

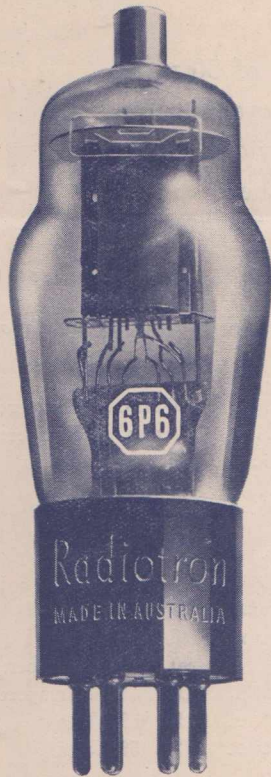
RADIOTRONICS

AMALGAMATED WIRELESS VALVE COMPANY LIMITED

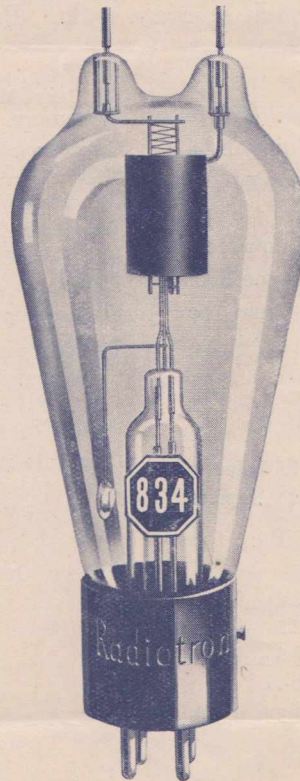


EXPERIMENTERS' BULLETIN No. 9

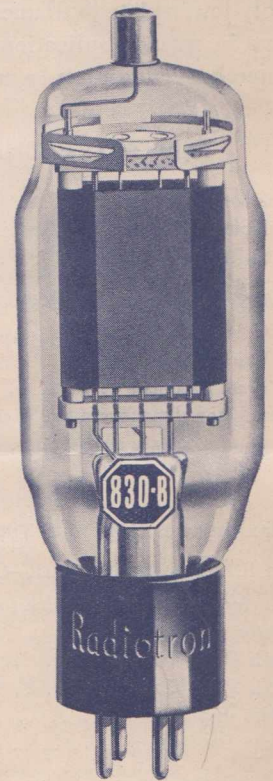
ISSUED 20TH MAY, 1936



RADIOTRON 6P6



RADIOTRON 834



RADIOTRON 830B

In this issue

NEW RADIOTRON TRANSMITTING VALVES

834 : Triode for ultra-high frequencies
(50 watts plate dissipation)

804 : Pentode (40 watts plate dissipation)

830B : Triode (60 watts plate dissipation)

6P6 : Pentode (10 watts plate dissipation), Circuit and details of operation

803 : Pentode (125 watts plate dissipation)

866 : Price Reduction

RADIOTRON 834

Triode R. F. Power Amplifier and Oscillator for Ultra-High Frequencies

Radiotron 834 is a triode with maximum plate dissipation of 50 watts at frequencies up to 100 megacycles and 25 watts at 350 megacycles. The grid and plate are supported from the top of the bulb by individual leads which are brought out through separate seals. Price £6/10/- net.

In application and bulb size Radiotron 834 is similar to type 800, but the plate dissipation is greater and the construction has been designed for improved ultra-high frequency operation. Type 834 has a lower amplification factor and considerably lower plate to filament capacity than type 800, but in many applications the two types may be interchanged with only minor adjustments.

TENTATIVE CHARACTERISTICS

Filament Voltage (A.C. or D.C.)	7.5 Volts
Filament Current	3.25 Amperes
Amplification Factor	10.5

Direct Interelectrode Capacitances (Approx.):

Grid-Plate	2.6 $\mu\mu\text{f}$
Grid-Filament	2.2 $\mu\mu\text{f}$
Plate-Filament	0.6 $\mu\mu\text{f}$

Bulb (for dimensions, see diagram) S-21

Base (for socket connections, see diagram), Medium, 4-Pin, Bayonet.

Maximum Ratings and Typical Operating Conditions

As R.F. POWER AMPLIFIER—CLASS B TELEPHONY.

Carrier conditions per valve for use with a max. modulation factor of 1.0.

D.C. Plate Voltage	1250 max. Volts
D.C. Plate Current	100 max. Milliamperes
Plate Input	75 max. Watts
Plate Dissipation	50 max. Watts

Typical Operation:

Filament Voltage (A.C.),	7.5	7.5	7.5	Volts
D.C. Plate Voltage	750	1000	1250	Volts
D.C. Grid Voltage (Approx.)	-70	-90	-115	Volts
Peak R.F. Grid Voltage (Approx.)	90	100	115	Volts
D.C. Plate Current	50	50	50	Milliamperes
D.C. Grid Current (Approx.)**	1	0.5	0	Milliampere
Driving Power (Approx.)** ^o	3.3	3.1	3	Watts
Power Output (Approx.),	11	16	20	Watts

As PLATE-MODULATED R.F. POWER AMPLIFIER—CLASS C TELEPHONY.

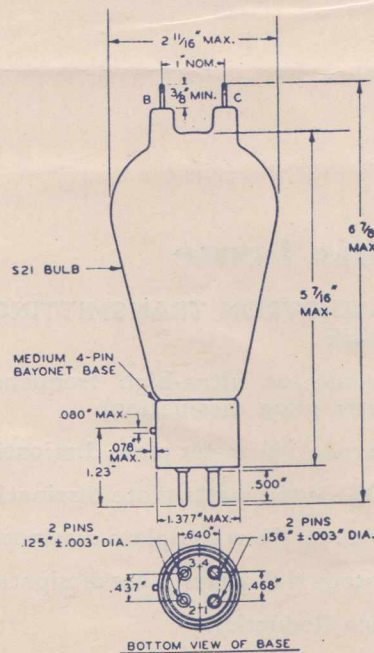
Carrier conditions per valve for use with a max. modulation factor of 1.0.

D.C. Plate Voltage	1000 max. Volts
D.C. Plate Current	100 max. Milliamperes
D.C. Grid Current	20 max. Milliamperes
Plate Input	100 max. Watts
Plate Dissipation	35 max. Watts

Typical Operation:

Filament Voltage (A.C.)	7.5	7.5	Volts
D.C. Plate Voltage	750	1000	Volts
D.C. Grid Voltage (Approx.)	-290	-310	Volts
Peak R.F. Grid Voltage (Approx.)	415	435	Volts
D.C. Plate Current	90	90	Milliamperes
D.C. Grid Current (Approx.)**	20	17.5	Milliamperes
Driving Power (Approx.)**	7.5	6.5	Watts
Power Output (Approx.)	42	58	Watts

OUTLINE DRAWING



Radiotron 834 continued.

