PYE

MODEL TT1

THIS is a 14-in., Band I/III transistor portable television receiver. It may be operated from 50-c/s. A.C. mains supplies in the range 200–250 volts, a 12-volt lead–acid battery (*e.g.*, car battery), or the internally fitted nine-cell 10-volt battery. The internal battery can be recharged from the mains. It must *not* under any circumstances be operated from D.C. mains supplies, or serious damage, attended by risk of fire, will result. If a low-voltage external power source is used, it must be of absolutely stable polarity, capable of delivering approximately 3 A. with a dead smooth characteristic at a strictly maintained 12-volts on or off load, and very preferably fitted with reverse current circuit-break facility: it is essential that a D.C. supply of reversed polarity must never enter or be applied to the receiver. Amplified mean-level A.G.C. is applied to the first vision I.F. stage, and A.V.C. is incorporated in the sound channel. Flywheel line synchronisation is used. The I.F.s are 38·15 Mc/s. sound and 34·65 Mc/s. vision. *Caution:* The chassis is connected to one side of the mains supply, and may therefore be " live ".

It is essential to provide adequate ventilation both underneath and at rear.

Transistor and Diode Types and Functions

V1	AF102	R.F. amplifier
V2	AF102	Mixer
V3	AF102	Local oscillator
V4	OC171	1st sound I.F. amplifier
V5	OC171	2nd sound I.F. amplifier
V6	OC171	3rd sound I.F. amplifier
V7	CG64H	Sound demodulator
V8	CG64H	Sound interference limiter
V9	OC82D	Audio driver
V10	OC82	Push–pull audio output stage
V11	OC82	Push–pull audio output stage
V12	1S101	Mains rectifier
V13	1S101	Mains rectifier
V14	OC171	1st vision I.F. amplifier
V15	OC171	2nd vision I.F. amplifier
V16	OC171	3rd vision I.F. amplifier
V17	OC171	4th vision I.F. amplifier
V18	CG64H	Vision demodulator
V19	OC170	1st video amplifier
V20	OC71	A.G.C. amplifier
V21	V15/20R	2nd video amplifier
V22	OC44	Sync. separator
V23	OC71	Frame sync. pulse inverter
V24	OA81	Frame oscillator damper
V25	OC72	Frame blocking oscillator
V26	OC72	Frame driver

V27	OC23	Frame output
V28	OA81	Frame output damper
V29	OC71	Flywheel line sync. phase splitter
V30	OA81 (2)	Flywheel line sync. discriminator
V31	OC201	Flywheel line sync. A.F.C. amplifier
V32	OC72	Line oscillator
V33	OA81	Line oscillator damper
V34	OC23	Line driver
V35	2G221	Line output
V36	2G221	Line output
V37	OA81	Frame oscillator H.T. rectifier
V38	OC28B	Efficiency diode
V39	OA81	Video amplifier H.T. rectifier
V40	OA81	Brightness
V41	EY51	E.H.T. rectifier
V42	FST1/4	Picture-tube H.T. rectifier
V43	C14/13A	Picture tube

Notes on Supplies

When connecting the low-voltage supply, fit the three-pin socket supplied to a suitable length of not lighter than 14/0·036 insulated twin flex connected to the 12-volt D.C. supply as follows: (1) positive lead to the pin socket terminal marked " 2 " on the left-hand side (interior rear view) of the moulded keying groove, with the latter in lowermost position; (2) negative lead to the pin socket marked " 1 " on the right-hand side (interior rear view) of the moulded keying groove, with the latter in lowermost position; (3) third pin-socket terminal marked " E " blank.

If the receiver is to be supplied from the functional battery of a motor vehicle the latter must have a positive-earth electrical system. It is not recommended that the engine of the vehicle is left running whilst the receiver is working off the functional battery.

When using an external battery, particularly the functional battery of a motor vehicle, it is well advised to avoid discharging beyond a residual working reserve of discharge capacity.

When the receiver is switched off with an external battery still connected the internal battery continues to trickle charge until the terminal voltages of the batteries equalise. The external battery will not in consequence be more than slightly discharged.

Recharging.—During normal operation, the battery receives an automatic trickle charge. To trickle-charge when the receiver is not in use, proceed as follows: (1) set function switch to " charge "; (2) put mains on–off switch on; (3) observe red indicator light on at rear cover; (4) check necessary charging time. 7 hours recharge is necessary for 1 hour discharge, 14 hours recharge for 2 hours discharge. Whilst the battery can withstand occasional low overcharging, continuing overcharging will cause serious damage.

Chassis Removal

(1) Detach function switch knob at the bottom left-hand corner of the rear cover. (2) Disconnect either external or internal aerial lead plug, and, if fitted, the internal aerial rods. (3) Remove eight back-cover screws

