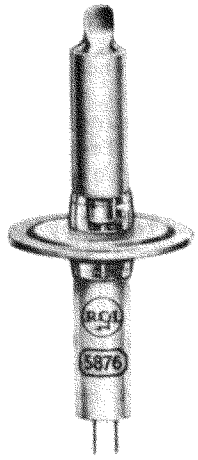
5876

UHF HIGH-MU TRIODE

"Pencil Type" for Grounded-Grid Service

TENTATIVE DATA

RCA-5876 is a general-purpose, high-mu triode intended particularly for use in grounded-grid service as an rf amplifier, if amplifier, or mixer tube in receivers operating at frequencies up to about 1000 megacycles per second; as a frequency multiplier up to about 1500 megacycles per second; and as an oscillator up to 1700 megacycles per second. The 5876 may also be used as a low power rf amplifier in mobile transmitters



Actual Size

As an unmodulated class C rf amplifier, the 5876 is capable of giving a useful power output of 5 watts at 500 megacycles per second. As an unmodulated class C oscillator, the 5876 can deliver a useful power output of 3 watts at 500 megacycles per second and 750 milliwatts at 1700 megacycles per second.

Featured in the 5876 is the "pencil-type" construction which not only meets requirements as to minimum transit time, low lead inductance, and low interelectrode capacitances, but also provides other desirable design features such as small size, light weight, low heater wattage, good thermal stability, and convenience of use in equipment design. The tube is less than 2-3/8 inches long and has a diameter of only 1/4 inch exclusive of the grid flange.

The coaxial-electrode structure employed is of the double-ended type in which the plate cylinder and cathode cylinder extend outward from each side of the grid flange. The latter is particularly effective in permitting isolation of the plate circuit from the cathode circuit in grounded-grid service. Although designed for use in circuits of the coaxial-cylinder type, the 5876 is also suitable for use in circuits of the line type and lumped-circuit type.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 5%	volts
Current	0.135	ampere
Direct Interelectrode Capacitances (Approx.):		
Grid To Plate	1.4	μμf
Grid to Cathode	2.5	μμf
Plate to Cathode	0.035 max.	μμf

Mechanical:

Mounting Position	Any
Dimensions and Terminal Connections	See Outline Drawing

CLASS A_1 AMPLIFIER

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE	300 max.	volts
DC GRID VOLTAGE	−100 max.	volts
DC PLATE CURRENT	25 max.	ma
PLATE DISSIPATION◇	6.25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PLATE-SEAL TEMPERATURE	175 max.	°C

Characteristics:

Plate Voltage	250	volts
Cathode-Bias Resistor	75	ohms
Amplification Factor	56	
Plate Resistance	8625	ohms
Transconductance	6500	μmhos
Plate Current	18	ma

Maximum Circuit Values:

Grid-Circuit Resistance	0.5 max.	megohm

PLATE-MODULATED RF POWER AMP. - Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS° Ratings, *Absolute Values*:

DC PLATE VOLTAGE	275 max.	volts
DC GRID VOLTAGE	−100 max.	volts
DC PLATE CURRENT	22 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	6.0 max.	watts
PLATE DISSIPATION◇	4.25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PLATE-SEAL TEMPERATURE	175 max.	°C

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	megohm

RF POWER AMPLIFIER & OSC. - Class C Telegraphy

Key-down conditions per tube without amplitude modulation•

Maximum CCS° Ratings, *Absolute Values*:

DC PLATE VOLTAGE	360 max.	volts
DC GRID VOLTAGE	−100 max.	volts
DC PLATE CURRENT	25 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	9 max.	watts
PLATE DISSIPATION◇	6.25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PLATE-SEAL TEMPERATURE	175 max.	°C

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5876-4-50
Photolithigraphed in U.S.A.

Typical Operation as Oscillator in Grounded-Grid Circuit:

	500 Mc	1700 Mc	
DC Plate Voltage	250	250	volts
DC Grid Voltage♦	-12	-2	volts
DC Plate Current	23	23	ma
DC Grid Current (Approx.)	6	3	ma
Useful Power Output (Approx.)	3	0.75	watts

Typical Operation as RF Power Amplifier in Grounded-Grid Circuit:

	500 Mc	
DC Plate Voltage	275	volts
DC Grid Voltage♦	-51	volts
DC Plate Current	23	ma
DC Grid Current (Approx.)	7	ma
Driver Power Output (Approx.)	2	watts
Useful Power Output (Approx.)	5	watts

Maximum Circuit Values:

