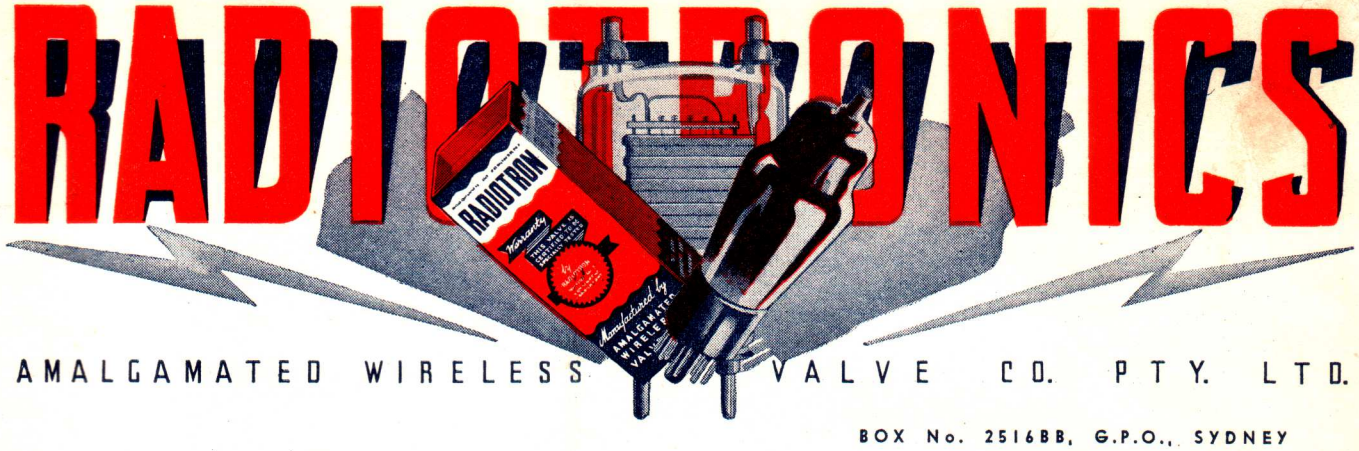
RADIOTRONICS



AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

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

TECHNICAL BULLETIN No. 106 **30th September, 1940**

In this issue:—

PROBLEMS OF SERIES FILAMENT OPERATION
1.4 VOLT VALVES

When 1.4 volt filaments are connected in series or series-parallel for operation from high voltage sources, a number of precautions are necessary to ensure optimum operation of the valves. The operation of 1.4 volt filament valves from A.C. mains, 2 volt and 6 volt batteries has previously been referred to in Radiotronics.*

Filament Voltage and Current for Mains Operation.

When 1.4 volt valves are operated from the mains the filament voltage should be reduced to 1.3 volts for each filament so that a reasonable tolerance is available for line voltage fluctuation in either the positive or negative direction. No allowance, of course, is to be made for a gradually falling voltage, as is the case with a battery.

Most 1.4 volt valves have filaments which draw 50 mA. at 1.4 volts, but this current is decreased to 47.5 mA. at 1.3 volts. Those types drawing a filament current of 100 mA. at 1.4 volts will draw only 95 mA. at 1.3 volts. A curve of filament current plotted against filament voltage is included for reference (Fig. 4).

The filament circuits may be adjusted by an accurate measurement of the voltage at the filament pins of the valve or the current through the filament. Either method is satisfactory provided that errors are not introduced by the measuring instruments, but if a voltage measurement is made it is desirable to check several valves of the same type in order that a typical valve may be obtained.

Circuit Design.

In the design of series and series-parallel filament circuits the following points should be considered:—

(a) The failure or removal of one valve should not result in the burnout of the filament of a second valve.

(b) Charging or leakage currents from condensers in the receiver or B supply should not pass through the valve filaments in any operating condition.

(c) The more negative valve filaments in the circuit should be protected from excessive filament current due to the passage of the "cathode current" (plate and screen current) of valves having filaments in a more positive position.

(d) The valves should be operated within their maximum ratings.

(e) The A.V.C. should not be less effective with series-filament operation than with parallel-filament operation.

(f) Adequate filtering is required to reduce the hum in the receiver.

(g) The switching of the filament circuits from parallel to series or series-parallel should be simple.

Circuit Diagrams.

Several typical circuit diagrams are shown in Figs. 1, 2 and 3. These correspond to a typical 5-valve receiver, Radiotron circuit RA51.* These do not by any means include all possible filament arrangements and are merely representative of the most popular circuits.

* Radiotronics 101, page 63.
104, pages 29-30.

* Radiotronics 105, page 38.

Fig. 1 is a series parallel system in which one valve is common to two "chains". This is similar to the arrangement frequently used with 2 volt 120 mA. valves for operation from a 6 volt accumulator.

Fig. 2 is a modification of Fig. 1 in which the common filament is placed at the negative end and two separate dropping resistors are used.

Fig. 3 is a straightforward series filament arrangement.

These are to be examined for their more important features.

