'TRADER' SERVICE SHEET

268

PHILIPS 747A (Latest Type) AND 747AX

AN interesting point in the design of the latest Philips 747A receiver is the use of two separate diodes for A.V.C. purposes in order to overcome a form of distortion sometimes found when only one diode is employed. The receiver is a 4-valve (plus rectifier) A.C. 3-band superhet suitable for mains of 100-250 V, 50-100 C/S.

A very similar chassis is fitted in the 747AX receiver but this is arranged so that it can be operated on D.C. mains via a vibrator unit, and has a different mains input plug

In addition, a similar chassis is employed in the 698A and 699A radiograms. This *Service Sheet* was prepared on a 747A of the latest type.

It should be noted that some of the first models which were produced had an ordinary output pentode in place of the double diode pentode and do not use two diodes for A.V.C., the circuit being considerably different. These models are not covered here.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling coils **L2, L3** and condenser **C4** to mixed coupled band-pass filter. Primary coils **L4, L5** are tuned by **C38**; secondaries **L9, L10** by **C40**. Coupling is effected by condensers **C6** (M.W.), **C5** (L.W.) and coils **L6, L7** which also form part of a selectivity circuit. On S.W., input is via coupling condenser **C2** to single-tuned circuit **L8, C40**. I.F. filtering by **L1, C35** across aerial circuit.

First valve (**V1, Mullard metallised FC4**) is an octode operating as frequency changer with electron coupling. Oscillator grid coils **L11** (S.W.), **L12** (M.W.) and **L13** (L.W.) are tuned by **C41**; parallel trimming by **C11** (S.W.), **C42** (M.W.) and **C43** (L.W.); series tracking by **C13** (M.W.) and **C12** (L.W.). Anode reaction by **L14** (S.W.), **L15** (M.W.) and **L16** (L.W.).

Second valve (**V2, Mullard metallised VP4B**), is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C44, L17, L18, C45** and **C46, L19, L20, C47.**

Intermediate frequency 128 KC/S.

Diode second detector is not part of **V3** but is part of double diode pentode output valve (**V4, Mullard Pen4DD**). Audio frequency component in rectified output is developed across load resistance **R13** and passed via manual volume control **R17,** coupling condenser **C20** (and on S.W. **C21**), variable R.C. tone filter **R18, R19, C22, C23** and corrector circuit **R20, C24** to C.G. of triode section of double diode triode valve (**V3, Mullard metallised TDD4**). Operating potential for cathode-ray tuning indicator (**T.I., Mullard TV4**) is obtained from potential divider **R14, R15** across **R13.**

One diode of **V3** is strapped to the cathode; the second, fed from **V2** anode via **C18,** provides D.C. potential which is developed across load resistance **R25** and fed back through decoupling circuit as G.B. to I.F. valve, to provide undelayed automatic volume control for this stage. A.V.C. to **V1** is delayed, however, by a rather complicated system. The controlling G.B. potential is that at the second (delay) diode of **V4** which is positively biased via its load resistance **R32.** While no signal is being received a very small voltage drop will occur, due to the diode current, as the internal resistance of the diode is low compared with **R32.** This condition is maintained until the negative potential of **V3** A.V.C. diode rises, due to the strength of an incoming signal, to a value sufficient to neutralise, via **R26,** the opposite polarity of **V4** delay diode, after which normal A.V.C. action will occur in proportion to the strength of the signal. On S.W., **V1** is not controlled.

Resistance-capacity coupling by **R24, C28** and **R27** via **R29** between **V3** triode and pentode section of **V4.** G.B. for **V4** is obtained from drop along **R30** in H.T. negative lead to chassis. Fixed tone correction in anode circuit by **C31.** Provision for connection of low impedance external speaker across secondary of internal speaker transformer **T1.**

Negative feed-back circuit **C32, L21, R33** between secondary of **T1** and cathode circuit of **V3** is coupled (except on S.W. and Gram.) by **R22, L22.** **S22** short-circuits these two latter on S.W. and Gram.

