RADIOTRONICS

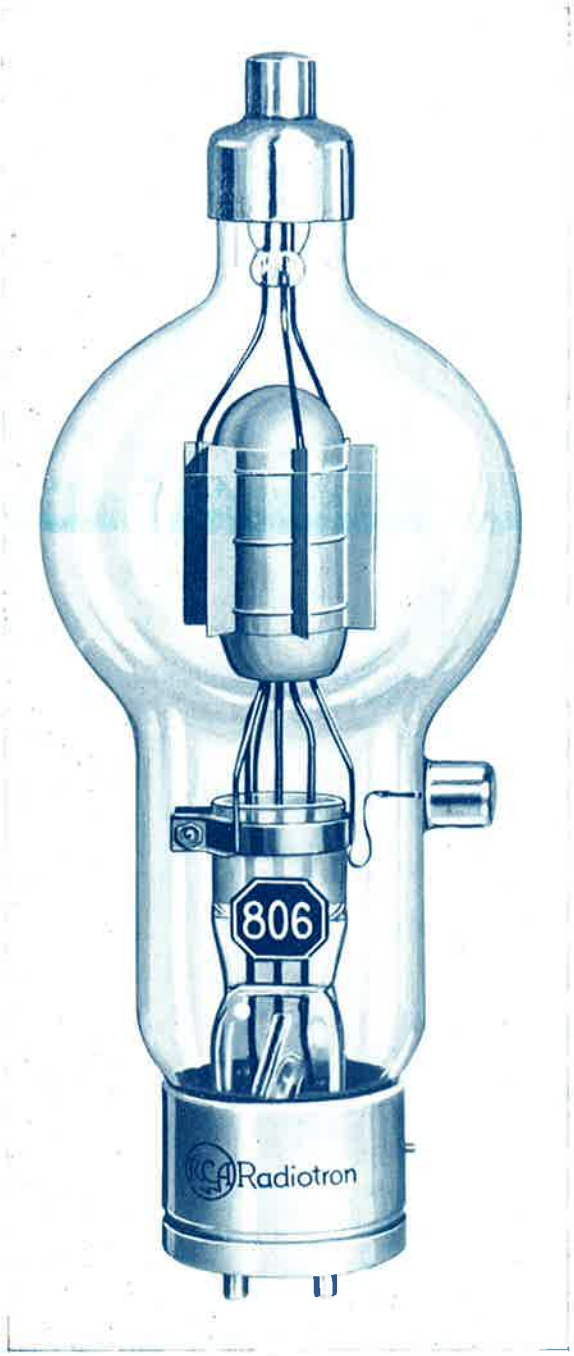
AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

BOX No 2516BB, G.P.O. SYDNEY

TECHNICAL BULLETIN No. 97

18th APRIL, 1939

In this issue:—



The illustration depicts Radiotron 806, 150 watt plate dissipation Class B Triode. Special attention is directed to the totally enclosed construction of the tantalum plate, which improves overall efficiency by reducing stray electron loss and envelope bombardment. Radiotron 806 is suitable for operation as R-F Power Amplifier, Oscillator, and Modulator, and may be used at maximum ratings up to 30 Mc/s.

List Price, ... £9/10/-.

5 VALVE

2 VOLT BATTERY RECEIVERS

As a result of numerous enquiries, we are pleased to reprint two circuits, first given in Radiotronics 80, which have given extremely good service and which in their class are of excellent design. The only change which has been made to the original circuits is to change from the old type valves to the standard "G" series. The circuits are similar in most respects except that circuit A58 is for vibrator operation and A59 for B battery operation.

The good performance of these receivers is due largely to the following points which have been incorporated in their design:—

(1) An R.F. stage is used providing better sensitivity and lower noise level, particularly on the broadcast band, as well as enabling A.V.C. to be applied to the R.F. stage in place of the converter.

(2) The A.V.C. action is arranged to be most effective on the R.F. stage. In order to give a rapid cut-off the R.F. valve is operated with reduced screen voltage from a source of almost constant screen voltage.

