.361
16	21	Spindle (switch + V.C.) ... ..	28.400.350
16	22	Valveholder ... ..	28.619.700
16	23	Spring (driving cord) ... ..	28.838.860
16	24	Vernier unit ... ..	28.740.470
16	25	Flat spring ... ..	28.882.360
16	26	Seven-pin valveholder ... ..	28.751.811
16	27	Four-pin valveholder ... ..	28.225.420
		Contact 3-2 (pick-up) ... ..	28.838.850
		Contact 1-1 (switch) ... ..	28.904.211
		Contact 2-2 ... ..	28.904.161
		Contact 2-1 ... ..	28.904.393
		Contact 4-2-4 ... ..	28.904.260
		Contact 4-1-4 ... ..	28.904.290
16	28	Spring ... ..	28.904.182
16	28	Spring ... ..	28.930.600
		Holder ... ..	28.730.462
			28.077.380

## TOOLS, TEST INSTRUMENTS AND GAUGES.

Fig.	Description.	Code No.
1	Service oscillator ... ..	G.M.2880F
	Universal testboard ... ..	4256
9	Universal and valve testboard ... ..	7629
10	Universal cradle ... ..	09.991.380
7	Bracket for scale ... ..	09.992.130
	Lever for fixing coils... ..	09.991.560
	Box spanner for electrolytic condensers ... ..	09.991.540
	Trimming spanner, 8 mm. ... ..	09.991.810
	Trimming spanner, 6 mm. ... ..	09.992.040
	Trimming screwdriver ... ..	09.991.501
8	15° jig ... ..	09.991.741
14	Centring jig ... ..	09.991.530
	Pertinax feeler gauges ... ..	09.990.840
	Clip for fixing coils ... ..	28.080.870
	Condenser 32,000 $\mu$ F ... ..	28.199.800
	Condenser 0.1 $\mu$ F ... ..	28.199.090
	Resistance 25,000 ohms ... ..	28.770.390
	Locking wax S413 ... ..	02.851.360

## COILS.

747A & 747AX.

Designation	Resistance Value in Ohms	Code Number
S1	—	28.534.08.0
S2		
S3		
S4		
S5	375.0	28.546.08.0
S6	140.0	28.570.48.0
S7	40.0	}
S8	100.0	
S9	4.5	
S10	48.0	
S11	4.5	
S12	48.0	
S13	0.05	
S14	12.0	
S15	35.0	
S16	4.5	
S17	9.0	28.571.59.0
S18	40.0	}
S19	0.05	
S20	135.0	
S21	135.0	
S22	135.0	
S23	40.0	
S24	95.0	
S25	800.0	
S26	0.4	
S29	1.0	
S30	1.0	28.571.60.0
*S31	—	28.587.08.0
S32	175.0	28.571.59.0
S27	3.5 ohms	28.570.50.0
(Cone & Coil 747AX)	3.5 ohms	28.587.09.0
S28	3.5 ohms	28.587.70.0
(Cone & Coil 747A)	3.5 ohms	28.570.72.0
	3.5 ohms	28.534.13.0
	3.5 ohms	28.546.10.0
	3.5 ohms	28.587.93.0
	3.5 ohms	28.860.410
	3.5 ohms	28.860.300

**RESISTANCES**  
**747A**

Designation	Value	Code No.
R3	3,200 ohms      0.25 watt	28.773.750
R4	50,000 ohms    0.25 watt	28.773.870
R6	50 ohms        0.25 watt	28.773.570
R10	250 ohms       0.25 watt	28.773.640
R12	0.2 megohm    0.25 watt	28.773.930
R15	0.64 megohm   0.25 watt	28.773.980
R17	50 ohms        0.25 watt	28.773.570
R19	4,000 ohms     0.25 watt	28.773.760
R20	1 megohm       0.5 watt	28.770.550
R21	0.5 megohm    0.25 watt	28.773.970
R22	0.1 megohm    0.25 watt	28.773.900
R25	160 ohms       0.5 watt	28.770.170
R26	640 ohms       0.25 watt	28.773.680
R28	1.6 megohms   0.5 watt	28.770.570
R29	0.1 megohm    0.25 watt	28.773.900
R30	0.5 megohm	28.815.020
R31	32 ohms        0.25 watt	28.773.550

For other resistances and condensers 747A, see under  
747AX.

