SERVICE SHEET FOR

TRANSISTOR PORTABLE Q3

CIRCUIT ANALYSIS

Battery consumption 15 mA with no signal input.

Code	Transistor Function	Type	Ref. No.	Ec	Ic	Eb	Ee
V1	Frequency Changer	Yellow Circle 1	865182	−2·4(−1·6)	0·5 mA	−0·6(−0·3)	−0·5(−0·45)
V2	1st I.F. Amplifier	Yellow Circle 2	865183	−5·7(−5·6)	1·2 mA	−0·66(−0·3)	−0·58(−0·5)
V3	2nd I.F. Amplifier	Yellow Circle 3	865184	−5·7(−5·6)	1·05 mA	−0·9(−0·8)	−0·73(−0·65)
V4	A.F. Amplifier	Yellow Circle 4	865185	−5·5(−5·3)	4·0 mA	−1·0(−0·6)	−0·85(−0·80)
V5	Output	Yellow Circle 5	865186	−8·95(−8·95)	2·0 mA	−0·2(−0·18)	—
V6	Output	Yellow Circle 5	865186	−8·95(−8·95)	2·0 mA	−0·2(−0·18)	—

NOTE:—All measurements taken on M.W. band with no signal input. Gang fully meshed. Measurements taken with an Avometer model 8 instrument which has a resistance of 20,000 ohms per volt. The figures in brackets are the readings obtained with an Avometer model 7.

TRIMMING PROCEDURE

Apply signal as below:-	Set receiver controls to:	Adjust in order for maximum output:
1. 470 kc/s between chassis and junction of S1 and C5.	Low frequency end of M.W.	Ferrite cores of T3, T2 and T1.
2. As 1 but 600 kc/s.	M.W. 500 metres.	Iron dust core of L5.
3. As 1 but 1500 kc/s.	M.W. 200 metres.	Trimmer C7.
4. Repeat 2 and 3 until calibration is correct.		
5. As 1 but 214 kc/s.	L.W. 1400 metres.	Trimmer C4.
6. 214 kc/s to rod aerial via loop at 50 cms from centre of rod with L1 nearest loop.	L.W. 1400 metres.	Adjust position of L4 on rod aerial and seal in position with Polystyrene Dope.
7. As 6 but 600 kc/s.	M.W. 500 metres.	Adjust position of L1 on rod aerial.
8. As 6 but 1500 kc/s.	M.W. 200 metres.	Trimmer C2.
9. Repeat 7 and 8 until tracking is correct. Seal L1 with Polystyrene Dope.		

NOTE:—The alignment of the aerial circuits, tests 6 to 9, must be carried out with the chassis and speaker mounted on the front panel.

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FAULT FINDING PROCEDURE

Precautions

1. Do not make continuity measurements with the transistors in circuit.
2. Do not carry out soldering operations with the receiver connected to test equipment.
3. When replacing a transistor leave the leads at least $\frac{3}{8}$" long and use as little heat as possible.

D.C. Tests

1. Check the battery voltage: if this shows less than 6·5 volts on load the battery should be discarded.
2. Check the emitter voltages of V1 to V4, these voltages should be within ±25% of the values shown on the circuit.
3. Measure the collector currents of V5 and V6. (Normally between 1 and 5 mA with no signal input).
   NOTE:—If the readings obtained in 2 and 3 are normal, a transistor fault is unlikely.
4. If any of the readings obtained are abnormal, check collector and base voltages of the transistor in question: note that V2 and V3 derive their base bias from the emitter voltage of V4.

Notes:-

(a) A high emitter voltage would indicate an open circuit emitter resistor or a faulty bias chain, or transistor. To check for a faulty transistor the simplest method is to remove the forward bias on the base; the emitter voltage should then be less than 0·1 volts.
To test V1, V4 or V5 and V6 disconnect R3, R11 or R15.
To test V2 short circuit the junction of R9 and R10 to chassis.

Note:—Due to the circuit arrangement it is not practicable to apply a similar test to V3, which is, in any case, unlikely to develop a fault of this nature.

(b) A low emitter voltage would indicate incorrect bias or collector voltages, or a faulty transistor.

Signal Tests.