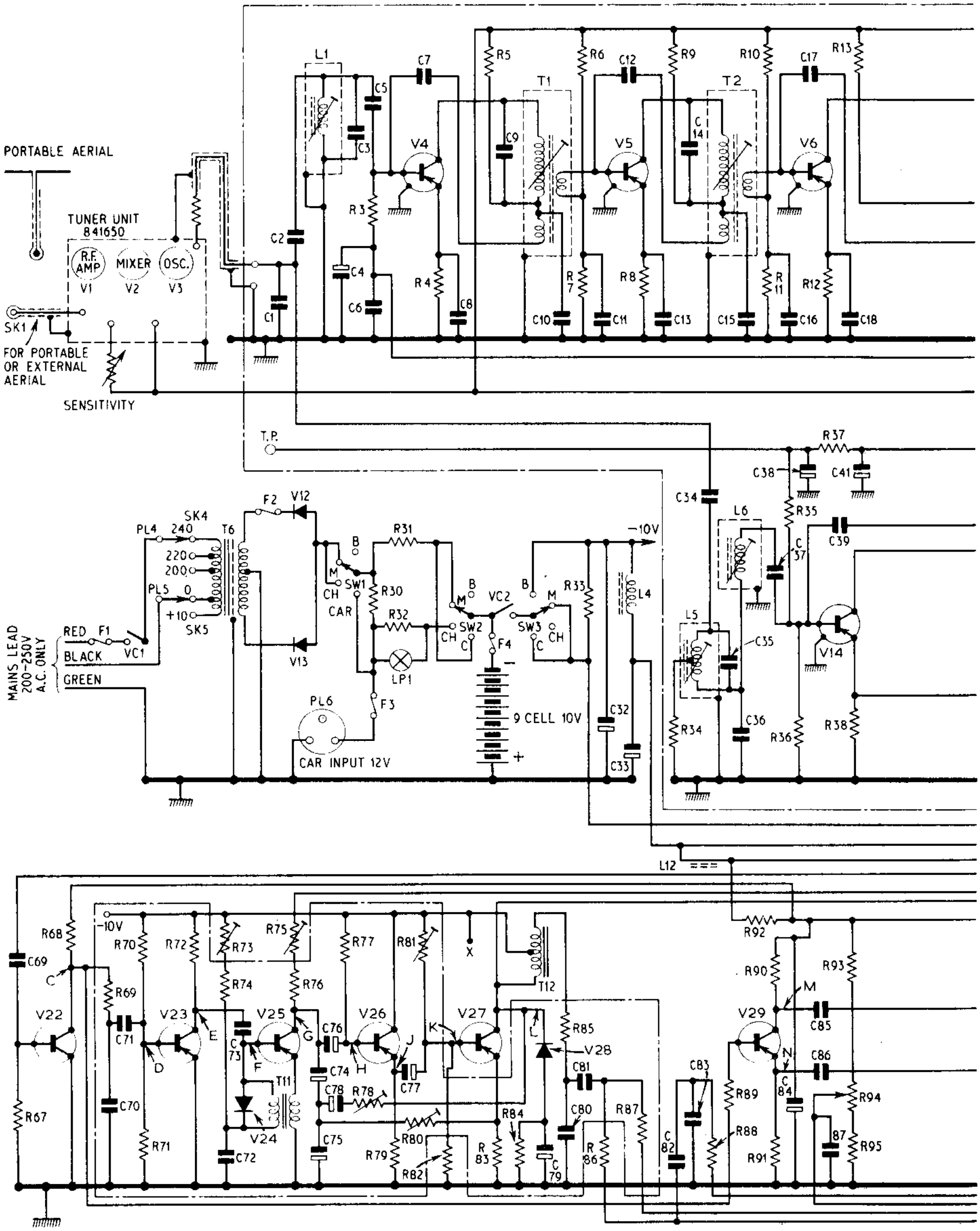
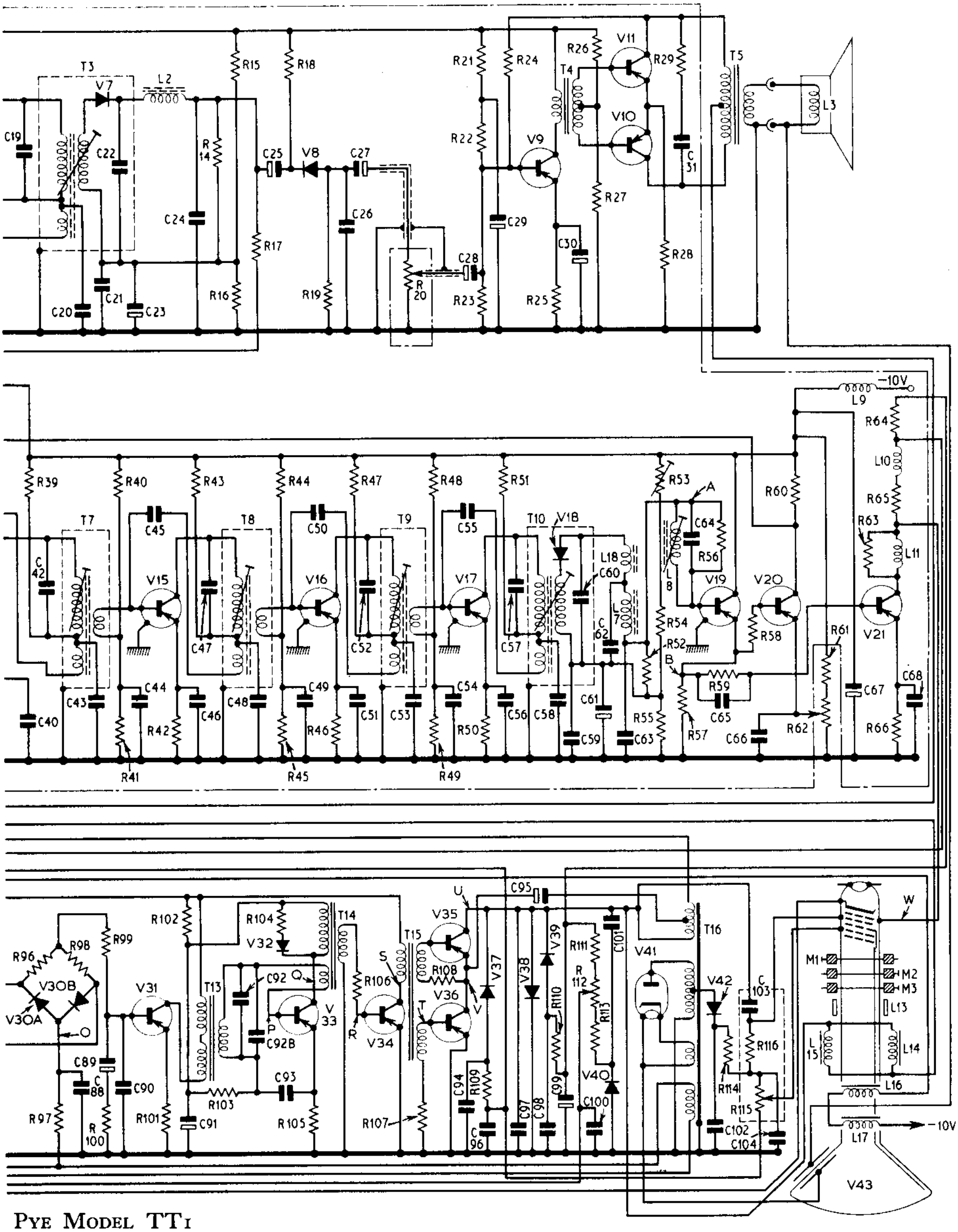


Fig. 1.—Circuit Diagram—

Note: C92B not fitted

Capacitors.		C6	1,000 pF.	C12	8·2 pF.*	C18	1,000 pF.	C24	10 pF. (5%)
C1	82 pF. (5%)	C7	8·2 pF.*	C13	1,000 pF.	C19	27 pF. (5%)	C25	5 (12 v.)
C2	47 pF.	C8	1,000 pF.	C14	27 pF. (5%)	C20	1,000 pF.	C26	0·02
C3	39 pF. (5%)	C9	27 pF. (5%)	C15	1,000 pF.	C21	1,000 pF.	C27	5 (12 v.)
C4	8 (50 v.)	C10	1,000 pF.	C16	1,000 pF.	C22	10 pF.	C28	2 (150 v.)
C5	10 pF. (5%)	C11	1,000 pF.	C17	6·8 pF.*	C23	5 (12 v.)	C29	100 (12 v.)