**CONDENSERS**  
**747A**

Designation	Value	Code No.
C6	0.1 $\mu$ F	28.199.090
C7	0.1 $\mu$ F	28.199.090
C8	0.25 $\mu$ F	28.199.130
C33	10,000 $\mu\mu$ F	28.201.080
C34	800 $\mu\mu$ F	28.190.220
C36	6.4 $\mu\mu$ F	28.206.320
C37	100 $\mu\mu$ F	28.206.270
C38	200 $\mu\mu$ F	28.206.300
C42	50,000 $\mu\mu$ F	28.201.150
C43	1,000 $\mu\mu$ F	28.201.620

TYPE 747A.

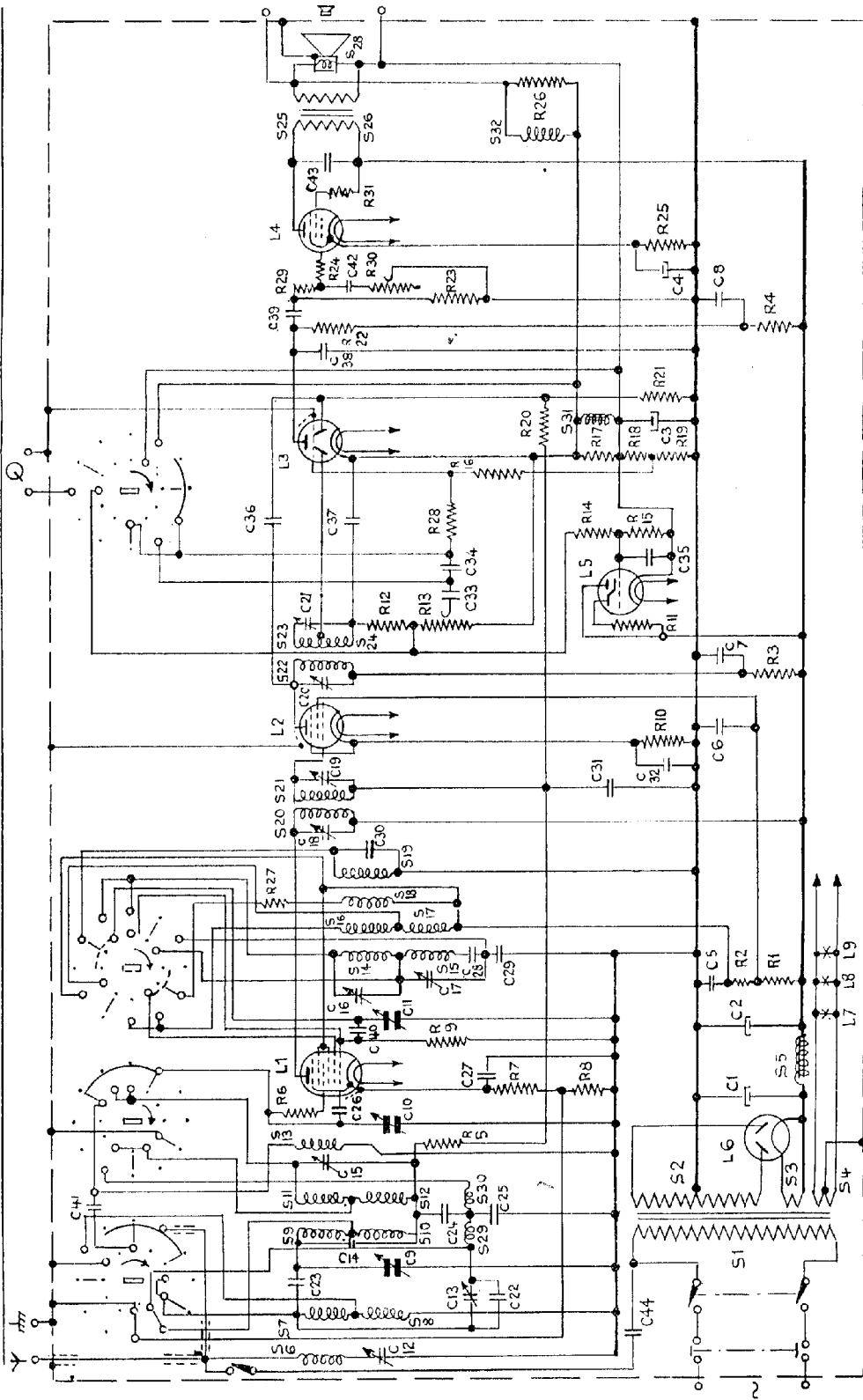
S: 6, 7, 8, 29, 30, 10, 1, 2, 3, 4, 11, 12, 13, 5, 14, 15, 16, 17, 18, 19, 20, 21.