1. If the fault cannot be located by the tests outlined so far, it will be necessary to trace the signal through the circuit. Due to the large variations in test gear, there is little point in quoting figures of sensitivity. The best method is to check the sensitivity at various points in the circuit against a known good receiver. The signal should be injected into the audio circuits via an electrolytic capacitor and into the R.F. circuits via a 0·1 μF paper capacitor.
2. Open circuit coupling or decoupling capacitors can be checked by temporarily connecting another capacitor of the appropriate value in parallel with the suspect component.
3. Distortion is most likely to be caused by the output stages. The best method of test is to inject an audio signal at 400 c/s to the base of V4, and using an oscilloscope observe the voltage waveform across R17. Due to the Class B operation the voltage across R17 will be composed of double frequency half sine waves, the amplitude of adjacent peaks, ideally, should be equal, but a discrepancy of up to 30% is permissible before audible distortion becomes objectionable. If the degree of unbalance is greater than 30% one of the output transistors should be replaced with a transistor that gives a better balance.

   Note:—Fixed neutralising is used and the values do not need to be changed when replacing an I.F. stage.

CIRCUIT DESCRIPTION

The aerial circuit comprises a ferrite rod with separate coils for Long and Medium Waves. L1 and L2 in series form the M.W. coil, tuned by C2 and C3, whilst C4 and C6 are switched across the L.W. coil, L4, to ensure that this coil is effectively short-circuited on M.W. The L.W. coil is tuned by C2 and C3 with C1 in parallel to restrict the coverage. Taps on the aerial coils provide the correct impedance to match into the base of the self-oscillating mixer V1.

The oscillator coil, L5, is tuned on M.W., by C7, C8 and C9, and on L.W. by C4 and C6 in parallel with this combination.

V1 oscillates due to feedback between emitter and collector via L5. Initially the base of V1 is biased negatively with respect to the emitter by the potentiometer R3 and R4. The amplitude of oscillation builds up until, over part of the cycle, the emitter is driven negative with respect to the base and the stage is cut-off. Thus rectification of the oscillator voltage occurs at the emitter and C10 charges in a direction to oppose the original bias, stabilising the amplitude of oscillation. R2 prevents spurious oscillation at the high frequency end of M.W.

Mixing of the signal and local oscillator frequencies occurs at the base emitter junction of V1. After amplification the required difference frequency is selected by T1, which also provides the correct matching between V1 collector and V2 base.

After further amplification by V2 and V3, the 1st and 2nd I.F. amplifiers, the I.F. signal is fed to the diode detector, D1, the required audio voltage being developed across the volume control, R10, which also serves as the diode load. Neutralisation of the I.F. amplifiers is provided by C14 and C18.

The 'earthy' end of R10 is connected to the emitter of V4, the audio driver stage, and is therefore at about 1 volt negative with respect to chassis: this voltage is used to provide the forward base bias for V2, via the A.G.C. feed resistor R8. When the receiver is tuned to a station the rectified carrier voltage, developed across R10, causes the diode end of R10 to become positive with respect to the emitter connection, thus reducing the bias of V2 and controlling the gain. The base bias of V3 is also derived from the emitter of V4.