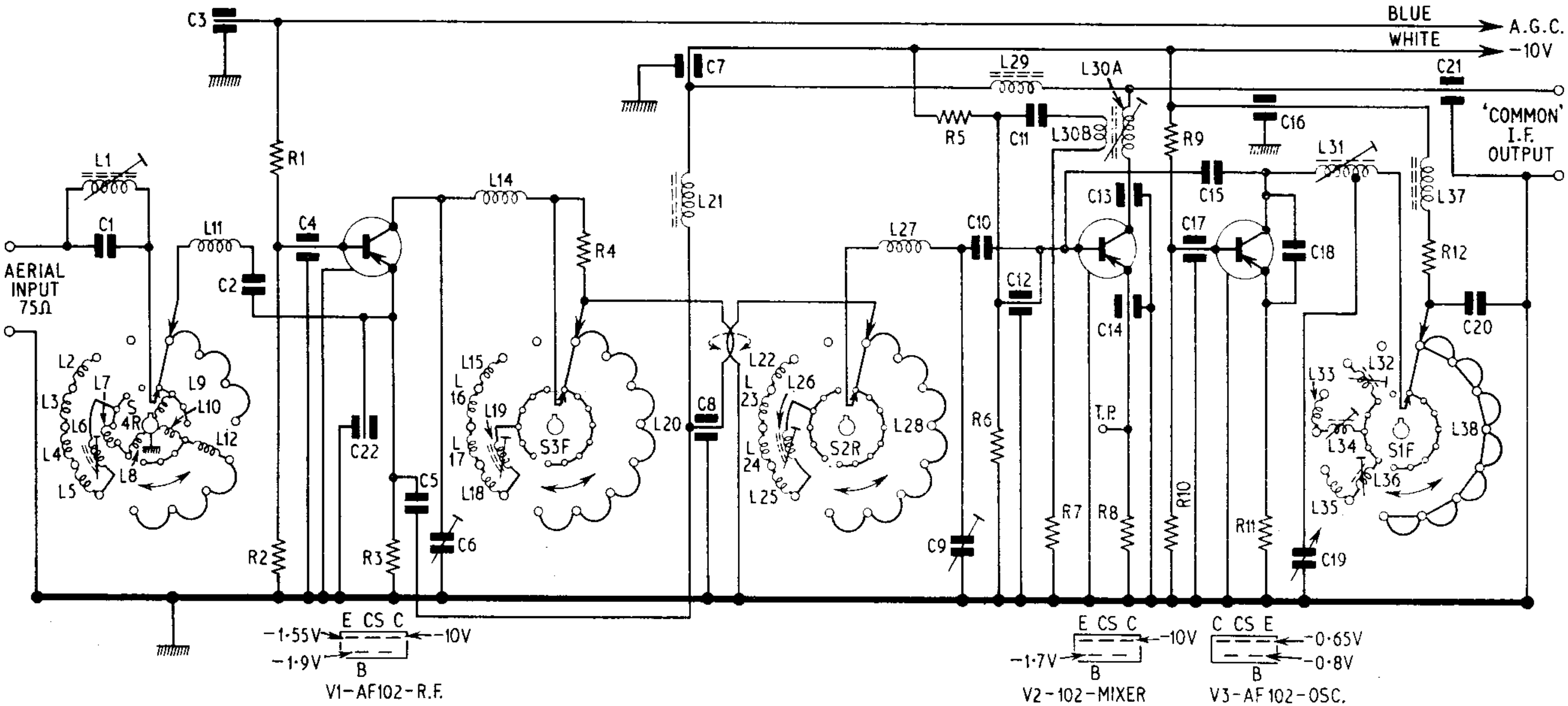


Pye Model TT1

in all receivers.

C30	100 (12 v.)	C34	27 pF. (5%)	C40	1,000 pF.	C46	1,000 pF.	C52	27 pF. (5%)
C31	0·1	C35	150 pF. (5%)	C41	8 (50 v.)	C47	33 pF. (5%)	C53	1,000 pF.
C32	10,000 μF. (25 v.)†	C36	47 pF. (5%)	C42	10 pF. (5%)	C48	1,000 pF.	C54	1,000 pF.
		C37	15 pF. (5%)	C43	1,000 pF.	C49	1,000 pF.	C55	6·8 pF.*
C33	10,000 μF. (25 v.)†	C38	50 (12 v.)	C44	1,000 pF.	C50	6·8 pF.*	C56	1,000 pF.
		C39	6·8 pF.*	C45	6·8 pF.*	C51	1,000 pF.	C57	10 pF. (5%)

(*continued on p.* 535)



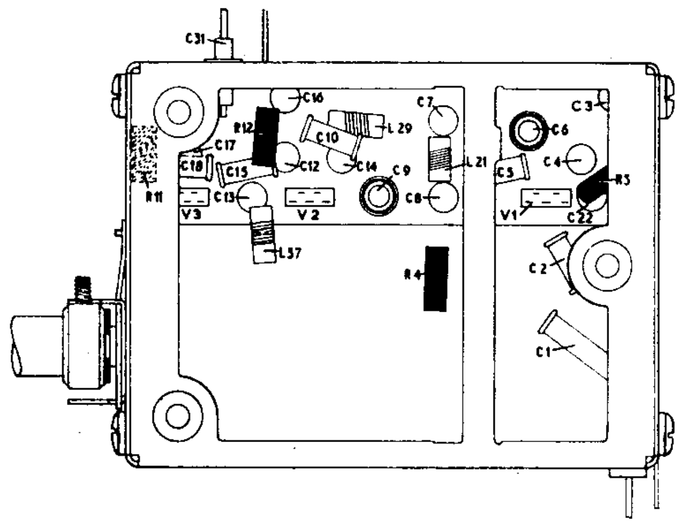


FIG. 2 (*above*).—CIRCUIT DIAGRAM OF THE TUNER UNIT, MODEL TT1

FIG. 3 (*left*).—UNDERCHASSIS PLAN VIEW OF TUNER UNIT

Capacitors.							
C1	150 pF.	C10	5 pF.	C19	Fine tuner	R4	15k
C2	5 pF.	C11	3·9 pF.	C20	15 pF. (5%)	R5	10k
C3	720 pF.	C12	22 pF.	C21	33 pF. (5%)	R6	2·2k
C4	720 pF.	C13	10 pF.	C22	10 pF.	R7	27
C5	3·3 pF.	C14	720 pF.			R8	1·2k
C6	0·5–3 pF.	C15	2·2 pF.	*Resistors.*		R9	15k
C7	720 pF.	C16	720 pF.	R1	10k	R10	1·5k
C8	30 pF.	C17	720 pF.	R2	2·2k	R11	560
C9	0·5–3 pF.	C18	2·2 pF.	R3	1·2k	R12	4·7k

Capacitors.	
C58	1,000 pF.
C59	1,000 pF.
C60	4·7 pF.
C61	5 (12 v.)
C62	4·7 pF.
C63	4·7 pF. (5%)
C64	270 pF. (5%)
C65	0·01
C66	1,000 pF.
C67	2 (150 v.)
C68	390 pF. (5%)
C69	0·25
C70	0·01
C71	0·05
C72	0·5
C73	0·02
C74	50 (12 v.)
C75	50 (6 v.)
C76	50 (12 v.)
C77	1,000 (12 v.)
C78	5 (50 v.)
C79	12 (50 v.)
C80	0·002
C81	0·05
C82	0·005
C83	0·005
C84	2,000 (15 v.)†
C85	0·01
C86	0·01
C87	0·25
C88	0·25
C89	5 (50 v.)
C90	0·25
C91	50 (12 v.)
C92	0·01 (5%)
C92B	0·002
C93	3,300 pF. (5%)
C94	0·1
C95	25 (25 v.)
C96	0·25
C97	0·17
C98	0·1
C99	16 (100 v.)
C100	0·25
C101	0·01
C102	0·02
C103	0·05
C104	0·25
Fuses.	
F1	250 mA.
F2	3 A.
F3	3 A.
F4	3 A.
Resistors.	
R1	100k (sensitivity)
R2	22
R3	1k
R4	1k
R5	150
R6	33k
R7	5·6k
R8	1k
R9	150
R10	33k
R11	5·6k
R12	1k
R13	150
R14	5·6k
R15	10k
R16	2·2k
R17	10k
R18	100k
R19	22k
R20	10k (volume)
R21	27k
R22	47k
R23	12k
R24	560k
R25	680 (5%)
R26	2·2k (5%)
R27	47 (5%)
R28	6·8
R29	120
R30	9 (5%, 2 W.)
R31	1 (5%, 3 W.)
R32	15 (5%, 2 W.)
R33	1·2 (5%, 3 W.)
R34	560 (5%)
R35	22k
R36	5·6k
R37	470
R38	1k
R39	150
R40	33k
R41	5·6k
R42	1k
R43	150
R44	33k
R45	5·6k
R46	1k
R47	150
R48	33k
R49	5·6k
R50	1k
R51	150
R52	3·3k (5%)
R53	5k (bias set.)
R54	12k
R55	560
R56	3·3k
R57	1k
R58	5·6k
R59	1k
R60	6·8k
R61	4·7k
R62	500 (contrast)
R63	18k
R64	1·5k (5%)
R65	5·6k (5%)
R66	82
R67	120k
R68	15k
R69	8·2k
R70	27k
R71	22k
R72	5·6k
R73	25k (frame hold)
R74	33k
R75	25k (height)
R76	22k
R77	12k
R78	2k (frame lin. 1)
R79	1k
R80	200 (frame lin. 2)
R81	25k (bias set.)
R82	1k
R83	2
R84	3·9k
R85	3·3k
R86	3·9k
R87	39k
R88	3·3k
R89	2·2k
R90	1·2k (5%)
R91	1·2k (5%)
R92	10
R93	2·2k
R94	1k (line hold)
R95	See below
R96	22k (5%)
R97	1k
R98	22k (5%)
R99	2·7k
R100	560
R101	33
R102	390
R103	33k
R104	56
R105	2
R106	18
R107	2
R108	2
R109	6·8k
R110	2·2k
R111	22k
R112	150k (brightness)
R113	22k
R114	820k
R115	2M (focus)
R116	180k
R117	2

R95 may be 120, 270, 390, 470, 560, 680 or 1k, selected on test.