As R.F. POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY.

Key-down conditions per valve without modulation‡.

D.C. Plate Voltage	1250 max. Volts
D.C. Plate Current	100 max. Milliamperes
D.C. Grid Current	20 max. Milliamperes
Plate Input	125 max. Watts
Plate Dissipation	50 max. Watts

Typical Operation:

Filament Voltage (A.C.),	7.5	7.5	7.5	Volts
D.C. Plate Voltage	750	1000	1250	Volts
D.C. Grid Voltage (Approx.)	-175	-200	-225	Volts
Peak R.F. Grid Voltage				
(Approx.)	300	325	350	Volts
D.C. Plate Current	90	90	90	Milliamperes
D.C. Grid Voltage (Approx.)**	20	17.5	15	Milliamperes
Driving Power (Approx.)**	5.5	5	4.5	Watts
Power Output (Approx.),	42	58	75	Watts

** Subject to wide variations depending on the impedance of the load circuit. High-impedance load circuits require more grid current and driving power to obtain the desired output. Low-impedance circuits need less grid current and driving power, but plate-circuit efficiency is sacrificed. The driving stage should be capable of delivering considerably more than the required driving power.

° At crest of audio-frequency cycle with modulation factor of 1.0.

‡ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

INSTALLATION

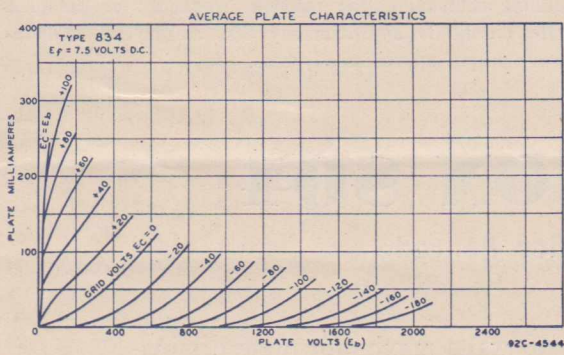
Connections to the grid and plate leads must be flexible enough so that normal expansion will not place a strain on the glass at the seals, yet heavy enough to carry the high circulating r.f. current. It is also necessary to provide a means for cooling the lead tips and their seals. A recommended method of doing this is to increase the radiating surface of each lead by means of a copper clamp connector having a cross-sectional area of at least 3/4 square inch. See diagram. Each lead wire should be connected to its copper clamp before the clamp is placed on the terminal tip. The clamp should be slightly sprung so that it can easily be slipped over its terminal. When the clamp is in place, carefully tighten the smaller bolt to insure good electrical contact. Connections should never be soldered directly to the valve terminal tips as the heat of the soldering operation may result in the cracking of the lead seals. The valve terminal tips should not be used to support coils, condensers, chokes, or other circuit parts.

The bulb becomes very hot during continuous operation so that free circulation of air should be provided. When the 834 is operated at frequencies higher than 60 megacycles, forced cooling of the valve is recommended. This may be done by means of a small electric fan. Under any condition of operation the maximum bulb temperature should not exceed 175°C (347°F) as measured by a thermometer placed against the glass at the top of the valve, midway between the grid and plate leads. Care should be taken that the bulb does not come in contact with any metallic object nor be subjected to the spray of any liquid. The installation of all wires and connections should be made so that they will not be close to or touch the bulb in order to avoid puncture of the glass due to peak voltage effects.

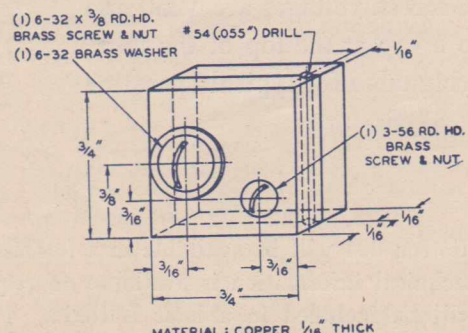
APPLICATION

As a Class B radio-frequency amplifier, Radiotron 834 should be used as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS. In this service the plate is supplied with unmodulated d.c. voltage and the grid is excited by r.f. voltage modulated at audio frequency in one of the preceding stages. It is important to note that in this service the plate dissipation is greatest when the carrier is unmodulated. The plate dissipation, therefore, should not exceed 50 watts for unmodulated carrier conditions. When the 834 is used as a Class B r.f. amplifier, plate voltage as high as 1250 volts may be used provided the d.c. plate current is reduced so that the maximum plate-input rating of 75 watts is not exceeded. Likewise, the d.c. plate current may be raised to 100 milliamperes, provided the plate voltage is reduced so that the maximum input rating is not exceeded. Grid bias for the 834 in Class B service should be obtained from a battery or other d.c. source of good regulation. It should not be obtained from a high-resistance supply such as a grid leak, nor from a rectifier, unless the latter has exceptionally good voltage regulation.

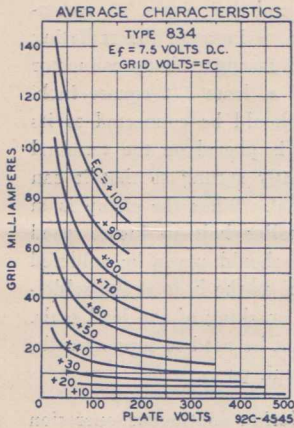
As a plate modulated Class C radio-frequency amplifier, the 834 should be used as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS. Grid bias for this service may be obtained from a grid leak of about 15000 ohms (15-watt size), from a suitable combination of grid leak and fixed supply of good regulation, or



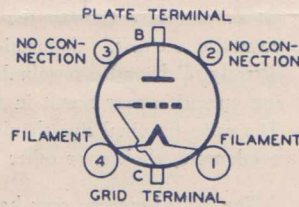
RADIATING CONNECTOR



from a cathode-bias resistor suitably by-passed for audio and radio frequencies. The combination method is particularly desirable because distortion effects are minimized by bias-supply compensation. Since the grid-bias voltage for Class C service is not particularly critical, correct adjustment may be obtained with values differing widely from those indicated for this service.



Top view of Radiotron 834 Socket Connections.



As a Class C radio-frequency amplifier and oscillator for telegraph service, Radiotron 834 may be used as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS. Grid bias for this service may be obtained from a grid leak of 10000 ohms, from a battery, from a rectifier, or from a cathode-bias resistor (preferably variable) suitably by-passed for radio frequencies. The cathode-bias method is advantageous, due to the fact the grid bias is automatically regulated in direct proportion to the sum of the plate and grid current and that there is little chance of the plate current becoming dangerously high, even if the r.f. grid excitation is removed. The grid-leak bias method has the advantage of simplicity and of

automatically biasing the grid in proportion to the excitation voltage available. Special care must be observed with the use of the latter system because the accidental removal of the excitation will cause the grid bias to fall to zero so that the plate current, and consequently the plate dissipation, will rise to excessive values. The use of a protective device designed to open the plate circuit on excessive rises of plate current will minimize the danger of overload. Since the grid-bias voltage for Class C service is not particularly critical, correct adjustment may be obtained with widely different values.