Grid-Circuit Resistance . . . . . 0.1 max. megohm

FREQUENCY MULTIPLIER

Maximum CCS° Ratings, *Absolute Values*:

DC PLATE VOLTAGE	330 max.	volts
DC GRID VOLTAGE	-100 max.	volts
DC PLATE CURRENT	22 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	7.5 max.	watts
PLATE DISSIPATION◊	6.25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PLATE-SEAL TEMPERATURE	175 max.	°C

Typical Operation:

	Tripler to 480 Mc	Doubler to 960 Mc	
DC Plate Voltage	300	300	volts
DC Grid Voltage♦	-90	-70	volts
DC Plate Current	18	17.3	ma
DC Grid Current (Approx.)	6	7	ma
Driver Power Output (Approx.)	2.1	2	watts
Useful Power Output (Approx.)	2.1	2	watts

Maximum Circuit Values:

Grid-Circuit Resistance . . . . . 0.1 max. megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Av.	Max.	
Heater Current	1	0.125	0.135	0.145	ampere
Grid-to Plate Capacitance	-	1.2	1.4	1.6	μμf
Grid-to Cathode Capacitance	-	2.2	2.5	2.8	μμf
Plate-to Cathode Capacitance	-	-	-	0.035	μμf

Note 1: With 6.3 volts ac or dc on heater.

◊ In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the terminal to provide adequate heat conduction.

° Continuous Commercial Service.

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

♦ Obtained from grid resistor.

INSTALLATION and APPLICATION

The 5876 may be mounted in any position. Connections to the cathode cylinder, grid flange, and plate cylinder should be made by flexible spring contacts only. The connectors must make firm, large-surface contact, yet must be sufficiently flexible so that no part of the tube is subjected to strain. Unless this recommendation is observed, the glass-to-metal seals may be damaged.

The *heater* leads of the 5876 fit the Cinch socket No. 54A11953. They should not be soldered to circuit elements. The heat of the soldering operation may crack the glass seals of the heater leads and damage the tube.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.

The *temperature* of the plate seal should not exceed 175 degrees centigrade (at the hottest point). The temperature may be measured with temperature sensitive paint, such as Tempilaq. The latter is made by the Tempil Corporation, 132 West 22nd Street, New York 11, N. Y. in the form of liquid and stick, and is stated by the manufacturer to have an accuracy of one percent.

The *maximum ratings* are limiting values above which the serviceability of the 5876 may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by an amount such that the absolute values will never be exceeded under any usual conditions of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

In *class A_1 amplifier service*, grid-bias voltage should be obtained from a cathode resistor.

In *plate-modulated class C rf power amplifier service*, the 5876 should be supplied with bias from a grid resistor, or from a suitable combination of grid resistor and fixed supply or grid resistor and cathode resistor. The cathode resistor should be bypassed for both audio and radio frequencies. The combination method of grid resistor and fixed supply has the advantage of not only protecting the tube from damage through loss of excitation but also of minimizing distortion by bias-supply compensation. Grid-bias voltage is not particularly critical so that correct adjustment may be obtained with values differing widely from the calculated values.

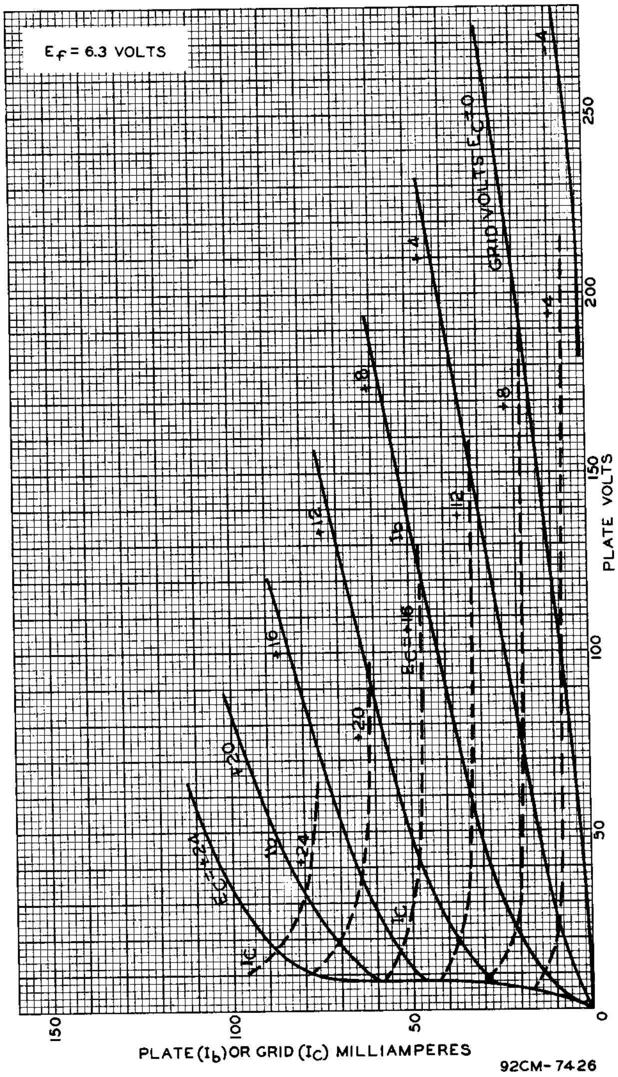
In *grounded-grid plate-modulated class C telephony service*, the 5876 can be modulated 100 percent if the rf driver stage is also modulated 100 percent simultaneously. Care should be taken to insure that the driver-modulation and the amplifier-modulation voltages are exactly in phase. In such service, the 5876 requires increased driving power, but increased power output is obtained as shown in the tabulated data.

