RADIOTRON

MODEL UV-204A
250-WATT OUTPUT

INSTRUCTIONS J-84

Edition "A"

Radio Corporation of America

233 Broadway
New York City

10 South La Salle Street
Chicago, Ill.

28 Geary Street
San Francisco, Cal.

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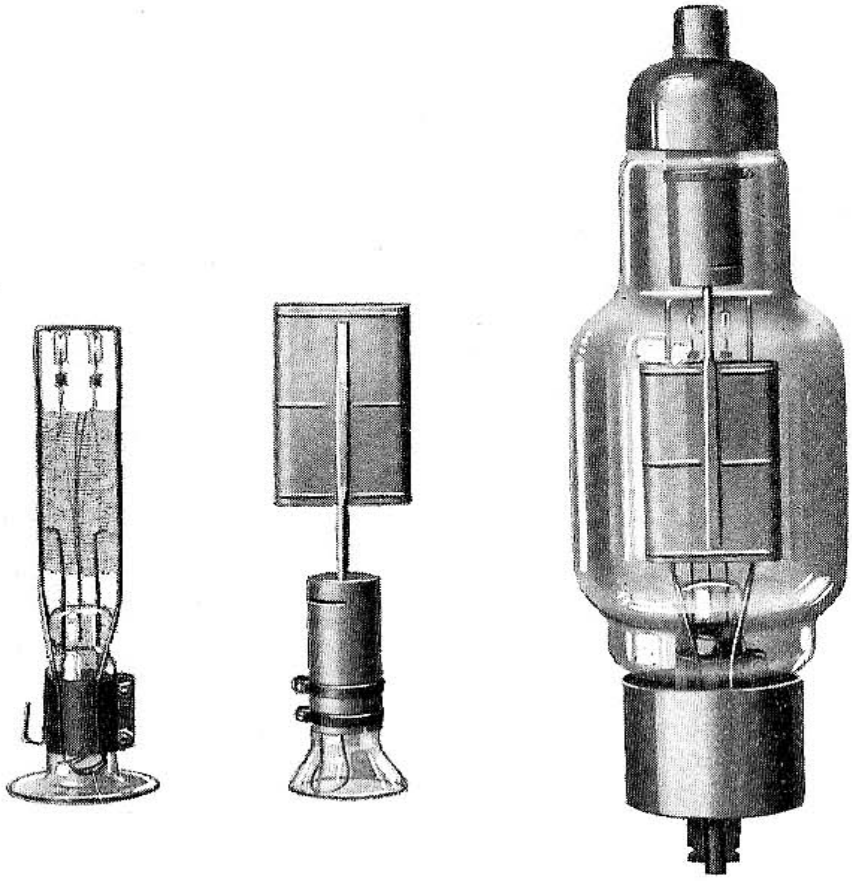

Fig. 1. Radiotron UV-204A Assembly

TRANSMITTING RADIOTRON
Model UV-204A
250-Watt Output

RATING

Output	250 watts
Filament volts	11
Filament amperes	3.85
Plate volts	2000
Plate amperes (oscillating)	.200
Maximum safe plate power dissipation	250 watts
Voltage amplification constant	25

GENERAL

SHIPMENT

Each radiotron is packed in a separate crate or carton. The net weight is approximately 2 pounds and the shipping weight is 9 pounds with the crate and 6 pounds with the carton. The radiotrons are suspended in the crate or carton by ticking or tape. The following precautions should be observed in storing or handling these radiotrons:

Radiotrons should be handled with extreme care, as they may be injured permanently if subjected to sudden jars. They should be stored in the crates as received and should not be piled on top of one another. They should not be exposed to the weather.

DESCRIPTION

The UV-204A Radiotron is designed for use as an oscillator, modulator or power amplifier. Fig. 1 shows its internal and external appearance.

INSTALLATION

The radiotron is designed to use the UT-501 and 502 standard mountings. The overall length is 14¼ inches plus or minus ⅛ inch. Fig. 2 shows the proper mounting position when the radiotron is used in a built-up set.

This radiotron may be operated in a vertical or horizontal position. If the tube is mounted horizontally, the plate should lie in a vertical plane, that is, on edge. If mounted in a vertical position, the cathode end (large end) should be up.

