



INSTRUCTION BOOK NO. 5-7077R
BEAT FREQUENCY OSCILLATOR 14, 15,
16R7077
SERIAL NO. 693 & ABOVE

47 York Street, Sydney

INSTRUCTION BOOKS SERIES 7077R

AMENDMENT 150949

Beat Frequency Oscillator Series R7077

Capacitors C1 and C7 each comprising two capacitors in parallel, have been replaced by capacitors C1, C33 and C7, C34. C1, C33 are connected in parallel, C7, C34 being also connected in parallel, as shown on the amended circuit diagram.

All component schedules have the following changes made to them:-

- C1 becomes: 800 μ F. \pm 1%, 500V.W., silvered mica, Simplex SMX.
- C7 becomes: 800 μ F. \pm 1%, 500V.W., silvered mica, Simplex SMX.
- C33 added: 160 μ F. \pm 1%, 500V.W., silvered mica, Simplex SMX.
- C34 added: 160 μ F. \pm 1%, 500V.W., silvered mica, Simplex SMX.

AMENDMENT TO INSTRUCTION BOOK NO. 5-7077R

This Instruction Book now covers the type 16R7077, which is electrically identical to the types 14R and 15R, but is fitted in a case designed for mounting in a standard 19 inch equipment rack.

A separate front cover panel is used to carry the engravings, and a dust cover is clipped on from the rear.

110848

INSTRUCTION BOOK NO. 5-7077R

AMENDMENT 131047

Whereas the Beat Frequency Oscillator type 14R7077 described in this book is a portable unit, the type 15R7077 is designed for mounting in a standard 19" equipment rack, the height of the panel being $8 \frac{23}{32}$ inches. Electrically, types 14R and 15R7077 are identical including controls and engraving on the front panels.

INSTRUCTION BOOK NO. 5-7077R

BEAT FREQUENCY OSCILLATOR

A.W.A. TYPE 14R7077

SERIAL NOS. 693 AND ABOVE

Amalgamated Wireless (A'sia) Limited

47 York Street

SYDNEY

30074⁵⁷

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1. GENERAL DESCRIPTION

1.1 Main Features

The A.W.A. Beat Frequency Oscillator, type 14R7077 is a compact and portable unit designed for general test purposes. The complete unit is housed in a grey wrinkle-finished steel case measuring 12" x 8", and the total weight is 24 lbs. A leather carrying handle is fixed to the top of the case.

The unit has a frequency range of 10 c/s to 13.0 kilocycles which is covered in a single step. A 9" diameter, semi-circular scale is engraved on the front of the unit and is calibrated directly as outlined in sub-section 1.2 (c).

Particular attention has been paid in the design to the elimination of frequency drift caused by variations in temperature and supply voltage. Mica capacitors and robust coil formers have been used in the L.C. circuits of the oscillator, and resistance stabilising is employed.

The unit is completely self-contained and all controls and output terminals are mounted on the front panel. The controls on the front panel comprise a Main Frequency Control, calibrated from 10 to 13,000 c/s; a zero-set control for adjusting zero frequency output to come at zero on the scale; and a voltage output control calibrated from 1 to 10 in arbitrary units. There is also a magic eye which indicates zero beat for use with the zero-set control.

1.2 Summary of Characteristics

(a) Power Supply

Built-in Unit 220-260 volts) input
 50-60 c/s)

Power Demand 50 watts approx.

(b) Frequency Range

The frequency range is from 10 c/s to 13.0 kilocycles, calibration being on a 9" diameter semi-circular scale, the frequency required being selected by a 3" diameter control knob.

(c) Frequency Calibration

Below 100 c/s the scale is almost linear; above 100 c/s it is approximately logarithmic.

The scale is calibrated every

5 c/s from 10 to 100 c/s
10 c/s from 100 to 300 c/s

20 c/s from 300 to 500 c/s
25 c/s from 500 to 700 c/s
50 c/s from 700 to 1 Kc.
100 c/s from 1 to 2 Kc.
200 c/s from 2 to 5 Kc.
500 c/s from 5 to 13.0 Kc.

The calibration is correct to within 2.0 per cent from 30 c/s to 13.0 Kc., and 10 per cent below 30 c/s.