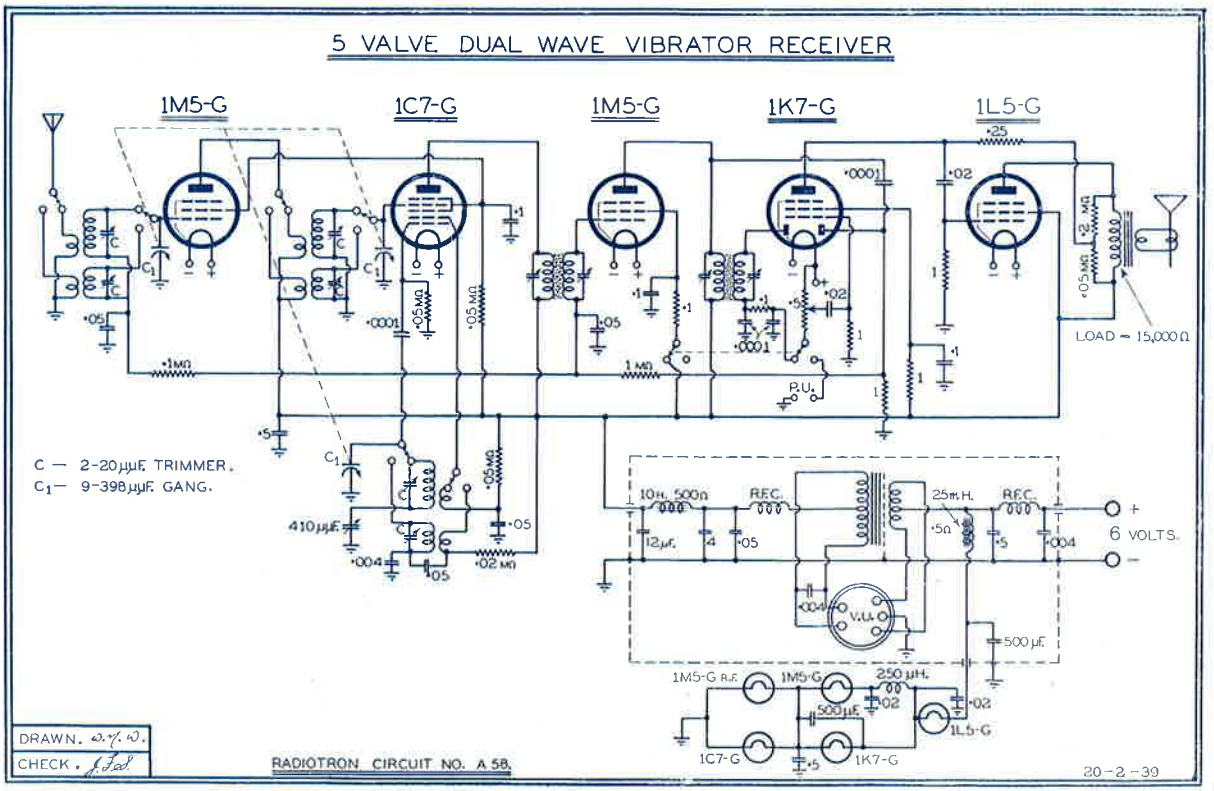
(3) The Converter valve is operated at fixed zero bias on both wave bands, thereby giving high gain and avoiding frequency shift due to fading on short-waves.