Fig. 1

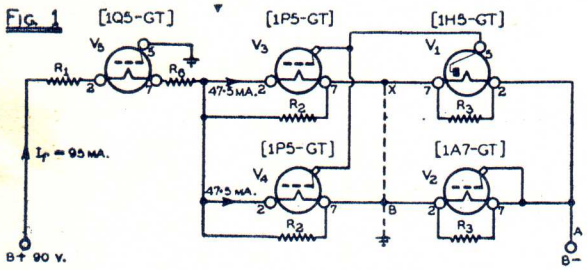


Fig. 2

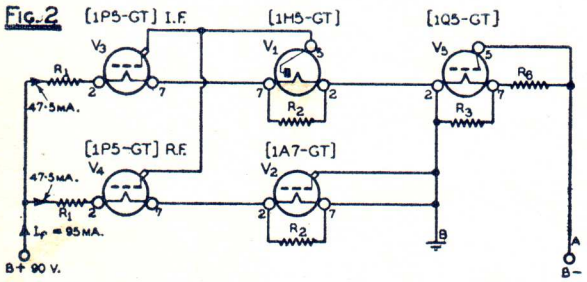
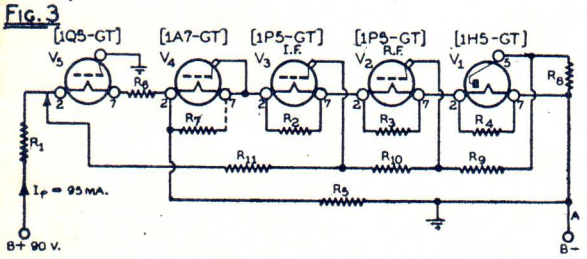


Fig. 3



R_1—*Filament dropping resistance.*
R_2, R_3, R_4, R_7—*"Cathode current" shunting resistances.*
R_5—*Filament current shunting resistance.*
R_6—*Bias resistance.*
R_8—*Diode load.*
R_9—*A.V.C. filter resistance.*
R_{10}, R_{11}—*"A.V.C. grid bias" resistance.*
$R_{10} = (R_8 + R_9)$. R_{10} *is of the order of 2 megohms per 1.3 volts.*

Filament Failure.

The failure or removal of V_1 may result in the failure of V_2 and V_4. If points B and X are linked, the failure or removal of V_1 will result in the failure of V_2. This form of series-parallel connection is not a desirable arrangement since it results in secondary valve failures, which are not experienced with the circuits of Figs. 2 or 3. A receiver incorporating the circuit of Fig. 1 should display a warning notice stating that valves should not be removed from their sockets while the filament supply is switched on.

Earth Connections.

Any of the systems may be earthed at B— or more conveniently at a positive point such as B (Figs. 1 and 2). In any case the circuits should be arranged to prevent excessive filament currents due to the charging or leakage currents of the condensers in the receiver or B supply.

Cathode Current.

When several filaments are connected in series, the plate and screen currents (i.e., the cathode current) of each valve must pass through the filaments on its negative side. The filament at the extreme negative end of the "chain" must, therefore, carry the whole of the cathode currents of all the remaining valves in the "chain".

With the 1.4 volt series of valves the ratio of "cathode current" to filament current is particularly high, thus it becomes necessary (in order to avoid incorrect filament voltages) to provide a shunt resistance across the filaments of the more negative valves in either series or series-parallel operation. The correct value of each resistance may be found by calculation or experimentally.

A.V.C.

It is more difficult to design an efficient A.V.C. circuit with series or series-parallel operation than with parallel filament operation. In the normal type of A.V.C. circuit the grid returns from the several controlled stages are brought to a common point and the zero signal grid voltage on these stages is the same. With series or series-parallel operation, however, the filament voltages differ with the result that the zero signal bias on one or more stages may differ from zero by a multiple of the filament voltage. The series-parallel circuit has the advantage that two valves have their filaments at the same potential and may therefore be controlled with equal efficiency. The second detector (V_1 in Fig. 1) may be operated so that the diode is at the end of the filament nearest to the controlled stages, so that the zero signal bias is close to zero voltage. In the case of type 1H5-GT the diode is situated near the end of the filament which is connected to pin No. 7, and in the circuit of Fig. 1 this may be made positive with respect to pin 2. By this means a satisfactory control of two stages is possible. Similar remarks apply in the case of Fig. 2.

When a series filament arrangement is used this same device provides only one controlled stage with a zero signal bias of zero voltage. If an attempt is made to operate a second stage on A.V.C., without making special provision for the difference in potential, the second controlled stage will operate at a bias of —1.3 volts where this filament is more positive than the first controlled stage. One method of avoiding this difficulty is shown in Fig. 3 and includes an A.V.C. potential divider consisting of resistors R8, R9, R10 and R11. R10 may be made of the order of 2 megohms while R11 may have a resistance of 2 megohms per 1.3 volt drop. By this means the zero signal voltage of each grid is maintained close to zero with respect to the negative terminal of its own filament, but the control voltage applied to each grid is less than the A.V.C. voltage generated by the diode. In this circuit V2 is shown as having a higher proportion of the control voltage than V3.

Switching.

The switching of the filaments should not present any great problem. The shunt resistors may be connected permanently across the valve filaments, in which case they will increase the A battery drain

with parallel filament operation, or they may be switched out of circuit for parallel filament operation.

Filtering.

Inductance—capacitance or resistance—capacitance filters or both may be used to smooth the rectified A.C. Hum voltages due to poor smoothing of the rectified A.C. for the filament circuit may appear as a distressing "modulation hum" in the receiver output when a signal is received.

