NUMBER SEVENTY-TWO **'TRADER' SERVICE SHEETS**

PYE T9 SUPERHET

A TRIODE output valve is employed in the Pye T9 superhet for A.C. mains operation. Provision is made for an extension speaker and also a gramophone pick-up.

There are three models of this receiver altogether—one for 40-100 cycles, 200-250 V; another for 40-100 cycles, 100-150 V, and the third for 25-40 cycles, 200-250 V.

A similar chassis is employed in the T9/RG radio-gramophone.

CIRCUIT DESCRIPTION

Two alternative aerial connections to coupling coil **L1. A1** connection is for normal use; **A2,** connected via fixed series condenser **C1,** is used when receiver is operated in "swamp" areas. Band-pass input filter is inductively coupled. Primary **L2, L3** tuned by **C22**; secondary **L4, L5** tuned by **C24.**

First valve (**V1, Ever Ready A80A** or **Mullard FC4, metallised**) is an octode operating as frequency changer with electron coupling. Oscillator grid tuning coils **L6, L7** tuned by **C26** which has shaped vanes for tracking; anode reaction coil **L8.** Variable resistance **R3** in **V1** cathode circuit forms sensitivity control by varying fixed G.B. applied to variable-mu pentode section.

Second valve, a variable-mu H.F. pentode (**V2, Ever Ready A50N** or **Mullard VP4A, metallised**), operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **L9, L10** and **L11, L12.**

Intermediate frequency 127 KC/S.

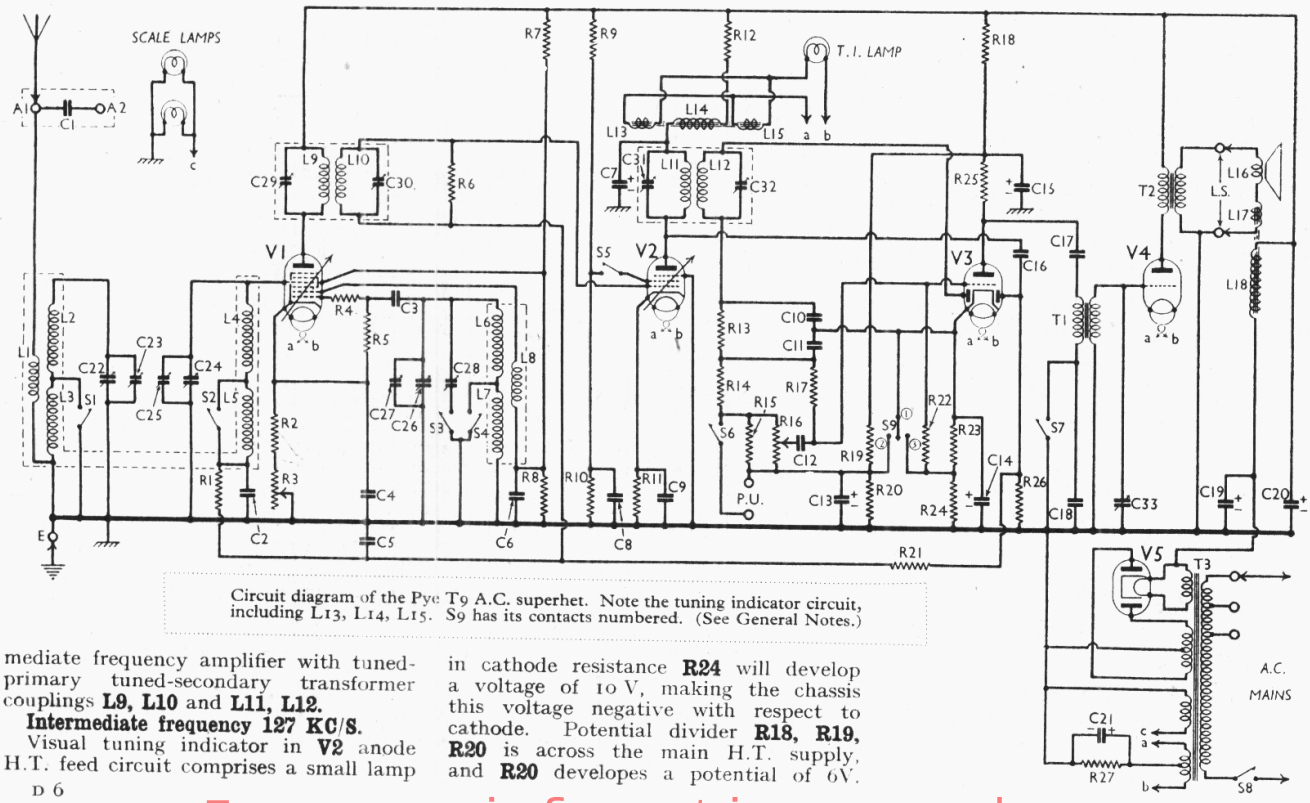
Visual tuning indicator in **V2** anode H.T. feed circuit comprises a small lamp working in conjunction with chokes **L13, L14, L15,** which have a common core. When there is no signal input to the receiver, **V2** is in its most sensitive state owing to the A.V.C. system, and, therefore, the anode current (D.C.) passing through **L14** is at its highest. The core is thus magnetised to a certain extent, and the inductances, and therefore the impedances, of the coils **L13, L15** (in parallel) are at their lowest, with the result that the lamp (connected in series together with the mains transformer heater winding) glows brightly. As a carrier wave is tuned in the action of the A.V.C. circuit reduces the anode current of **V2** flowing through **L14,** and thus decreases the magnetisation of the core. This, in turn, increases the impedances of **L13, L15** and the brilliance of the lamp becomes less until the receiver is accurately tuned, when it glows dimly.