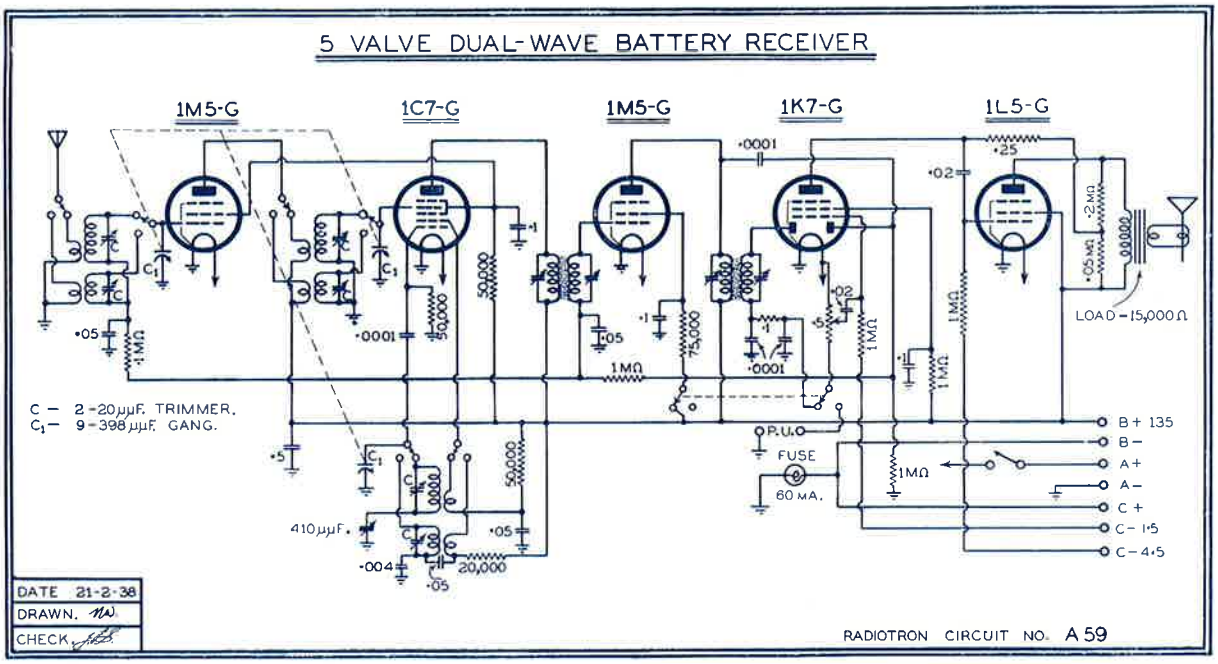
(4) A high gain I.F. stage is used in order to give the optimum performance on the short-wave band.

(5) Distortion due to modulation rise in the I.F. amplifier is avoided by supplying the screen through a dropping resistor from B+. This gives a more remote cut-off and therefore a less rapid action due to A.V.C.

(6) Delayed A.V.C. is used with a very small delay voltage so as to be operative even on fairly weak signals.

(7) Negative feedback is employed to reduce the harmonic distortion from the power pentode without any loss of power output. If it is desired to obtain the highest sensitivity for short-wave reception the negative feedback may be eliminated by short circuiting the .05 megohm resistor in the voltage divider across the load. If this short circuiting is accomplished by a switch it may be so arranged as to provide negative feedback on the broadcast band and high amplification on the short-wave band.





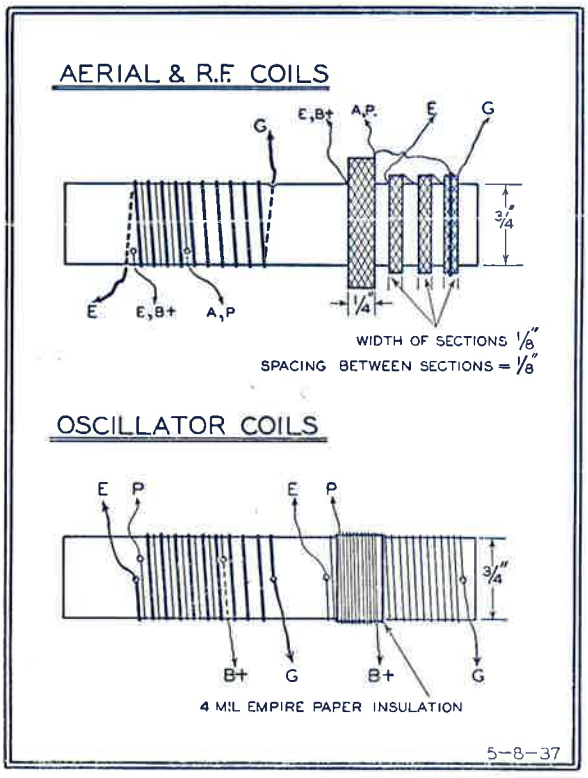
(8) A filament switch and fuse are incorporated in circuit A59 in such a position that no likely failure of any valve or component will result in the remaining valves being burnt out.

(9) Provision is made for a gramophone pick-up to be connected.

The short-wave band intended to be covered by this receiver is from 16 to 51 metres. If it is desired to cover the 13-39 metre band it may be necessary to return the oscillator grid leak to filament positive in place of filament negative in order to obtain sufficiently strong oscillation. This connection is undesirable on the broadcast band since it reduces the plate resistance of the 1C7-G valve and it is preferable to arrange for switching over the grid leak as the wave band is changed. This precaution is only necessary below 16 metres. For alternative methods of high frequency operation reference should be made to Radiotronics 94, page 6.

Coils suitable for this receiver are shown in the diagram and table.