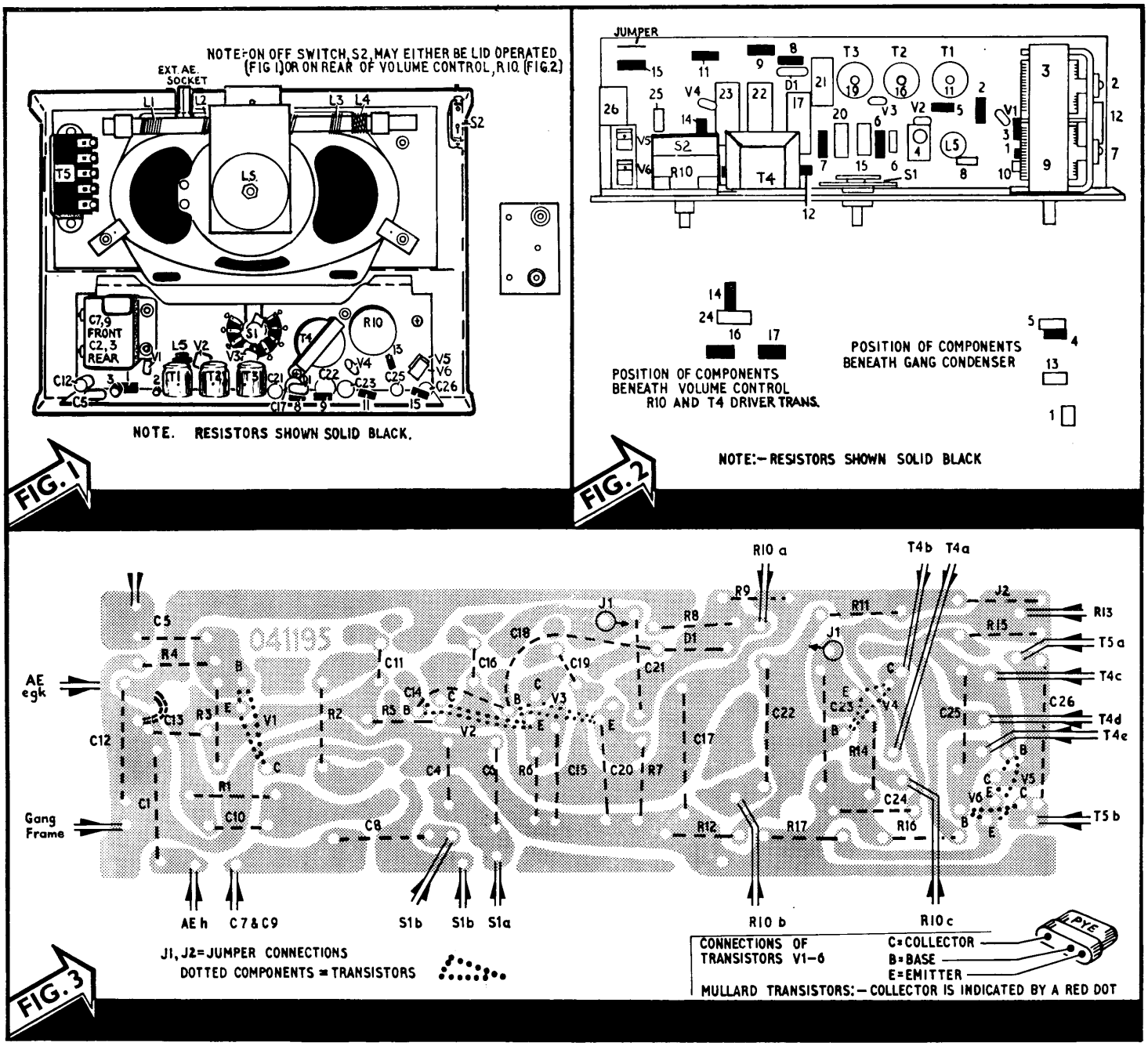
After amplification by V4 the audio signal is fed to the output stages, V5 and V6, via the push-pull driver transformer T4. Bias for V4 is obtained from the potential divider R11 and R12. C24 acts as an additional I.F. filter whilst C25 restricts the ringing which occurs in the driver transformer.

The output stages operate in Class B, being driven in the conducting direction by the negative half-cycles of signal. The potential divider formed by R15 and R16 provides forward bias, thus establishing the quiescent collector current of each stage at about 1—5 mA. At full output the peak current of each stage rises to 125 mA, whilst the average battery current at normal listening levels would be 25—35 mA. C26 removes most of the objectionable distortion which arises from the Class B operation of the output stages.

Stabilisation of the DC operating conditions of all stages is achieved by the use of emitter resistors.

Replacement Output Transistors

If one of the output transistors becomes faulty it will be advisable to replace both transistors in order to ensure correct matching: replacement output transistors should be ordered under Part Number 865186.