* May vary in production.

† Non-inductive.

and detach back cover. (4) Remove two rear chassis-fixing screws at bottom of chassis. (5) Withdraw chassis sufficiently to disconnect speaker leads and picture-tube base and E.H.T. cavity terminal connectors. (6) Note the positional sequence of, or alternatively tag, the deflection yoke feed leads, which should then be disconnected. (7) Withdraw chassis completely.

Circuit Description

Tuner.—This unit is outwardly similar to the thirteen-channel incremental-inductance tuner used previously on Pye television receivers. The two thermionic valves are, however, replaced by three AF102 high-frequency transistors for the R.F. amplifier, mixer and local-oscillator stages. The R.F. stage is used with grounded-base connection, and neutralisation is applied from the collector circuit. R.F. sensitivity control is provided by alteration of the base bias of this stage. The R.F. stage is bandpass-coupled to the mixer transistor, which is used with grounded-emitter connection, and injection of R.F. signal and local-oscillator drive is at the mixer base. The third transistor is used in a form of Colpitts local-oscillator circuit. The I.F. output from the tuner is developed in a tuned circuit in the collector circuit of the mixer stage, and is fed to the I.F. amplifiers by a short co-axial cable and " bottom-capacitance " coupling.

Sound Channel.—The signal from the tuner is applied by capacitance coupling to the three neutralised OC171 grounded-emitter sound I.F. amplifier stages, at the normal intermediate frequency of 38·15 Mc/s. These are followed by a CG64 crystal diode detector, and reverse A.G.C. bias derived from this stage is applied to the base of the 1st I.F. amplifier. The detector is followed by a following-limiter noise suppressor circuit (V8) similar to that used in thermionic valve receivers, except that the capacitance and resistance values involved are rather different to suit the low input impedance of the audio amplifier. The audio amplifier consists of one OC82D transistor driving a matched pair of OC82 transistors in a

Class B output stage. These amplifiers provide an audio power output of approximately 1 watt to a 5-in. loudspeaker.

Vision Channel.—The 34·65-Mc/s. vision I.F. carrier signal from the tuner is " bottom-capacitance " coupled to the vision I.F. amplifier via a bridged-T sound I.F. trap. The four vision I.F. amplifiers use OC171 transistors and the vision channel frequency-response shaping is achieved by using two high " Q " and two low " Q " tuned coupling transformers in a staggered tuning arrangement. Like the sound I.F. stages, all four transistors are neutralised, from collector to base circuits, by deriving an anti-phase signal from an over-winding tightly coupled to each collector tuned circuit. The I.F. amplifiers are followed by a crystal diode vision detector, and in order to achieve D.C. video coupling to the picture tube the whole detector circuit is raised to a negative potential with respect to chassis to obtain correct base bias conditions for the video output stage. Between the vision detector and the video amplifiers a 3·5 Mc/s. inter-I.F. beat trap circuit is inserted. The video amplifier consists of two stages, the first of which is an OC170 transistor used as an " emitter-follower " stage to convert the relatively high output impedance of the detector to the very low impedance necessary to drive the base of the final video amplifier. The video output stage uses a selected V15/20R transistor and provides an output of some 50 volts to drive the grid of the picture tube. Whilst all other circuits on the I.F. panel are fed from the common 10-volt supply line, the video amplifier collector is fed from a −60-volt H.T. supply derived from a rectifier circuit driven by the line output transformer.

The vision A.G.C. circuit and associated contrast potentiometer involve a further OC71 transistor as an A.G.C. amplifier to amplify the D.C. component of the detected signal and provide the necessary reversal of A.G.C. polarity to bias the 1st vision I.F. amplifier base and thus reduce its gain on strong signals.

Contrast control is given by a potentiometer across the −10-volt supply to the take-off terminal of which the emitter of the A.G.C. amplifier is connected. The emitter potential, and, therefore, reverse bias on the OC71 base, are thus controlled by the contrast potentiometer, and the detector output level at which A.G.C. action commences also varied.

Sync. Separator.—For this a fast-switching OC44 transistor is used. The composite video signal to the separator base is derived from a tap on the video output amplifier collector load. During the sync. period the negative-going signal drives the sync. separator hard into conduction so that a sharp positive-going sync. pulse is produced across the collector resistor. Simultaneously the flow of base current charges the base capacitor, and, as the signal returns to sync. base level on the positive-going trailing edge of the sync. pulse, the separator base is left biased-off and no video signal can reach the time-base circuits connected to the collector load.

Frame Time-base.—Four stages are used in the frame time-base, most of the circuit of which is built on to a second printed-circuit board. The first stage uses an OC71 primarily intended to invert the frame sync. pulse to a positive-going signal to trigger the frame oscillator. It also aids the isolation of the frame scan time-base from the line time-base. An OC72 is used as frame blocking oscillator, regeneration being obtained by transformer coupling between emitter and base circuits. The frame hold control operates by altering the base-circuit time-constant to adjust the " switched-off " period of the transistor. The time-base " charge " circuit is connected to the collector of the oscillator and H.T. is fed via the height control from a second −60-volt H.T. source provided by the line output transformer. An OC72 emitter-follower stage is used between the oscillator and the OC23 power output transistor, in order to avoid the necessity of providing the large output-stage base drive current from the " charge " circuit capacitors. Overall feedback is used from both the OC23 collector and emitter circuits via preset rheostats to provide linearity adjustment. The collector circuit of the frame output stage is connected directly to the frame deflector coils, but, in order to overcome the picture shift due to the D.C. component of the scanning current, the deflector coils are shunted by a choke of large inductance and very low resistance compared with the coils themselves. A further winding on the choke is used to provide a frame blanking signal which is applied to the cathode of the picture tube.

Both the frame oscillator base circuit and the collector of the output stage are provided with OA81 clamp diode circuits to prevent damage to the respective transistors from the high peak voltages induced during the flyback period.

Line Time-base.—The whole of one side of the chassis is used for the components of the line time-base and its associated circuits. The time-base proper consists of three stages: OC72 blocking oscillator, OC23 driver and two 2G221 power transistors operated in series in the output stage.