(Continued on page 26)



GRID BLOCKING
HOW TO AVOID WITH 6K8-G

It has been found that with "shunt feed" A.V.C. systems in which the A.V.C. is applied through a high resistance directly to the grid of the valve, grid blocking is liable to occur with Radiotron 6K8-G. In view of this occurrence it is recommended that shunt feed A.V.C. should not be used with this valve and that the more popular series feed arrangement should be adopted.

1.4 VOLT SERIES
VERTICAL MOUNTING

Attention is drawn to the fact that the 1.4 volt series of valves is intended for operation in a vertical position only, as shown in the Radiotron Operating Position Chart issued as a supplement to the previous number of Radiotronics. These valves are not suitable for operation in a horizontal position or at any intermediate angle.

5 VALVE 2 VOLT BATTERY RECEIVERS

(Continued from page 25)

COIL DETAILS

Note that these coil data apply only to particular conditions, and adjustment will normally be required in differing layouts. The effective inductance of the coils is affected by the length of leads, the shield cans, and proximity to other components in the case of unshielded coils. The band coverage is affected by the total stray capacitances as well as by the capacitance of the gang condenser. Using gang condenser B, the band coverage will be wider than with condenser A. Any minor adjustments in the coils should be made in the same proportion to both primary and secondary.

COIL	PRIMARY	SECONDARY
AERIAL 550-1500 Kc.	375 turns 40 S.W.G. S.S.E. with one turn over hot end of secondary.	120 turns 5/44 Litz, in three equal sections.
AERIAL 16.0-51 metres	4.25 turns 28 B. & S. D.S.C. interwound from bottom of secondary.	11.7 turns 22 B. & S. E., wound in screw cuts 16 T.P.I.
R.F. 550-1500 Kc.	950 turns 40 S.W.G. S.S.E. with one turn over hot end of secondary.	120 turns 5/44 Litz, in three equal sections.
R.F. 16.0-51 metres	8.75 turns 28 B. & S. D.S.C. interwound from bottom of secondary.	11.45 turns 22 B. & S. E., wound in screw cuts 16 T.P.I.
OSCILLATOR 550-1500 Kc.	30 turns 34 B. & S. E. wound over bottom of secondary.	100 turns 31 B. & S. E.
OSCILLATOR 16.0-51 metres	6.5 turns 44 S.W.G. D.S.C. interwound from bottom of secondary.	10.9 turns 22 B. & S. E., wound in screw cuts 16 T.P.I.

COIL FORMERS: All coils wound on $\frac{3}{4}$ inch diameter bakelite former.

SHIELD CAN: Internal Diameter, $2\frac{1}{8}$ inches.

TUNING CONDENSER:—A. 10– 390 $\mu\mu$F. See note above.
B. 9– 398 $\mu\mu$F.

MAX. EFFECTIVE STRAY CAPACITANCES: A. 34 $\mu\mu$F. (including valve, input, trimmer, wiring and coil).
B. 35 $\mu\mu$F.

INTERMEDIATE FREQUENCY: 465 Kc./s.

OSCILLATOR GRID CURRENT

WHY LIMITS ARE IMPOSED

In order to assist the design engineer, recommended top and bottom limits for oscillator grid currents of the more popular types of Radiotron converter valves have been made available. For satisfactory operation it is strongly recommended that these values should be regarded as definite limits. In order, however, to explain the effects that take place, a short description is given for type 6K8-G.

For Radiotron 6K8-G it is recommended that the oscillator grid current with the recommended grid resistor of 50,000 ohms should be between .1 and .2 mA. (100-200 μA). Reference to the published curves shows that the optimum conversion conductance occurs very close to an oscillator voltage corresponding to a grid current of .1 mA. At higher values of oscillator grid current the conversion conductance falls but the plate resistance rises. It can be shown that the fall of conversion conductance is more serious than the rise of plate resistance in the effect on gain, so that the nett effect is that as the oscillator grid current increases the gain decreases slightly. There is therefore an advantage in avoiding too high a value of oscillator grid current. A further reason is that at a certain critical high value of oscillator grid current a form of instability occurs and the valve is sometimes said to "spill over". The value of oscillator grid

current at which this effect takes place varies with different layouts and with different screening and is higher with good screening. It is obviously desirable to operate the valve so that an ample margin of safety is given against "spilling over".

