

# Cunningham

## RADIO TUBES

C-56



### SUPER-TRIODE AMPLIFIER

The 56 is a three-electrode tube of the uni-potential heater-cathode type recommended for use as detector, amplifier, or oscillator in a-c receivers designed for it. This tube is characterized by its small overall size, its relatively low heater power consumption, its high mutual conductance, and its comparatively high amplification factor. The 56 is especially useful in resistance-coupled audio-frequency amplifiers.

### CHARACTERISTICS

|                                      |          |                   |
|--------------------------------------|----------|-------------------|
| HEATER VOLTAGE (A. C. or D. C.)..... | 2.5      | Volts             |
| HEATER CURRENT .....                 | 1.0      | Ampere            |
| PLATE VOLTAGE .....                  | 250 max. | Volts             |
| GRID VOLTAGE* .....                  | -13.5    | Volts             |
| PLATE CURRENT .....                  | 5        | Milliamperes      |
| PLATE RESISTANCE .....               | 9500     | Ohms              |
| AMPLIFICATION FACTOR .....           | 13.8     |                   |
| MUTUAL CONDUCTANCE .....             | 1450     | Micromhos         |
| GRID-PLATE CAPACITANCE .....         | 3.2      | $\mu\mu\text{f.}$ |
| GRID-CATHODE CAPACITANCE .....       | 3.2      | $\mu\mu\text{f.}$ |
| PLATE-CATHODE CAPACITANCE .....      | 2.2      | $\mu\mu\text{f.}$ |
| MAXIMUM OVERALL LENGTH .....         |          | $4\frac{1}{4}$ "  |
| MAXIMUM DIAMETER .....               |          | $1\frac{9}{16}$ " |
| BULB (See page 42, Fig. 6) .....     |          | S-12              |
| BASE .....                           |          | Small 5-Pin       |

\* If a grid coupling resistor is used, its maximum value should not exceed 1.0 megohm.

### INSTALLATION

The base of the 56 is of the small five-pin type. Its pins fit the standard five-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with its heater pin openings one vertically above the other. For socket connections, see page 39, Fig. 8.

The heater is designed to operate at 2.5 volts. The transformer winding supplying the heater circuit should be designed to operate the heater at this recommended value (as measured at the heater terminals) when rated voltage is applied to the primary of the power transformer operating under average load.

The cathode should be connected either to the mid-tap on the heater supply winding or to the mid-tap of a 50 ohm (approximate) resistor shunted across the winding. If this practice is not followed, the heater may be biased negative with respect to the cathode by not more than 45 volts. When the cathode is not connected directly to the heater in a-c receivers, attention should be given to keeping the impedance of the circuit between heater and cathode as low as possible. Unless this is done, hum may arise because of heater to cathode leakage.

### APPLICATION

As an amplifier, the 56 is applicable either to radio-frequency or audio-frequency circuits. Recommended operating conditions for service using transformer coupling are given under CHARACTERISTICS. For circuits utilizing resistance coupling, typical operating conditions are as follows: Plate supply voltage, 250 volts; grid bias voltage,