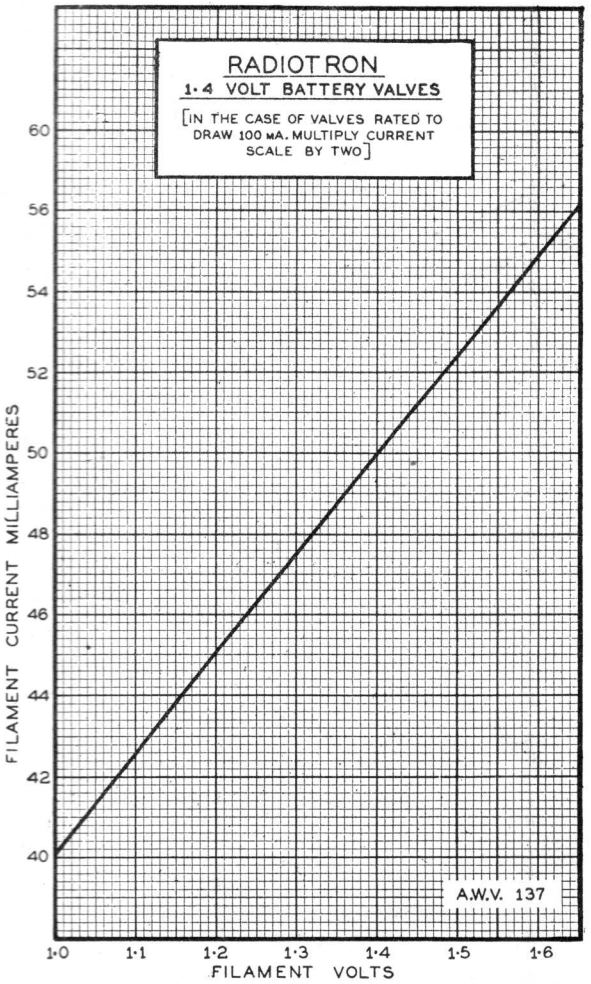


Fig. 4.—Curve of Filament Current—Filament Voltage for a 1.4 volt valve.

Rectifier Valve.

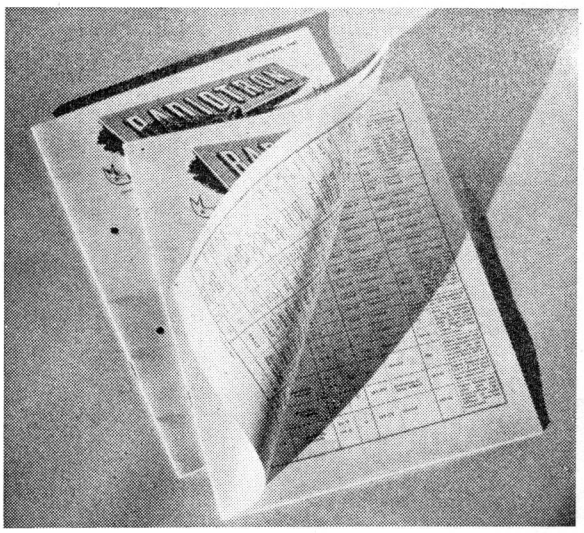
A high impedance rectifier valve such as the 5Y3-G has an impedance which is comparable with the load resistance. When one valve is replaced by another the variation in impedance may be sufficient to cause a change in the filament voltage of the amplifier valves of sufficient magnitude to require correction. One method by which this may be done is to employ a tapping switch to adjust the load resistance so that the filament voltages may be set to 1.3 volts whenever the valve is changed or the set is serviced without changing the rectifier valve.

A preferable arrangement is to employ type 5V4-G low impedance rectifier with a resistance of the order of 200 ohms in series with each plate. These resistors have the effect of reducing the change in output voltage due to an increase in impedance of the rectifier. With this arrangement valves may be changed without a check on filament voltage being necessary.

RADIOTRON EQUIVALENT VALVE TYPE CHART

In Radiotronics 105 an announcement was made to the effect that a new and comprehensive equivalent valve chart was in the course of preparation. **This chart is now complete and copies are available from this office at a cost of 3d. post paid.**

The new chart lists in a convenient style practically all known Australian and American receiving valves, defining each type and giving for each the rated filament voltage, filament current, cathode type and valve construction.



In separate columns are indicated the nearest imported Radiotron and nearest Australian-made Radiotron equivalents, with explanatory notes where such are necessary. At the end of the chart is an appendix giving useful general information.

Although the present Australian-made range of valves embraces a wide selection of valve types for new equipment and provides the majority of the important replacement types, this chart should nevertheless prove very useful at a time when imports are being restricted and when some imported valves may become unavailable.

Enquiries should be addressed to Amalgamated Wireless Valve Co. Pty. Ltd., Box 2516 BB, G.P.O., Sydney.

AUSTRALIAN-MADE OCTAL BASED TYPES SUITABLE FOR NEW EQUIPMENT

This list of Australian-made octal-based types (26 in all) is given as a guide to equipment manufacturers. It includes all the more recent octal-based types in the Australian-made Radiotron range, and these have been grouped in accordance with the filament voltage or function.

1.4 volt: 1A7-GT, 1D8-GT, 1H5-GT, 1N5-GT, 1P5-GT, 1Q5-GT.

2 volt: 1C7-G, 1D5-GP, 1J6-G, 1K5-G, 1K7-G, 1L5-G, 1M5-G.

Rectifiers: 5V4-G, 5Y3-G.

6.3 volt: 6A8-G, 6B6-G, 6B8-G, 6F6-G, 6G8-G, 6J7-G, 6J8-G, 6K7-GT, 6K8-G, 6U7-G, 6V6-G.