When the oscillator grid current is decreased below .1 mA. the conversion conductance rapidly decreases and this, in conjunction with a rapid decrease in plate resistance, results in an extremely rapid fall of gain. The operation of the valve is therefore extremely critical regarding oscillator grid current and an unsatisfactory condition of operation is the result. In addition to the operation being extremely critical as regards oscillator grid current in this region there is another and even more important effect. As the oscillator grid current decreases so the total cathode current increases. The cathode current should never under any circumstances exceed 16 mA. and on a typical valve this cathode current is reached when the oscillator grid current is reduced to about .08 mA. (80 μA). It is therefore advisable to maintain the oscillator grid current well above this extreme bottom limit.

Experience shows that there is a slight advantage in decreasing the oscillator grid current on the short-wave band and as a result the recommended limits of grid current may be taken as:—

Broadcast band ..... 100-250 μA.
35-105 metres ..... 100-250 μA.
13-35 metres ..... 100-200 μA.*

*The minimum oscillator grid current may be decreased to 80 μA. if difficulty is found in keeping to the higher limit.

Radiotron 6K8-G valves should never be operated with less than 80 μA. oscillator grid current since otherwise the dissipation limit will be exceeded.

RADIOTRON 1620

TRIPLE GRID AMPLIFIER

Radiotron 1620 is a metal valve having characteristics very similar to those of Radiotron 6J7 but being particularly intended for applications which are critical as to microphonics. In this respect type 1620 fulfils a similar function to Radiotron 1603 which is a glass valve having a 6-pin base.

TENTATIVE CHARACTERISTICS

Heater	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.3	amp.
Direct Interelectrode Capacitances—Pentode Connection:⊕		
Grid to Plate	0.005 max.	μuf
Input	7.0	μuf
Output	12.0	μuf
Maximum Overall Length		$3\frac{1}{8}$"
Maximum Diameter		$1\frac{5}{16}$"
Bulb		Metal Shell, MT-8
Cap		Miniature
Base		Small Wafer Octal 7-Pin
Pin 1—Shell	Pin 5—Suppressor	
Pin 2—Heater	Pin 7—Heater	
Pin 3—Plate	Pin 8—Cathode	
Pin 4—Screen	Cap —Grid	
Mounting Position		Any

CLASS A_1 AMPLIFIER—Pentode Connection

Operating Conditions and Characteristics:

Heater*	6.3	6.3	volts
Plate	100	250 max.	volts
Screen	100 max.	100 max.	volts
Grid#	−3	−3	volts
Suppressor	Tied to cathode at socket		
Amp. Factor	1185	†	
Plate Res.	1.0	⊙	megohms
Transcond.	1185	1225	μmhos
Grid Bias°°	—	−8	approx. volts
Plate Cur.	2.0	2.1	mA.
Screen Cur.	0.5	0.5	mA.

† Greater than 1500.
⊙ Greater than 1.5 megohms.
°° Approx., for current cut-off.

CLASS A_1 AMPLIFIER--Triode Connection⊗⊗

Operating Conditions and Characteristics:

Heater*	6.3	volts
Plate	250 max.	volts
Grid#	−8	volts
Amp. Fact.	20	
Plate Res.	9100	ohms
Transcond.	2200	μmhos
Plate Cur.	7.8	mA.

⊕ With shell connected to cathode.

* In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

⊗⊗ Screen and suppressor tied to plate.

The d-c resistance in the grid circuit should not exceed 1.0 megohm.

RADIOTRON 1621

POWER PENTODE

Radiotron 1621 is a metal valve having characteristics somewhat resembling those of type 6F6 but designed particularly for applications requiring continuity of service. It is capable of operating either as a triode (with screen tied to plate) or as a Class A_1 pentode and is particularly suited to operation in push-pull. A power output of 2 watts with 1% total harmonic distortion with push-pull triodes or a power output of 5 watts with 3% total harmonic distortion with push-pull pentodes is obtainable under Class A_1 operation on a fixed resistive load.

RADIOTRON 1621

(Continued from page 27)

TENTATIVE CHARACTERISTICS

Heater*	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.7	amp.
Maximum Overall Length		$3\frac{1}{4}$"
Maximum Diameter		$1\frac{5}{16}$"
Bulb		Metal Shell, MT-8
Base		Small Wafer Octal 7-Pin
Pin 1—Shell	Pin 5—Grid	
Pin 2—Heater	Pin 7—Heater	
Pin 3—Plate	Pin 8—Cathode	
Pin 4—Screen		
Mounting Position		Any

PUSH-PULL AMPLIFIER—Class A_1
(Triode Connection) Screen tied to plate.