H.T. current is supplied by full-wave rectifying valve (**V5, Philips 1821**). Smoothing by iron-cored choke **L24** and large capacity electrolytic condensers **C30, C33.**

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (four screws with washers) gives access to most of the under-chassis components.

Removing Chassis.—If it should be necessary to remove the chassis from the cabinet, remove the four control knobs (recessed grub screws, two in each of the large knobs) and the four bolts (with washers) holding the chassis to the bottom of the cabinet. Then unsolder the earthing lead to the screen on the bottom of the cabinet and the leads from the T.I. to the scale lamps, and remove the bracket carrying the T.I. holder (screw with milled head). Now unsolder the leads from the output transformer and speaker.

Next free the scale lamp leads from the two cleats holding them to the sub-baffle and remove the scale assembly (four round-head wood screws with washers), when the chassis and scale assembly can be withdrawn together.

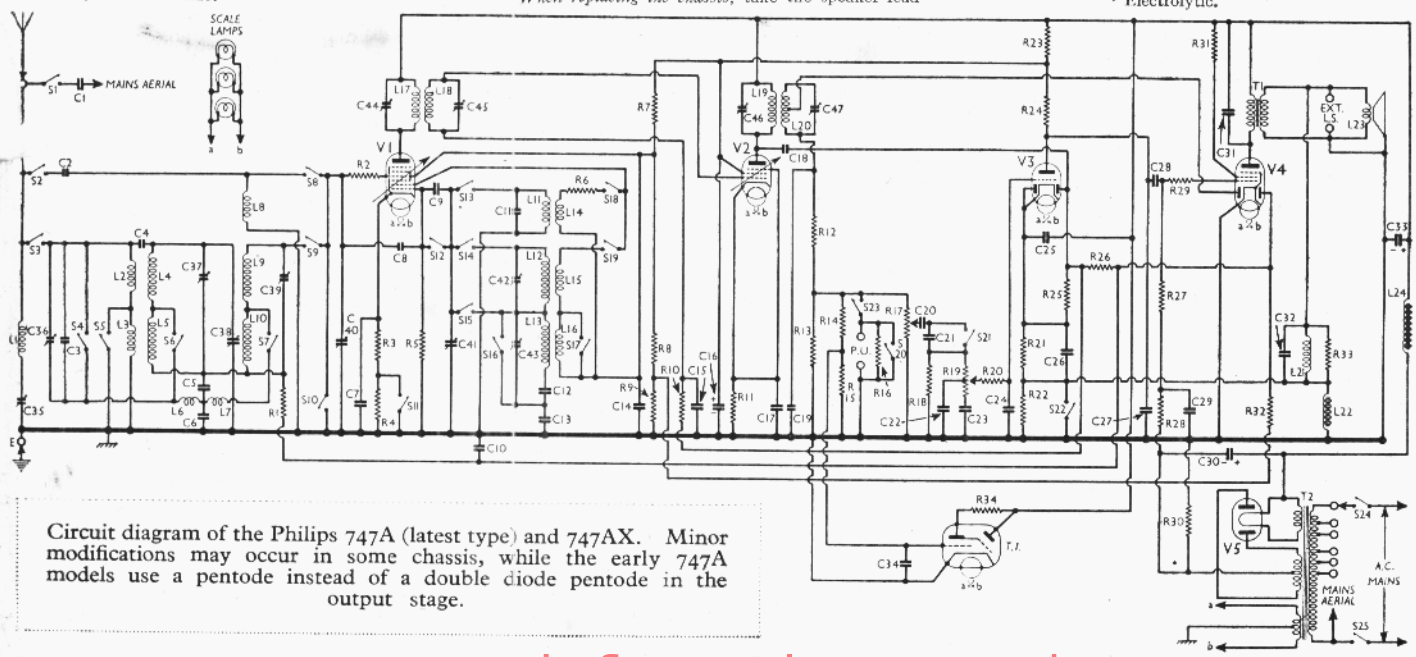
When replacing the chassis, take the speaker lead with green paint on it to the secondary contact nearer the back of the cabinet and to tags 1 and 2 (numbered from left to right) on the speaker terminal panel. The red-painted lead to the primary should go to the contact nearer the back of the cabinet. Note that the large control knob with a white dot should go on the spindle of the tone control.