NOVEL U.H.F. TRANSMITTING VALVE

RADIOTRON 825 GIVES 35 WATTS AT 500 Mc/s.

For many years past there has been intensified research on the problem of designing a transmitting valve which gives a satisfactory power output at good efficiency on wavelengths less than 1 metre. Radiotron 825 is the successful outcome of work carried out in the R.C.A.-Radiotron Laboratories.*

The elementary principles of the operation of Radiotron 825 are shown in the cross-section of Fig. 1 from which it will be seen that the cathode and control-grid are of conventional design, but the plate is replaced by a "collector" and a "resonator tank circuit". The purpose of the "collector" is merely to collect electrons reaching it from the cathode, and to

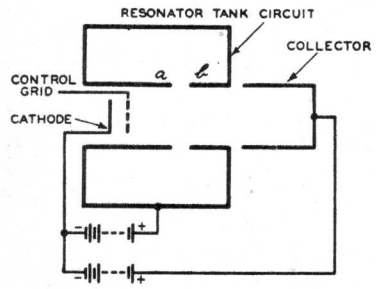


Fig. 1

dissipate the energy loss in the form of heat; it serves no useful purpose in the development of R.F. power. The "resonator tank circuit" is shown in perspective in Fig. 2. It is made from two concentric copper tubes of similar length, with sheet copper end pieces each having a central hole of diameter equal to the diameter of the inner tube. These parts are all soldered together to form a surface of high conductivity. The inner tube has a complete gap cut across it, at right angles to its axis, to correspond with the gap a-b of Fig. 1. The surface of the geometrical solid, so formed, is then that of a complete surface of revolution of a Hertz resonator, about a line displaced

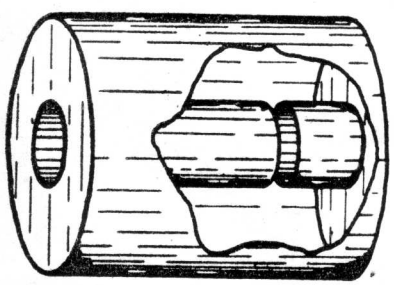


Fig. 2

from, but parallel to, its gap. The path from a (Fig. 1) over the metallic surface to b forms the inductance, while the self-capacitance of the resonator forms the capacitance of a tuned circuit. The whole is thus equivalent to an inductance in parallel with a capacitance connected to the points a and b.

The passage of electrons from the cathode to the collector constitutes a current in the horizontal plane (Fig. 1) and the variations in the electron flow, brought about through the R.F. voltage applied to the control grid, produce a radio frequency current in the resonator tank circuit. A high voltage will be produced across the gap a-b when the resonator tank circuit is tuned to the input frequency or to a harmonic of it, and the phase of this voltage will be such as to decelerate the electrons traversing the gap during the half-period of maximum intensity of electron current flow. The energy represented by the loss of kinetic energy of the electron stream is transferred by electro-magnetic induction to the resonator tank circuit.

The construction shown in Fig. 1 is not a practical one since the electrons tend to be deflected from the straight path between cathode and collector, and to strike the walls of the inner cylinder of the tank circuit. Two methods in combination are used to provide "focussing" of the electron stream in much the same way as in a cathode-ray tube. These methods are shown in Fig. 3 in

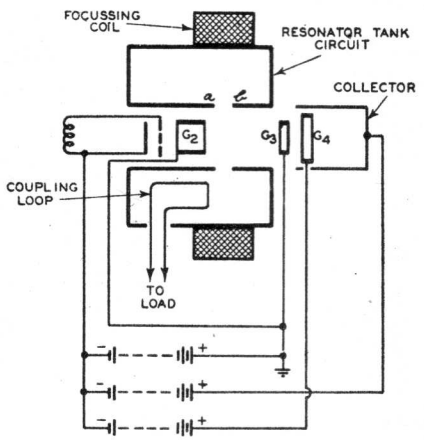


Fig. 3

which a "focussing coil" is arranged around the outside of the tank circuit, and two positive accelerating electrodes (G_2 and G_3) each in the form of an open ended cylinder, are mounted within the inner cylinder of the tank circuit. With this improved arrangement the tank circuit may be outside the glass envelope since the bombardment of the inner surface of the tank circuit has been eliminated, and the induction of the electron stream takes effect through the glass.

The R.F. energy from the tank circuit may be collected by means of a "coupling loop" coupled to the tank circuit. This may take the form of a simple loop of suitable area inserted into the interior of the resonator through a small hole in the outer cylinder.

The voltages are (as usual in valve practice) taken with respect to the cathode, but it is most satisfactory for electrodes G_2 and G_3 to be at earth

* For a more detailed study of the principles involved, see A. W. Haeff "An U.H.F. Power Amplifier of Novel Design", Electronics, February, 1939, pp. 30-32.
A. W. Haeff and L. S. Nergaard "A Wide Band Inductive-Output Amplifier", Proc. I.R.E., March, 1940, pp. 126-130.

potential. A fourth electrode (G_4) is added to prevent secondary emission from the collector reaching the other electrodes.

A complete diagram of a practical set-up is given in Fig. 4 in which the glass envelope is indicated by a light broken line. The resonator is changed in shape from the simple form of Fig. 2 in order to accommodate a more efficient magnetic focussing system with two air-gap "lenses".