(d) Output Voltage and Impedance

The output is 250 milliwatts maximum, subject to the distortion figures shown in (e). This equals 12.5V across a 600-ohm load. The open circuit output is up to approximately 30 volts.

The output impedance is 600 ohms.

(e) Harmonic Distortion

(i) With 2 volts into 600 ohms load:

at 50 c/s less than 4% (R.M.S. sum)
at 400 c/s less than 1% (R.M.S. sum)
at 1,000 c/s less than 1% (R.M.S. sum)
at 7,500 c/s less than 1% (R.M.S. sum)

(ii) With 10 volts into 600 ohms load:

at 50 c/s less than 10% (R.M.S. sum)
at 400 c/s less than 3% (R.M.S. sum)
at 1,000 c/s less than 3% (R.M.S. sum)
at 7,500 c/s less than 3% (R.M.S. sum)

(iii) With 10 volts into 50,000 ohms load:

at 50 c/s less than 10% (R.M.S. sum)
at 400 c/s less than 1.5% (R.M.S. sum)
at 1,000 c/s less than 1.5% (R.M.S. sum)
at 7,500 c/s less than 2% (R.M.S. sum)

(f) Noise Level

The noise level is better than 40 db. below a reference level of 6 milliwatts.

(g) Frequency Response

The frequency response is flat within ± 2 db. from 30 to 10,000 c/s.

(h) Radio Frequency Content

From fixed oscillator: negligible

From variable frequency oscillator: about 0.05V max. into 600 ohms.

(j) Weight and Dimensions

Width	12"
Depth	8"
Height	8"
Weight	24 lbs.

1.3 Valve List

The valves used are tabulated below with their circuit reference numbers and function.

<u>Circ. Ref. No.</u>	<u>Type</u>	<u>Function</u>
V1	6J8G	Variable oscillator and buffer amplifier (100-87.0Kc)
V2	6J8G	Fixed oscillator and buffer amplifier (100Kc.)
V3	6J8G	Mixer
V4	6V6G	Output
V5	6X5GT	Rectifier
V6	6U5/6G5	Zero indication

Total valve complement:

3 x 6J8G
1 x 6V6G
1 x 6U5/6G5
1 x 6X5GT

2. INSTALLATION

2.1 Mounting

The instrument is mounted in a steel case from which it may be removed by unscrewing four nickel-plated screws situated near the front edge of the case.

2.2 Valves

All valves should be inserted in their correct positions as shown by stencilling on the chassis.

2.3 Power Connections

The instrument is supplied with a power cable and three pin adaptor to plug into a 220-260V, 50-60 c/s A.C. supply. As delivered the unit is adjusted to suit mains voltage from 230-250V. Should the mains voltage at any place of installation be within the range 210-230, it will be necessary to transfer the fuse to the "220V." position. The fuse panel is mounted on the underside of the chassis.

When replacing fuses, always employ "auto" type of 3 ampere rating.

2.4 Audio Output Connections

The generator impedance is approximately 600 ohms at all values of output voltage. Three output terminals are provided, two being labelled 600 ohms and corresponding to the 600 ohms transformer winding, while the third is a centre tap on this winding. The secondary winding is electrostatically shielded from the primary and is balanced to earth. None of the three terminals is earthed internally, a separate earth terminal being provided for use when the output is not required to be balanced. The optimum load for maximum power output is 600 ohms. Higher values of load up to open circuit conditions are permissible, however.

3. OPERATING INSTRUCTIONS

With the unit connected to the 220-260V A.C supply and switched on, the main tuning control should be set to zero on the scale. If the output frequency is not zero, but is close to it, then the magic eye will be seen blinking at a rate equal to the actual output frequency being delivered. The ZERO SET control should now be adjusted until the eye blinks more and more slowly. Finally, when zero frequency is reached, the blinking will cease, and the eye will open out to its fullest extent. The unit is then ready for operation.

During the first few minutes, the zero may drift appreciably as the unit warms up. This should be checked by disconnecting the output leads, returning to zero on the scale and re-adjusting the ZERO SET control as in para. 1 above. This check should be made from time to time until the drift becomes negligible. The unit will then operate for long periods without any appreciable drift in the zero.