Removing Speaker.—To remove the speaker from the cabinet, first remove the chassis, then slacken the four clamps (nuts, lock nuts and washers) holding it to the sub-baffle. *When replacing,* see that the terminal panel is at the top.

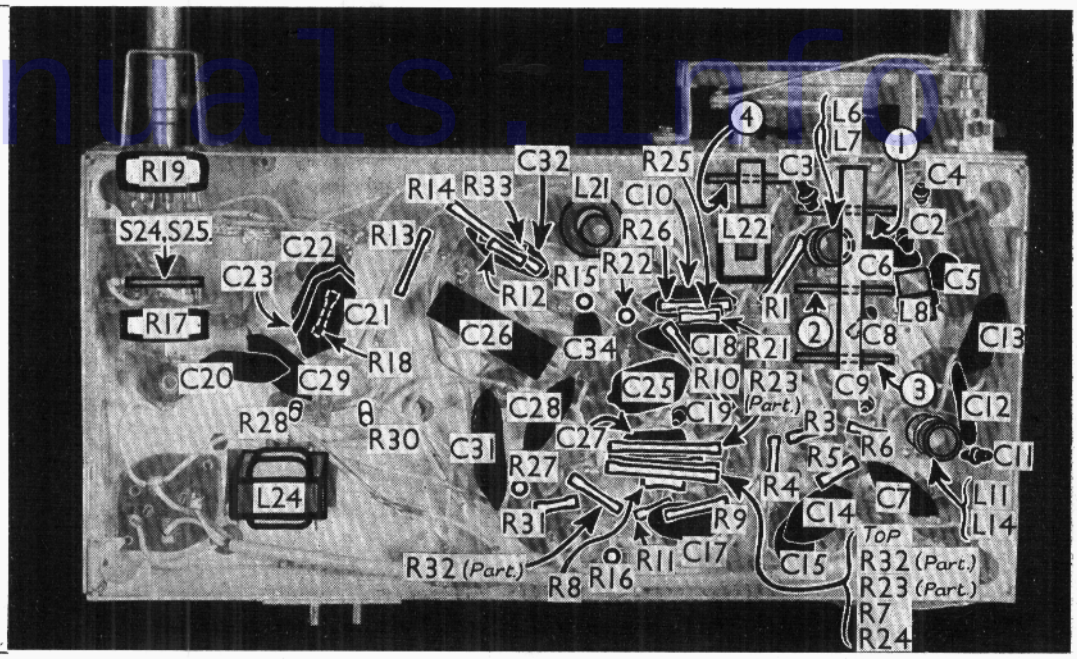
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Mains aerial condenser	0·0005
C2	Aerial S.W. series condenser	0·000016
C3	Image suppressor (fixed)	0·00002
C4	M.W. and L.W. aerial coupling	0·00001
C5	Parts band-pass coupling	0·016
C6	Parts band-pass coupling	0·025
C7	V1 cathode by-pass	0·05
C8	Small coupling	0·000002
C9	V1 osc. C.G. condenser	0·0001
C10	V1 A.V.C. line decoupling	0·1
C11	Osc. circuit S.W. trimmer	0·0000064
C12	Osc. circuit L.W. tracker	0·0007
C13	Osc. circuit M.W. tracker	0·00149
C14	V1 S.G. and osc. anode R.F. by-pass	0·1
C15	V2 C.G. decoupling	0·001
C16*	V2 S.G. and V3 triode anode decoupling	32·0
C17	V2 cathode by-pass	0·1
C18	Coupling to V3 A.V.C. diode	0·00002
C19	I.F. by-pass	0·00005
C20	A.F. coupling to V3 triode	0·005
C21	S.W. A.F. coupling to V3 triode	0·00025
C22	Parts variable T.C. filter	0·00025
C23	Parts variable T.C. filter	0·00064
C24	Part fixed T.C. filter	0·0001
C25	R.F. by-pass	0·0016
C26*	V3 cathode by-pass	50·0
C27	I.F. by-pass	0·0004
C28	V3 triode to V4 A.F. coupling	0·02
C29	V4 C.G. decoupling	0·125
C30*	Part H.T. smoothing	32·0
C31	Fixed tone corrector	0·002
C32	Part negative feed-back	0·05
C33*	Part H.T. smoothing	32·0

* Electrolytic.



