



# RADIOTRONICS

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

**TECHNICAL BULLETIN No. 71**

**30th DECEMBER, 1936**

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## **5 WATTS OUTPUT FROM RADIOTRONS**

### **42 and 6F6**

As class A pentodes the 42 and 6F6 have been very widely used with plate and screen voltages equal to 250 volts and under these conditions a power output up to 3 watts is obtainable. A considerably higher output may be obtained through the operation of these valves with plate and screen voltages equal to 315 volts. The power output is 5 watts with a load resistance of 7,000 ohms, plate current 42mA and screen current 8mA. The correct grid bias is -22 volts and the correct cathode bias resistor is 450 ohms. The advantage of increased power output is that at a level of 3 watts the distortion is considerably less than that given by the same valves operated with a supply of 250 volts. A grid circuit resistance of 0.5 megohm is permitted with self-bias.

Inverse feed-back is recommended for use in all cases whether for 3 watt or 5 watt conditions. The application of inverse feed-back to resistance coupled output valves is given elsewhere in this bulletin.

**INVERSE FEED-BACK WITH RESISTANCE COUPLING**

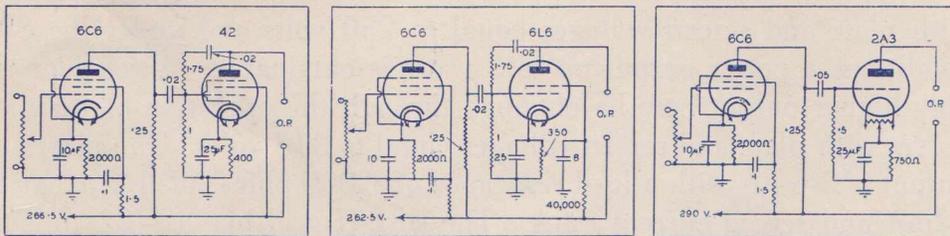
Although transformer coupling is recommended for general use with inverse feed-back circuits, there are certain cases where resistance coupling may be used. Typical circuits showing the application of resistance coupling and inverse feed-back to Radiotron types 42 and 6L6 are given in figures 1 and 2. The 6F6 may be regarded as being interchangeable with 42. With these circuits larger power outputs may be obtained before the distortion becomes excessive, or alternatively for the same power output the distortion is very noticeably reduced. These particular circuits are strongly recommended where pentodes are employed as power amplifiers. The additional components are very few and the advantages conferred are very great. It should be pointed out that types 6B7S and 75 are not suitable in place of the 6C6 resistance coupled audio amplifier.

Although these circuits using inverse feed-back will be found very much more satisfactory than the conventional use of such pentodes, the quality obtained is not equal to that given by Class A triode valves either single or push-pull. This is due to the low plate resistance of the triode valves enabling the loud speaker to respond accurately to transients. The circuit of a single triode valve (type 2A3) is shown in figure 3, and is recommended for application where quality is of first importance. The input to this amplifier for full output of 3.5 watts is less than 0.3 volts RMS, so that any normal pick up may be used. When the 6C6 is used as an audio amplifier, it will generally be found most convenient to use Radiotron 6B7S as the Intermediate Frequency Amplifier.

Fig. 1.

Fig. 2.

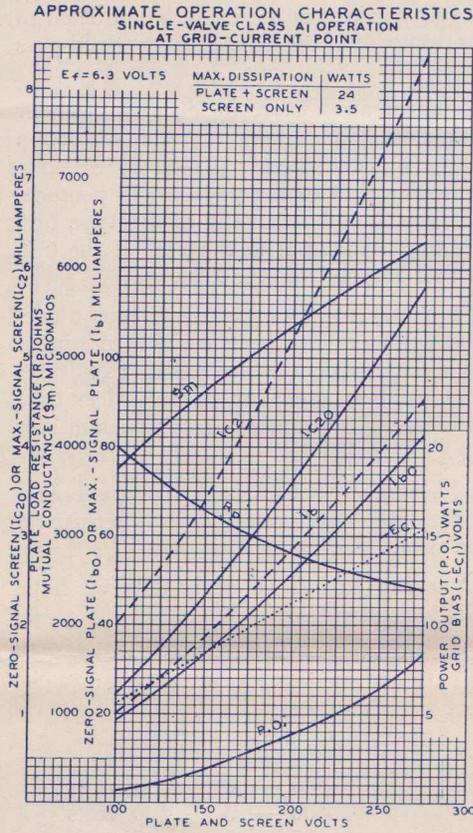
Fig. 3.