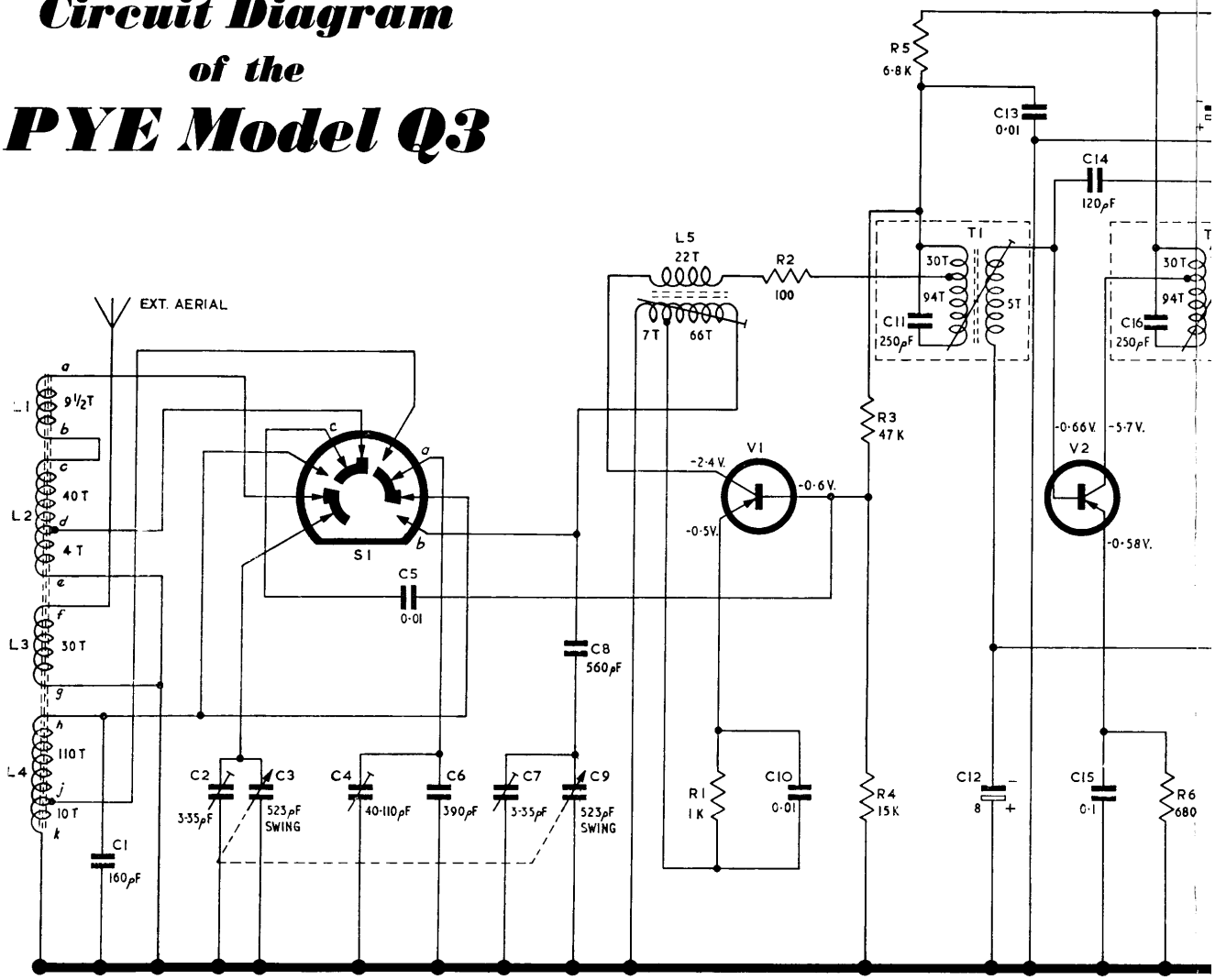
Notes

TO REMOVE CHASSIS

1. Unscrew the knurled head captive screw at rear of cabinet.
2. Lift up the chrome panel from the back.
3. Lift retaining springs, disengage chassis from pivot pin and lift out.
4. When replacing chassis, ensure that pivot pins are engaged in side bracket slots before lowering panel.

BATTERY ALTERNATIVES: 9 volt; Ever Ready PP9. Vidor T6009.