Circuit diagram of the Philips 747A (latest type) and 747AX. Minor modifications may occur in some chassis, while the early 747A models use a pentode instead of a double diode pentode in the output stage.



Under-chassis view. **R23** and **R32** each consist of two resistors. The four wave-change switch units are indicated, and shown in detail overleaf. **S24** and **S25** are the mains switches, ganged with **R17**.

	CONDENSERS (*Continued*)	Values (μF)
C34	T.I. feed decoupling	0·05
C35‡	Aerial I.F. filter tuning	0·00017
C36‡	Image suppression adjuster	0·00003
C37‡	Band-pass pri. M.W. trimmer	0·00003
C38†	Band-pass primary tuning	0·00049
C39‡	Band-pass sec. M.W. trimmer	0·00003
C40†	Band-pass secondary and S.W. aerial tuning	0·00049
C41†	Oscillator circuit tuning	0·00049
C42‡	Osc. circuit M.W. trimmer	0·00003
C43‡	Osc. circuit L.W. trimmer	0·00003
C44‡	1st I.F. trans. pri. tuning	0·00017
C45‡	1st I.F. trans. sec. tuning	0·00017
C46‡	2nd I.F. trans. pri. tuning	0·00017
C47‡	2nd I.F. trans. pri. tuning	0·00017

† Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	V1 pent. C.G. decoupling	100,000
R2	V1 pent. C.G. stopper	32
R3	V1 fixed G.B. resistance	250
R4	Radio muting on gram.	10,000
R5	V1 osc. C.G. resistance	50,000
R6	V1 osc. anode S.W. stabiliser	50
R7	Parts V1, V2 S.G.'s, V1 osc. anode, and V3 triode anode	10,000
R8	H.T. feed; V4 A.V.C. delay	32,000
R9	diode pos. bias potentiometer	64,000
R10	V2 C.G. decoupling	2,000,000
R11	V2 fixed G.B. resistance	400
R12	I.F. stopper	250,000
R13	V4 signal diode load	1,600,000
R14	T.I. control potential divider	5,000,000
R15		1,600,000
R16	Pick-up shunt	100,000
R17	Manual volume control	500,000
R18	Part of variable T.C. filter	800,000
R19	Variable tone control, total	600,000
R20	Part fixed T.C. filter	160,000
R21	V3 triode G.B. resistance	3,200
R22	Part negative feed-back circuit	20
R23	Part of pot. with R7, R8 and R9	10,000*
R24	V3 triode load resistance	100,000
R25	V3 A.V.C. diode load	500,000
R26	V3 A.V.C. diode and V4 delay diode coupling	1,000,000
R27	V4 pent. C.G. resistance	500,000
R28	V4 pent. C.G. decoupling	320,000
R29	V4 pent. C.G. stopper	1,000
R30	V4 G.B. resistance	125
R31	V4 S.G. H.T. feed	50
R32	V4 delay diode load	9,000,000†
R33	Part negative feed-back circuit	800
R34	T.I. anode H.T. feed	2,000,000