22, 23, 24, 31

32, 25, 26, 27, 28.

C: 12, 44, 3, 22, 14, 23, 9, 24, 25, 41, 15, 10, 26, 1, 27, 40, 2, 11, 16, 17, 28, 29, 5, 30, 18, 31, 19, 32, 6, 20, 7, 21, 33, 34, 35, 36, 37, 3, 38, 39, 8, 42, 4, 43

R: 5, 6, 7, 8, 9, 2, 27, 1, 10, 3, 11, 12, 13, 14, 15, 28, 16, 17, 18, 19, 20, 21, 22, 4, 23, 29, 30, 24, 25, 31, 26



# VALVE VOLTAGES AND CURRENTS.

## TYPE 747A.

	L1 (FC4)	L2 (VP4B)	L3 (TDD4)	L4 (PENA4)	
Va	250	250	100	235	Volts
Vg1	100	170	—	250	Volts
Vg235	2.2*	2.2*	5.6*	6.5*	Volts
Ia	1.2	5.2	1.0	36	Milliamps.
Ig2	2.2	2.4	—	6.0	Milliamps.
Ig35	6.5	—	—	—	Milliamps.

Volt s across C2 = 250 v.

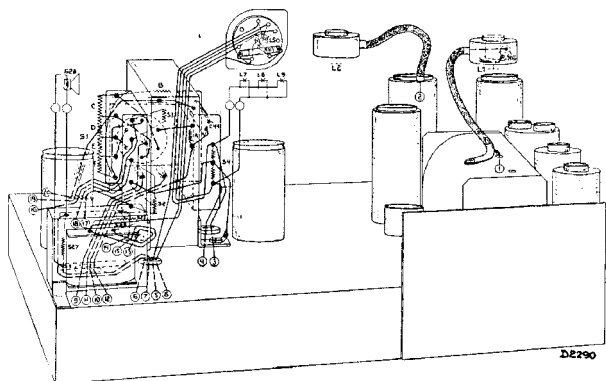
Total watts = 55.

\* Between cathode and E.

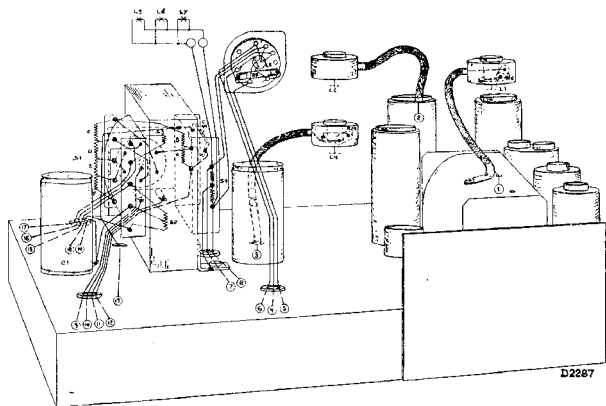
The voltages are measured with voltmeters having a resistance of 2,000 Ohms per volt. Moving coil voltmeters give readings which depend upon the resistance used and the current consumption of the meter itself.

The values given above are the mean of several measurements, therefore some readings obtained may differ appreciably, due to the tolerances of the components as well as the valves. Before finally deciding that a valve is defective, it is recommended that a replacement test with the same type of valve is made.