# THE CUNNINGHAM RADIO TUBE MANUAL

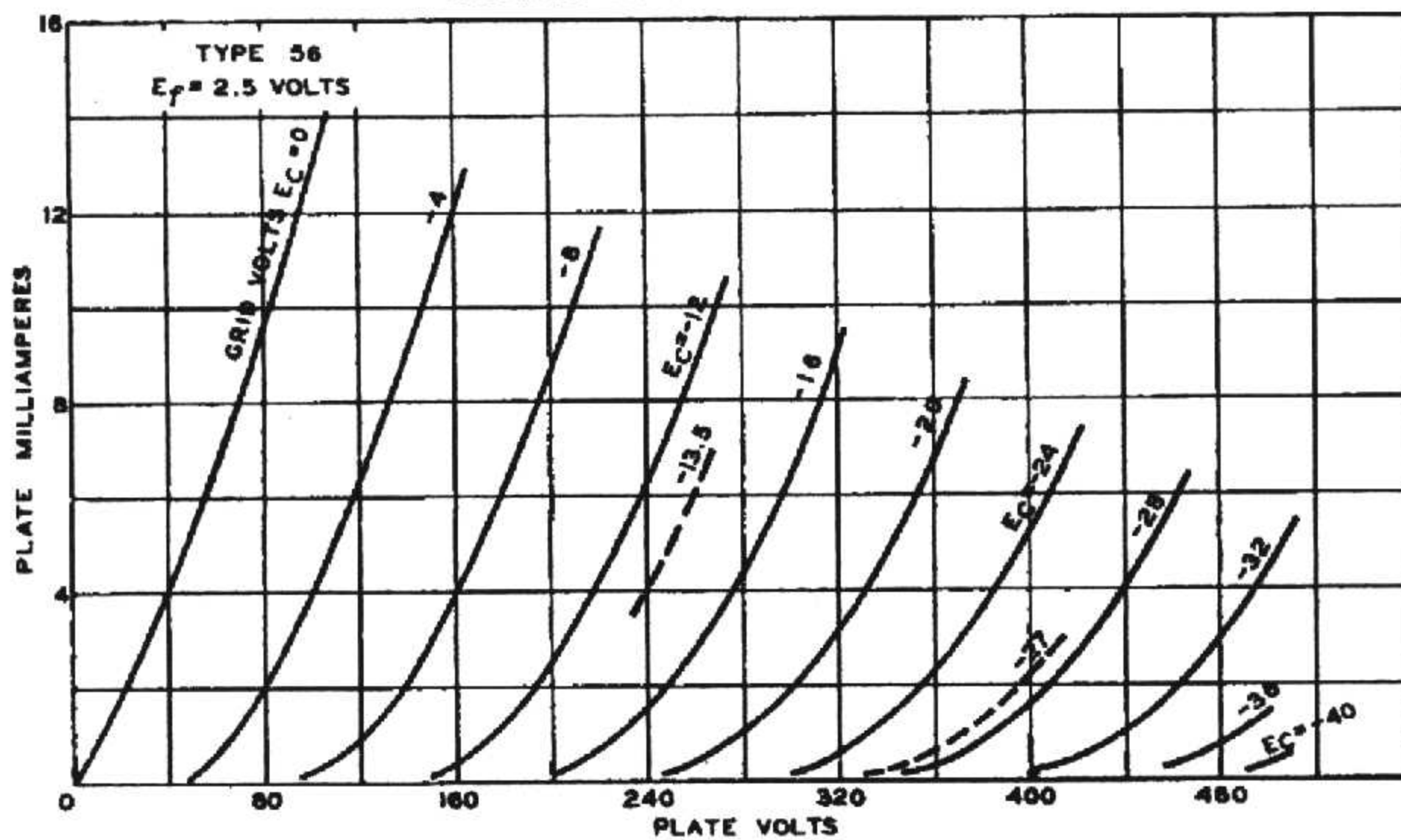
-9 volts (approximate); plate load resistor, 50000 to 100000 ohms; and plate current, 1 to 2 milliamperes.

As a detector, the 56 may be of the grid leak and condenser or grid bias type. The plate voltage for the grid leak and condenser method should be about 45 volts. A grid leak of from 1 to 5 megohms with a grid condenser of 0.00025  $\mu$ f. is satisfactory. For the grid bias method of detection, the maximum plate supply voltage of 250 volts may be used together with a negative grid bias voltage of approximately 20 volts. The plate current should be adjusted to 0.2 milliampere with no a-c input signal voltage. The grid bias voltage may be supplied from the voltage drop in a resistor between cathode and ground. The value of this self-biasing resistor is not critical, 100000 to 150000 ohms being suitable. The higher value will permit the application of a larger input signal.

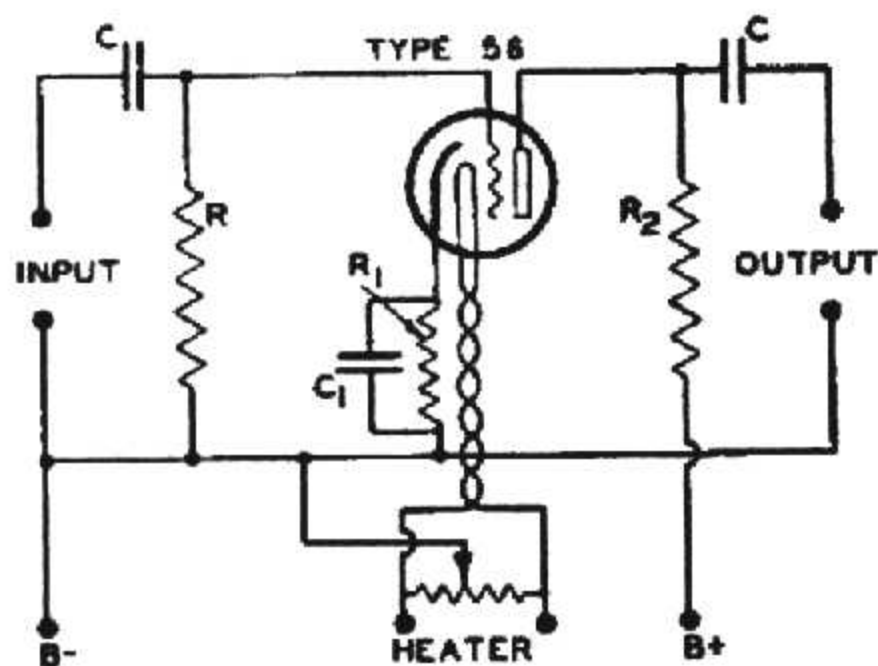
The 56 may be employed as a two-electrode detector preferably by connecting the plate to the cathode for the one electrode and using the grid for the other. With this arrangement, a-c input voltages as high as 40 volts RMS may be applied between grid and cathode.