Diode second detector forms part of double diode triode (**V3, Ever Ready A23A** or **Mullard TDD4, metallised**), which also provides a special form of quiet automatic volume control and L.F. amplification. Second diode, fed from **V2** anode via condenser **C16,** provides D.C. potential which is developed across **R26** and fed back as G.B. to the F.C. and I.F. valves to give A.V.C.

When no signal is being received, the anode current of **V3** triode section flowing in cathode resistance **R24** will develop a voltage of 10 V, making the chassis this voltage negative with respect to cathode. Potential divider **R18, R19, R20** is across the main H.T. supply, and **R20** developes a potential of 6V. This means that the junction between **R19** and **R20** is 6 V positive with respect to the chassis and, therefore, 4 V negative with respect to the cathode. From the diagram it will be seen that resistances **R15, R14, R17** and **R22** form a potential divider connected between **R19, R20** junction and **V3** cathode, and, further, that the potential of 4V already mentioned is applied across the network. It follows, therefore, that the negative bias potential applied to the triode grid is that developed across **R22** (2.5V) and the negative bias applied to the signal diode anode is that across **R22** and **R17** (3.8 V).

When a signal is received and rectified a current flows in the circuit comprising **L12, R13, R14, R15, R20** and **R24.** This current develops at the **R13, R14** junction a negative potential with respect to the **R19, R20** junction, thus increasing the negative bias applied to the triode and thereby reducing its anode current and the voltage developed across **R24.** As the signal increases, the voltage across **R24** will be reduced, and also the negative bias applied to the signal diode. The circuit is so arranged that the diode bias is reduced to zero with quite a weak signal input, thus avoiding distortion. The bias, of course, increases between stations, and, in paralysing the diode, gives inter-station noise suppression.

Switch **S9** is of the single pole change-over type forming an additional sensitivity control. Normally, contacts 1 and 3 are closed thus S.C. **V3** cathode resistance **R23,** but when **R3** is at maximum sensitivity, contacts 1 and 2 close.



Circuit diagram of the Pye T9 A.C. superhet. Note the tuning indicator circuit, including L13, L14, L15. S9 has its contacts numbered. (See General Notes.)

Audio-frequency component in output from signal diode is tapped off by manual volume control **R16** and passed via coupling condenser **C12** to **V3** triode for amplification. Provision for connection of pick-up by switch **S6**. **S5** breaks **V2** S.G. H.T. feed circuit on gram., and thus prevents radio break-through.

Parallel-fed transformer coupling by **R25, C17** and **T1** to triode output valve (**V4, Ever Ready S30C** or **Mullard AC 044**). Variable condenser **C33** in grid circuit forms high-note attenuator; fixed condenser **C18** working in conjunction with switch **S7** attenuates bass response.