Top View 747AX



Top View 747A

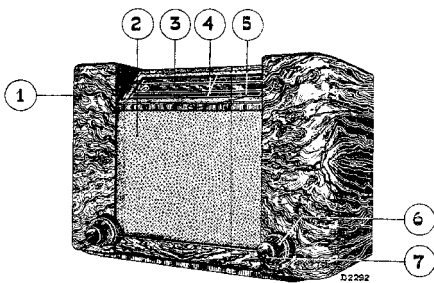


Fig. 15

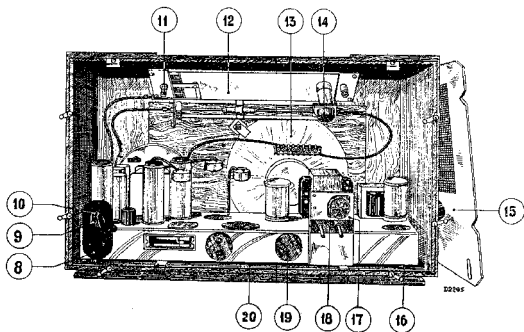
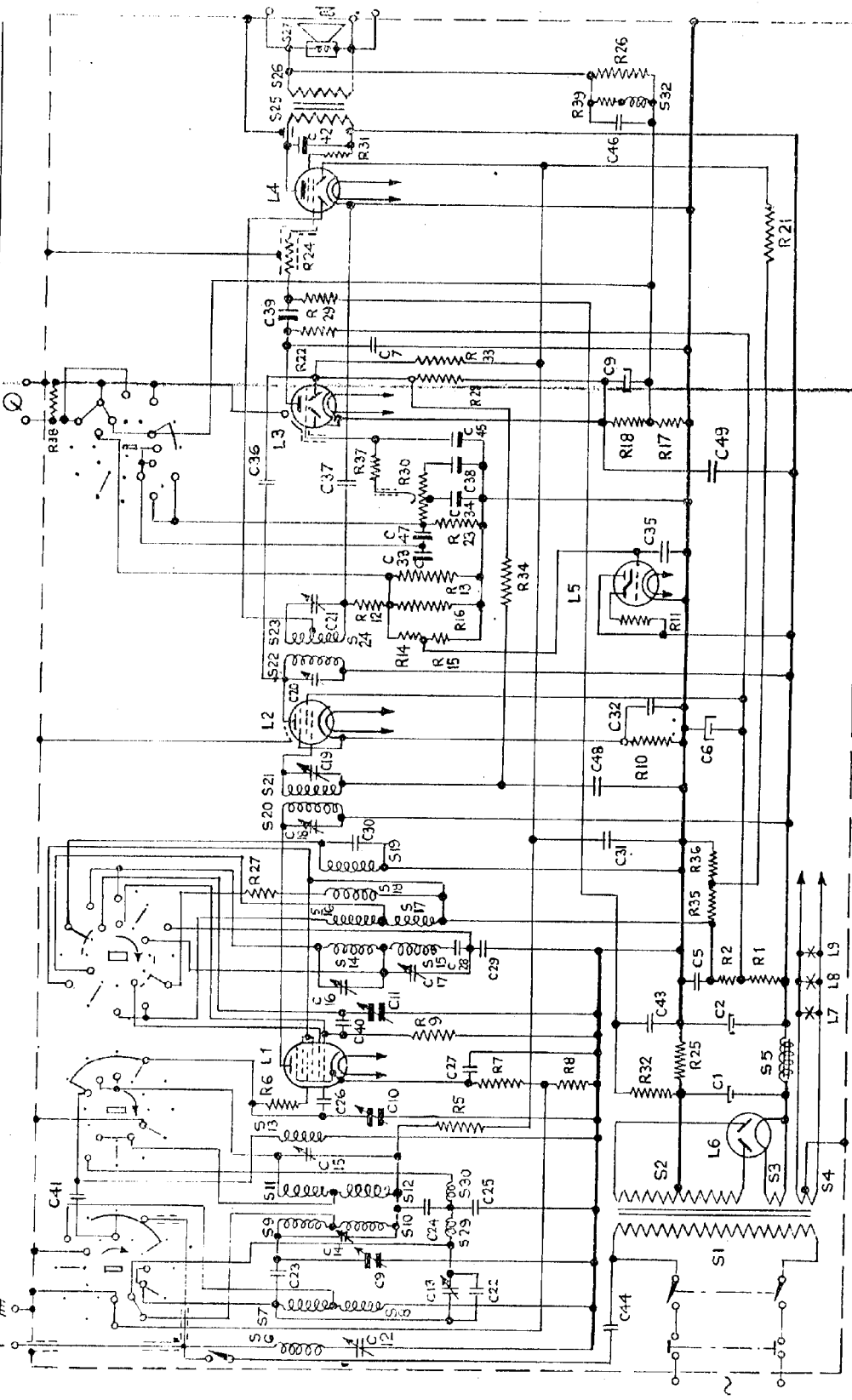