The d.c. grid current will vary with individual valves. Under any condition of operation, the maximum value should not exceed 20 milliamperes.

Radiotron 834 may be operated at maximum ratings in all classes of service at frequencies as high as 100 megacycles. The valve may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised (other maximum ratings are the same as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS). The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used at 100, 170 and 350 Mc for any class of service. Special attention should be given to adequate ventilation and the maintenance of normal ambient temperatures at these frequencies.

Frequency	100	170	350	Megacycles
Percentage of Max. Rated Plate Voltage, and Plate Input ..	100 max.	75 max.	50 max.	Per Cent.

With the grid connected to the plate through the shortest possible connection, the resonant frequency of the grid-plate circuit is approximately 500 megacycles and the power output approximately zero.

RADIOTRON 804

R. F. Power Amplifier Pentode

Radiotron 804 is a Pentode rated at 40 watts maximum plate dissipation and suitable for suppressor grid modulation. The filament takes 7.5 volts 3.0 amperes and the maximum plate and screen voltages are 1250 and 300 respectively. The plate is brought out to a cap at the top of the bulb. The carrier power output is given in the following table for typical operating conditions at maximum plate voltages. Price £7/5/- net.

APPLICATION

Carrier Output

R.F. Amplifier—Class B Telephony	16 Watts
Suppressor-modulated Amplifier—Class C	21 Watts
Grid-modulated Amplifier—Class C	21 Watts
Plate-modulated Amplifier—Class C	50 Watts
R.F. Amplifier and Oscillator—Class C Tele-	
graphy	80 Watts

Radiotron 804 will be available in a few weeks. Full technical information is available on request and will be included in a later Bulletin. Price £7/5/- net.

RADIOTRON 830 B

Triode Class B Modulator, R. F. Amplifier, Oscillator.
60 Watts Maximum Plate Dissipation

In Radiotron 830-B the plate lead is brought out at the top of the bulb. As R.F. amplifier or oscillator the 830-B can be operated at maximum ratings at frequencies up to 15 megacycles, at 75% of maximum up to 30 megacycles and 50% of maximum up to 60 megacycles. With the grid connected to the plate through the shortest possible connection, the resonant frequency of the grid-plate circuit is approximately 90 megacycles and the power output approximately zero.

When two or more Radiotron 830-B's are operated in parallel, a non-inductive resistance of 10 to 100 ohms should be placed in series with the grid lead of each valve, close to the socket terminal, to prevent parasitic oscillations. Price £4/5/- net.

TENTATIVE CHARACTERISTICS

Filament Voltage (A.C. or D.C.)	10 Volts
Filament Current	2 Amperes
Amplification Factor	25
Direct Interelectrode Capacitances (Approx.):	
Grid Plate	11 $\mu\mu\text{f}$
Grid Filament	5 $\mu\mu\text{f}$
Plate Filament	1.8 $\mu\mu\text{f}$
Bulb (for dimensions, see diagram)	T-16
Cap (for connections, see diagram)	Small Metal
Base (for socket connections, see diagram)	Medium 4-Pin Bayonet.

Maximum Ratings and Typical Operating Conditions

As A.F. POWER AMPLIFIER AND MODULATOR—CLASS B.

D.C. Plate Voltage	1000 max. Volts
Max. Signal D.C. Plate Current*	150 max. Milliamperes
Max. Signal Plate Input*	150 max. Watts
Plate Dissipation*	60 max. Watts

Typical Operation—2 Valves:

Unless otherwise specified, values are for 2 valves.

Filament Voltage (A.C.)	10	10	Volts.
D.C. Plate Voltage	800	1000	Volts
D.C. Grid Voltage (Approx.)†	-27	-35	Volts
Peak A.F. Grid-to-Grid Voltage (Approx.)	250	270	Volts
Zero-Sig. D.C. Plate Current	20	20	Milliamperes
Max-Sig. D.C. Plate Current	280	280	Milliamperes
Load Resistance (Per valve)	1500	1900	Ohms
Effective Load Res. (Plate-to-plate)	6000	7600	Ohms
Max-Sig. Driving Power (Approx.)	5	6	Watts
Max-Sig. Power Output (Approx.)	135	175	Watts

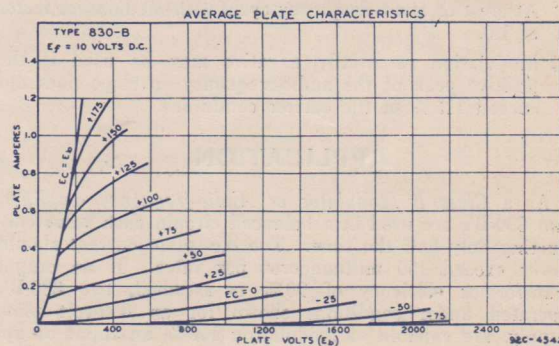
As R.F. POWER AMPLIFIER—CLASS B TELEPHONY.

Carrier conditions per valve for use with a max. modulation factor of 1.0.

D.C. Plate Voltage	1000 max	Volts
D.C. Plate Current	100 max.	Milliamperes
Plate Input	90 max.	Watts
Plate Dissipation	60 max.	Watts

Typical Operation:

Filament Voltage (A.C.)	10	10	Volts
D.C. Plate Voltage	800	1000	Volts
D.C. Grid Voltage (Approx.)†	-27	-35	Volts
Peak R.F. Grid Voltage (Approx.)	85	85	Volts
D.C. Plate Current	95	85	Milliamperes
D.C. Grid Current (Approx.)**	7	6	Milliamperes
Driving Power (Approx.)**	9	6	Watts
Power Output (Approx.)	23	26	Watts



As PLATE-MODULATED R.F. POWER AMPLIFIER—CLASS C TELEPHONY.

Carrier conditions per valve for use with a max. modulation factor of 1.0.

D.C. Plate Voltage	800 max. Volts
D.C. Grid Voltage	-300 max. Volts
D.C. Plate Current	100 max. Milliamperes
D.C. Grid Current	30 max. Milliamperes
Plate Input	80 max. Watts
Plate Dissipation	40 max. Watts

Typical Operation:

Filament Voltage (A.C.)	10	10	10	Volts
D.C. Plate Voltage	600	800		Volts
D.C. Grid Voltage (Approx.)	-140	-150		Volts
Peak R.F. Grid Voltage (Approx.)	255	265		Volts
D.C. Plate Current	95	95		Milliamperes
D.C. Grid Current (Approx.)**	30	20		Milliamperes
Driving Power (Approx.)**	7	5		Watts
Power Output (Approx.)	38	50		Watts

As R.F. POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY.