H.T. current is supplied by full-wave rectifying valve (**V5, Ever Ready A11B** or **Mullard IW3**). Smoothing by speaker field coil **L18** and condensers **C19, C20**.

DISMANTLING THE SET

A detachable bottom (metal plate) is fitted to the cabinet. When removed (four round-head wood screws and one nut) it gives access to the under-chassis.

Removing Chassis.—To remove the chassis from the cabinet, remove the back, the four control knobs (pull off) and the four bolts (with large metal washers) holding the chassis to the cabinet bottom. Free the speaker leads from the clip on the side of the cabinet and then remove the metal plate from the cabinet bottom. It is then possible to remove the knurled nut holding the tuning indicator bulb. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To remove the chassis entirely, free the speaker plugs from the sockets on the back of the chassis and remove the field leads from the speaker (screw terminals).

When replacing chassis, note that there is a paxolin strip between the chassis and each of the wooden chassis supports.

Removing Speaker.—The speaker is held to the sub-baffle by four bolts and can be removed by removing the four nuts and spring washers from these.

COMPONENTS AND VALUES

	Resistances	Values (ohms)
R1	V1 pent. cont. grid decoupling	10,000
R2	V1 fixed G.B. resistance ..	150*
R3	V1 sensitivity control ..	2,000
R4	V1 osc. grid series resistance ..	1,000
R5	V1 osc. grid resistance ..	100,000
R6	1st I.F. trans. sec. shunt ..	260,000
R7	V1 S.G.'s and osc. anode potential divider	30,000
R8		40,000
R9		80,000
R10	V2 S.G. H.T. potential divider	100,000
R11	V2 fixed G.B. resistance ..	200
R12	V2 anode decoupling	10,000
R13	I.F. stopper	100,000
R14	V3 signal diode load ..	160,000
R15		260,000
R16	Manual volume control ..	250,000
R17	Part of Q.A.V.C. circuit ..	1,100,000
R18	Q.A.V.C. circuit H.T. potential divider ..	10,000
R19		100,000
R20		3,000
R21	A.V.C. circuit decoupling ..	1,100,000
R22	V3 triode grid resistance ..	2,100,000
R23†	V3 cathode resistances	1,000
R24		3,000
R25	V3 triode anode load	30,000
R26	V3 A.V.C. diode load	510,000
R27	V4 G.B. resistance	750

* May be 300 O. † May not be in early chassis.