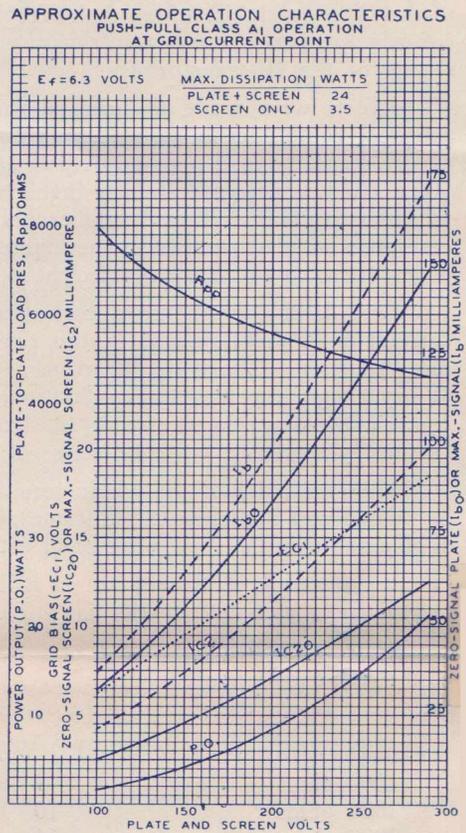
**EQUAL PLATE AND SCREEN VOLTAGE OPERATION OF THE 6L6**

In many applications it is convenient to use equal plate and screen voltages for the 6L6. The curves given have been calculated from ideal valve equations and will be found to be approximately correct over the range of voltages covered. Slight errors may be found to occur and the curves should be used only as working approximations.

RADIOTRON 6L6



RADIOTRON 6L6



The total plate and screen dissipation of the 6L6 should not exceed 24 watts and that of the screen itself should not exceed 3.5 watts. The screen dissipation increases with power output because of rectification in the screen circuit; plate dissipation decreases with increasing power output. Hence the maximum screen dissipation value should not be exceeded with full signal applied and the maximum plate and screen dissipation value should not be exceeded when no signal is applied.

**5 VALVE A.C. CIRCUIT FOR FIDELITY**

There has been much discussion for and against high-fidelity receivers. In any receiver claiming fidelity, there are two essential features to be considered; the first is harmonic distortion and the second is frequency range. Experiments have proved that it is possible to obtain in a simple radio receiver as low a degree of harmonic distortion as is given by complicated multi-valve receivers coming within the standard specification of "High Fidelity Receivers", in fact it is found that the reduction of harmonic distortion can be much more easily accomplished with a smaller number of valves than with the more complicated circuits. It has also been found that if the audio frequency range is not required to be linear, up to the normally accepted lower limit of 7,500 cycles per second, many difficulties are removed.

In this Bulletin a circuit is given for a simple A.C. Receiver of fairly conventional design which has an audio frequency range limited by the side-band cutting of the IF channel. The high audio frequency response may therefore be adjusted to cover a medium or narrower range as determined by the coupling or band-pass setting of the IF transformers.

Efforts were made to bring down the harmonic distortion occurring under practical conditions to an extremely low value. It was found that the distortion occurred mostly in a pentode output stage, this was therefore replaced by a triode (type 2A3) which gave slightly higher output than that of the popular 42 pentode. In order to obtain sufficient grid excitation it was found necessary to use type 6C6 resistance coupled pentode as the audio amplifier. An input to the grid of the 6C6 of less than 0.3 volt RMS, is sufficient to give full output from the 2A3.

Considerable harmonic distortion is frequently found to occur in the diode-detector and A.V.C. system. In this circuit precautions have been taken to minimise this distortion. The total distortion of this circuit under any practical conditions of input signal, percentage modulation, or of loud speaker impedance is less than 7%. With conventional circuits the harmonic distortion under the same conditions frequently reaches a value in excess of 30%.

The sensitivity of the whole receiver with iron core IF transformers averages between 4 and 5 microvolts (absolute) over the broadcast band and good sensitivity is obtainable on the short wave band with the same circuit.

Investigation of this circuit is still proceeding and at an early date we hope to give more complete details and individual measurements.

The circuit diagram is self-explanatory except that the resistance of the field coil (FC) and the secondary voltage of the transformer (T) are not given. The following values are given for three different field wattages.