* Two 20,000 Ω in parallel. † One 5 MΩ and one 4 MΩ in series.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial I.F. filter coil	140·0
L2	Aerial band-pass coupling coils	40·0
L3		100·0
L4	Band-pass primary coils	4·5
L5		48·0
L6	Band-pass coupling coils	1·0
L7		1·0
L8	Aerial S.W. tuning coil	0·05
L9	Band-pass secondary coils	4·5
L10		48·0
L11	Osc. circuit S.W. tuning coil	0·05
L12	Osc. circuit M.W. tuning coil	12·0
L13	Osc. circuit L.W. tuning coil	35·0
L14	Osc. anode S.W. reaction coil	40·0
L15	Osc. anode M.W. reaction coil	4·5
L16	Osc. anode L.W. reaction coil	9·0
L17	1st I.F. trans. Pri.	135·0
L18	1st I.F. trans. Sec.	135·0
L19	2nd I.F. trans. Pri.	135·0
L20	2nd I.F. trans. Sec., total	135·0
L21	Parts negative feed-back circuit	175·0
L22		3·0
L23	Speaker speech coil	3·5
L24	H.T. smoothing choke	375·0
T1	Speaker input trans. Pri.	800·0
	Sec.	0·4
T2	Mains trans. Pri., total	43·0
	Heater sec.	0·05
	Rect. heat. sec.	0·15
	H.T. sec., total	245·0
S1	Mains aerial switch	—
S2-S22	Waveband switches	—
S23	Gram. P.U. switch	—
S24 S25	Mains switches, ganged R17	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 231 V, using the 220 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC4	265	1·4	82	4·7
	Oscillator	—	—	
	76	1·9	—	—
V2 VP4B	265	7·4	155	2·4
V3 TDD4	62	0·8	—	—
V4 Pen4DD	245	34·0	265	6·0
V5 1821	275†	—	—	—

† Each anode, A.C.

GENERAL NOTES

Switches.—**S1** is the mains aerial switch, mounted on a bracket at the rear of the chassis, just above the **A** and **E** sockets. Two contacts of the switch unit are blank, while the other two forming the switch are *closed* when the lever control is moved so as to cover the aerial socket.

S2-S23 are the waveband and pick-up switches, ganged in four rotary units beneath the chassis. These are indicated in our under-chassis view, and are shown in detail in the diagrams on page VIII. There is a good deal of interconnection between the switches, particularly on the fourth unit, which we have indicated as clearly as possible.

The table (page VIII) gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

S24 and **S25** are the Q.M.B. mains switches, ganged with the volume control **R17.**

Coils.—**L1**; **L2-L5**; **L9**, **L10**; **L12, L13, L15, L16** and the I.F. transformers **L17, L18** and **L19, L20** are in six screened units on the chassis deck. All but the fourth of these have a trimmer at the top of their cans. The fourth has two trimmers.

L6, L7; **L8**; and **L11, L14** are on three small unscreened tubular formers beneath the chassis. **L21, L22** and **L24** are also beneath the chassis.

Scale Lamps.—These are three Philips M.E.S. types with tubular bulbs, type 8042-07.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (5·5 Ω) external speaker.

Resistances R23, R32.—**R23** consists of two 20,000 Ω resistors in parallel, and **R32** of 0·4 MΩ and 5 MΩ in series.

Components R2, R20, C24 and **R29.**—**R2** is inside the top cap connector of **V1, R20** and **C24** are inside the top cap connector of **V3,** and **R29** is inside the top-cap connector of **V4.**

T.I. Connections.—The TV4 is fitted with a side contact base, with two contacts blank. Starting with the blank contact in the group of four close together, and proceeding anti-clockwise, looking at the underside of the holder, the connections are: 1, blank; 2 and 3, heater; 4, cathode; 5, blank, 6, grid; 7, target; 8, anode.

R34 is connected directly across contacts 7 and 8 on the holder.

V4 Connections.—The Pen4DD has a 7-pin base with connections differing from usual. The anode and cathode are interchanged, so that pin 2 is cathode and pin 6 is anode.

Chassis Divergencies.—We have examined circuit diagrams of the 797A and 797AX, and neither agrees entirely with our own chassis, which resembles most nearly the 797AX. The early 797A chassis had an ordinary pentode for **V4,** and not a double diode pentode, and this, of course, affects the A.F. end of the set considerably.

Some of the values for components do not agree

Continued overleaf

PHILIPS 747A—*Continued*

with the makers' figures for the 707 AX, but the differences are not important.

R33 may be 320 O, **L22** may not be present, and **C25** may not be present.

The radiogram models are similar in the main, but again certain component values in the A.F. end may be different.

To cover all the divergencies here would be very confusing, and, working from this *Service Sheet* the competent engineer should not find serious difficulty in following any of the divergent chassis.

