



# Cunningham RADIO TUBES

C-335

## SUPER-CONTROL RADIO-FREQUENCY AMPLIFIER

The '35 is a super-control screen grid amplifier tube containing a 2.5 volt heater-cathode of the equi-potential type. It is recommended as a radio-frequency amplifier and an intermediate-frequency amplifier in a-c receivers. The '35 is very effective in reducing cross-modulation and modulation-distortion over the entire range of received signals. Its design is such as to permit easy control of a large range of signal voltages without the use of local-distance switches or antenna potentiometers. This super-control feature makes the tube adaptable to circuits incorporating automatic volume control. See page 15 for Super-Control feature.

### CHARACTERISTICS

HEATER VOLTAGE (A. C. or D. C.)	2.5	Volts
HEATER CURRENT	1.75	Amperes
PLATE VOLTAGE*	180 250	Volts
SCREEN VOLTAGE	75 90 max.	Volts
GRID VOLTAGE, Variable (Minimum)	-1.5 -3	Volts
PLATE CURRENT	5.8 6.5	Milliamperes
SCREEN CURRENT (Maximum)	2.5 2.5	Milliamperes
PLATE RESISTANCE	350000 350000	Ohms
AMPLIFICATION FACTOR	385 370	
MUTUAL CONDUCTANCE	1100 1050	Micromhos
MUTUAL CONDUCTANCE	{ At -40 volts bias 5 15	Micromhos
	{ At -50 volts bias — 1 min.	Micromho
EFFECTIVE GRID-PLATE CAPACITANCE	0.010 maximum	μf.
INPUT CAPACITANCE	5	μf.
OUTPUT CAPACITANCE	10	μf.
OVERALL LENGTH		1 <sup>25</sup> / <sub>32</sub> " to 5 <sup>1</sup> / <sub>32</sub> "
MAXIMUM DIAMETER		1 <sup>13</sup> / <sub>16</sub> "
BULB (See page 42, Fig. 11)		S-14
CAP		Small Metal
BASE		Medium 5-Pin

\* Maximum plate voltage = 275 volts.

### INSTALLATION

The **base** pins of the '35 fit the standard five-contact socket. The socket may be mounted to hold the tube in any position. For socket connections, see page 39, Fig. 9.

The **heater** of the '35 is intended for operation from a 2.5 volt winding of the power transformer. The voltage applied to the heater terminals should be the rated value of 2.5 volts under operating conditions and with average line voltage.

The **cathode connection** to the heater should be made (1) to the movable arm of a potentiometer connected across the heater winding of the power transformer, or (2) to a mid-tapped resistor across the heater winding, or (3) to the mid-point of the heater winding itself.

The positive **screen voltage** for the '35 may be obtained from a fixed or variable tap on a voltage divider across the supply voltage or a portion of the supply.

Complete **shielding** for all stages of the circuit is necessary if maximum gain and the volume-control range capabilities of this tube are to be realized.

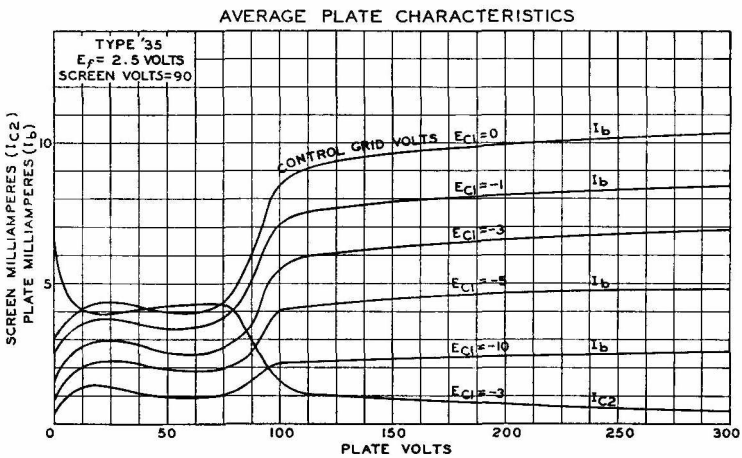
## APPLICATION

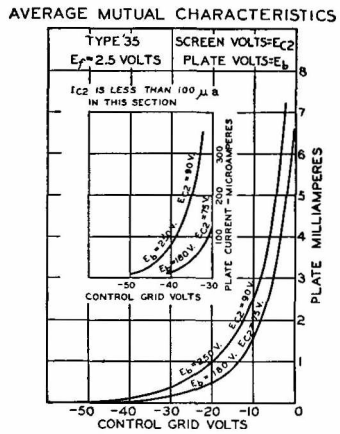
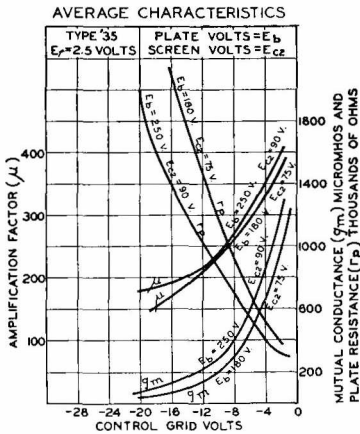
As a radio-frequency and intermediate-frequency amplifier, the '35 should be operated as shown under CHARACTERISTICS. In general, properly designed radio-frequency transformers are preferable to interstage coupling impedances, especially in cases where a high impedance B-supply may cause oscillation below radio frequencies.