Fig. 16

S: 6, 7, 8, 29, 30, 9, 10, 1, 2, 3, 4, 11, 12, 13, 5, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 32, 25, 26, 27  
 C: 12, 44, 13, 22, 14, 23, 9, 24, 25, 41, 15, 43, 10, 26, 1, 27, 40, 2, 11, 16, 17, 28, 29, 31, 5, 30, 18, 48, 19, 32, 6, 20, 21, 47, 33, 35, 36, 37, 34, 38, 45, 7, 3, 33, 42, 46  
 R: 1, 14, 15, 11, 12, 16, 34, 13, 23, 30, 37, 38, 17, 16, 23, 33, 22, 29, 24, 21, 31, 39, 26, 2, 35, 36, 27, 1, 9, 5, 37, 6, 25, 7, 8, 9



# VALVE VOLTAGES AND CURRENTS.

## TYPE 747AX

	L1 (FC4)	L2 (VP4B)	L3 (TDD4)	L4 (PEN4DD)	
Va	245	245	96	230	Volts
Vg 2.35	110	160	—	250	Volts
Vg	2*	3.4*	2*	6.5†	Volts
Ia	2.0	6.0	.8	30	Milliamps.
Ig 2	1.8	2.0	—	5.3	Milliamps.
Ig 35	5.0	—	—	—	—

Volts across C2 = 240.

\* Between cathode and E.

† Between C1 case and E.

L7, L8 = 8042.00

L9 = 8042.07.

L5 = TV4.

L6 = 1821.

The voltages are measured with voltmeters having a resistance of 2,000 Ohms per volt. Moving coil voltmeters give readings which depend upon the resistance used and the current consumption of the meter itself.

The values given above are the mean of several measurements, therefore some readings obtained may differ appreciably, due to the tolerances of the components as well as the valves. Before finally deciding that a valve is defective, it is recommended that a replacement test with the same type of valve is made.

CONDENSERS 747AX		
Designation	Value	Code Number
C27	50,000 $\mu\mu\text{F}$	28.201.15.0
C28	700 $\mu\mu\text{F}$	28.192.26.0
C29	1,490 $\mu\mu\text{F}$	28.192.27.0
C30	6.4 $\mu\mu\text{F}$	28.206.32.0
C31	0.1 $\mu\text{F}$	28.201.18.0
C32	0.1 $\mu\text{F}$	28.201.18.0
C33	5,000 $\mu\mu\text{F}$	28.198.96.0*
C34	250 $\mu\mu\text{F}$	28.190.17.0*
C35	50,000 $\mu\mu\text{F}$	28.201.15.0
C36	20 $\mu\mu\text{F}$	28.206.37.0
C37	50 $\mu\mu\text{F}$	28.206.24.0
C38	640 $\mu\mu\text{F}$	28.190.21.0*
C39	20,000 $\mu\mu\text{F}$	28.199.02.0*
C40	100 $\mu\mu\text{F}$	28.206.27.0
C41	16 $\mu\mu\text{F}$	28.206.36.0
C42	2,000 $\mu\mu\text{F}$	28.201.48.0
C43	0.125 $\mu\text{F}$	28.201.19.0
C44	500 $\mu\mu\text{F}$	28.192.50.0
C45	100 $\mu\mu\text{F}$	28.201.19.0*
C46	50,000 $\mu\mu\text{F}$	28.201.15.0
C47	250 $\mu\mu\text{F}$	28.190.17.0*
C48	1,000 $\mu\mu\text{F}$	28.190.23.0

\*See page 10, para. 9.