The output voltage may be adjusted by the control marked OUTPUT. On a 600 ohms load about 12.5V may be obtained, while on open circuit the maximum is about 30V.

Controls

4.2

(a) Frequency

A two-speed dial, providing either a direct drive or a reduction of approximately 55:1, controls the beat frequency which is indicated by a pointer associated with a semi-circular scale, of length about 18" engraved directly on the pressure plate forming the front of the unit.

4. TECHNICAL DESCRIPTION

4.1 Circuit Arrangement

The audio output of the unit is obtained by selecting the difference frequency component which is produced by mixing the outputs of two low radio-frequency oscillators. This difference frequency is filtered, amplified and supplied to the output terminals.

Of the two heterodyning oscillators, one is fixed at 100 Kc. and the other is variable from this value to 87.0 Kc. by means of a variable air capacitor employing plates shaped to give an approximately logarithmic law to the generated beat frequency scale calibration.

The other stages of the unit comprise a mixer amplifier, a power output stage and a rectifier for power supply.

The low radio-frequency oscillator circuits have been designed to minimise, as far as possible, frequency drift caused by variations of temperature and supply voltage. Mica capacitors and robust coil formers have been used in the L.C. circuits, and resistance stabilising is employed. The layout of the two oscillators is approximately symmetrical, both electrically and mechanically, to minimise differential drifting of the generated frequencies which would cause large drifts in beat frequency.

Each low radio-frequency oscillator consists of a tuned-grid triode oscillator, electron-coupled to the heptode buffer amplifier in the same envelope (6J8G). The output from the variable oscillator buffer is fed directly to the mixer (6J8G). The fixed oscillator output is filtered and fed to the mixer.

A low-pass filter placed between the mixer and output stage effectively removes the other products of the mixer from the audio frequency voltage applied to the output valve.

The output stage consists of a beam tetrode (6V6G) to which inverse feedback is applied, firstly to reduce the harmonic content of the audio output, secondly to reduce and stabilise the output impedance and lastly to improve the frequency response characteristics.

4.2 Controls

(a) Frequency

A two-speed dial, providing either a direct drive or a reduction of approximately 56:1, controls the beat frequency which is indicated by a pointer associated with a semi-circular scale, of length about 14" engraved directly on the process plate forming the front of the unit.

(b) Zero Set

The generated beat frequency may at any time be brought into agreement with the scale calibration by means of the ZERO SET control. The main frequency control is first set to zero and then the two high frequency oscillators brought to zero beat by means of the zero set control. Slow beating between the two oscillators produces a slow variation of the shadow angle of the electric eye indicator.

(c) Output Control

The output at audio frequency is controlled by a knob which operates a potentiometer and thus varies the audio input to the power amplifier. This determines the level of the audio output.

VI, 6383:
Variable Oscillator
Anode: 150 volts
Screen: 70 volts
Cathode: 0 volts
Grid: 155 volts

5. MAINTENANCE

5.1 Re-alignment of Frequency Calibration

As delivered, the units are adjusted so that the accuracy of the frequency calibration is within the figures quoted in sub-section 1.2 (c). It should not be necessary to interfere with any internal adjustment unless either oscillator coil is replaced. When re-calibration is decided to be essential the following procedure is suitable.

- (i) Remove unit from its case, reconnect mains supply and switch on. Set the ZERO SET capacitor so that the plates are half-meshed, and the main tuning control to zero. Unscrew variable oscillator slug L1 and fixed oscillator slug L2 as far as possible.
- (ii) Allow the unit time to warm up, then screw in each slug until each oscillator is tuned exactly to 100 Kc. Check the frequency visually against the multi-vibrator by using a C.R.O coupled to the anode of each buffer amplifier in turn. The scale calibration should now be correct if the capacitance variation of the variable capacitor is normal, although in some instances slight pruning of the gang may be necessary. When any adjustment is made to the variable capacitor, it is necessary to check the zero setting and to see that both oscillators are tuned to 100 Kc. when dial pointer indicates zero.

5.2 General Data

Other faults may be traced by reference to the voltage measurements and other information outlined below and also to Section 6 "Component Schedule".