Plate Supply Voltage	327.5 max.	volts
Plate Dissipation	8.3 max.	watts
Typical Operation:		
(Unless otherwise specified, values are for 2 valves)		
Plate Supply□	327.5	volts
Cathode Resistor△	500	ohms
Peak A-F Grid-to-Grid Voltage	54	volts
Zero-Sig. Plate Current	55	mA.
Max.-Sig. Plate Current	59	mA.
Load Resistance (plate to plate)	5000	ohms
Total Harmonic Distortion	1	%
Power Output	2	watts

□ Actual voltage between cathode and plate will be plate supply voltage minus voltage drop in cathode resistor.

△ Type of input coupling used should not introduce too much resistance in the grid circuit. Transformer- or impedance-coupling devices are recommended. The grid circuit may have a resistance as high as, but not greater than, 0.5 megohm provided the heater voltage is not allowed to rise more than 10% above rated value under any condition of operation.

PUSH-PULL AMPLIFIER—Class A_1
(Pentode Connection)

Plate Voltage	300 max.	volts
Screen Voltage	300 max.	volts
Plate Dissipation	7.9 max.	watts
Screen Input	1.9 max.	watts
(Unless otherwise specified, values are for 2 valves)		
Plate	300	volts
Screen	300	volts
D-C Grid Voltage°	−30	volts
Peak A-F Grid-to-Grid Voltage	60	volts
Zero-Sig. Plate Current	38	mA.
Max.-Sig. Plate Current	69	mA.
Zero-Sig. Screen Current	6.5	mA.
Max.-Sig. Screen Current	13	mA.
Load Resistance (plate to plate)	4000	ohms
Total Harmonic Distortion	3	%
Power Output	5	watts

* In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

° Type of input coupling should not introduce too much resistance in the grid circuit. Transformer- or impedance-coupling devices are recommended. When the grid circuit has a resistance not higher than 0.05 megohm, fixed bias may be used; for higher values, cathode bias is required. With cathode bias, the grid circuit may have a resistance as high as, but not greater than, 0.5 megohm provided the heater voltage is not allowed to rise more than 10% above rated value under any condition of operation.

RADIOTRON 1622

BEAM POWER AMPLIFIER

Radiotron 1622 is a metal valve resembling type 6L6 but intended for applications requiring continuity of service. Two of these valves in push-pull Class A_1 are capable of giving an output of 10 watts with a total harmonic distortion of 1% on a fixed resistive load.

TENTATIVE CHARACTERISTICS

Heater	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.9	amp.
Maximum Overall Length		$4\frac{5}{16}$"
Maximum Diameter		$1\frac{5}{8}$"
Bulb		Metal Shell, MT-10
Base		Small Wafer Octal 7-Pin
Pin 1—Shell	Pin 5—Grid	
Pin 2—Heater	Pin 7—Heater	
Pin 3—Plate	Pin 8—Cathode	
Pin 4—Screen		
Mounting Position		Any