† 28.180.130 may also be used.

## RESISTANCES 747AX.

Designation.	Value	Code No.
R1	10,000 ohms } 2 par. } 1 watt }	28.771.03.0
R2	10,000 ohms } 1 watt }	28.771.00.0
R5	0.1 megohm 0.25 watt	28.773.90.0
R6	32 ohms 0.25 watt	28.773.55.0
R7	250 ohms 0.25 watt	28.773.64.0
R8	10,000 ohms 0.25 watt	28.773.80.0
R9	50,000 ohms 0.25 watt	28.773.87.0
R10	400 ohms 0.25 watt	28.773.66.0
R11	2 megohms 1 watt	28.771.23.0
R12	0.25 megohm 0.25 watt	28.773.94.0
R13	0.5 megohm	28.814.52.0
R14	5 megohms 1 watt	28.771.27.0
R15	1.6 megohms 0.5 watt	28.770.57.0
R16	1.6 megohms 0.5 watt	28.770.57.0
R17	20 ohms 0.25 watt	28.773.53.0
R18	3,200 ohms 0.25 watt	28.773.75.0
R21	9 megohms 2 watts } (in series) }	28.771.26.0 28.771.27.0
R22	0.1 megohm 0.5 watt	28.770.45.0
R23	0.8 megohm 0.25 watt	28.773.99.0
R24	1,000 ohms 0.25 watt	28.773.70.0
R25	125 ohms 0.5 watt	28.770.16.0
R26	320 ohms 0.25 watt	28.773.65.0
R27	50 ohms 0.25 watt	28.773.57.0
R28	0.5 megohm 0.25 watt	28.773.97.0
R29	0.5 megohm 0.25 watt	28.773.97.0
R30	0.3-0.3 megohm	28.815.01.0
R31	50 ohms 0.25 watt	28.773.57.0
R32	0.32 megohm 0.25 watt	28.773.95.0
R33	1 megohm 0.5 watt	28.770.55.0
R34	2 megohms 1 watt	28.771.23.0
R35	32,000 ohms 0.25 watt	28.773.85.0
R36	64,000 ohms 0.25 watt	28.773.88.0
R37	0.16 megohm 0.25 watt	28.773.92.0
R38	0.1 megohm 0.25 watt	28.773.90.0
R39	50 ohms 0.25 watt	28.773.57.0

## CONDENSERS 747AX

Designation	Value	Code Number
C1	32 $\mu$ F	28.180.13.0
C2	32 $\mu$ F	28.180.13.0
C3	50 $\mu$ F	28.180.32.0
C5	0.1 $\mu$ F	28.199.09.0
C6	32 $\mu$ F	28.182.40.0†
C7	400 $\mu\mu$ F	28.190.19.0
C9	11—490 $\mu\mu$ F } C10 } C11 }	28.211.42.0
C12	12—170 $\mu\mu$ F	
C13	2.5—30 $\mu\mu$ F	
C14	2.5—30 $\mu\mu$ F	28.570.48.0
C15	2.5—30 $\mu\mu$ F	28.211.32.0
C16	2.5—30 $\mu\mu$ F	28.571.59.0
C18	12—170 $\mu\mu$ F	28.571.60.0
C19	12—170 $\mu\mu$ F	28.570.50.0
C20	12—170 $\mu\mu$ F	28.211.31.0
C21	12—170 $\mu\mu$ F	28.570.70.0
C22	20 $\mu\mu$ F	28.211.31.0
C23	10 $\mu\mu$ F	28.570.72.0
C24	16,000 $\mu\mu$ F	28.206.37.0
C25	25,000 $\mu\mu$ F	28.206.34.0
C26	2 $\mu\mu$ F	28.201.10.0
		28.201.12.0
		28.205.88.0