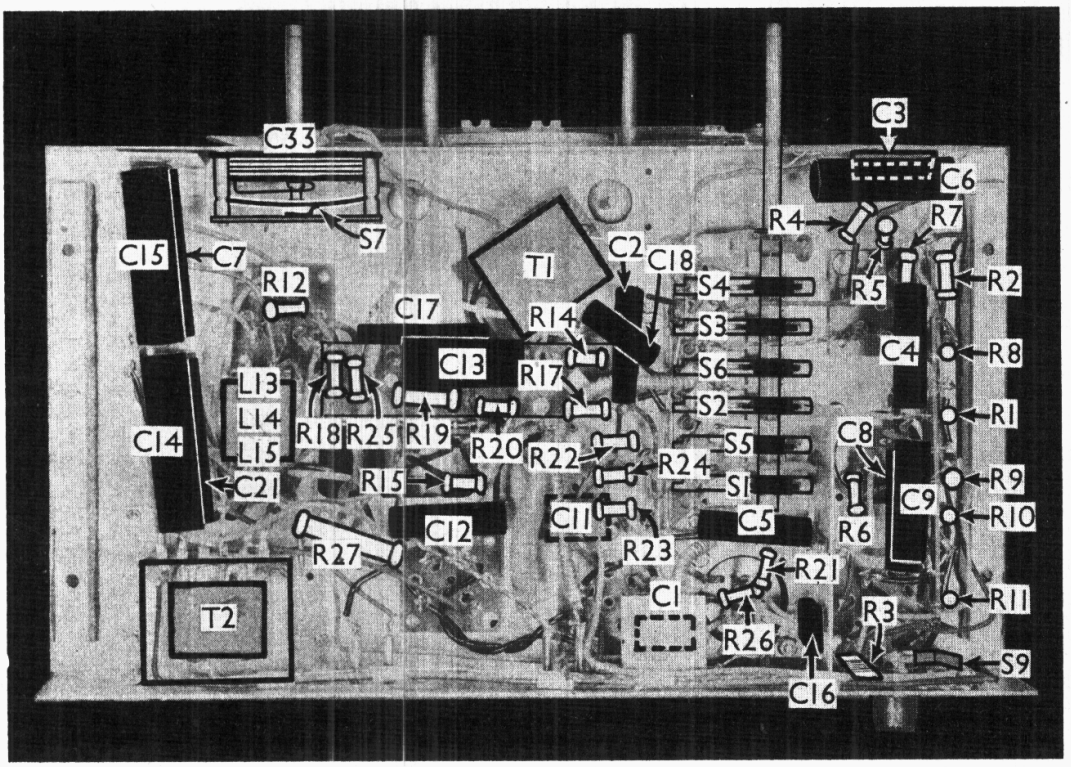
	Condensers	Values (μF)
C1	Aerial series condenser ..	0·000015
C2	V1 pent. cont. grid decoupling	0·1
C3	V1 osc. grid condenser ..	0·001
C4	V1 cathode by-pass	0·1
C5	A.V.C. circuit decoupling ..	0·1
C6	V1 S.G.'s by-pass; osc. anode decoupling	0·25
C7*	V2 anode decoupling	2·0
C8	V2 S.G. by-pass	0·1
C9	V2 cathode by-pass	0·1
C10	I.F. by-passes	0·0001
C11		0·0001
C12	L.F. coupling to V3 triode ..	0·05
C13*	Part of Q.A.V.C. circuit ..	10·0
C14*	V3 cathode by-pass	10·0
C15*	V3 anode decoupling	2·0
C16	Coupling to V3 A.V.C. diode ..	0·0001
C17	L.F. coupling to T1 ..	0·25

	Condensers (Contd.)	Values (μF)
C18	Bass attenuator	0·01
C19*	H.T. smoothing ..	8·0
C20*		8·0
C21*	V4 G.B. resistance by-pass ..	20·0
C22	Band-pass primary tuning ..	—
C23‡	Band-pass primary trimmer ..	—
C24	Band-pass secondary tuning ..	—
C25‡	Band-pass secondary trimmer	—
C26	Oscillator tuning	—
C27‡	Oscillator main trimmer ..	—
C28‡	Oscillator L.W. trimmer ..	—
C29‡	1st I.F. trans. pri. tuning ..	—
C30‡	1st I.F. trans. sec. tuning ..	—
C31‡	2nd I.F. trans. pri. tuning ..	—
C32‡	2nd I.F. trans. sec. tuning ..	—
C33	Variable tone control . ..	—

* Electrolytic. ‡ Pre-set.

	Other Components	Values (ohms)
L1	Aerial coupling coil	24·0
L2	Band-pass primary coils	2·3
L3		15·0
L4	Band-pass secondary coils	2·3
L5		15·0
L6	Oscillator grid tuning coils	1·7
L7		3·3
L8	Oscillator anode coil	45·0
L9	1st I.F. trans. Pri. ..	93·0
L10	Sec. ..	93·0
L11	2nd I.F. trans. Pri. ..	42·0
L12	Sec. ..	42·0
L13	Tuning indicator A.C. coil ..	20·0
L14	D.C. coil ..	2,850·0
L15	chokes A.C. coil ..	20·0
L16	Speaker speech coil	1·2
L17	Hum neutralising coil	0·2
L18	Speaker field winding	1,650·0
T1	Intervalve transformer Pri.	600·0
	Sec.	2,100·0
T2	Output transformer Pri...	190·0
	Sec...	0·1
T3	Mains trans. Pri. total ..	44·0
	Heater sec. ..	0·04
	Lamp sec. ..	0·35
	Rect. heat. sec.	0·2
	H.T. sec. ..	350·0
S1-S4	Waveband switches	—
S5	Radio muting switch (gram.) ..	—
S6	Gram. pick-up switch ..	—
S7*	Bass attenuator switch ..	—
S8	Mains switch, ganged R16 ..	—
S9†	Sensitivity switch	—

*Ganged with tone control condenser C33.
† Operated by cam on sensitivity control (R3).