Key-down conditions per valve without modulation‡.

D.C. Plate Voltage	1000 max. Volts
D.C. Grid Voltage	-300 max. Volts
D.C. Plate Current	150 max. Milliamperes
D.C. Grid Current	30 max. Milliamperes
Plate Input	150 max. Watts
Plate Dissipation	60 max. Watts

Typical Operation:

Filament Voltage (A.C.)	10	10	10	Volts
D.C. Plate Voltage	600	800	1000	Volts
D.C. Grid Voltage (Approx.)	-95	-105	-110	Volts
Peak R.F. Grid Voltage (Approx.)	235	245	250	Volts
D.C. Plate Current	140	140	140	Milliamperes
D.C. Grid Current (Approx.)**	30	30	30	Milliamperes
Driving Power (Approx.)**	7	7	7	Watts
Power Output (Approx.)	45	70	90	Watts

* Averaged over any audio-frequency cycle.

† Grid voltages are given with respect to the mid-point of filament operated on a.c. If d.c. is used, each stated value of grid voltage should be decreased by 3.75 volts and be referred to the negative end of the filament.

** Subject to wide variations depending on the impedance of the load circuit. High-impedance load circuits require more grid current and driving power to obtain the desired output. Low-impedance circuits need less grid current and driving power, but plate-circuit efficiency is sacrificed. The driving stage should be capable of delivering considerably more than the required driving power.

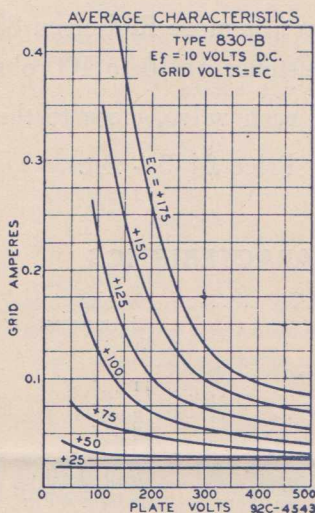
° At crest of audio-frequency cycle with modulation factor of 1.0.

‡ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

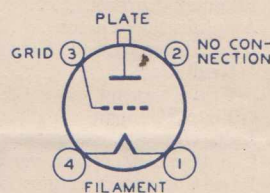
APPLICATION

As a Class B Modulator or Audio-frequency amplifier, two 830-B's are used in a balanced circuit, each valve conducting only half the time. The d.c. plate current never exceed 150 milliamperes per valve. If an output transformer efficiency of 90% is assumed, two 830-B's operated under conditions shown for an 800-volt plate supply, are capable of modulating 100% an input of approximately 240 watts to a Class C r.f. power amplifier. The

input transformer should be designed to give good frequency response when operated into an open circuit, such as that represented by the grid circuit of the Class B stage when the signal amplitude is small. It should also be designed to handle the required input power for a strong signal. The output transformer should be designed so that the resistance load presented by the modulated Class C amplifier is reflected as a plate-to-plate load of 6000 ohms in the Class B stage for the 800-volt conditions. Since two 830-B's will modulate 240 watts, a convenient Class C amplifier would be one operating at 800 volts and 300 milliamperes. These conditions represent a resistance of approximately 2670 ohms. The ratio of the output transformer is then $\sqrt{6000 \div 2670}$, or 1.5 to 1, step-down. The transformer should be designed with a core sufficiently large to avoid saturation effects, which would impair the quality of the output. If the secondary is to carry the d.c. plate current of the modulated amplifier, the core should be made larger and include an air gap to compensate for the d.c. magnetization current. Grid bias for the 830-B in Class B a.f. service should be obtained from a battery or other d.c. source of good regulation. It should not be obtained from a high-resistance supply such as a grid leak, nor from a rectifier, unless the latter has exceptionally good voltage regulation.



Top view of Radiotron 830B Socket Connections



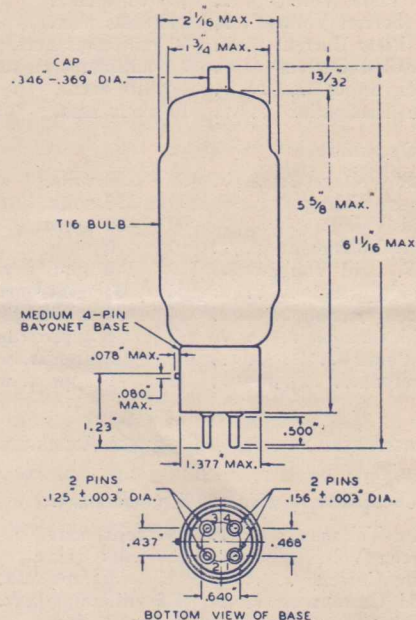
As a Class B radio-frequency amplifier, RCA-830-B should be used as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS. In this service the plate is supplied with unmodulated d.c. voltage and the grid is excited by r.f. voltage modulated at audio frequency in one of the preceding stages. It is important to note that for Class B r.f. operation the plate dissipation is greatest when the carrier is unmodulated. It is necessary, therefore, that the plate dissipation should not exceed 60 watts for unmodulated conditions. Grid bias for Class B r.f. service should be obtained in the same manner as for Class B a.f. service. When the 830-B is used as a Class B r.f. amplifier, plate voltage as high as 1000 volts may be used, provided the d.c. plate current is reduced so that the maximum plate-input rating of 90 watts is not exceeded. Likewise, the d.c. plate current may be raised to 100 milliamperes, provided the plate voltage is reduced so that the maximum input rating is not exceeded.

As a plate-modulated Class C radio-frequency amplifier, the 830-B should be used as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS. Grid bias for this service may be obtained from a grid leak

of about 5000 ohms (10-watt size), from a suitable combination of grid leak and fixed supply of good regulation, or from a cathode-bias resistor suitably by-passed for audio and radio frequencies. The combination method is particularly desirable because distortion effects are minimized by bias-supply compensation. Since the grid-bias voltage for Class C service is not particularly critical, correct adjustment may be obtained with values differing widely from those indicated for this service.