As an oscillator, the 56 may be operated with a plate voltage of approximately 90 volts and zero grid bias. A lower value of plate voltage may be found desirable in some applications.

AVERAGE PLATE CHARACTERISTICS

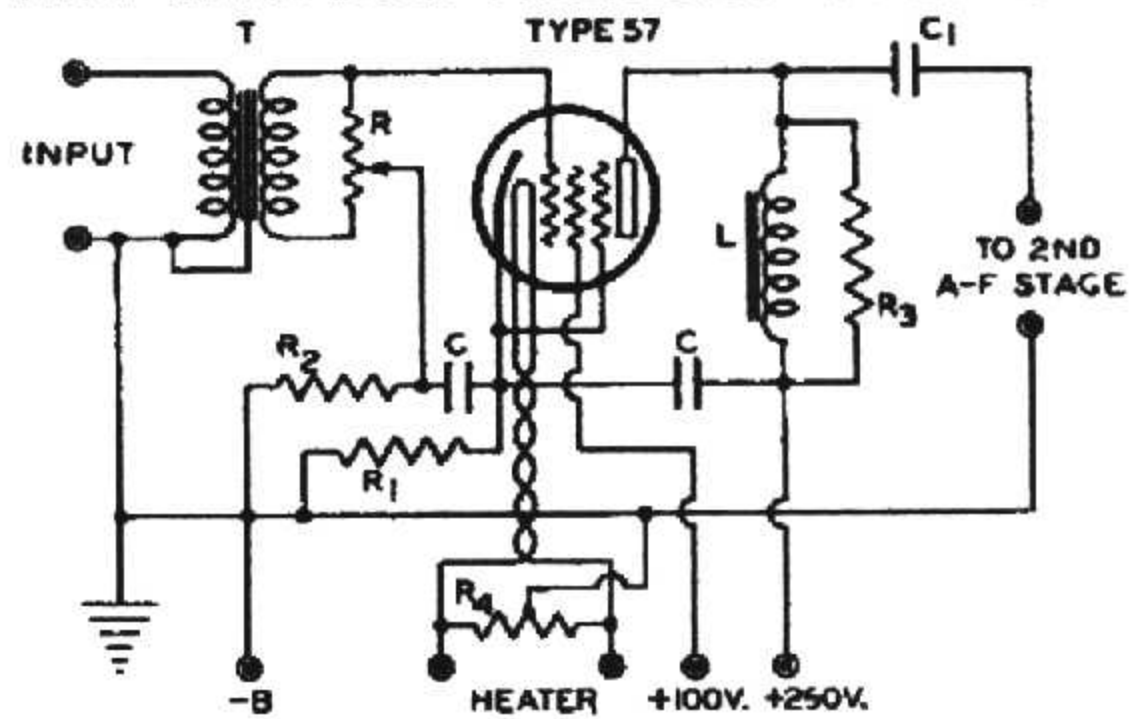


RESISTANCE-COUPLED A-F AMPLIFIER



- R = GRID RESISTOR (1.0 MEGOHM, MAX)
- R<sub>1</sub> = SELF-BIASING RESISTOR (3000 OHMS)
- R<sub>2</sub> = COUPLING RESISTOR (50000 TO 100000 OHMS)
- C = COUPLING CONDENSER (0.1  $\mu$ f. - 1.0  $\mu$ f.)
- C<sub>1</sub> = BY-PASS CONDENSER (4  $\mu$ f.)

HIGH-GAIN AUDIO-FREQUENCY AMPLIFIER



- C = A-F BY-PASS CONDENSER (0.5  $\mu$ f.)
- C<sub>1</sub> = COUPLING CONDENSER (0.01  $\mu$ f.)
- R = VOLUME CONTROL POTENTIOMETER (250000 OHMS)
- R<sub>1</sub> = SELF-BIASING RESISTOR (1000 OHM, 1 WATT)
- R<sub>2</sub> = DECOUPLING RESISTOR (250000 OHMS)
- R<sub>3</sub> = COMPENSATING RESISTOR (250000 OHMS)
- R<sub>4</sub> = CENTER-TAPPED RESISTOR (50 OHMS)
- T = INPUT TRANSFORMER
- L = 300 TO 500 HENRY CHOKE