Volume control of receivers designed for the '35 may be accomplished by variation of the negative grid bias of this tube. In order to utilize the full volume-control range of the '35, an available grid bias voltage of approximately 50 volts will be required, depending upon the circuit design and operating conditions. This voltage should preferably be obtained from a potentiometer or bleeder circuit. If, however, the receiver is designed so that the required volume control can be obtained without exceeding 45 volts, the cathode-resistor method of obtaining the grid-bias control is permissible.

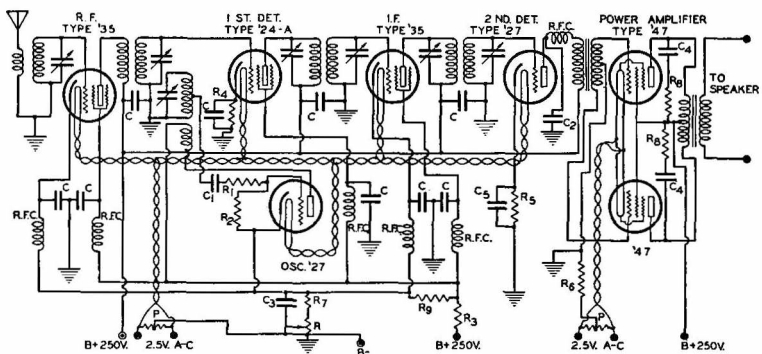
As a detector working directly into an audio-frequency amplifier, the '35 is not ordinarily suited. However, this tube does have a very useful application as a first detector in superheterodyne circuits. Suitable operating voltages for such service are: Plate voltage, 250 volts; screen voltage, 90 volts; and grid bias, -7 volts with a 6-volt peak swing from the oscillator. By varying the grid bias on the first detector in conjunction with that on the radio-frequency and/or the intermediate-frequency stages, additional control of volume may be accomplished.

As an audio-frequency amplifier, the '35 may be used in a single stage, resistance-coupled circuit when it is followed by not more than one amplifier stage. Additional stages of amplification are not recommended because of the possibility of noise and microphonic disturbances resulting from the high level of amplification. Suitable operating voltages for such service are: Plate supply voltage, 180 to 250 volts, applied through a load resistor of 10000 to 20000 ohms; screen voltage 25 volts; grid bias, -1 volt. In general, the higher value of load resistor will permit increased amplification but will give poorer fidelity. The higher plate supply voltages allow increased signal swing without distortion but are not required where only small signals are to be amplified. In resistance-coupled circuits employing the '35, the grid resistor should have a value not exceeding 1.0 megohm.





**TYPICAL SUPERHETERODYNE RECEIVER FOR A-C OPERATION**



- $C = R-F$  BY-PASS CONDENSER (0.1  $\mu f$ .)
- $C_1 =$  OSC. GRID CONDENSER (0.00075  $\mu f$ .)
- $C_2 = R-F$  BY-PASS CONDENSER (0.00025  $\mu f$ .)
- $C_3 = R-F$  BY-PASS CONDENSER (0.9  $\mu f$ .)
- $C_4 =$  CONDENSER (0.03  $\mu f$  APPROX.)
- $R =$  VOLUME CONTROL POTENTIOMETER (8 000 OHMS)
- $R_1 =$  RESISTOR (6 000 OHMS)
- $R_2 =$  OSCILLATOR GRID LEAK (40 000 OHMS)
- $R_3 =$  RESISTOR (14 000 OHMS)
- $R_4 =$  SELF-BIASING RESISTOR (1 500 OHMS)
- $R_5 =$  SELF-BIASING RESISTOR (50 000 OHMS)
- $R_6 =$  SELF-BIASING RESISTOR (225 OHMS)
- $R_7 =$  PARTIAL SELF-BIAS RESISTOR (150 OHMS)
- $R_8 =$  RESISTOR (10 000 OHMS APPROX.)
- $R_9 =$  RESISTOR (8 000 OHMS)
- $P =$  POTENTIOMETER (20 OHMS)
- $C_5 = A-F$  BY-PASS CONDENSER (2-4  $\mu f$ )

Optional power amplifier using '45's shown on page 61.