As a Class C radio-frequency amplifier and oscillator for telegraph service, RCA-830-B may be used as shown under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS. Grid bias for this service may be obtained from a grid leak of 5000 ohms, from a battery, from a rectifier, or from a cathode-bias resistor (preferably variable) suitably by-passed for radio frequencies. The cathode-bias method is advantageous due to the fact that the grid bias is automatically regulated in direct proportion to the sum of the plate and grid current and that there is little chance of the plate current becoming dangerously high, even if the r.f. grid excitation is removed. The grid-leak bias method has the advantage of simplicity and of automatically biasing the grid in proportion to the excitation voltage available. Special care must be observed with the use of the latter system because the accidental removal of the excitation will cause the grid bias to fall to zero so that the plate current, and consequently the plate dissipation, will rise to excessive values. The use of a protective device designed to open the plate circuit on excessive rises of plate current will minimize the danger of overload. Since the grid-bias

voltage for Class C service is not particularly critical, correct adjustment may be obtained with widely different values.



The d.c. grid current will vary with individual valves. Under any condition of operation, the maximum value should not exceed 30 milliamperes.

RADIOTRON 6P6

New Radiotron R. F. Power Pentode Suitable for Suppressor-Grid Modulation

Radiotron 6P6 is an Australian-made low-power pentode transmitting valve intended primarily for use as a suppressor-grid modulated R.F. power amplifier (telegraphy), crystal or electron-coupled oscillator, and frequency multiplier. The plate connection is brought to the top of the bulb in accordance with standard practice, giving reduced grid-plate capacity, and simplifying the layout. In general, it will be found advisable to take the precaution of neutralising the grid-plate capacity.

The bulb and base are similar to type 42, and the base connections are similar except that the suppressor in the 6P6 replaces the plate of the 42. Price 16/- net.

TENTATIVE CHARACTERISTICS

Heater voltage	6.3 volts.
Heater current	0.7 amps.
Grid-plate capacity	0.7 $\mu\mu\text{f.}$
Input capacity	8 $\mu\mu\text{f.}$
Output capacity	12 $\mu\mu\text{f.}$
Bulb	ST.14.
Cap	Small metal.
Base	Medium 6 pin.

Maximum Ratings and Typical Operating Condition

As R.F. POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY (Key down conditions).

D.C. Plate Voltage	..	450 volts max.
D.C. Screen Voltage	..	200 volts max.
D.C. Plate Current	..	50 milliamps max.
D.C. Grid Current	..	7.5 milliamps max.
Screen Input	..	4 watts max.
Plate Dissipation	..	10 watts max.

Typical Operation.

D.C. Plate Voltage	..	450	250 volts.
D.C. Screen Voltage	..	200	150 volts.
D.C. Grid Voltage	..	-90	-80 approx. volts.
Suppressor Voltage	..	0	0
Peak R.F. Grid Voltage	..	150	140 approx. volts.
D.C. Plate Current	..	45	34 milliamps.
D.C. Screen Current	..	14	18 milliamps.
D.C. Grid Current	..	2	4 approx. milliamps.
Driving Power	..	0.7	1.3 approx. watts.
Power Output	..	12	5 approx. watts.

As SUPPRESSOR MODULATED R.F. POWER AMPLIFIER—CLASS C TELEPHONY.

Carrier Conditions to give 100% modulation.

D.C. Plate Voltage	..	450 volts max.
D.C. Screen Voltage	..	150 volts max.
D.C. Plate Current	..	25 milliamps max.
D.C. Grid Current	..	7.5 milliamps max.
Screen Input	..	4 watts max.
Plate Dissipation	..	10 watts max.

Typical Operation.

D.C. Plate Voltage	..	450	250 volts.
D.C. Screen Voltage	..	150	150 volts.
D.C. Grid Voltage	..	-90	-90 approx. volts.

D.C. Suppressor Voltage	..	-45	-20 approx. volts.
Peak R.F. Grid Voltage	..	130	130 approx. volts.
Peak A.F. Suppressor Voltage	..	65	30 approx. volts.
D.C. Plate Current	..	21	19 milliamps.
D.C. Grid Current	..	2.5	4.2 approx. milliamps.
D.C. Screen Current	..	17	22.5 milliamps.
Driving Power	..	0.5	1.0 approx. watts.
Carrier Power Output	..	3.0	1.2 approx. watts.

As PENTODE FREQUENCY DOUBLER.

Typical Operation.

D.C. Plate Voltage	..	450 volts.
D.C. Screen Voltage	..	200 volts.
D.C. Grid Voltage	..	-120 approx. volts.
D.C. Plate Current	..	40 milliamps.
D.C. Screen Current	..	18 milliamps.
D.C. Grid Current	..	2 approx. milliamps.
Power Output (2nd Harmonic)	..	8 approx. watts.

As TRIODE FREQUENCY DOUBLER.

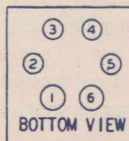
(G2 and G3 tied to G1 acting as control grid.)

Typical Operation.

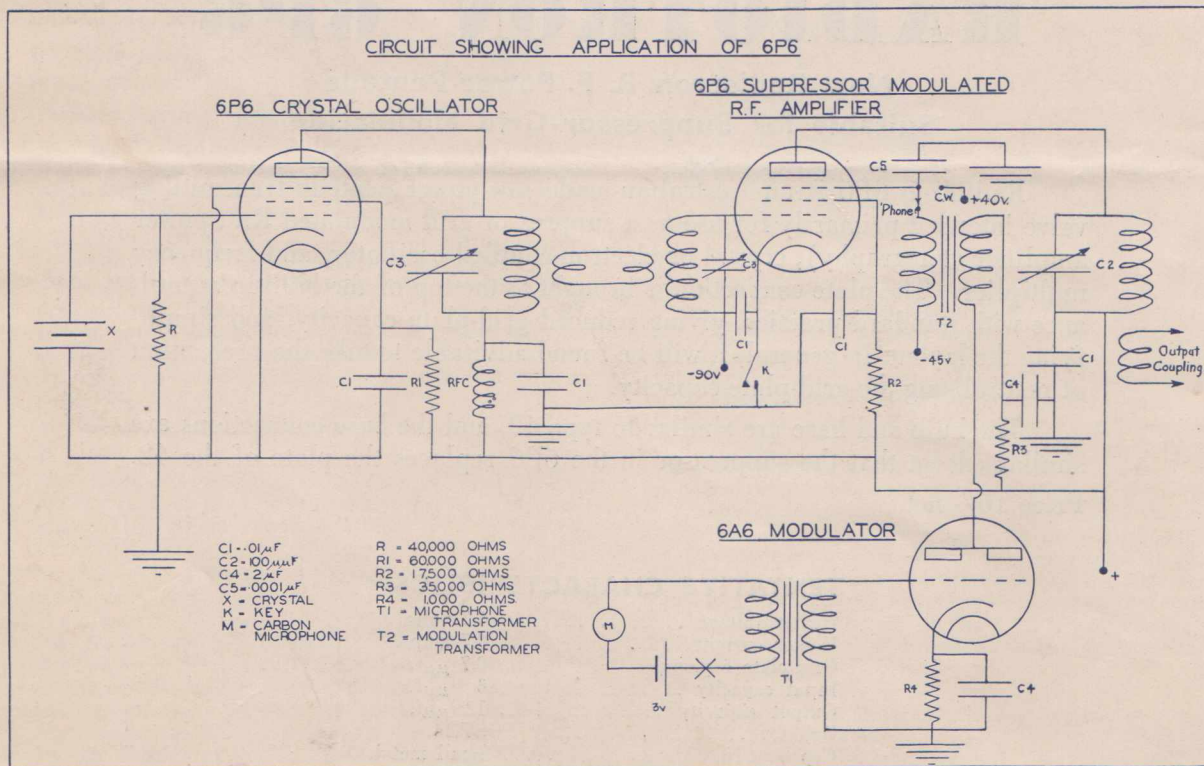
D.C. Plate Voltage	..	450 volts.
D.C. Grid Voltage	..	-25 approx. volts.
D.C. Plate Current	..	40 milliamps.
D.C. Grid Current	..	18 approx. milliamps.
Power Output (2nd Harmonic)	..	8 approx. watts.