In *class C rf telegraphy service*, the 5876 may be supplied with bias by any convenient method. When the tube is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed bias must be used to limit the plate current and, therefore, the plate dissipation to a safe value. If the 5876 is operated at a plate voltage of 300 volts, a fixed bias of at least -2 volts should be used.

In *grounded-grid circuits* the grid-driving voltage and the developed rf plate voltage act in series to supply the load circuit. As a result, the required driving power is increased over that needed for grounded-cathode circuits. The increased driving power is not lost because it appears as output from the grounded-grid stage. If the driving voltage and grid current are increased, the output will always increase.

In tuning a grounded-grid rf amplifier, it must be remembered that variations in the load on the output stage will produce corresponding variations in the load on the driving stage. This effect will be noticed by the simultaneous increase in plate currents of both the output and driving stages.

When more radio-frequency power is required than can be obtained from a single tube, push-pull or parallel circuit arrangements may be used. Two tubes in parallel or push-pull will give approximately twice the power output of one tube. The parallel connection requires no increase in exciting voltage necessary to drive a single tube. With either connection, the driving power required is approximately twice that for a single tube. The push-pull arrangement has the advantage of cancelling the even-order harmonics from the output and of simplifying the balancing of high-frequency circuits. When two or more tubes are used in the circuit, precautions should be taken to balance the plate currents.



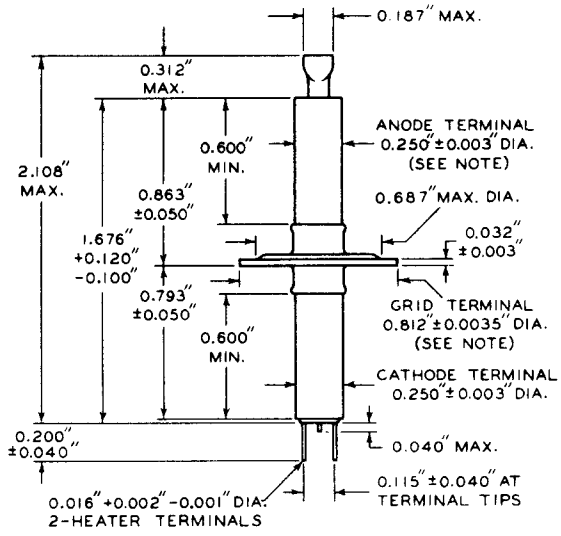
Average Plate Characteristics of Type 5876.

REFERENCES

G. M. Rose, D. W. Power and W. A. Harris, *"Pencil-Type UHF Triodes"*, RCA Review, Vol. 10, No.3, pp. 321-338 (September, 1949).

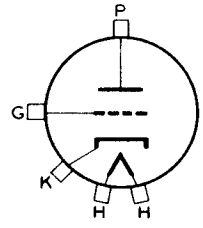
E. E. SPITZER, *"Grounded-Grid Power Amplifiers"*, Electronics, Vol. 19, No.4, pp. 138-141 (April, 1946).

DIMENSIONAL OUTLINE



NOTE: MAX. ECCENTRICITY OF ℄ (AXIS) OF ANODE TERMINAL OR GRID-TERMINAL FLANGE WITH RESPECT TO THE ℄ (AXIS) OF THE CATHODE TERMINAL IS 0.008".

TERMINAL CONNECTIONS



H: HEATER
K: CATHODE
G: GRID
P: PLATE