The oscillator stage is of fairly conventional form, relying on magnetic coupling between base and collector circuits to provide regeneration. Also in series with the base circuit is a

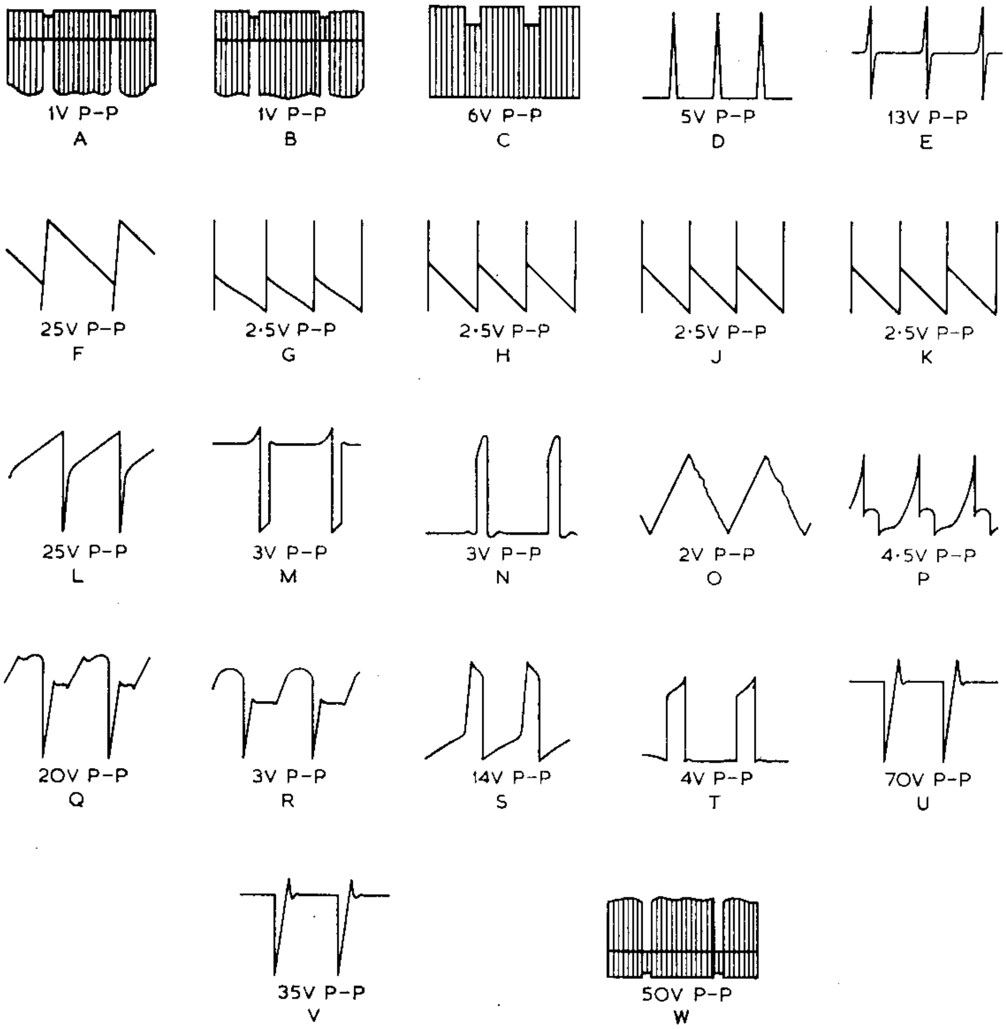


FIG. 4.—WAVEFORMS, MODEL TT1
Letters refer to points in circuit, see Fig. 1.

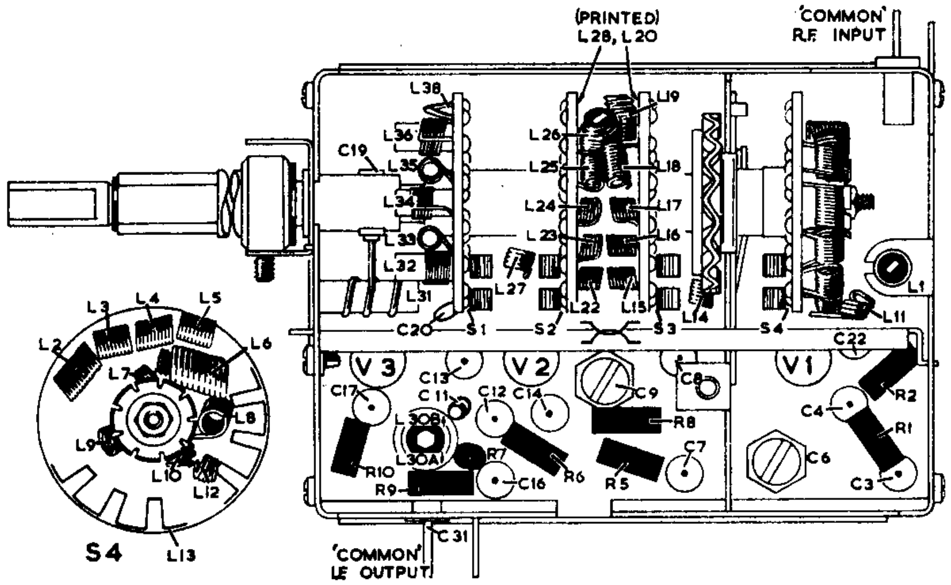


FIG. 5.—UPPER CHASSIS PLAN VIEW OF TUNER UNIT

tuned winding which forms part of a novel A.F.C. circuit which is described later. A clamp diode circuit is connected across the oscillator collector circuit to protect the transistor against peak voltages produced by the transformer primary inductance at the start of the "switched-off" period. A third winding on the blocking oscillator transformer feeds the base of the driver stage. The two output-stage transistors require considerable power input, both during the scan period when they are switched-on, and also to switch them off again, due to the hole storage effects in the transistors. Since good thermal stability in the oscillator is not compatible with the large output-stage drive required, it is desirable to use a driver stage between the oscillator and the output transistors, and for this purpose the fast-switching OC23 is used.

Two series-connected 2G221 power transistors are used in the line output stage to share the flyback voltage pulse developed in the inductance of the deflector coils. As with the frame time-base, the output stages are connected directly to the deflector coils, and the line output transformer primary winding serves as a shunt for the D.C. component of the deflection current. The remaining functions of the output transformer are to provide the E.H.T. voltage from an overwinding, the picture-tube second anode voltage and a pulse phase-test voltage for the A.F.C. synchronising circuit.

Also connected to the collector circuit of the horizontal output stages are an OC28B transistor used as an efficiency diode, and three further OA81 diode rectifier circuits which produce one +60-volt supply for the brightness control bias circuit and two −60-volt supplies. One of the latter supplies is used solely for the video output amplifier, and the other provides the current to the vertical time-base "charge" circuit and one end of the focus potentiometer on the picture tube. An EY51 E.H.T. rectifier provides the final anode supply for the cathode-ray tube.

Line Oscillator A.F.C.—A flywheel synchronising circuit is used for the line time-base with a new type of oscillator control method. The line sync. pulses from the synchronising separator are fed to an OC71 phase-splitter stage with equal collector and emitter load resistors. The two equal anti-phase sync. pulses developed are applied in the correct "polarity-sense" to the reference sync. input terminals of an A.F.C. discriminator bridge circuit employing two OA81 crystal diodes, where they are used as the reference in a phase-comparison test of an oscillator-derived sawtooth voltage supplied by the horizontal scan output transformer. The discriminator generates a phase-dependent D.C. output, both the magnitude and polarity of which are controlled by the phase difference between the point of zero datum-level in the sawtooth flyback and the reference sync. This output is smoothed by a filter and anti-hunt network (C90, C89/R100) and applied as control bias to the horizontal A.F.C. D.C. amplifier transistor (V31). Connected to the collector of this transistor is a pair of windings on a ferrite core, the permeability of which may be varied by the current flowing through the collector windings. Also on the core of this component is a third winding which is part of a tuned circuit connected in series with the feedback to the horizontal oscillator base. This circuit acts in the first place as a frequency stabiliser for the horizontal oscillator, but, since the core permeability, and hence the inductance, may be varied externally by the A.F.C. bias, it provides a ready means of providing oscillator frequency control. This method of A.F.C. is particularly suited to a transistor blocking oscillator, since control of frequency is not primarily determined by the resistance in the oscillator circuit, and it is therefore less sensitive to thermal variations in the oscillator transistor. In order to minimise still further variations due to temperature in the A.F.C. circuit, the silicon OC201 transistor was chosen for service as D.C. amplifier. The horizontal hold control is connected in series with the A.F.C. phase-test sawtooth circuit to the discriminator and serves to set the initial bias on the D.C. amplifier, and hence the initial operating frequency of the blocking oscillator.