Bottom View of Socket Connections.

- Pin 1—Heater.
- Pin 2—Suppressor.
- Pin 3—Screen.
- Pin 4—Control grid.



- Pin 5—Cathode.
- Pin 6—Heater.
- Top Cap—Plate.



INSTALLATION

The heater of the 6P6 may be operated from A.C. or D.C. In circuits where the cathode operates at earth potential, it should be tied to the centre-tap of the heater supply for A.C. and the negative end of the heater for D.C. supply. In electron-coupled circuits, where the cathode is above earth potential, the heater should not be tied to the cathode but earthed. The peak voltage between heater and cathode should never exceed 90 volts.

In setting up any particular circuit the limitations of plate dissipation (difference between input and output), plate voltage, and plate current, should not be exceeded.

The screen voltage may be obtained from a separate source, a potentiometer, or through a series resistor in the plate supply. A potentiometer supply is recommended.

Suppressor voltage for the 6P6 may be obtained from a battery or potentiometer connected across the main D.C. high-tension supply. Both methods provide ample regulation for cases where the suppressor draws current.

Adequate shielding between input and output circuits is necessary. In cases where the shielding is efficient, neutralisation of the grid-plate capacity will be found unnecessary.

Great care should be taken in making circuit adjustments, as under certain conditions high screen and plate currents may flow, which are par-

ticularly damaging to the screen. It is advisable to use a 3000 ohm. resistor in series with the common negative high-voltage lead during adjustments.

APPLICATION

As a Class C R.F. Amplifier or Oscillator for telegraphy, typical operating conditions and maximum ratings are shown above. Grid bias may be obtained from any of the conventional methods, viz., (i) From a grid leak of 50000 to 20000 ohms. depending on the available grid excitation, (ii) from a battery, (iii) Rectifier, (iv) a cathode bias resistor preferably variable, and suitably by-passed for both audio and radio frequencies. The cathode-bias method has the advantage of automatically protecting the valve when the grid excitation is accidentally removed or circuits are detuned. The grid leak method has the advantage of simplicity and of automatically adjusting the bias in accordance with the excitation available. The grid bias voltage is not particularly critical for optimum results with this valve. The working D.C. grid current will vary accordingly.

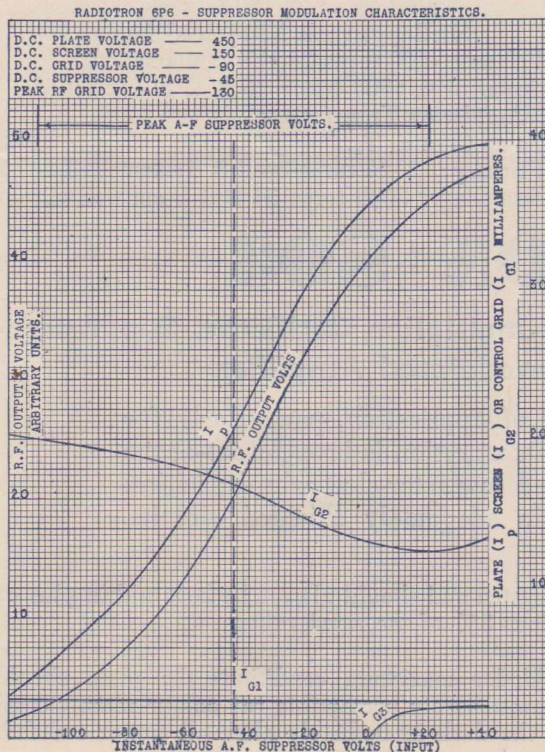
A slight advantage will be obtained by operating the suppressor at a positive voltage up to 40 volts max. Reduced input to the screen results, together with a small increase in plate circuit efficiency.

As a suppressor modulated Class C R.F. amplifier, typical operating conditions will be found in the characteristic data. Grid bias may be obtained by the same methods as used for Class C R.F. amplifier service. Suppressor bias is best obtained from a potentiometer on the main D.C. high voltage supply. It may also be obtained from battery supply.

The operation of a suppressor-modulated self-excited oscillator differs slightly from that of an amplifier, and for a modulated oscillator it will be found that optimum results are obtained by reducing the suppressor D.C. bias and peak A.F. voltage to approx. two-thirds of the values shown under amplifier operating conditions. Frequency modulation in the case of a modulated oscillator is reduced to a practically negligible quantity.

As an R.F. frequency doubler, the 6P6 may be operated as a pentode or alternatively as a high-mu triode by connecting the three grids together to form a control grid. Typical operating conditions are shown. The use of the valve under two different conditions as a frequency doubler, enables a selection to be made for optimum coupling to preceding and succeeding stages. Operation as control grid modulated amplifier is permissible but is not considered advisable in view of the improved results obtained with suppressor grid modulation.

Other applications of the 6P6 are possible, and enquiry will be welcome along these lines.



An Inexpensive Telephone Transmitter, Using Radiotron 6P6 and Suppressor-Grid Modulation

The suppressor grid originally added to the screen-grid tetrode for the purpose of reducing the effect of secondary emissions, has provided a ready means of controlling the valve characteristics. This control is now used in low-power valves for the modulation of radio-frequency power amplifiers and oscillators.

While normal operation of a pentode as R.F. power amplifier or oscillator requires for maximum output that the suppressor be at cathode potential or slightly positive, when modulation is to be applied, the valve must operate under this optimum condition at its instantaneous peak output. For this reason, the suppressor is biased negatively until the R.F. output is one-quarter that to be obtained on modulation peaks (i.e., one-half the peak value of R.F. output current). The unmodulated plate efficiency is thereby reduced to one-half the normal value (approx. 30%) and D.C. plate current input falls to half the normal value. The screen input will increase. This means that when 100% modulation is applied (the suppressor grid being at the positive audio peak), the instantaneous output is four times the carrier power, and plate efficiency rises to a maximum. The average plate efficiency with 100% modulation is then intermediate in value between the carrier efficiency and peak efficiency, and approximates 45%.