(a) Voltage Measurements

The values given below are as read with a 1,000 ohms/volt type meter using the 500 volt scale for H.T. voltages and the 10V scale for cathode voltages. All voltages are measured with respect to Earth (see Drg. No. 7077D7), and may vary as much as $\pm 10\%$ from figures quoted.

Input Volts:- 240V A.C.

V1, 6J8G:

Variable Oscillator -

Anode:	160 volts
Screen:	70 volts
Cathode:	0 volts
Osc. Anode	135 volts

AMENDMENT 2811475.2 General Data(a) Voltage Measurements

NOTE that the table given on Pages 8 and 9 applies to units having Serial Nos. below 693 ONLY. The table given hereunder applies to Serial Nos. 693 and above. NOTE also that for these latter units resistor R14 becomes 80,000 Ω , 1W., carbon, code 600719.

Input Volts -- 240V. A.C.V1, 6J8G: Variable Oscillator -

Anode: 195 volts
Screen: 75 volts
Cathode: 0 volts
Osc. Anode: 165 volts

V2, 6J8G: Fixed Oscillator -

Anode: 195 volts
Screen: 75 volts
Cathode: 0 volts
Osc. Anode: 165 volts

V3, 6J8G: Mixer Valve -

Anode: 165 volts
Screen: 125 volts
Cathode: 4.0 volts

V4, 6V6G: Output Valve -

Anode: 290 volts
Screen: 110 volts
Cathode: 4.5 volts

V6, 6U5/6G5: Zero Indicator -

Target: 270 volts
Plate: 18 volts

Heaters 6.3V. A.C.
H.T. (1st electrolytic): (C32) 390V. D.C.
H.T. (2nd electrolytic): (C29) 275V. D.C.
H.T. (3rd electrolytic): (C28) 265V. D.C.
V5, 6X5CT, A.C. on plates: 365 + 365 volts.

V2, 6J8G:

Fixed Oscillator -

Anode: 165 volts
 Screen: 70 volts
 Cathode: 0 volts
 Osc. Anode: 135 volts

V3, 6J8G:

Mixer Valve -

Anode: 145 volts
 Screen: 110 volts
 Cathode: 3.6 volts

V4, 6V6G

Output Valve -

Anode: 255 volts
 Screen: 60 volts
 Cathode: 3 volts

V6, 6U5/
6G5:Zero Indicator -

Target: 255 volts

Heaters

6.25 volts A.C.

H.T. (1st electrolytic):

(C32) 350V D.C.

H.T. (2nd electrolytic):

(C29) 275V D.C.

H.T. (3rd electrolytic):

(C28) 265V D.C.

V5, 6X5G AC on plates:

335 + 335 volts

(b) Approximate Resistance Values

Output transformer:

Primary 600 ohms
 Secondary 30 ohms

Power transformer:

Primary 27 ohms
 Secondary 325 ohms/
 side

Chokes, filter:

450 ohms

Chokes, low-pass filter:

1,000 ohms

Oscillator coils:

Primary 12 ohms
 Secondary 24 ohms
 (centre tapped)

Fixed coil in fixed
oscillator anode circuit:

8 ohms

6. COMPONENT SCHEDULE

Note: When ordering replacement parts, please quote all information given below.