FIELD COIL	FIELD WATTS	TRANSFORMER
1000 ohms	7	385 — 0 — 385 volts
1500 ohms	10	400 — 0 — 400 volts
2000 ohms	14	425 — 0 — 425 volts

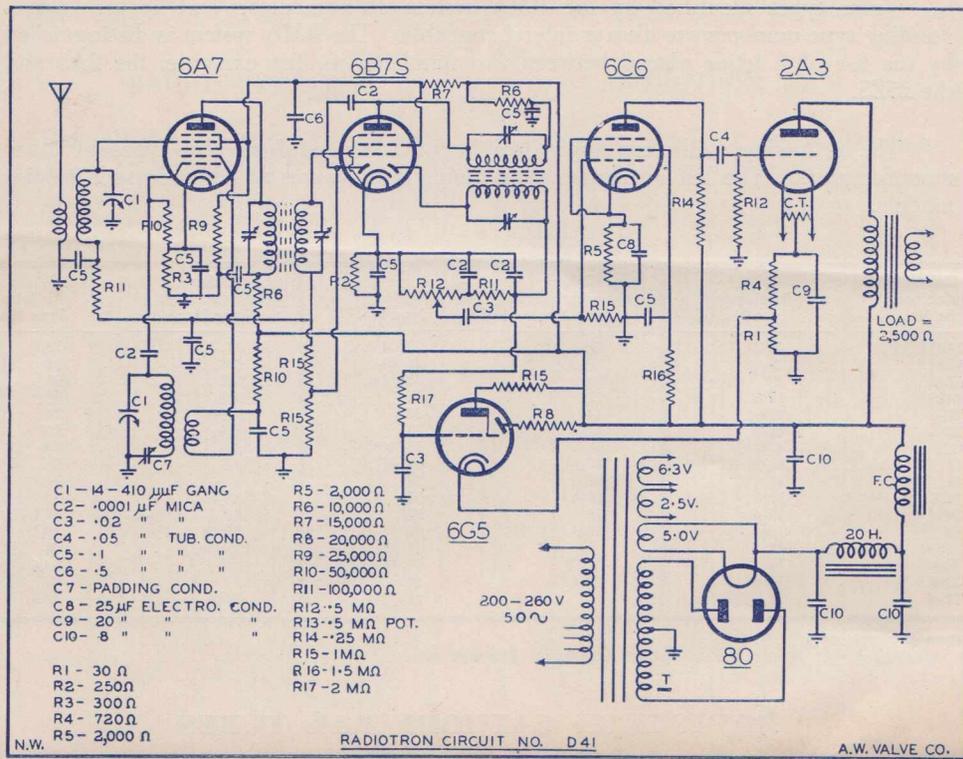
Radiotron 6G5 is shown in the circuit in accordance with the method described in Radiotronics Technical Bulletin No. 70. With this arrangement the 6G5 will respond to very weak signals and it was found that perceptible deflection was given with a carrier input of 100 microvolts. Complete closure of the gap occurred with a signal input of 20,000 microvolts. This particular arrangement appears to be very well suited to normal applications and overlapping will not normally occur even on strong local stations. The sensitivity of the 6G5 is sufficiently good to be used on the reception of weak stations and short wave stations.

The 6G5 may be omitted if desired without any change of circuit.

## TONAL BALANCE AT LOW VOLUME

When a radio receiver or amplifier is adjusted to give correct tonal balance on full volume, it is found that at very low volume the response is lacking in bass and also to a less extent in highs. This effect is due not to the amplifier but to a characteristic of the human ear and if correct tonal balance is required at all volumes it is necessary to use some form of compensation which will give additional

CIRCUIT OF A.C. RECEIVER



bass response at low volume. This may be accomplished automatically through a filter circuit operated through the volume control setting or it may be manual in the form of a "bass boost" control. The necessity for such an addition becomes more apparent when the power output of the amplifier is greater than about 5 watts. Information on particular forms of bass boosting, whether automatic or manual, is available on request.

**RADIOTRON 25L6 Beam Amplifier Valve for AC-DC Sets**

Announcement has been made of the release of Radiotron 25L6, which is similar in application to Radiotron 6L6 but has a heater operating at 25 volts 0.3 ampere. The power output is considerably in excess of that given by any other equivalent valve and will make the AC-DC set give a performance, as regards output, equal to or greater than that of most AC sets in use to-day. Stocks of the new valve are not expected until early in February 1937. Complete technical data will be given at the earliest opportunity.