VALVE ANALYSIS

Readings of valve voltages and currents given in the table overleaf were measured with the receiver operating on 225 V mains, with no signal input and with the tuning condenser at minimum on the M.W. range. The sensitivity control was at maximum and the volume control at minimum. Voltages were measured on the 1,200 V scale of an Avometer, with chassis as negative.

(*Continued overleaf*)

Under-chassis view. C1 is inside a small screening box. C3 is beneath C6. S9 is operated by a cam on the spindle of R3. (See General Notes.) R23 may not occur in some chassis.

PYE T9 (Continued)

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 A80A*	310	2·0	85	4·0
V2 A50N	240	4·9	90	2·1
V3 A23A	110	4·7	—	—
V4 S30C	300	41·0	—	—
V5 A11B	355†	—	—	—

* Osc. anode (G2) 90 V, 1·7 mA.
† Each anode, A.C.

GENERAL NOTES

Switches.—**S1-S6** are in one unit, the positions of which are given in the table below. **S1-S4** are the waveband switches, **S5** is a radio muting switch used when a pick-up is operating. The pick-up is brought into circuit by **S6**. In the following table O indicates open, and C closed.

Position	S1	S2	S3	S4	S5	S6
M.W.	C	C	O	C	C	O
L.W.	O	O	C	O	C	O
Gram.	C	C	C	O	O	C

S7 is the tone control switch combined with the bass control condenser (**C18**), while **S8** is the mains switch, ganged with the volume control (**R16**).

S9 is a switch associated with the sensitivity control **R3**. When the latter is rotated fully to the "max." position (clockwise), the contacts 1 and 2 are closed, thus further increasing the sensitivity, but in other positions of **R3**, contacts 1 and 3 are closed. The contacts are shown numbered in the circuit diagram, but not elsewhere. **S9** may not occur in some early models of the chassis.

Coils.—The band-pass and oscillator coils, **L1-L5** and **L6-L8**, are in two screened units on the chassis deck. Note that the latter unit also contains **C28**.

The I.F. transformers, **L9, L10** and **L11, L12**, are in two screened units, containing also the trimmers **C29-C32**. In addition, the second I.F. transformer unit also contains **R13** and **C10**.

Scale Lamps.—These are two Ever Ready 3.5 V 0.3 A M.E.S. types.

Tuning Indicator Lamp.—This is a Philip's M.E.S. type, rated at 2.0 V, 0.1 A. No other rating should be used.

External Speaker.—This should be of the low resistance type (1.5 to 2.5 O).

Resistance R23, Switch S9.—These are in our chassis, and are included in our circuit diagram. They do not occur in the makers' original diagram.

Condenser C1.—This is in a small screening box behind the aerial sockets.

Condensers C19, C20.—These are two 8 μF dry electrolytics in a single unit, with a common negative (black) lead. The positive of **C19** is the yellow lead and of **C20**, the red lead.

Resistance R2.—This has a value of 150 O in our chassis, but may be 300 O.

CIRCUIT ALIGNMENT

Adjustment of Scale.—Rotate tuning knob in an anti-clockwise direction until pointer is at higher wavelength end of scale. Push the flat end of a pencil through the hole in the side of gang condenser cover, and against the vanes. Rock the vanes by means of tuning knob, until it is felt that rotor vanes are fully in mesh with stators. The pointer of scale should now be on the end line of higher wavelength end of scale. If this is not so, a small adjustment may be made by loosening the clips holding scale, and sliding it to the correct position.

A larger adjustment may be made by loosening the two grub screws behind the driving disc, which interrupts the drive to the condenser. The pointer can now be set at any position by rotating tuning knob.

Adjustment of I.F. Circuits.—Any adjustments to the I.F. circuits should be made before the signal frequency and oscillator circuits are adjusted.