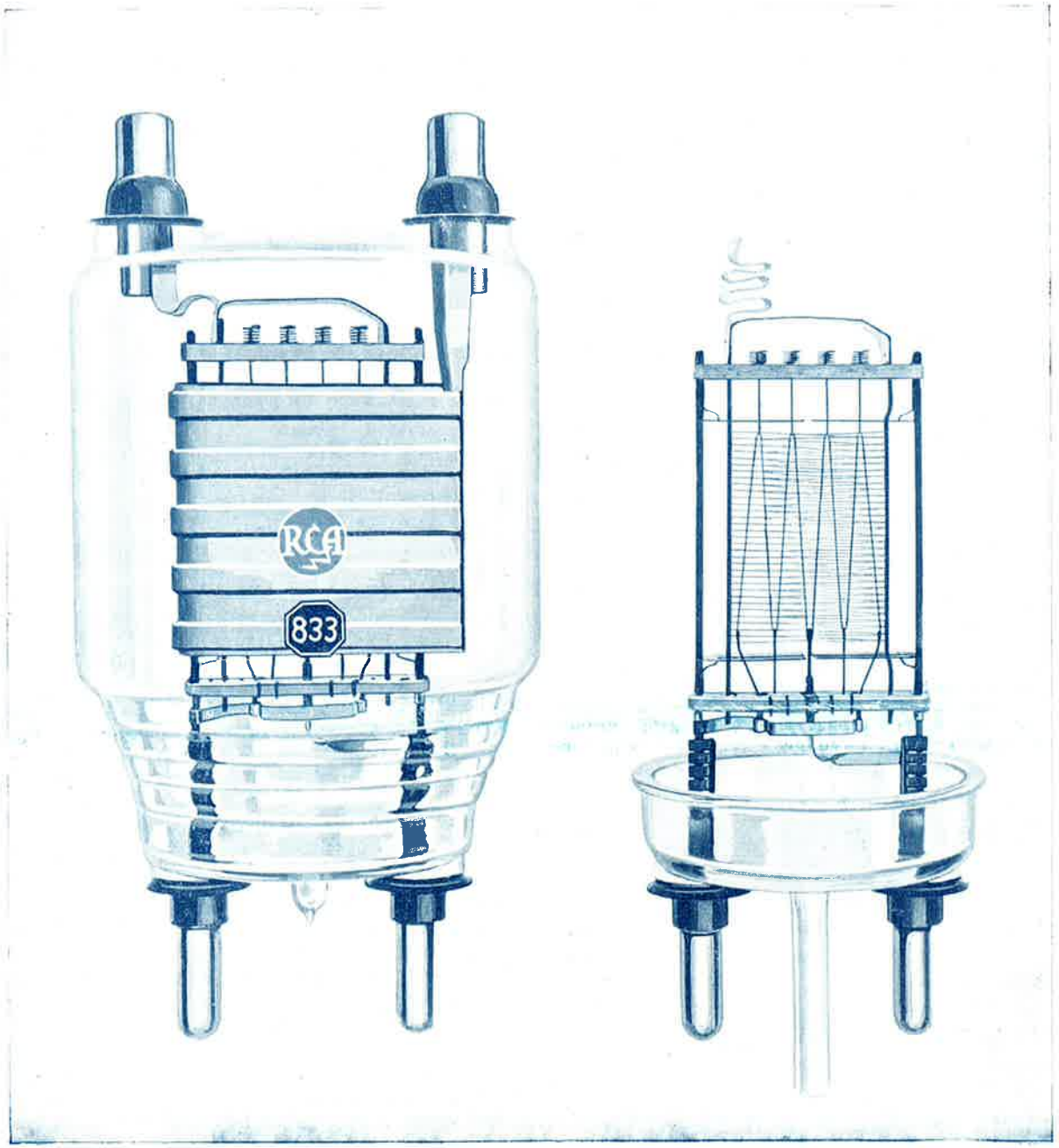
PUSH-PULL AMPLIFIER—Class A_1

Plate Voltage	300 max.	volts
Screen Voltage	250 max.	volts
Plate Dissipation	13.8 max.	watts
Screen Input	1.3 max.	watts
Typical Operation:		
(Unless otherwise specified, values are for 2 valves)		
Heater*	6.3	volts
Plate	300	volts
Screen	250	volts
D-C Grid Voltage•	−20	volts
Peak A-F Grid-to-Grid Voltage	40	volts
Zero-Sig. Plate Current	86	mA.
Max.-Sig. Plate Current	125	mA.
Zero-Sig. Screen Current	4	mA.
Max.-Sig. Screen Current	10.5	mA.
Load Resistance (plate to plate)	4000	ohms
Total Harmonic Distortion	1	%
Power Output	10	watts

* The heater voltage should never fluctuate so that it exceeds 7 volts. The potential difference between heater and cathode should be kept as low as possible.

• The type of input coupling used should not introduce too much resistance in the grid circuit. Transformer- or impedance-coupling devices are recommended. When the grid circuit has a resistance not higher than 0.1 megohm, fixed bias may be used; for higher values, cathode bias is required. With cathode bias, the grid circuit may have a resistance not to exceed 0.5 megohm, provided the heater voltage is not allowed to rise more than 10% above the rated value under any condition of operation.