**INTERCHANGEABLE TYPES OF VALVES**

In general, the last two digits of a three-digit receiving valve type number are the significant type designation. Thus, the Radiotron 27 is interchangeable with the C-327. In the case of a suffixed letter, the same rule applies; for example, the Radiotron 71A will replace the UX-171A of our manufacture and also the FY-71A or AG-71A, etc., of other manufacturers.

Exceptions to this rule include the following types, for which we do not have an interchangeable type: KR-20, KR-22, 57-AS, 59-B, G-84, 182B, 183, 401, 482A, 482B, 483, 484, 485, 985.

Valve types identified by the RMA system of numbering and having corresponding type numbers are always interchangeable. The RMA system is distinguished by the use of a letter placed between two numbers, as, for example, the 2A3 and the 25Z5.

The following Radiotron types can be interchanged for valve types of other manufacturers. The list also gives type numbers of valves which supersede earlier models.

Other Manufacturers' Type No.	Radiotron Type No.	Other Manufacturers' Type No.	Radiotron Type No.	Other Manufacturers' Type No.	Radiotron Type No.
2A3H	2A3	'39	39/44	95	2A5
6Z3	1-v	'39-A	39/44	98	84
6Z4	84	'44	39/44	585	50
14Z3	12Z3	'51	35	586	50
'00	00-A	64	36*	P-861	84
'01	01-A	64-A	36*	986	83†
'12	112-A	65	39/44*	AD	1-v
'13	80	65-A	39/44*	AF	82
'16	81	67	37*	AG	83
'16-B	81	67-A	37*	KR-1	1-v
'24	24-A	68	38*	KR-5	6A4
25S	1B5-25S	68-A	38*	KR-25	2A5
27HM	56	'71	71-A	KR-28	84
'36-A	36	'71-B	71-A	LA	6A4
'37-A	37	80M	83†	PZ	47
'38-A	38	'88	83†	PZH	2A5

\* In Automobile sets only.

† When receiver's power transformer will stand additional filament current.

### RADIOTRON CATHODE RAY TUBES

Complete data on all Radiotron Cathode Ray Tubes is available on request, but for convenient reference a table is shown giving the most important characteristics.

SCREEN	SCREEN DIA.	DEFLECTION	RADIOTRON TYPE No.	SPECIAL FEATURES	NETT PRICE
Greenish (general purpose)	9-inch	Electromagnetic	903		£58 10 0
	5-inch	Electrostatic-magnetic	904		£24 0 0*
		Electrostatic	905	Identical to 907 and 909 except for screen material.	£20 0 0*
		High-voltage electrostatic	912	Anode No. 2 max. 15,000 volts.	On application
		3-inch	Electrostatic	906	Identical to 908 and 910 except for screen material. Identical to 911 except for gun material.
	Electrostatic		911	Has gun unusually free from magnetisation effects; otherwise identical with 906.	£10 0 0
* Bluish (short persistence)	5-inch	Electrostatic	907	Similar to 905 and 909 except for screen material.	£23 10 0
	3-inch	Electrostatic	908	Identical to 906 and 910 except for screen material.	£10 0 0*
Bluish-white (long persistence)	5-inch	Electrostatic	909	Identical to 905 and 907 except for screen material.	£20 0 0
	3-inch	Electrostatic	910	Identical to 906 and 908 except for screen material.	£9 0 0*

\* Available from stock

## FLUORESCENT SCREEN CHARACTERISTICS

GREENISH SCREEN: (Types 903, 904, 905, 906, 911, 912).

The brightness drops to 1% after 0.057 second.

BLUISH SCREEN: (Types 907, 908).

The brightness becomes negligible in less than 30 microseconds.

BLUISH-WHITE (LONG PERSISTENCE) SCREEN: (Types 909, 910).

The brightness after 10 seconds is 0.018%.

NOTE ON PHOTOGRAPHIC APPLICATION:

All three types of screen are suited to photographic application either with orthochromatic or panchromatic plates. The exposure will depend on the sensitivity of the plates and also on the brilliance of the screen.