<u>Circ. Ref. No.</u>	<u>Description</u>	<u>A.W.A. Type No.</u> (unless otherwise stated)
(a) <u>Capacitors</u>		
C1	960 μ F., 500V.W., silver mica (1 x 800 μ F., $\pm 1\%$ + 160 μ F., $\pm 1\%$ in parallel)	Simplex SMX
C2	12-370 μ F., variable	7077U12
C3	5-15 μ F., variable	31U8316
C4	500 μ F., $\pm 5\%$, 500V.W., silver mica	226175
C5	0.1 μ F., 350V.W., paper	228121
C6	0.1 μ F., 350V.W., paper	228121
C7	960 μ F., 500V.W., silver mica (2-480 μ F., $\pm 1\%$ in parallel)	Simplex SMX
C8	500 μ F., $\pm 5\%$, 500V.W., silver mica	226175
C9	0.1 μ F., 350V.W., paper	228121
C10	0.1 μ F., 350V.W., paper	228121
C11	12 μ F., $\pm 10\%$, 500V.W., mica	224543
C12	4000 μ F., 500V.W., mica	224593
C13	0.05 μ F., 350V.W., paper	228115
C14	Not used	
C15	0.5 μ F., 350V.W., paper	228135
C16	0.12 μ F., 350V.W., paper	228123
C17	70 μ F., 500V.W., mica	Simplex P.T.
C18	70 μ F., 500V.W., mica	Simplex P.T.
C19	70 μ F., 500V.W., mica	Simplex P.T.
C20	70 μ F., 500V.W., mica	Simplex P.T.
C21	Not used	
C22	12 μ F., $\pm 10\%$, 500V.W., mica	224543
C23	0.01 μ F., 700V.W., paper	228301
C24	0.005 μ F., 700V.W., paper	228295
C25	150 μ F., 500V.W., mica	Simplex SM
C26	16 μ F., 525V.P., electrolytic	Ducon EE10783
C27	0.1 μ F., 350V.W., paper	228121
C28	16 μ F., 525V.P., electrolytic	Ducon EE10783
C29	16 μ F., 525V.P., electrolytic	Ducon EE10783
C30	0.01 μ F., 700V.W., paper	228301
C31	0.2 μ F., 350V.W.	228127
C32	8 μ F., 525V.P., electrolytic	Ducon EE10774
(b) <u>Resistors</u>		
R1	32,000 ohms, 1 watt, carbon	600711
R2	16,000 ohms, 1 watt, carbon	600705
R3	50,000 ohms, 1 watt, carbon	600715
R4	32,000 ohms, 2 watt, (2-63,000 ohms, 1 watt Code-600717, carbon, in parallel)	

R5	50,000 ohms, 1 watt, carbon	600715
R6	0.1 M Ω , 1/2 watt, carbon	600321
R7	32,000 ohms, 1 watt, carbon	600711
R8	16,000 ohms, 1 watt, carbon	600705
R9	50,000 ohms, 1 watt, carbon	600715
R10	50,000 ohms, 1 watt, carbon	600715
R11	50,000 ohms, 1 watt, carbon	600715
R12	800 ohms, 1 watt, carbon	600679
R13	32,000 ohms, 2 watt, (2-63,000 ohms, 1 watt, Code 600717, carbon, in parallel	
R14	0.1 M Ω , 1 watt, carbon	600721
R15	0.1 M Ω , variable potentiometer	620121
R16	0.1 M Ω , 1 watt, carbon	600721
R17	2.0 M Ω , 1 watt, carbon	600747
R18	250 ohms, 3 watt, wire-wound	602369
R19	50,000 ohms, 1 watt, carbon	600715
R20	500,000 ohms, 1 watt	600735
R21	10,000 ohms, 1 watt, carbon	600701
R22	1 M Ω , 1 watt, carbon	600741
R23	1 M Ω , 1 watt, carbon	600741
R24	3,200 ohms, 1 watt, carbon	600091
R25	200 ohms, 1 watt, carbon	I.R.C.
R26	200 ohms, 1 watt, carbon	I.R.C.
R27	32,000 ohms, 1 watt, carbon	600711
R28	32,000 ohms, 1 watt, carbon	600711
R29	50,000 ohms, 1 watt, carbon	600715
R30	1000 Ω , 5W., wire-wound	602881