Circuit Diagram of the PYE Model Q3



WAVECHANGE SWITCH SHOWN IN ANTI-CLOCKWISE POSITION I.E.
ALL RESISTORS IN OHMS UNLESS OTHERWISE STATED.
ALL CAPACITORS IN μF UNLESS OTHERWISE STATED

CAPACITORS

	Specification	±	Volts	Fig.	No.
C1	160 pF Polystyrene ...	2%	125	2	653246
C2*	3-35 pF Trimmer ...			2	
C3	523 pF Gang			1 & 2	800386
C4	40-110 pF Trimmer ...			2	800404
C5	0·01 μF Tubular ...		150	1 & 2	669104
C6	390 pF Polystyrene ...	2%	125	2	653239
C7*	3-35 pF Trimmer ...			1 & 2	
C8	560 pF Polystyrene ...	2%	125	2	653249
C9	523 pF Gang			1 & 2	800386
C10	0·01 μF Tubular ...		150	2	669104
C11†	250 pF Polystyrene ...	2%	125	2	653219
C12	8 μF Electrolytic ...		6	1 & 2	667949
C13	0·01 μF Tubular ...		150	2	669104
C14	120 pF Polystyrene ...	5%	125	1	653232
C15	0·1 μF Tubular ...		150	2	668720
C16†	250 pF Polystyrene ...	2%	125	2	653219
C17	100 μF Electrolytic ...		6	1 & 2	667950
C18	47 pF Polystyrene ...	5%	125	1	653323
C19†	250 pF Polystyrene ...	2%	125	2	653219
C20	0·1 μF Tubular ...		150	2	668720
C21	0·05 μF Tubular ...		250	1 & 2	668717
C22	4 μF Electrolytic ...		6	1 & 2	667948
C23	100 μF Electrolytic ...		6	2	667950

CAPACITORS (cont.)

	Specification	±	Volts	Fig.	No.
C24	0·005 μF Tubular ...		150	1 & 2	669103
C25	0·01 μF Tubular ...		150	2	669104
C26	0·25 μF Tubular ...		150	1 & 2	668723