TYPICAL R-F AMPLIFIER CIRCUIT FOR TYPE 825

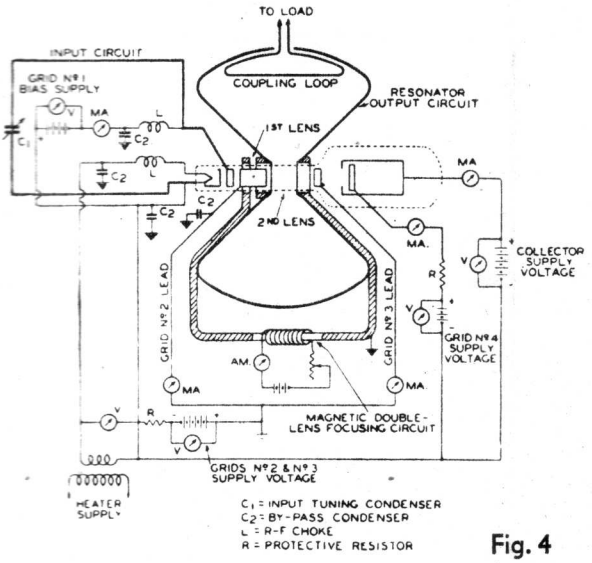
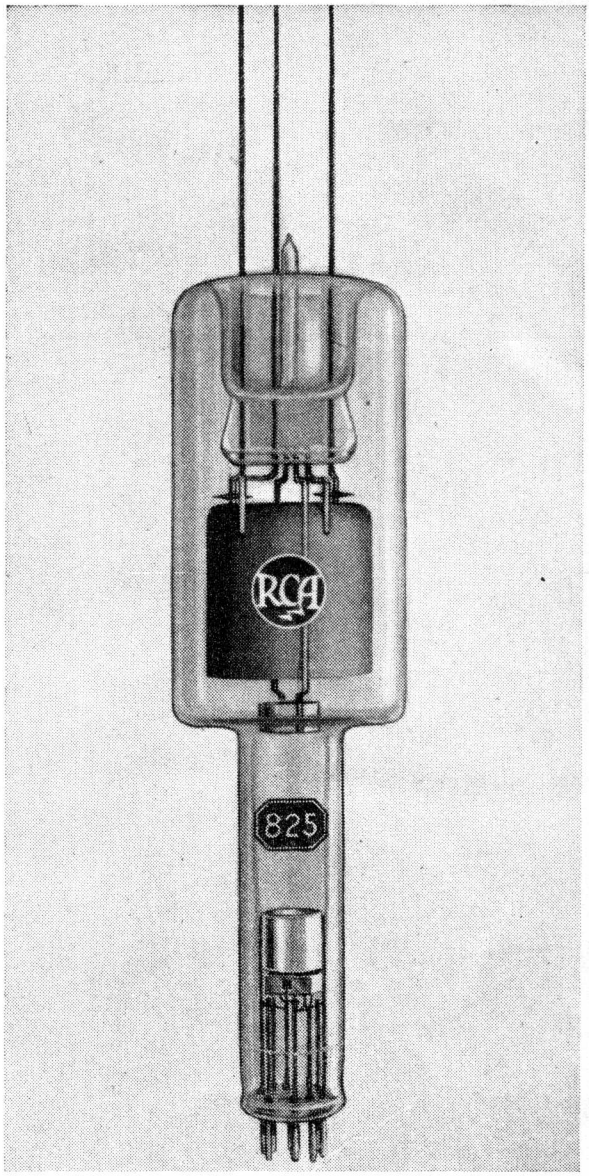


Fig. 4

Special Advantages of Radiotron 825

The close spacing between the control-grid and cathode provides high mutual conductance (5500 micromhos at a plate current of 50 mA.) and minimum transit-time effects. The output-input coupling is reduced to a negligible value through the use of the "inductive output" electrode arrangement. The input capacitance is low as a result of the shape and position of G_2. The efficiency is high owing to the low capacitance and low losses of the resonator tank circuit.

The voltages applied to the electrodes as an R.F. power amplifier and oscillator (Class C telegraphy) under typical conditions are — Collector 1500 volts, G_4 800 volts. G_3 3600 volts, G_2 3600 volts, G_1 −40 volts. The currents are — Collector 45 mA., G_4 2 mA., G_3 0.5 mA., G_2 1 mA., G_1 2.3 mA. (approx.). The power output under these conditions will be approximately 35 watts while under Class B telephony or Grid modulated class C telephony conditions the output will ge approximately 9 watts.



RADIOTRON 6J8-G

OPERATION CHARACTERISTICS

A new loose-leaf Data Sheet, released concurrently with this issue, gives the operation characteristics of Radiotron 6J8-G. Curves are given in which the conversion conductance, cathode current and plate current are plotted against oscillator grid current. It will be seen that maximum conversion conductance (297 μmhos.) occurs at a grid current of 250 μA. The "Normal Operating Region" is from 150 to 500 μA.; at the minimum oscillator grid current of 150 μA. the conversion conductance falls to 250 μmhos. while at 500 μA. it falls to 280 μmhos. The plate and cathode currents increase as the oscillator grid current is decreased, and operation at an oscillator grid current less than 100 μA. is not recommended.

RESTRICTION ON SALE OF TRANSMITTING VALVES

Transmitting valves may only be sold in Australia to clients who are in possession of a special license issued by the Senior Radio Inspector (P.M.G.'s Department). Copies of the forms required to be completed before such a license is granted are available on application.