CIRCUIT ALIGNMENT

It is not necessary to remove the chassis when aligning; merely place the receiver on its left side, and remove the bottom plate and the back of the cabinet.

I.F. Stages.—Connect up an earth wire, switch set to L.W., turn volume and tuning controls to maximum. Connect signal generator via a 0·032 μF condenser to control grid (top cap) of **V1** (leaving existing top cap connection) and chassis. Feed in a 128 KC/S signal.

Connect a 25,000 O resistor and 0·1 μF condenser in series, between top cap of **V2** and chassis. Adjust **C44** for maximum output. Connect the resistor and condenser between anode of **V1** and chassis, and adjust **C45** for maximum output. Connect the resistor and condenser across **L20**, and adjust **C46** for maximum output. Connect resistor and condenser between anode of **V2** and chassis, and adjust **C47** for maximum output.

Seal trimmers with wax, remove resistor and condenser, and signal generator coupling condenser.

R.F. and Oscillator Stages.—If chassis has not been removed from cabinet, the usual method employing a 15 degree jig cannot be used. In this case, ordinary scale settings may be used, providing calibration is not suspected of being inaccurate.

M.W.—Switch set to M.W., turn volume control to maximum, and tune to 208 m. on scale. Connect signal generator to **A** and **E** sockets via a dummy aerial, and feed in a 208 m. (1,442 KC/S) signal. Connect 25,000 O resistor and 0·1 μF condenser in series between top cap of **V2** and chassis. Adjust **C42, C39** and **C37** for maximum output. Re-adjust **C39,** then **C42,** and then seal all three trimmers.

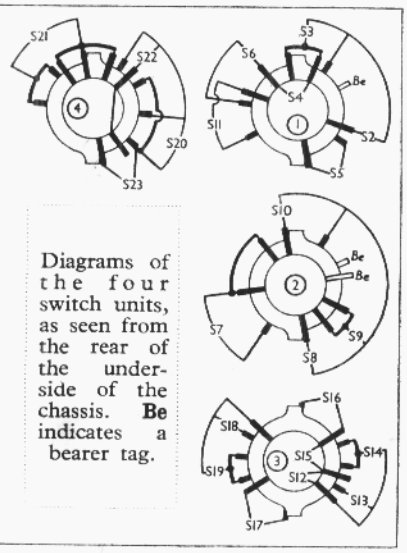
L.W.—Switch set to L.W. Feed in a 395 KC/S (760 m.) signal, tune it in, and adjust **C43** for maximum output, then re-seal.

Image Suppressor.—Switch set to M.W. Feed in a strong 1,000 KC/S (300 m.) signal, tune set to 403 m. on scale, and ajdust **C36** for *minimum* output, then re-seal.

I.F. Filter.—Switch set to L.W., feed in a strong 128 KC/S signal, turn tuning condenser to maximum, and adjust **C35** for *minimum* output, then re-seal.

SWITCH TABLE AND DIAGRAM

Switch	S.W.	M.W.	L.W.	Gram.
S2	C	—	—	—
S3	—	C	C	C
S4	—	—	—	C
S5	—	C	—	—
S6	C	C	—	C
S7	—	C	—	C
S8	C	—	—	—
S9	—	C	C	—
S10	—	—	—	C
S11	C	C	C	—
S12	—	C	C	—
S13	C	—	—	—
S14	—	C	C	—
S15	—	—	—	C
S16	—	C	—	—
S17	—	C	—	—
S18	C	—	—	—
S19	—	C	C	—
S20	C	C	C	—
S21	—	C	C	C
S22	C	—	—	C
S23	—	—	—	C



Diagrams of the four switch units, as seen from the rear of the underside of the chassis. **Be** indicates a bearer tag.

MAINTENANCE PROBLEMS

Unusual Cause of Distortion

A KB397 receiver was received with the complaint that signals intermittently became very distorted.

On test this was found to be the case, and it was noticed that if the metallising of the detector valve was held with the hand, the distortion would disappear.