If the radiotron is apt to be subjected to vibration or shock, it should be protected by some form of spring or rubber suspension.

The bulb gets very hot under normal load conditions and for this reason it should not be touched by any light inflammable material and should not come in contact with any metallic body or be subjected to drops or spray of any liquid.

Free circulation of air around the bulb is necessary and it is recommended that forced air ventilation be used wherever possible. Air pocket effects such as result from placing the radiotrons near the ceiling or in a small enclosure should be avoided.

The metal shell of the cathode end base must not be connected to the ground or any other part of the circuit.

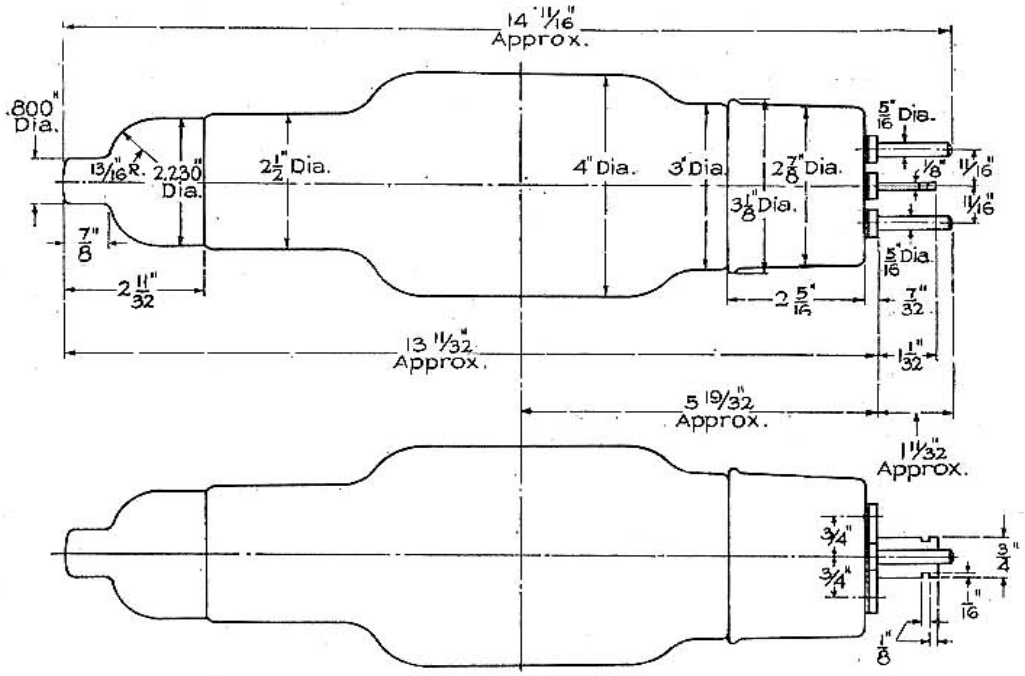

Fig. 2. Dimensional Outline Showing Mounting Spacing

Alternating current should be used to operate the filament when possible. A center tap on the secondary of the filament transformer should be used for grid and plate circuit returns. Rheostat control should be provided on the power supply side of the transformer. When it is necessary to use direct current to light the filament, the plate return lead should be connected to the positive terminal. In all cases the filament voltmeter leads should be connected directly to the socket terminals.

If radiotrons are to be operated in parallel, a small choke coil or, better still, a resistance of from ten to one hundred ohms, should be placed in the grid circuit of each radiotron as near as possible to the grid terminal of the socket to prevent the setting up of parasitic oscillations. The use of the resistance will result in a slight decrease in efficiency when the radiotron is being used as an oscillator.

In modulated CW circuits, particularly when buzzer modulation is employed, the peak voltages between grid and filament may become very high and in order to protect the radiotron from damage from this source, a $\frac{3}{32}$-in. spark gap should be connected between the grid and one side of the filament. This protective gap should be located directly on the mounting which accommodates the filament terminal end of the radiotron.