An examination of the 6P6 characteristics shows that the R.F. output current varies linearly with variation of suppressor voltage. Under these conditions the plate input remains constant with modulation, while power output increases by the 50% required for full modulation. Non-variation of the D.C. plate current during modulation is thus an indication of distortionless modulation.

Compared with plate modulation, suppressor control does not give the high R.F. outputs of the

former, but does not require a high-power audio system and speech amplifier, while the R.F. excitation requirements are small. Compared with control-grid modulation, its advantage lies in the fact that audio and radio frequency voltages are applied to separate electrodes, and the modulating electrode is not as critical as to D.C. bias. The field of suppressor-grid modulation is definitely in low-powered transmitters, of a simple and compact construction.

The circuit diagram shows an application of the 6P6 to an inexpensive phone transmitter using one 6P6 as crystal oscillator, a second 6P6 as suppressor modulated R.F. amplifier and a 6A6 as modulator, the plates and grids of the 6A6 being tied together. With this arrangement there is sufficient gain in the modulator to fully load the 6P6. For operation from a pickup a $3\frac{1}{2}$:1 transformer may be included between the pickup and the control grid of the 6A6. The plate supply voltage may be from 250 to 450 volts and the maximum carrier output will be 3.0 watts. The constants in the circuit diagram refer to 450 volt operation. A switch is used to change over the suppressor to +40 volts for C.W. operation. The R.F. output on C.W. is about 12 watts.

DETAILS OF TRANSFORMERS

T₁ Microphone Transformer.

Core: Iron Section, $\frac{3}{4}$ " x $\frac{3}{4}$ " stack.

Window .. $1\frac{1}{4}$ " x $\frac{5}{8}$ ".

Overall .. $2\frac{3}{4}$ " x 2" x $\frac{3}{4}$ " stack.

Shell-type core, butt-joined laminations.

Primary: 400 turns 26 B & S enamelled.

Secondary: 4000 turns 36 B & S enamelled. *1K010*

T₂ Modulation Transformer.

Same Core as *T₁*.

Primary: 3120 turns 36 B & S enamelled. *1K0*

Secondary: 2600 turns 34 B & S enamelled. *'83*

RADIOTRON 803

R.F. Power Pentode, Amplifier, Frequency-multiplier, Oscillator, Suppressor-modulated Amplifier, Grid-modulated Amplifier

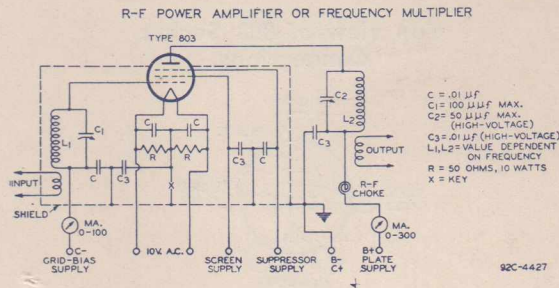
Radiotron 803 has a very wide field of application, particularly for high-power mobile transmitters. The plate connection is brought out at the top of the bulb to give high insulation and low inter-electrode capacities. Neutralisation is generally unnecessary in adequately shielded circuits. Price £18/- net.

The valve should be mounted in a vertical position, and in any application where vibration or shock is likely to be experienced a shock-absorbing suspension must be employed.

Free circulation of air around the bulb is necessary. Wire leads should be kept at a reasonable distance from the bulb. The filament is of thoriated

tungsten and should always be kept within plus or minus 5% of the rated value.

Under maximum conditions the plate should show a barely perceptible red colour when viewed in the dark immediately after all power switches have been opened.



If the screen voltage is obtained from a series dropping resistor, care should be taken to switch off the high voltage before switching off the filament. If the screen voltage is obtained from a separate source or from a potentiometer, the plate voltage should be applied before the screen voltage or simultaneously with it. The screen should never show more than a barely perceptible red colour.

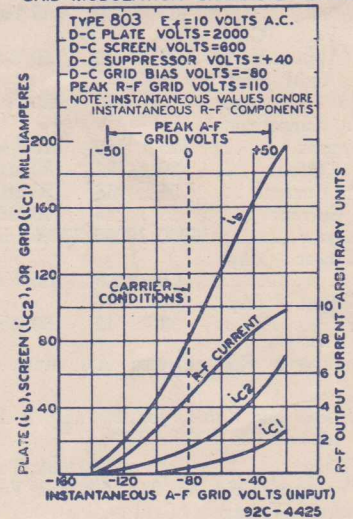
Shielding of the 803 should enclose the base end of the valve and extend up to a point level with the circular shield disc located at the bottom of the plate. Clearance between the glass bulb and the external shield should be at least 1/16in.

Radiotron 803 may be operated at maximum ratings at frequencies up to 20 megacycles. At frequencies above 20 megacycles the plate voltage and power input should be reduced. When two or more 803's are operated in parallel a non-inductive resistance of 10 to 100 ohms should be placed in series with the grid lead of each valve, close to the socket-terminal, to prevent parasitic oscillations.

TENTATIVE CHARACTERISTICS

- Filament Voltage (A.C. or D.C.) 10 Volts
- Filament Current 3.25 Amperes
- Mutual Conductance, for plate cur. of 55ma. 4000 Micromhos
- Direct Interelectrode Capacities:
 - Grid-Plate (with external shielding), 0.15 max. $\mu\mu\text{f}$.
 - Input 15.5 $\mu\mu\text{f}$
 - Output 28.5 $\mu\mu\text{f}$
- Bulb (for dimensions, see Diagram) T-20
- Cap (for connection, see Diagram) Large Metal Base (for socket connections, see Diagram), Giant 5-Pin Ceramic, Bayonet.

GRID MODULATION CHARACTERISTICS



Maximum Ratings and Typical Operating Conditions

As R-F Power Amplifier—CLASS B TELEPHONY.
Carrier Conditions per Valve; for use with a Modulation Factor up to 1.0.