RADIOTRON 833 U.H.F. HIGH POWER TRIODE



Intended primarily for U.H.F. operation, Radiotron 833 is a 300 watt plate dissipation high-mu triode of special construction for use as R.F. Amplifier, Oscillator and Class B modulator. The plate voltage may be as high as 3000 volts, with a maximum input of 1250 watts. Under typical Class C Telegraphy conditions of operation a maximum power output of 1000 watts is obtainable, while as a plate-modulated R.F. Amplifier the maximum power output is 635 watts. As a result of the special construction adopted in which the electrode structure is supported directly on post terminals to which the electrode connections are brought through separate seals, Radiotron 833 provides exceptional efficiency at high frequencies and can be operated at maximum ratings up to 30 Mc/s., and with reduced ratings with excellent results at frequencies as high as 100 Mc/s. The resonant frequency of the grid-plate circuit is 200 Mc/s.

LIST PRICE £35 0 0

RADIOTRONS 957, 958, 959
1.25 VOLT ACORN VALVES

We regret an error which occurred in the sub-title of our issue No. 96 (15th March, 1939) and would ask readers to alter their copies to read "1.25" volt Acorn valves in place of "1.4" as stated. It will be noticed that in the article and in the characteristics the correct filament voltage was given, but the sub-title was incorrect. A similar correction applies to page 6 of Radiotronics 94 under the heading "Radiotron News" in which all three types, 957, 958 and 959, should read as having 1.25 volt filaments.

It is regretted that this error occurred through confusion with the 1.4 volt series of radio receiving valves but we take the opportunity of stressing the fact that **the filaments are not suited for operation at a voltage higher than 1.25 volts plus the usual tolerance of 10%. They are therefore not suitable for operation without a series dropping resistor when the battery voltage under operating conditions is in excess of 1.375 volt.**

RADIOTRON NEWS

The following new releases have been announced and are listed for reference.

BANTAM TYPES (Suffix—GT indicates a Bantam Glass Valve)

Radiotron 6A8-GT pentagrid converter with characteristics similar to those of type 6A8-G.
Radiotron 6K7-GT with characteristics similar to those of type 6K7-G.
Radiotron 6Q7-GT with characteristics similar to those of type 6Q7-G.
Radiotron 25L6-GT with characteristics similar to those of type 25L6-G.
Radiotron 25Z6-GT with characteristics similar to those of type 25Z6-G, except that the maximum A.C. voltage per plate is limited to 125 volts R.M.S.

12.6 VOLT .15 AMP. BANTAM TYPES

Radiotron 12A8-GT with characteristics similar to those of type 6A8-G.
Radiotron 12K7-GT with characteristics similar to those of type 6K7-G.
Radiotron 12Q7-GT with characteristics similar to those of type 6Q7-G.

35 VOLT .15 AMP. BANTAM TYPES.

Radiotron 35L6-GT with characteristics somewhat resembling those of type 25L6 but with a lower maximum power output.
Radiotron 35Z4-GT half-wave high vacuum rectifier with a maximum D.C. output current of 100 mA.

12.6 VOLT .15 AMP. METAL VALVES.

Radiotron 12SA7 with characteristics similar to those of type 6SA7.
Radiotron 12SC7 with characteristics similar to those of type 6SC7.
Radiotron 12SJ7 with characteristics similar to those of type 6SJ7.
Radiotron 12SK7 with characteristics similar to those of type 6SK7.
Radiotron 12SQ7 with characteristics similar to those of type 6SQ7.
Radiotron 12C8 with characteristics similar to those of type 6B8.

MISCELLANEOUS TYPES.

Radiotrons 957, 958 and 959, previously announced as having 1.4 volt filaments, should be corrected to read as having 1.25 volt filaments. See paragraph elsewhere in this issue.

The following three types have been announced but stocks are not yet available. The characteristics are given elsewhere in this issue.

Radiotron 1620 metal R.F. pentode with characteristics similar to those of type 6J7, but intended for applications critical as to microphonics.
Radiotron 1621, metal power pentode, with characteristics resembling those of type 6F6, but intended for applications requiring continuity of service.
Radiotron 1622, metal beam power amplifier, with characteristics resembling those of type 6L6, but intended for applications requiring continuity of service.

SUBSCRIPTIONS

Australian readers are asked to forward at the earliest opportunity the card enclosed with this issue, together with the sum of 2/-, to cover the postage and incidental expenses for the year ending June 30, 1940. Radiotronics subscriptions are due on 1st July of each year. In order to avoid inconvenience to themselves through the loss of valuable information, readers are well advised to post early.

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