(c) Fuses

F1	375 mA Cartridge S8940 Series	370011
F2	375 mA Cartridge S8940 Series	370011

(d) Inductors

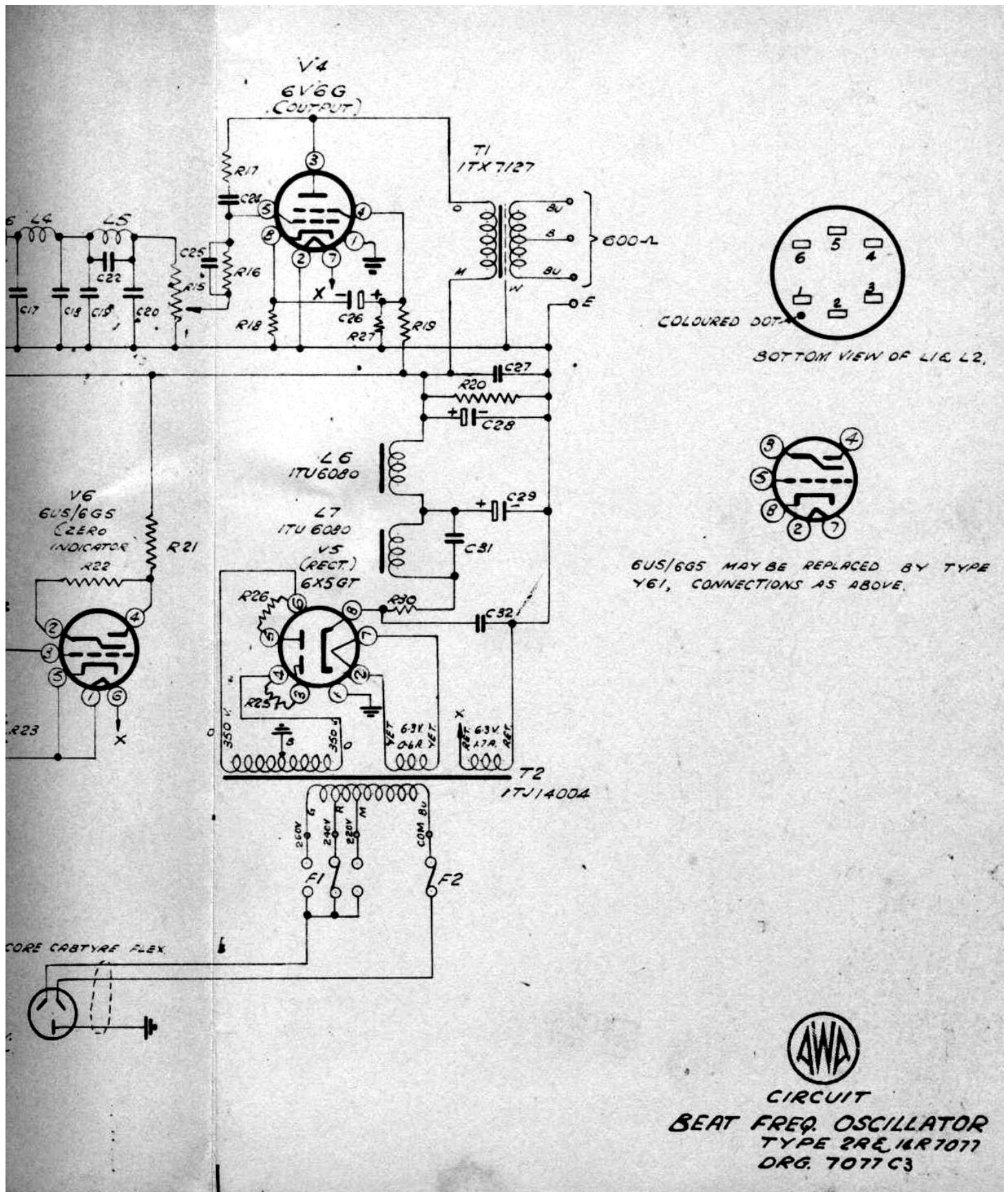
L1	Variable Oscillator	7077V36
L2	Fixed Oscillator	7077V36
L3	Fixed Oscillator anode circuit, filter choke	7077V38
L4	V3-V4 Filter choke	7077T80
L5	V3-V4 Filter choke	7077T80
L6	Filter choke	1TU6080
L7	Filter choke	1TU6080