RECEIVING VALVE MANUAL RC14

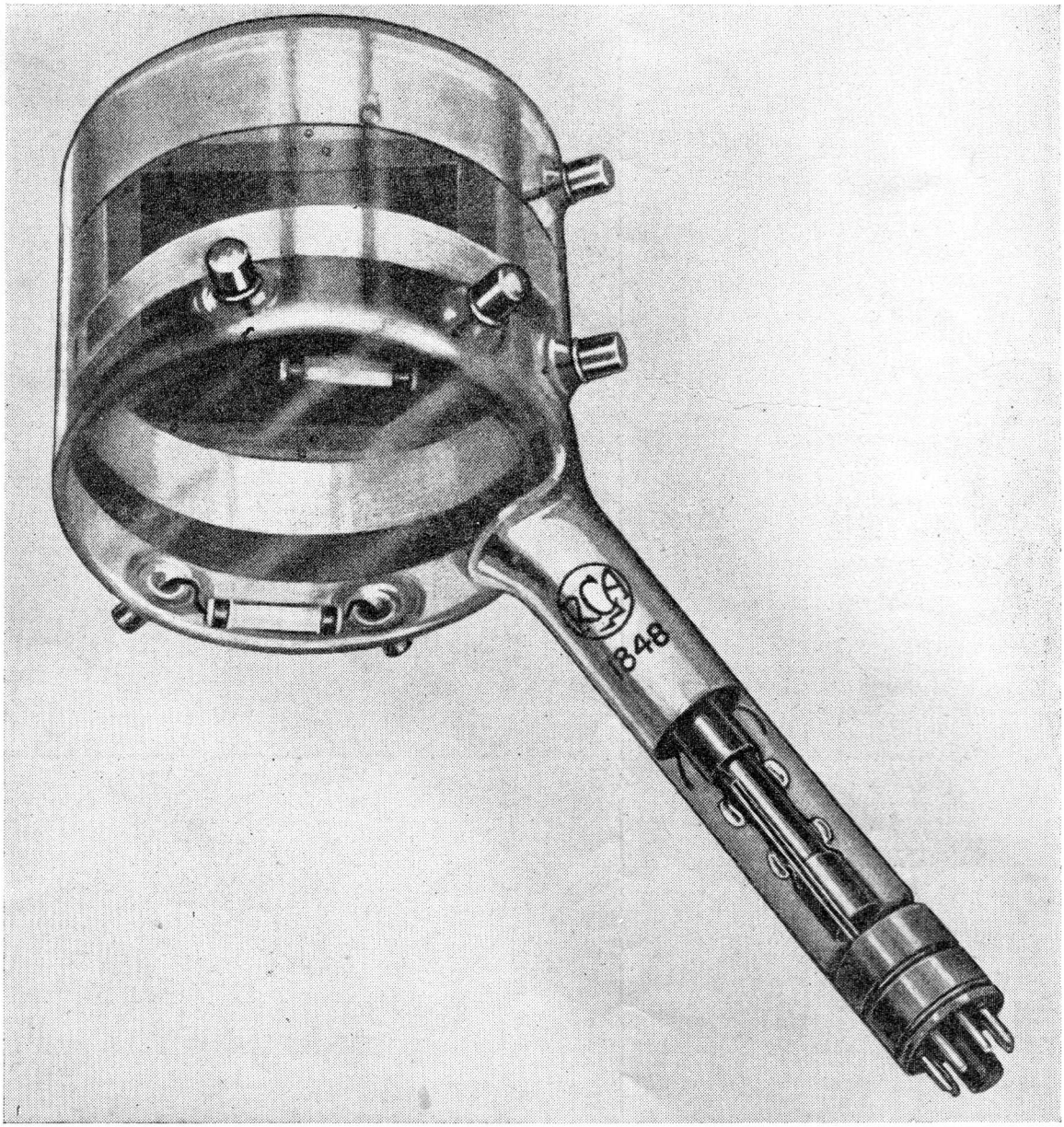
A first shipment of the new Radiotron Receiving Valve Manual RC14, superseding the previous Manual RC13, has been received and completely sold out. A further order has been placed and notification will be given in a later issue regarding its arrival.

THE USE OF SERIES RESISTORS WITH RADIOTRON 5V4-G RECTIFIER

Radiotron 5V4-G is a low impedance full-wave indirectly-heated rectifier which is already widely used. In common with all other low-impedance rectifiers, however, it is capable of being damaged through misuse or through a lack of understanding of its characteristics. Type 5Y3-G has a high internal impedance and may be operated under most adverse conditions for a limited time without damage, but type 5V4-G when operated under similar adverse conditions may suffer premature failure.

When a 5V4-G is used to supply current to a receiver or amplifier which requires good regulation (e.g., a Class B amplifier) it is advisable to make an accurate test of peak current with the aid of a cathode-ray oscillograph in order to ensure that the maximum rated peak current is not exceeded. A choke input filter is recommended for this class of service since it provides the best regulation without drawing a high peak current.

(Continued on page 55).



Iconoscope for television having small size, high resolution capability and high sensitivity. It uses electro-magnetic deflection and is especially suited for use in portable television cameras. It was first announced in Radiotronics 103.

CONSTANT CURRENT CURVES FOR RECTIFIERS

Constant current curves for triodes have been in use for several years, and are valuable for calculations concerning R.F. power amplifiers*. Constant current curves for rectifiers are, probably, the most convenient curves for ordinary use and enable the input (R.M.S.) voltage to be read directly for any output (D.C.) voltage or vice versa without interpolation.