This effect seemed to point out bad filtering of R.F. currents to earth, so the chassis was removed and the detector circuit examined, when it was noticed that an extra .001 μF by-pass condenser had been fitted some time as an extra.

This was connected one end to the anode of the detector and the other end was taken to an earthing tag some six inches away.

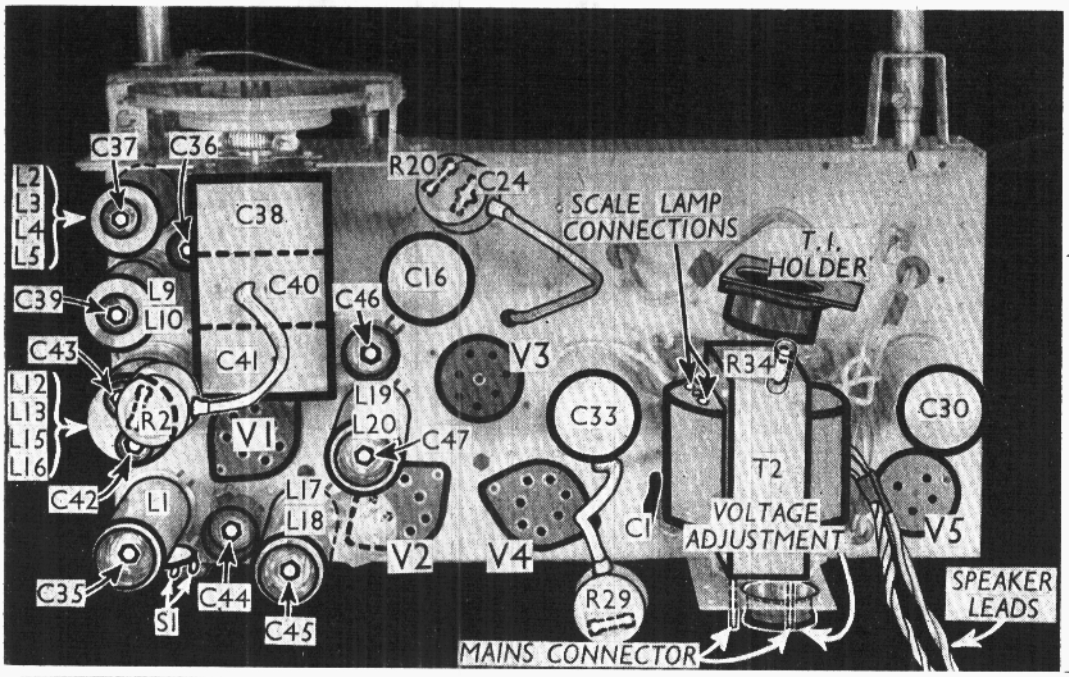
This looked harmless enough, but the fact that the chassis was subject to hand capacity as well as the valve metallising, showed that R.F. currents were flowing somewhere where they should not!

It was decided to fit the by-pass condenser by its tags straight between anode and cathode of the detector valve, in spite of the fact that the cathode was earthed.

This did the trick, as the distortion disappeared, and neither the valve nor the chassis showed the previous symptoms of hand capacity. Evidently the six-inch earth return lead of the by-pass condenser was radiating R.F. energy and causing the effects mentioned.

* * *

I don't know whether other service engineers have had any experience in re-aligning of the cheaper Philips and Mullard models in which the trimmers take the form of small tubes with wire wrapped round the outsides, capacity being adjusted by winding or unwinding turns. A more fiddling job I have never met. I took the point up with the makers, who, I understand, are bringing it to the notice of the designs section.—R.A.COATES, WHITBY.



Plan view of the chassis. Note the components inside the valve top cap connectors. **R34** is connected across two of the tags on the T.I. holder. **S1** is the mains aerial switch.

Printed in Great Britain as a supplement to *The Wireless & Electrical Trader* for the proprietors and publishers, *The Trader Publishing Co., Ltd.*, Dorset House, Stamford Street, London, S.E.1, by Sanders Phillips & Co., Ltd., The Baynard Press, Chryssell Road, London, S.W.9. Every Saturday.