*Part of Gang Capacitor †Integral Part of I.F. Tranformer

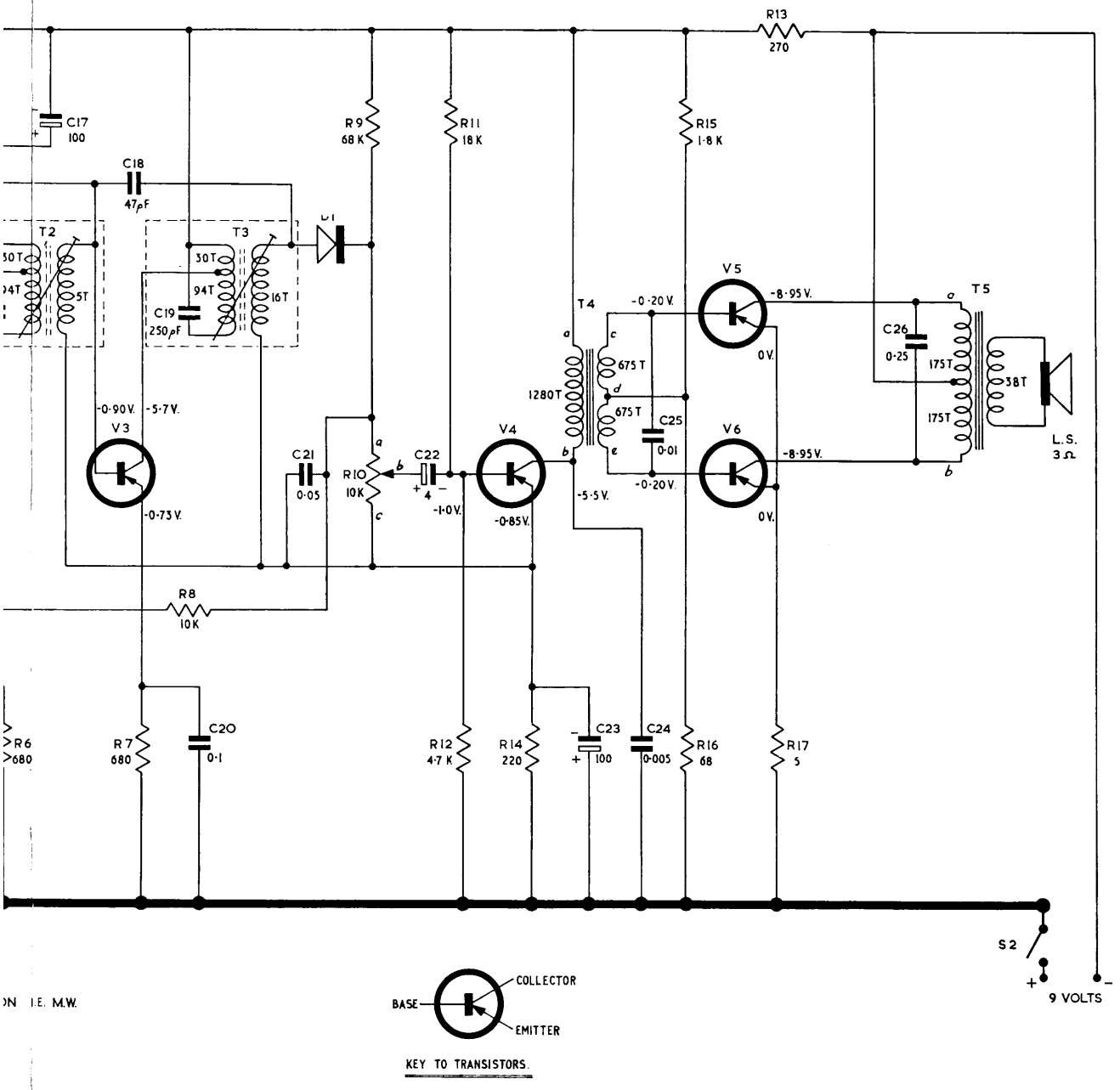
TRANSFORMERS

	Specification		Fig.	No.
T1	1st I.F. Trans.	Prim. 3·5Ω / Sec. 0·25Ω	1 & 2	077081
T2	2nd I.F. Trans.	Prim. 3·5Ω / Sec. 0·25Ω	1 & 2	077081
T3	3rd I.F. Trans.	Prim. 3·5Ω / Sec. 0·5Ω	1 & 2	077082
T4	Driver Trans.	Prim. 137Ω / Sec. 78·5Ω	1	771799
T5	Output Trans.	Prim. Start to Finish 4·2Ω / Sec. 0·26Ω	1	077205

RESI

	Ohms	
R1	1 K	
R2	100	
R3	47 K	
R4	15 K	
R5	6·8 K	
R6	680	
R7	680	
R8	10 K	
R9	68 K	
R10*	10 K Vol. Control, l switch	
R10*	10 K Vol. Control, w double pole switch	
R11	18 K	
R12	4·7 K	
R13	270	
R14	220	
R15	1·8 K	
R16	68	
R17	5	

*Refer to Fig. 1



KEY TO TRANSISTORS.

ON I.E. M.W.

RESISTORS

	±	Fig.	No.
... ...	20%	2	670662
... ...	10%	1 & 2	670670
... ...	10%	2	670613
... ...	10%	2	670630
... ...	10%	2	670629
... ...	20%	2	670648
... ...	20%	2	670648
... ...	10%	1 & 2	670631
... ...	10%	1 & 2	670642
rol, less			
... ...		1	810743
rol, with			
witch ...		2	810744
... ...	10%	1 & 2	671799
... ...	10%	2	670659
... ...	10%	1 & 2	670673
... ...	20%	2	675501
... ...	5%	2	671794
... ...	5%	2	672321
... ...	10%	2	672880

INDUCTORS

Specification	Fig.	No.
L1 M.W. Adjusting Coil L2 Main Aerial Winding L3 } L.W. and External Aerial Coil L4 }	1	073751
L5 M.W. & L.W. Oscillator Coil	2	078086

SWITCHES, ETC.