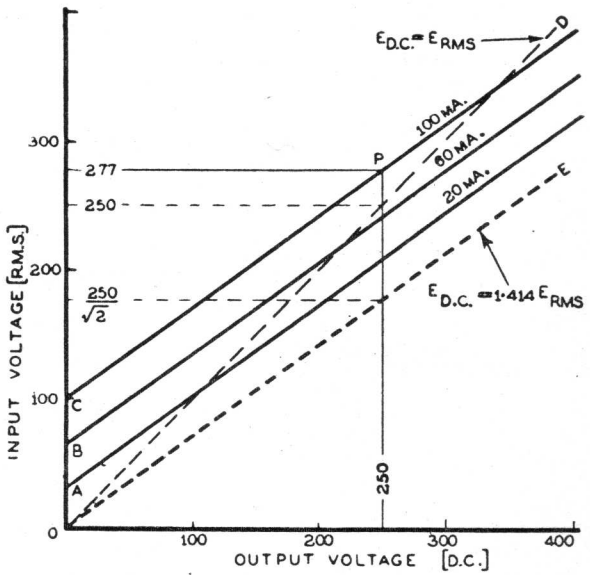
Constant current curves for a typical rectifier (Radiotron 5Y3-G) are shown in Figure 1. It will be seen that the input voltage is plotted as ordinate against the output voltage as abscissa and a curve is drawn for each specified value of D.C. output current. Three curves only are shown, although for design purposes a large number would be desirable; a complete family of curves is given on the loose leaf data sheet issued concurrently with this issue. These curves are, for all practical purposes, straight lines but are not quite parallel with one another.

As an example of the use of these curves, let it be assumed that it is required to find the R.M.S. input voltage for a D.C. of 100 mA. at 250 volts. On the horizontal axis the point of 250 volts (D.C.) is noted, and the vertical line followed until it intersects the 100 mA. line. The point of intersection (P) is then referred to the vertical axis which indicates that the input voltage is 277 volts.

It is obvious that any other output voltage could have been used in the example, and the corresponding input voltage deduced. Similarly, if the input voltage is known the output voltage may be obtained. If the output current does not correspond with one of the curves, the point of intersection may be obtained by interpolation with considerable accuracy, since the curves are straight, nearly parallel and almost uniformly spaced.

One family of curves corresponds only to the conditions of test, for example in the 5Y3-G loose leaf data sheet the curves are for the following conditions:—

(1) Input condenser 8 μF.
(2) Effective plate supply impedance 80 ohms per plate.



Those who are sufficiently interested to study further, will observe the line O D which corresponds with equal input and output voltages. Above and to the left of this line, the output voltage is less than the input voltage; below and to the right of this line the output voltage is greater than the input voltage.

Each of the points A, B, C, etc., at which the several current lines cut the vertical axis indicates the combined effective voltage drop in the valve and the transformer; in other words it is the input voltage required to maintain the specified load current with the load terminals short-circuited. Points O, A, B, C lie on a smooth curve when the voltage drop is plotted against the load-current.

The line O E is the theoretical limit of output voltage with no load-current, and is drawn to correspond with an output voltage of 1.414 times the R.M.S. input voltage.

All these curves should be regarded as applying to a typical valve, and reasonable allowance should be made for variations from valve to valve, particularly in the low-voltage high-current area. In this area the equivalent plate supply impedance and the valve impedance may become comparable with the load resistance.

* I. E. Mouromtseff & H. N. Kozanowski, Proc. I.R.E., Vol. 23, pp. 752-758, July (1935).

(Continued from page 54).

In normal use, however, a power supply of good regulation is not necessary and it might even be described (from the reliability point of view) as being undesirable. In a typical radio receiver it is possible to insert a small resistor (50 to 200 ohms or even higher) in each rectifier plate circuit with the object of improving the self-protection of the rectifier and its consequent ability to withstand surges and frequent switching on and off. The only detrimental effect is that the transformer voltage must be increased in order to maintain the same output voltage.

Type 5V4-G with a resistance of 50 to 75 ohms in each plate circuit has characteristics closely resembling those of type 5U4-G, and may therefore be used as a replacement under these conditions.

When type 5V4-G is used under continuous steady operating conditions it is not necessary to include such resistors in the circuit, but when the equipment is frequently switched on and off it is highly desirable that the resistors should be incorporated. The insertion of such resistors is not novel since it has been used for a considerable time past with type 25Z6-G. An additional advantage is that in certain circumstances the output current may be increased since the ratio of D.C. output current to peak current is increased. The ratings cover only the peak inverse voltage and the peak plate current per plate, and the valve may be used under any conditions in which these ratings are not exceeded.

Tests for peak plate current may be made by the use of a cathode-ray oscillograph connected across a small resistor between the centre tap of the transformer and the negative terminal of the first filter condenser.

RADIOTRON NEWS

Radiotron 1R5, which is a miniature 1.4 volt converter valve (see Radiotronics 102, p. 9), may now be operated with a screen voltage of 67.5 volts. This type is not at present available from stock.

Radiotron 1S4, which is a miniature 1.4 volt power pentode (see Radiotronics 102, p. 9), may now be operated with plate and screen voltages up to 67.5 volts. This type is not at present available from stock.