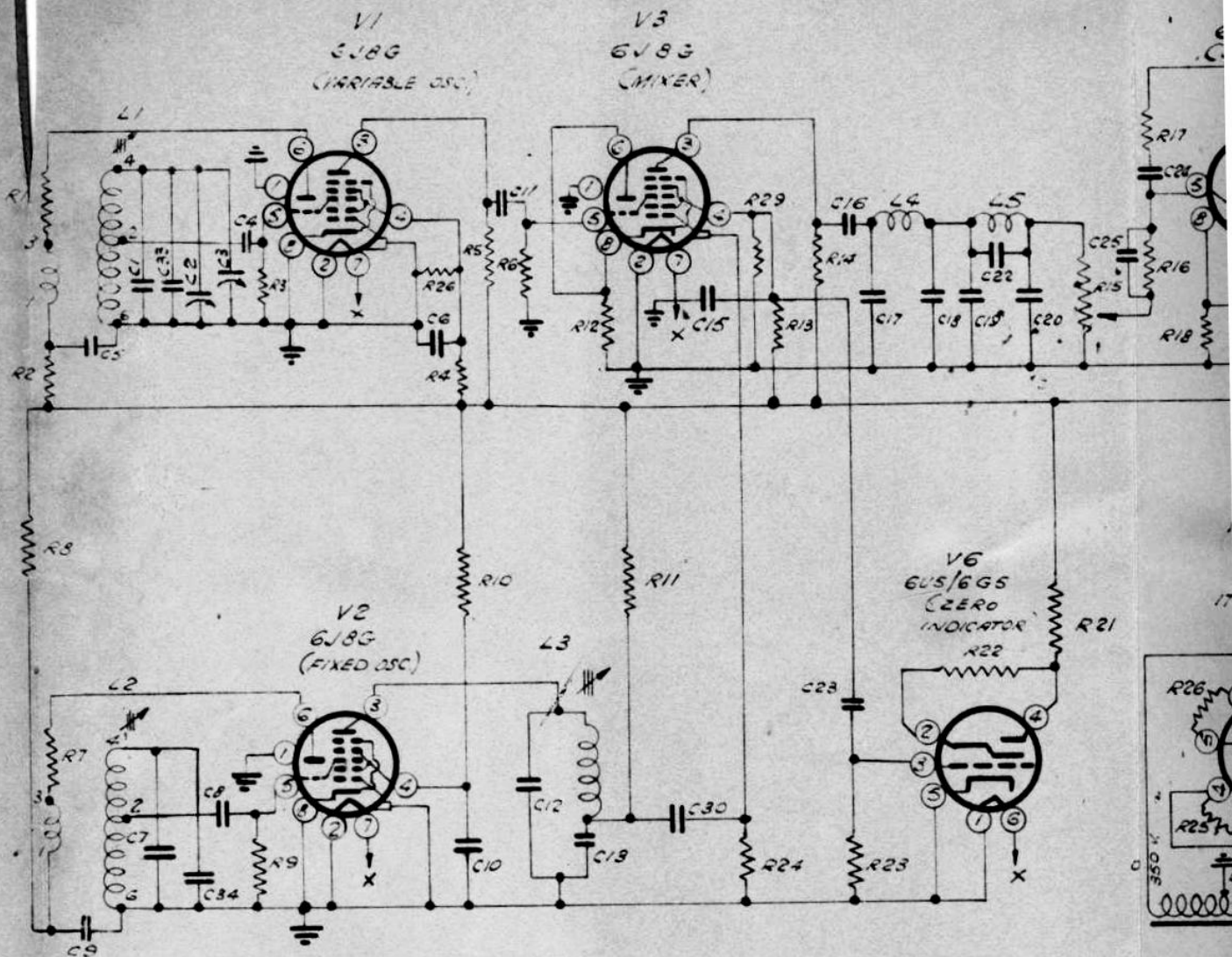
(e) Sockets

V1 to V5	Octal, moulded bakelite, with spring	793070
V6	6 pin, moulded bakelite, with spring	83331

(f) Transformers

T1	Output	1TX7127
T2	Power	3TJ14004





WIRING COLOUR CODE

H.T. AND LEADS TO PLATES - RED.
 SCREENS - BLUE
 GRID - GREEN
 EARTH - BLACK
 FILAMENTS OF ORDINARY TUBES - YELLOW

COLOUR	CODE
BLACK	(B)
BLUE	(BU)
GREEN	(G)
MAROON	(M)
ORANGE	(O)
RED	(R)
WHITE	(W)
YELLOW	(Y)
EMERALD TUBE	(E.T.)

3 CORE CABLE TYPE FLEX

3 FLAT PIN
 PLUG. 220-
 260 V.
 50 ~