Specification	Fig.	No.
S1 Wavechange Switch—2 position	1	083144
S2* On/Off Switch	1 & 2	830171
LS Loudspeaker 7" x 4"	1	850279
D1 OA 70 Diode	2	707301

*Refer to Fig. 1

MISCELLANEOUS

	No.
Cabinet	063238
Handle	071567
Motif; Pye:	048302
Backing; Motif:	071506
Escutcheon; Motif:	071494
Knob Assembly; Large: Tuning	073729
Knob Assembly; Large: Volume*	073730
Knob Assembly; Large: Volume-Off*	073749
Knob Assembly; Small: Wavechange	073731
Spring; Knob:	709526

*Refer to Fig. 1

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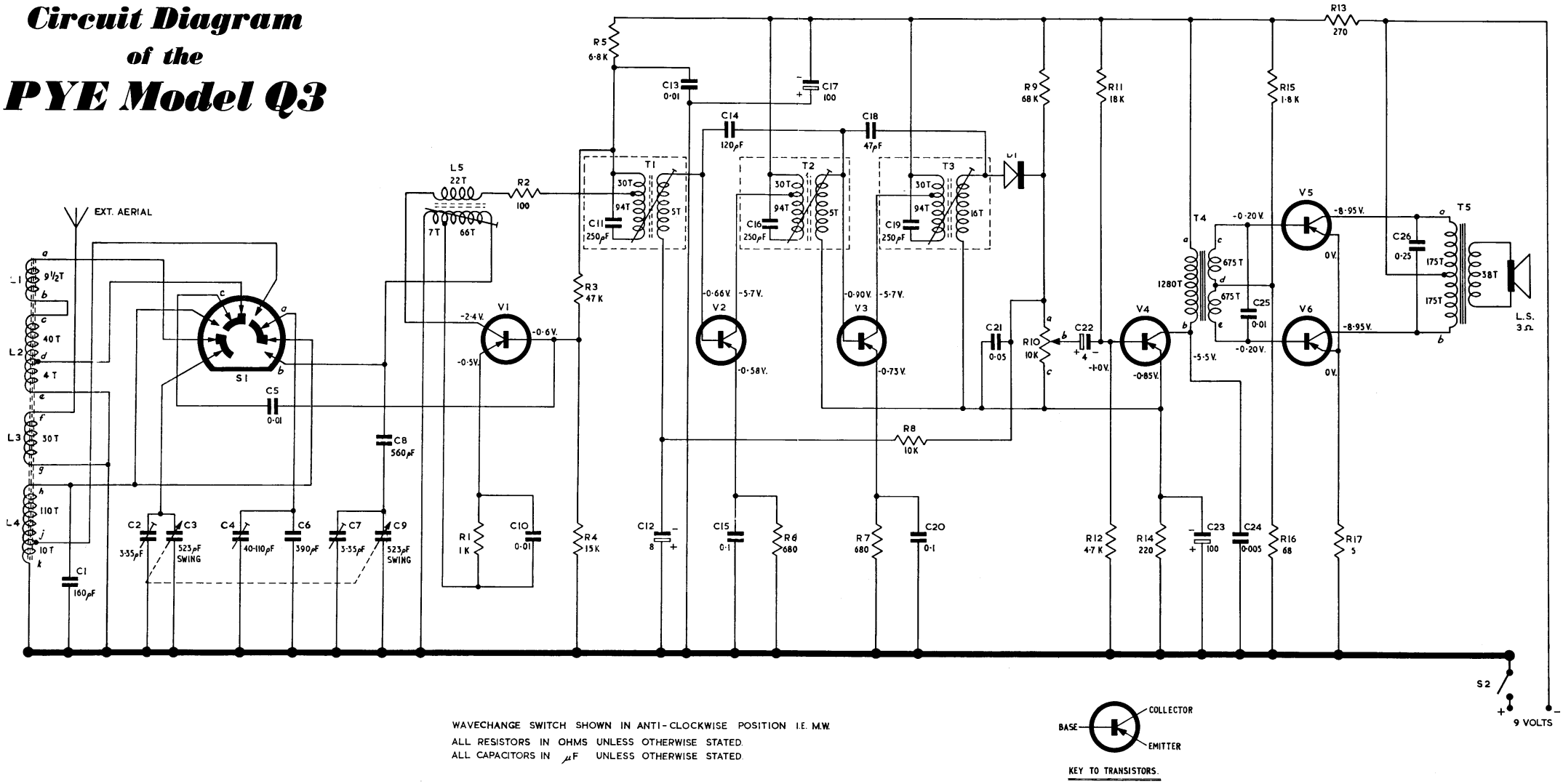

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