When radiotrons are used in parallel as modulators or audio frequency amplifiers it is advisable to supply a separate "C" battery adjustment or biasing resistance on each radiotron. The grid bias should then be adjusted for the correct plate dissipation in each radiotron and the circuit should be readjusted when a new radiotron is placed in service. When radiotrons are used in parallel as oscillators or radio frequency power amplifiers with highly positive grid swings, the dissipation will divide fairly equally between radiotrons without a separately controlled source of grid bias. In either case, and especially in the former, it is recommended that a plate current meter be provided in the plate circuit of each radiotron so that the heat dissipation on each plate may be known.

OPERATION

The filament of the radiotron should be operated at constant voltage rather than constant current and always at the rated voltage.

It should be noticed that due to the lower operating temperature the brilliancy of a thoriated filament is much less than that of the older type of tungsten filament. A voltmeter should always be used for maintaining the correct filament voltage.

When the radiotron is used in a new circuit or when adjustments are being made in the circuit, it is very important that the plate voltage be lowered in order to prevent possible damage to the radiotron or other apparatus if the circuit adjustments are incorrect.

In case of severe overload resulting in overheating of the radiotron, the electron emission may decrease. Unless the overload has liberated a large amount of gas, the activity of the filament may be restored by operating at rated filament voltage for ten minutes or longer with plate voltage off. This reactivation process may be accelerated by raising the filament voltage to twelve or thirteen volts but no higher.

When the radiotron is used as an oscillator or radio frequency amplifier, the plate power dissipation should never exceed 250 watts and when possible it should be kept below 200 watts, as the life of the radiotron is considerably increased by such conservative operation. An oscillating efficiency of at least 60 per cent may be obtained. Regardless of the actual output or input, the efficiency should always

be sufficient to limit the anode dissipation; that is, the difference between output and input to the safe value, namely, 250 watts. This anode dissipation results in a dull red color. This anode temperature should never be exceeded.

The d-c. plate voltage should normally never be greater than the rated value of 2000 volts. One exception is that in a non-modulated continuous wave telegraph circuit where extreme output is required, the voltage may be raised to 2500 volts, provided the plate power dissipation does not exceed the value given above.

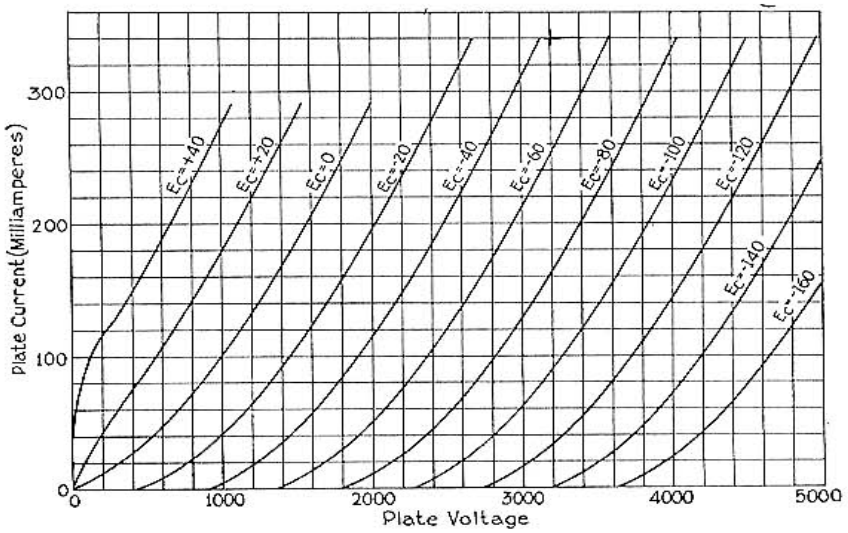

Fig. 3. Plate Voltage—Plate Current Family of Curves

In using the radiotron as a modulator the negative grid bias should be sufficient to limit the plate dissipation to 200 watts; that is, 100 milliamperes at 2000 volts. This is the maximum dissipation allowable and in a circuit where the dissipation increases when modulation takes place the grid bias must be increased so as to reduce the average dissipation to 200 watts.

If the plate current is much greater than the normal amount when the proper grid voltage is applied, it is often an indication that the radiotron is oscillating or that it is picking up a radio frequency voltage from other circuits. An inductive grid leak tends to aggravate this condition.