## EXPERIMENTERS' SECTION

### BEAM POWER VALVE FOR TRANSMITTING

#### *Radiotron 807*

The success of Radiotron 6L6 as an oscillator and frequency multiplier has opened the way for a special transmitting valve more suited to the wide range of requirements in amateur transmitters. Radiotron 807 is an indirectly heated cathode type incorporating directed Electron Beams. As the result of the use of electron beams the screen does not absorb appreciable power and at the same time the operation is similar to that of a pentode even though no suppressor grid is used. The extremely high power sensitivity makes this valve especially suited for use as a R.F. or A.F. amplifier and plate-modulated amplifier. The plate connection is brought out at the top of the glass bulb so as to obtain low grid-plate capacitance in R.F. applications. The 807 may be operated at maximum ratings in all classes of services at frequencies as high as 60 megacycles. The maximum plate dissipation is 21 watts. Radiotron 807 is equipped with a ceramic base.

Radiotron 807 may be used in any normal application of power amplifier pentodes, except for suppressor grid modulation. Where it is desired to use suppressor grid modulation a smaller valve such as the 6P6 may be modulated and used to drive the 807 as a linear class B amplifier. The output from a single 807 under these conditions will be 9 watts on telephony. Alternatively, due to the extremely low screen current, plate-modulation is practicable and very much more efficient than with any existing type of pentode valve. A power output of 17 watts (carrier) is obtained with a D.C. plate voltage of only 325 volts.

As an oscillator or Class C telegraphy amplifier the 807 gives a power output of 25 watts from a plate voltage of 400 volts. The driving power is only 0.18 watts.

Adequate shielding and isolation of the input and output circuits are necessary if optimum results are to be obtained. In some cases neutralisation may be necessary to prevent feed-back. A condenser of 0.1 microfarad between screen and cathode will be found necessary to by-pass radio frequency.

When operated as a plate-modulated class C amplifier, modulation of the screen voltage can be accomplished either by connecting the screen to a separate winding on the modulation transformer or by connecting it to a tap on the modulation transformer or choke through a blocking condenser. With the latter method an audio frequency choke should be connected in series with the screen supply lead. Control-grid bias for this service should preferably be obtained from a fixed source, although a combination of either grid leak and fixed supply or grid leak and cathode resistor may be also used.

Radiotron 807 may be used at frequencies higher than 60 megacycles with a reduction in rating. At 80 megacycles 75% of the maximum plate voltage and plate input may be used. With the grid connected to the plate through the shortest possible connection, the resonant frequency of the grid-plate circuit is approximately 155 megacycles. At this frequency the rating is reduced to 50% of the maximum rated plate voltage and plate input.

As an oscillator (crystal or self-excited), the 807 should be connected the same as in amplifier service. It is usually necessary where feed-back depends on the control-grid-to-plate capacity, to introduce external feed-back. This may be done by the use of a small condenser and not larger than two micromicrofarads connected between control grid and plate.

Complete technical data on operating conditions will be given at a later date. Brief characteristics are given below and further information is available on request. Enquiries should be addressed to Box 2516 BB, G.P.O., Sydney.

### RADIOTRON 807

#### TENTATIVE CHARACTERISTICS

Heater Voltage (A.C. or D.C.)	.....	6.3	Volts
Heater Current	.....	0.9	Ampere
Mutual Conductance (for plate current 72mA)	.....	6000	approx. Micromhos

#### DIRECT INTERELECTRODE CAPACITANCES

Grid-Plate (with external shielding)	.....	0.2 max.	$\mu\mu\text{f}$
Input	.....	11.6	$\mu\mu\text{f}$
Output	.....	5.6	$\mu\mu\text{f}$
Bulb	.....	ST-16	
Maximum Dimensions	.....	5 $\frac{3}{4}$ in. x 2 $\frac{1}{16}$ in.	
Cap (plate)	.....	Small Metal	
Base	.....	Medium 5-Pin Ceramic	
Socket Connections:			
1. Heater		4. Cathode	
2. Grid No. 2		5. Heater	
3. Grid No. 1		Cap. Plate	

#### MAXIMUM RATINGS

D-C Plate Voltage	.....	400	max. Volts
D-C Screen Voltage	.....	300	max. Volts
Plate Input (Class C. Telegraphy)	.....	40	max. Watts
Screen Input (Class C. Telegraphy)	.....	3.5	max. Watts
Plate Dissipation (Class C. Telegraphy)	.....	21	max. Watts

#### TYPICAL POWER OUTPUTS

Class AB 2 (2 valves)	.....	60	Watts
R.F. Amplifier (Class B. Telephony)	.....	9	Watts
Plate Modulated R.F. Power Amplifier	.....	17	Watts
R.F. Amplifier (Class C. Telegraphy)	.....	25	Watts

Radiotron 807: Nett Price - - - - £2/5/-.

Stocks are expected to arrive early in February, 1937.