Radiotron 1T4, which is a miniature 1.4 volt super-control pentode amplifier (see Radiotronics 102, p. 9), may now be operated with a maximum screen voltage of 67.5 volts. This type is not at present available from stock.

Radiotron 5W4-GT is a full-wave high-vacuum rectifier having a heater rating of 5.0 volts at 1.5 amps. The maximum peak inverse voltage is 1400 volts and the maximum peak plate current per plate 300 milliamps. This type is not at present available from stock.

Radiotron 7C7 is a triple-grid detector amplifier, similar electrically to type 6J7-G and having a 6.3 volt .15 amp. heater. It is enclosed in a T-9 tubular glass bulb and is fitted with an 8-pin lock-type base This type is not at present available from stock.

Radiotron VR75-30 is a new cold-cathode, glow-discharge voltage regulator tube, intended for use in applications where a constant D.C. output voltage of approximately 75 volts is required. The minimum starting voltage is 105 volts D.C. and the operating current is from 5 to 30 milliamps. (See article Radiotronics 98, p. 35). This type is not at present available from stock.

Radiotron 117N7-GT is a combined half-wave rectifier and beam power amplifier intended primarily for use in 1.4 V. Battery/A.C. receivers. (N.B.—An additional 1.4 V. power valve is required.) The heater rating is 117 V. at .09A., the rectifier output rating 75 mA. and the audio power output 1.2 watts. This type is not at present available from stock.

Radiotron 802. Dual ratings for this type are now available and will be supplied on request. Type 802 is of Australian manufacture.

Radiotron 810. Dual ratings for this type are now available and will be supplied on request.

Radiotron 825 is an entirely new type of multi-electrode valve in which the electron stream is inductively coupled to the output circuit. See article elsewhere in this issue.

Radiotron 827-R is a new air-cooled radiator type of U.H.F. transmitting beam power amplifier. It has a maximum plate dissipation rating of 800 watts in class C telegraph service and incorporates a number of unique design features Full information is available on application.

Radiotron 880 is a new three-electrode water-cooled valve capable of dissipating 20 kilowatts of power in class C telegraph service. It may be operated at full ratings up to 25 mc/s and at reduced ratings to 100 mc/s.

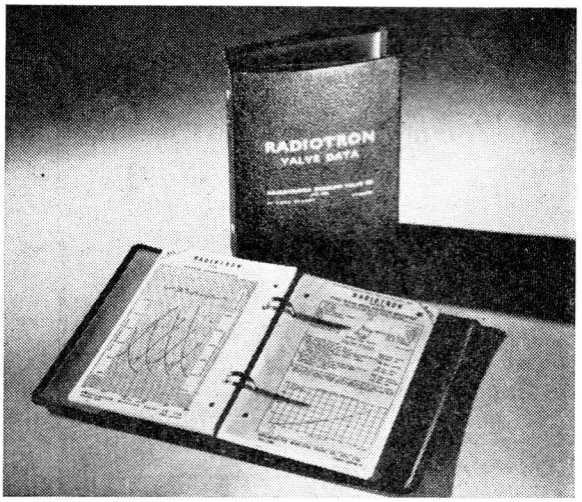
Radiotron 889-R is a new three-electrode valve employing a fin-type radiator for cooling, and having a maximum plate dissipation of 5 kilowatts in class C telegraph service. Type 889-R may be operated at full ratings up to 25 mc/s and at reduced ratings to 100 mc/s.

Radiotron 893-R is a three electrode transmitting valve for use as an R.F. power amplifier, oscillator or class B modulator. It has a maximum plate voltage rating of 20,000 volts, a plate dissipation of 20 kilowatts and is fitted with a fin-type radiator for forced-air cooling. More detailed information is available on request.

Radiotron 1847 is a small iconoscope intended primarily for use in amateur television transmitters. It employs electrostatic deflection and operates with an anode voltage of 600 volts. This type is not at present available from stock.

NEW VALVE DATA COVER

Following numerous requests, we are pleased to announce the release of a new and more elaborate loose-leaf cover for the Radiotron valve data sheets. The new cover, illustrated below, is of black rexine cloth with gold-embossed title, and is fitted with two rings spaced 8 centimetres apart.



The chief feature of the new cover apart from the improved wearing quality is that it is capable of being opened out flat on the table. This is a distinct advantage, particularly when working with characteristic curves.

All new data sheets, including those issued concurrently with this bulletin, will be punched to suit both the old and the new covers. Existing sheets may be punched to suit the new cover with an ordinary office punch, or, if forwarded to this office together with the order for a new cover, will be fitted free of charge.

The cost of the new cover is 3/- posted or with data sheets 5/- posted. All inquiries should be addressed to Amalgamated Wireless Valve Co. Pty. Ltd., Box 2516BB, G.P.O., Sydney.

VALVE DATA SHEETS

Ten Radiotron Loose Leaf Valve Data Sheets are being released concurrently with this issue. These are:—

Title Sheet	
List of Contents	
Type 5Y3-G	sheets 1 and 2
Types 6B7, 6B7S	1 sheet (data)
Type 6J8-G	1 sheet (data)
Type 6K8-G	1 sheet (data)
Type 6L6-G	sheets 1 and 2
Types 6X5, 6X5-G, 6X5-GT	1 sheet (data)

Existing sheets for types 5Y3-G, 6J8-G, 6K8-G, 6L6-G (data 1 and 2) and 6X5-G should be removed from the Data Book.

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