Power Supplies.—The basic power supply for the receiver is a 10-volt 3·5-a.h. nickel–cadmium accumulator. This type of battery is of very rugged construction and, being constructed of sealed cells, will not spill, requires no "topping-up" and does not produce any corrosive fumes. It can also stand idle even in a discharged condition without harmful effects. It is thus well suited to use inside the receiver, and requires no maintenance other than charging from the mains power pack.

The receiver is provided with a power-supply selector switch (function-switch) which may be set for the particular mode of operation required. In the "Battery" position the receiver operates directly from the accumulator, and at least 2 hours of operation can be expected from the fully charged battery. In the "Mains" position a transformer draws power from the A.C. mains. It is full-wave rectified by a pair of 1S101 silicon rectifiers and connected across the battery. The receiver will then operate indefinitely with the battery "float charging" across the receiver load. The battery charging continues with the charge current tapering off to zero when the e.m.f. of the battery becomes equal to that across the receiver-loaded power supply. In this way the battery is maintained in a reasonable state of charge with normal mains operation, and the permanent connection of the battery also has the two useful effects of greatly smoothing out the ripple from the mains supply and

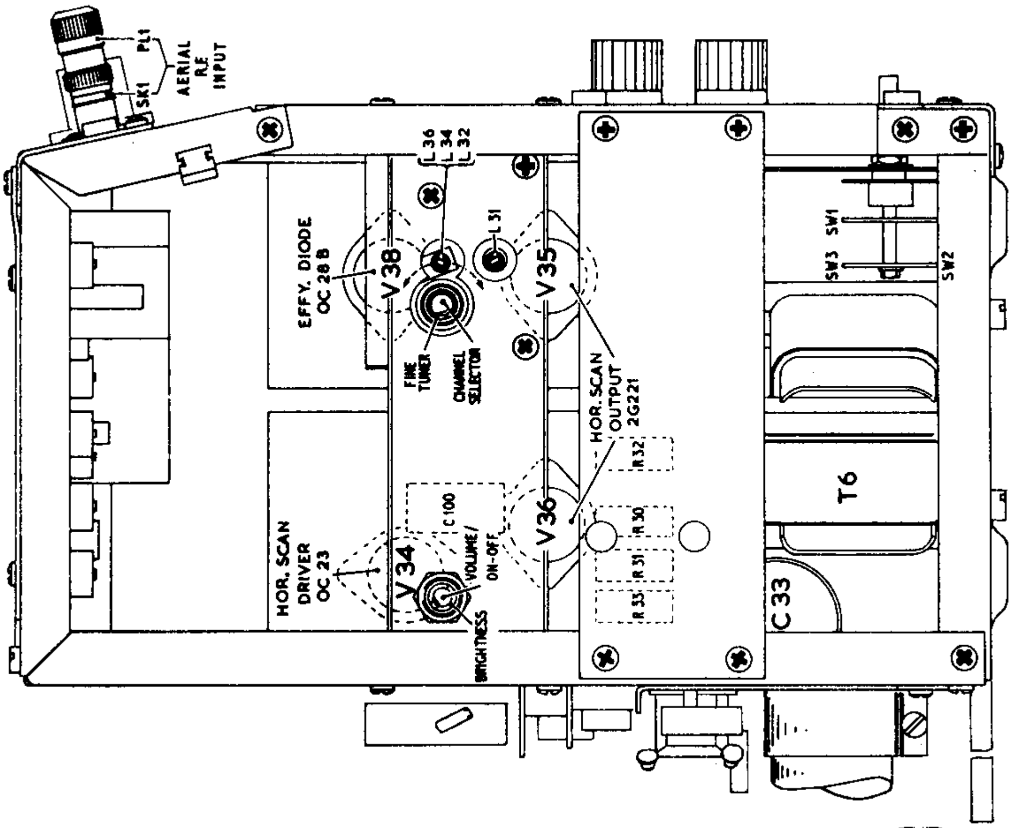


FIG. 7.—CHASSIS RIGHT-HAND SIDE ELEVATION

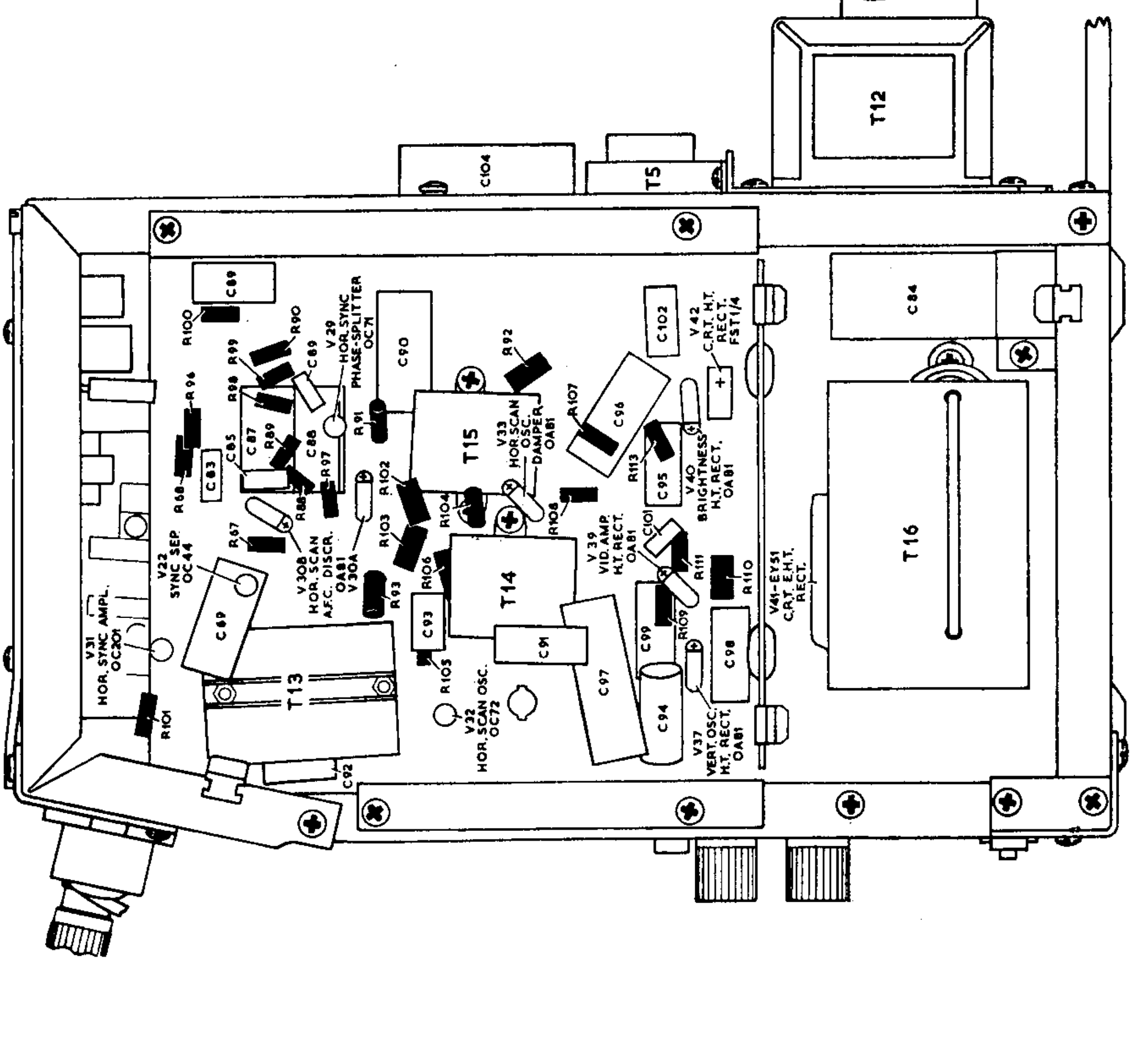


FIG. 6.—CHASSIS LEFT-HAND ELEVATION

also of stabilising the receiver 10-volt supply in the event of mains voltage fluctuations. Since the open-circuit e.m.f. of the battery is higher than the 10 volts required by the receiver, a small resistor is inserted between the battery and the receiver load in the mains position.

The third switch position is marked " Charge ". In this position the mains power supply is connected to the battery and the receiver load disconnected. The power pack then acts as a normal mains charger for the battery and is intended to provide a fast overnight charge for the battery when the receiver is required for portable use on the following day. A completely discharged battery requires a period of 14 hours to become fully charged. A red warning light is fitted to indicate when charging is taking place and the receiver is otherwise in operation.