In using the radiotron as an audio frequency amplifier, to obtain undistorted output the grid bias should be adjusted so as to give a plate dissipation of not greater than 200 watts. Under these conditions plate voltage as high as 2500 volts may be used provided the 200-watt dissipation figure is not exceeded and the grid swings are not great enough to cause appreciable distortion with a resulting

increase in average plate current. In using these radiotrons for this purpose, Fig. 3 should be examined for the optimum values of grid bias, maximum grid swing and plate voltage.

In all cases, regardless of the use to which the radiotron is put, careful handling and conservative operation will result in longer and more uniform life.

USE AT HIGH FREQUENCIES

When the radiotron is used in frequencies in excess of 3000 kilocycles (below 100 meters) special precautions should be taken in order to make certain that it is not harmed by abnormal conditions.

The safe limits for some of the insulating materials used in the radiotron are less at the higher frequencies and, therefore, conservative plate voltages and power inputs should always be used in order to prevent excessive energy dissipation within the radiotron.

The plate voltage should never exceed 2000 volts and the plate dissipation should be limited to 200 watts or less for frequencies in excess of 3000 kilocycles (below 100 meters).

Two of the most common causes of failure at high frequencies are burnouts of the grid or plate lead inside the bulb or base, and failure of the glass stem or other insulation. Burnout of the grid or plate lead inside of the bulb or base is caused by excessive currents, established by the inter-electrode capacity of the radiotron. At low frequencies, the capacity reactances are so high that their currents are negligible, but at high frequencies the capacity reactances are greatly reduced and the currents may become excessive if proper precautions are not taken.

In general this radiotron can be used at frequencies below 30,000 kilocycles (above 10 meters) if the grid and plate oscillating currents do not exceed 10 amperes. A fuse blowing at this value placed in the circuit close to the grid or plate terminal will serve as a protection to the leads. A grid or plate lead inside of the radiotron should never be operated at such a temperature that it shows color.

The capacity between the grid and plate is about 20 micro-microfarads. In general, satisfactory operation can be obtained without unbasing. If it is desired to reduce socket capacity this may be done by soldering the connecting wires directly to the terminals of this tube. Unbasing is not necessary and is apt to harm the radiotron.

Great care should be taken to prevent brush discharge in any part of the radiotron. Such discharge will usually overheat the glass very quickly and cause breakdown or puncture of the glass. Incorrect circuit adjustments and the use of too high a plate voltage will tend to aggravate this trouble.

For frequencies above 30,000 kilocycles (below 10 meters) even greater care should be used to prevent such a discharge and overheating of the interior lead wires. It may be found necessary to reduce the plate voltage and dissipation as the frequency is increased, in order to prevent trouble.

RADIOTRON LIFE

One of the most important features of a radiotron is its operating life. The length of this operating life shows a wide variation with respect to operating conditions and to some extent with respect to individual radiotrons of the same type.

When radiotrons, are received, it is recommended that they be immediately tested for a few short intervals in the equipment in which they are to be operated, before being set aside as spares. In this way any possible defects traceable to design, manufacture or transportation will be indicated at an early date. For the same reason radiotrons should be placed in service in order of receipt.

Radiotrons held as spares should be operated under normal conditions at intervals of approximately once each month to insure their being in satisfactory condition. When putting a radiotron in service that has been standing idle for some time, the radiotron should be operated with the filament at normal voltage for 10 minutes with the plate voltage off or greatly reduced. Starting with a reduced value, the plate voltage may then be gradually increased to its normal value as the radiotron warms up.

If a defective radiotron is to be returned for inspection it must be as carefully packed as when originally shipped, as broken ones cannot be properly inspected or tested.

Completely filled out service reports help materially in keeping the manufacturer informed as to the quality and reliability of the product. Many improvements in the radiotron quality in the past have been due to information obtained from data compiled from service reports. It is urged, therefore, that the service reports accompanying the radiotron be carefully filled out and returned if the radiotron becomes inoperative.

In case a UV-204A tube is found to be inoperative it should be returned, together with its service reports, to the Radio Corporation, if purchased directly from them, or to the agent of the Radio Corporation from whom it was purchased.