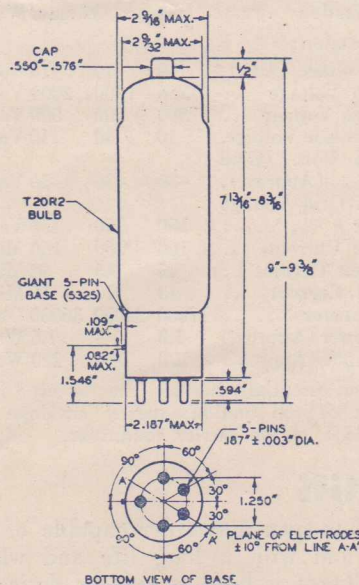
D.C. Plate Voltage	2000 max. Volts
D.C. Screen Voltage (Grid No. 2),	600 max. Volts
D.C. Suppressor Voltage (Grid No. 3)	60 max. Volts
D.C. Plate Current	90 max. Milliamperes
Plate Input	180 max. Watts
Plate Dissipation	125 max. Watts
Screen Dissipation	20 max. Watts

Typical Operation:

Filament Voltage (A.C.),	10	10	10	Volts
D.C. Plate Voltage	1250	1500	2000	Volts
D.C. Screen Voltage	600	600	600	Volts
D.C. Suppressor Voltage	40	40	40	Volts
D.C. Grid Volt. (Grid No. 1), Approx.	-40	-40	-40	Volts
Peak R.F. Grid Voltage (Approx.)	55	55	55	Volts
D.C. Plate Current	80	80	80	Milliamperes
D.C. Screen Current	15	15	15	Milliamperes
D.C. Grid Current	3	3	3	Milliamperes
Driving Power (Approx.)*,	1.5	1.5	1.5	Watts
Power Output (Approx.),	33	40	53	Watts

* At crest of a-f cycle.

OUTLINE DRAWING



As SUPPRESSOR-MODULATED R.F. POWER AMPLIFIER—CLASS C TELEPHONY.

Carrier Conditions per Valve; for use with a Modulation Factor up to 1.0.

D.C. Plate Voltage	2000 max. Volts
D.C. Screen Voltage (Grid No. 2)	600 max. Volts
D.C. Plate Current	90 max. Milliamperes
D.C. Grid Current	50 max. Milliamperes
Plate Input	180 max. Watts
Plate Dissipation	125 max. Watts
Screen Dissipation	30 max. Watts

Typical Operation:

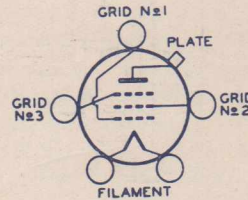
Filament Voltage (A.C.)	10	10	10	Volts
D.C. Plate Voltage	1250	1500	2000	Volts
D.C. Screen Voltage	400	500	500	Volts
D.C. Suppressor Voltage (Grid No. 3), (Approx.)	-85	-110	-135	Volts
D.C. Grid Volt. (Grid No. 1), (Approx.)	-35	-50	-50	Volts
Peak R.F. Grid Volt. (Approx.)	110	120	120	Volts
Peak A.F. Suppressor Volt. (Approx.)	125	150	175	Volts
D.C. Plate Current	80	80	80	Milliamperes
D.C. Screen Current	55	55	55	Milliamperes
D.C. Grid Current	15	15	15	Milliamperes
Screen Resistor	15000	18000	27000	Ohms
Driving Power (Approx.)*	1.6	1.6	1.6	Watts
Power Output (Approx.)	33	40	53	Watts

As GRID-MODULATED R.F. POWER AMPLIFIER—CLASS C TELEPHONY.

Carrier Conditions per Valve; for use with a Modulation Factor up to 1.0.

D.C. Plate Voltage	2000 max. Volts
D.C. Screen Voltage (Grid No. 2)	600 max. Volts
D.C. Suppressor Voltage (Grid No. 3)	60 max. Volts

Top view of 803 Socket Connections.



TOP VIEW

D.C. Plate Current	90 max. Milliamperes
Plate Input	180 max. Watts
Plate Dissipation	125 max. Watts
Screen Dissipation	20 max. Watts

Typical Operation:

Filament Voltage (A.C.)	10	10	10	Volts
D.C. Plate Voltage	1250	1500	2000	Volts
D.C. Screen Voltage	600	600	600	Volts
D.C. Suppressor Voltage	40	40	40	Volts
D.C. Grid Volt. (Grid No. 1), (Approx.)	-80	-80	-80	Volts
Peak A.F. Grid Volt. (Approx.)	50	50	50	Volts
Peak R.F. Grid Volt. (Approx.)	115	115	110	Volts
D.C. Plate Current	80	80	80	Milliamperes
D.C. Screen Current	15	15	15	Milliamperes
D.C. Grid Current	4	4	4	Milliamperes
Driving Power (Approx.)*	2	2	2	Watts
Power Output (Approx.)	33	40	53	Watts

* At crest of a-f cycle.

As R.F. POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY.

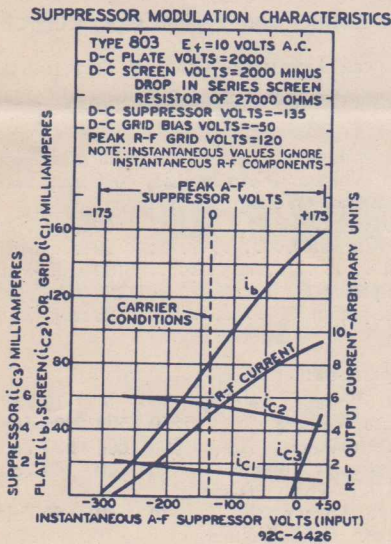
Key-down Condition per Valve without Modulation.**

D.C. Plate Voltage	2000 max. Volts
D.C. Screen Voltage (Grid No. 2)	600 max. Volts
D.C. Suppressor Voltage (Grid No. 3)	60 max. Volts
D.C. Plate Current	175 max. Milliamperes
D.C. Grid Current	50 max. Milliamperes
Plate Input	350 max. Watts
Plate Dissipation	125 max. Watts
Screen Dissipation	30 max. Watts

Typical Operation:

Filament Voltage (A.C.)	10	10	10	Volts
D.C. Plate Voltage	1250	1500	2000	Volts
D.C. Screen Voltage	500	500	500	Volts
D.C. Suppressor Voltage	40	40	40	Volts
D.C. Grid Volt. (Grid No. 1), (Approx.)	-30	-30	-30	Volts
Peak R.F. Grid Voltage (Approx.)	150	150	150	Volts
D.C. Plate Current	160	160	160	Milliamperes
D.C. Screen Current	45	45	42	Milliamperes
D.C. Grid Current	18	18	16	Milliamperes
Screen Resistor	17000	22000	36000	Ohms
Driving Power (Approx.)	1.8	1.8	1.6	Watts
Power Output (Approx.)	130	160	210	Watts

** Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.



RADIOTRON 866

Owing to the recent price reduction on Radiotron 866, which is now only 25/- net to licensed experimenters, it is anticipated that this type will prove even more popular than at present. Many experimenters who are using somewhat low voltages will

be pleased to own a rectifier capable of working efficiently and with a long life and which will deliver voltages as high as may be desired. Why not invest in a set of Radiotron 866's and avoid anxiety about the rectifier?