In the fourth switch position marked " Car " the duties of the mains power pack may, in effect, be replaced by a 12-volt car battery. With the 12-volt battery connected to its own polarised socket on the receiver the internal receiver battery " float-charges " across the car battery and the receiver can be operated for a period of some 20–30 hours, depending on the capacity of the car battery.

The two sections of the volume-control switch are used for switching-off the input circuit to the mains transformer, and to switch the connection between the receiver and the internal battery.

Apart from the internal battery, further smoothing and decoupling is accomplished by a 10,000-μF. electrolytic capacitor, and in the supply lead to the line time-base a small choke and second 10,000-μF. capacitor decouple the large time-base currents from the remainder of the receiver circuits.

Voltages

The readings below were measured with a mains input of 240 volts A.C., using, except for E.H.T., a 20,000-ohms/volt voltmeter. *All voltages are negative unless otherwise indicated.* Voltages were taken with signal input and controls set to give a normal picture with 1-volt *p–p* at junction L8/R56/C64. H.T. voltage −10 v.; Total H.T. current −1·5 A.

Transistor	*Base, volts*	*Collector, volts*	*Emitter, volts*	*Transistor*	*Base, volts*	*Collector, volts*	*Emitter, volts*
V4	0·7	9·3	0·5	V22	+4·5	—	0
V5, V6	1·2	9·5	1	V23	0·2	0·05	0
V9	1	9·5	0·9	V25	+6·8	6·5	—
V10, V11	0·18	11·5	0·05	V26	7·4	9·7	7·5
V14	0·4	9·5	0·2	V27	0·5	9·4	0·25
V15, V16, V17	1·2	9·5	1	V29	4	4·8	3·8
				V31	0·7	8·7	0·2
V19	1	9·5	0·7	V33	+0·4	4·75	0·02
V20	0·6	2·5	0·4	V34	+0·12	8	0
V21	0·6	20	0·4				

Picture-tube Voltages.—Cathode +2 v. (zero beam current); grid −26 v. (100-v. range); first anode +160 v. (250-v. range); focus (pin 6) − 70 — +180 v. (1000-v. range); E.H.T. + 9–9·5 kV. (zero beam current).

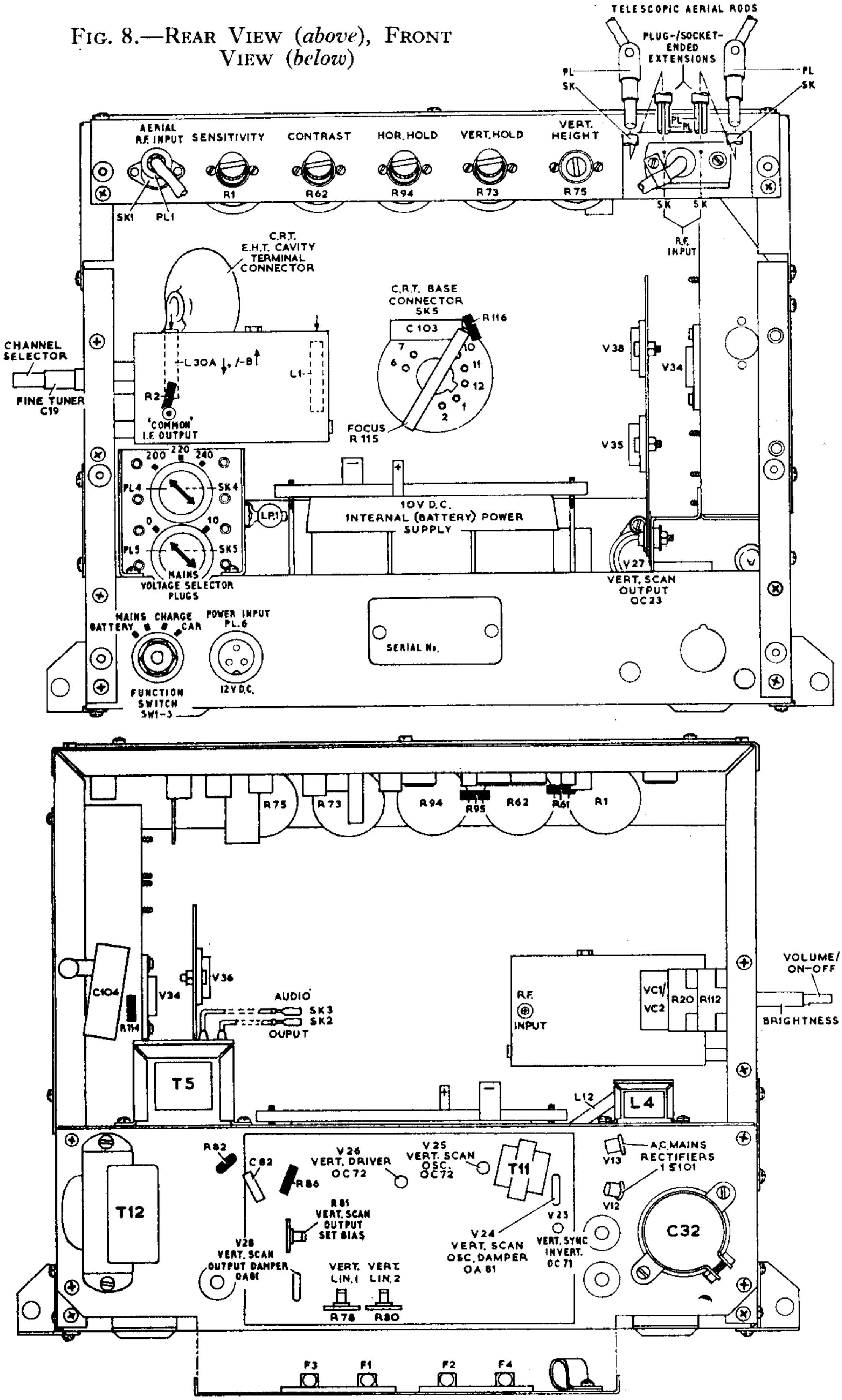
Diode readings.—Junction R84/C79 24 v.; junction R96/C85 +0·3 v.; junction R97/C88 2·3 v.; junction R98/C86 3·6 v.; junction R104/V33 4·1 v.; junction R109/C94 64 v.; junction R110/C98 68 v.; junction R113/C101 +57 v.