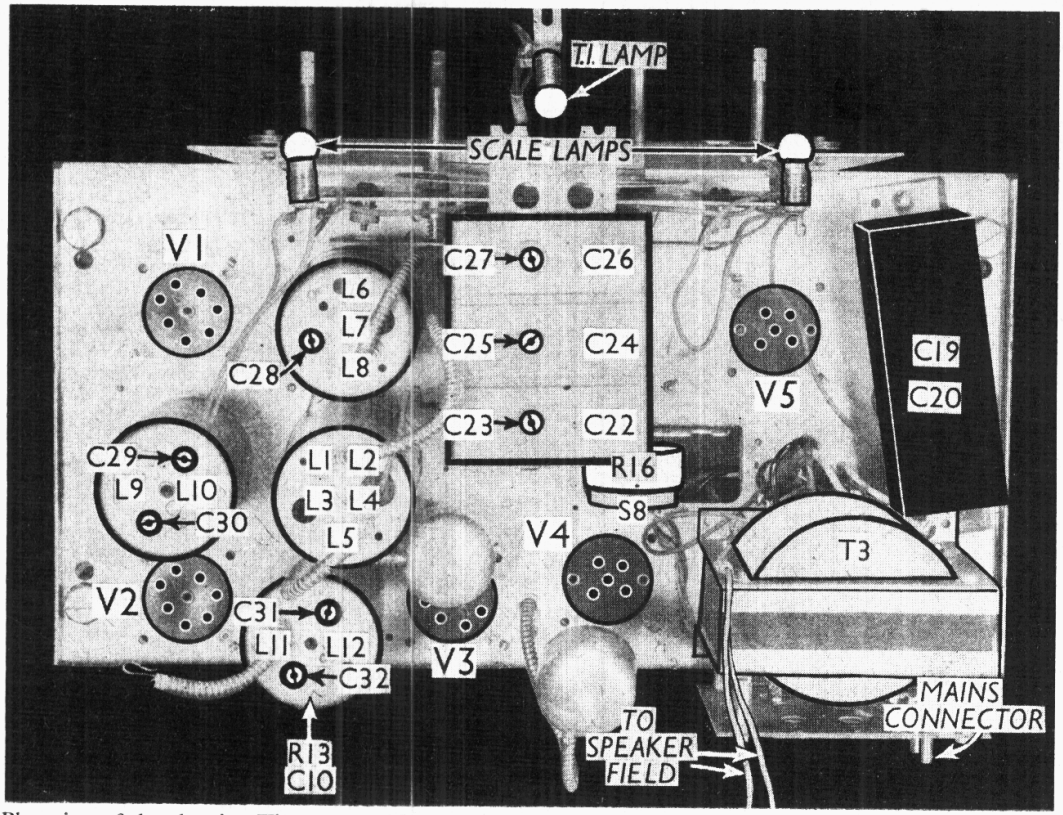
Apply a modulated 127 KC/S signal between **V1** control grid and chassis, via a .002 μF condenser. The lead to the control grid terminal is removed, and a 0.5 MO resistance is connected between the terminal and chassis. To stop the valve oscillating, connect a 0.25 μF condenser from oscillator anode to chassis. Connect an output meter across primary of the output transformer, **T2**.

Adjust **C32, C31, C30, C29** in that order for maximum output, progressively reducing the input if necessary. Use a loading resistance of 50,000 O when making these adjustments, connecting the resistance across the secondary when adjusting the primary of each transformer, and *vice versa*.

Adjustment of Signal Frequency and Oscillator Circuits.—Rotate gang condenser so that the pointer is on the line at the lower wavelength end of the scale. Apply a modulated signal of 196 m. between aerial terminal and chassis, and switch receiver to M.W. Adjust the main oscillator trimmer **C27** for maximum output. If more than one peak is obtained, that nearer to minimum capacity is the correct one. Next adjust **C25** and **C23** for maximum output, and finally re-check all three. Check again at the top of the scale, say 500 m., and if setting is 15-20 m. low, it is fairly certain that **C27** is tuned to the incorrect peak. If this occurs, re-trim roughly at 500 m., and then repeat the process at 196 m.

Now switch receiver to the L.W. band, and rotate the gang condenser until the pointer registers 1,300 m. Apply a 1,300 m. modulated signal, and adjust **C28** to a point mid-way between the two consecutive peaks.

During the above adjustments, progressively reduce the input as the circuits come into tune, to keep the signal below the value at which A.V.C. commences.



Plan view of the chassis. The screen of L11, L12 also contains R13 and C10. All the trimmers are clearly indicated.