Main and Auxiliary Controls

Fine Tuning.—(1) Turn fine tuning knob anti-clockwise until " sound breakthrough " on vision is obtained. (2) Slowly reverse rotation, adjust and set for maximum resolution of picture detail. (3) Observe that picture is absolutely free of " sound breakthrough " on vision and the degree of signal-graining is not excessive. If not, readjust slightly for best acceptable picture consistent with maximum resolution of detail.

Volume/On–Off.—(1) Audible operational click of mains control switch at the anti-clockwise end of volume potentiometer knob range. (2) Functional heating time 90 seconds approximately. (3) Mains power supply should always be interrupted by first switching-off at the receiver.

FIG. 8.—REAR VIEW (*above*), FRONT VIEW (*below*)



Brightness.—(1) Adjust brightness potentiometer knob to setting for desired brightness. (2) Observe that the degree of contrast over the whole shade gradation from picture-black to peak-white is correct or acceptable, but if not adjust contrast control.

Contrast.—(1) Check that picture is of nominally correct brightness. (2) Turn contrast potentiometer knob clockwise (increase contrast) or anti-clockwise (reduce contrast) and adjust, if necessary in conjunction with the brightness control, to give correct or acceptable contrast over the whole shade gradation from picture-black to peak-white. (3) Observe that sound and vision are free from signal-overload distortion, but if not adjust the sensitivity control.

Sensitivity.—(1) Check that picture is of nominally correct brightness and contrast. (2) Turn sensitivity potentiometer knob fully clockwise (maximum sensitivity), back-off and set at point where distortion of sound and vision has completely disappeared.

1st Video Amplifier Set Bias.—Adjust 1st video amplifier set bias potentiometer to give −0·4 volt D.C. across C59, C61 or R55.

Line Hold.—(1) Adjust the line hold potentiometer knob until set at mid-point of synchronised picture (lock-in) range. (2) Check that lock-in range is approximately centrally positioned within the range of the control knob. If too close to or even partly out with one end of the range a component-value check is indicated. (3) Check, by symmetrical maladjustment tests, that picture is free from any tendency to synchronous collapse. (4) Check that oscillator pull-in is not greater than ±200 c/s. as follows: (*a*) Turn the line hold potentiometer knob clockwise (decrease frequency) or anti-clockwise (increase frequency) until asynchronous collapse only *just* occurs. (*b*) Slowly reverse rotation, observing periodic appearance of *stable formation* of near-horizontal black bars. (*c*) When oscillator lock-on is imminent pull-in in cycles per second is given by fifty times the number of black bars. (*d*) Check that frequency-asymmetry of pull-in is not more than 50 c/s. (*e*) If pull-in exceeds ±200 c/s. a component-value check is indicated.

Frame Hold.—(1) Adjust frame hold potentiometer knob to mid-point of synchronised picture range. (2) Check, by symmetrical maladjustment tests, that picture is free from any tendency to upward or downward picture rollover.

Height.—(1) Set up test-pattern picture on c.r.t. (2) Check that picture is nominally correctly linearised, centred and orientated, and that width is nominally correct. (3) Adjust the height potentiometer knob to give about ¼ in. of symmetrical overscan. (4) Check that vertical picture geometry is correct or acceptable, but, if not, slightly readjust the height control.

Frame Linearity.—(1) Set up test-pattern picture on c.r.t. (2) Check that frame scan output set bias control is correctly set and picture is nominally correctly centred and orientated, and that width/line linearity is nominally correct. (3) Adjust height control and set to give a small amount of vertical underscan and the picture only just fails to fill the c.r.t. screen. (4) Adjust the frame linearity 1 (overall linearity) and frame linearity 2 (topmost linearity) knobs and set to give correct or acceptable linearity. (5) Readjust height as given under " Height ", operation (3).

Frame Output Set Bias.—(1) Set-up test-pattern picture on c.r.t. (2) Check that picture centring and orientation are nominally correct. (3) Turn height knob and set at range mid-point. (4)* Turn the frame scan output set bias potentiometer until set at maximum resistance. (5) Observe the presence of frame compression at a bright band or line along the top of the picture. (6)* Adjust the potentiometer until scan compression appears at the bottom of the picture while that at the top has disappeared. (7)* Readjust potentiometer and set just beyond point at which scan compression at the bottom of the picture disappears. (8) Linearise picture as given under " Frame Linearity ". (9) Adjust picture for correct height, see above.

Centring.—(1) Set-up a test pattern † or ordinary picture on the c.r.t. (2) Adjust picture centring magnets independently and set to position picture centrally on the screen.

Orientation.—(1) Set-up test-pattern † or ordinary picture on the c.r.t. (2) Loosen picture rotation clamp. (3) Leaving the width/linearity sleeve undisturbed, adjust the deflector coil yoke and set with picture in correct orientation. *Note:* When using a test pattern picture, observation at normal viewing distance is a most critical orientation test unless a graticule aid is available. (4) Re-tighten picture rotation clamp. (5) Check picture centring.

Focusing.—(1) Set-up test pattern † or ordinary picture on the c.r.t. (2) Using slightly

* The frame scan output set bias potentiometer must not be turned or set to minimum resistance as damage to the transistor may ensue.

† Preferable, but not essential.

reduced brightness adjust focus potentiometer slider for maximum overall resolution of picture detail. *Note:* When the settings for resolution of horizontal and vertical detail are found to be different an improvement may be effected by resetting the ion-trap magnet in the alternative position, *i.e.*, reversed both in orientation and position.

Ion-trap.—(1) Check that ion-trap magnet is nominally correctly set on the c.r.t. tube neck positioned just beyond the c.r.t. base and orientated with the magnet clamp-plate arrow on the same radius as Pin 3 if towards the screen, or Pin 9 if towards the base. (2) Obtain a visible raster, if necessary advancing the brightness control and manipulating the ion-trap magnet to make the raster appear. (3) Check that centring and orientation are nominally correct. (4) Reduce brightness until raster is just visible. (5) Leaving orientation undisturbed, adjust the axial position of the ion-trap magnet on the c.r.t. tube neck and set for maximum raster brightness. (6) Leaving the axial position undisturbed, adjust the orientation of the ion-trap magnet and set for maximum raster brightness. (7) Check, by symmetrical maladjustment tests, that ion-trap magnet is set for maximum raster brightness. (8) Tighten the ion-trap magnet lock-screw.

Width/Line Linearity Sleeve.—(1) Check that the width/line linearity sleeve is nominally correctly set on the c.r.t. tube neck, positioned rearwards towards the base as far as possible with the sleeve gap in the medial horizontal plane of the deflection yoke at three o'clock to the right or nine o'clock to the left. (2) Set-up a test-pattern picture on the c.r.t. (3) Check that height, frame linearity, centring and orientation are at least nominally correct. (4) Leaving the orientation of the sleeve gap undisturbed, move the sleeve into the deflector coil tunnel and set to give marginal degree of symmetrical overscan. (5) Leaving the axial position undisturbed, adjust the orientation of the sleeve in a clockwise or counter-clockwise direction and set to give correct or acceptable overall picture geometry.