

BULLETIN

POWER AMPLIFIER CX-345

This is a new tube which does not replace any other tube in the Cunningham line. CX-345 is not interchangeable with any Cunningham power amplifier.

Type CX-345
POWER AMPLIFIER



Type CX-345 is a new loud speaker power amplifier tube which will give power outputs between that obtained from the CX-371A and CX-350. It has been designed primarily for operation in A.C. sets and for this service has incorporated in it a very sturdy and long life filament. In general appearances it is similar to the CX-371A with a larger bulb.

This tube has been designed to operate at plate voltages of 180 to 250 volts, maximum. The grid bias at 180 volts is 33 volts for direct current operation and 34.5 volts for A.C. operation. At 250 volts the grid bias values are 48.5 volts and 50 volts for D.C. and A.C. operation, respectively.

In electrical characteristics it is similar to the CX-371A in that the amplification factor is 3.5, plate resistance is 1,750 ohms and mutual conductance is 2000 at a plate voltage of 250 volts. Under these conditions the average plate current is 34 milliamperes. The CX-345 is not interchangeable with CX-371A however, because the filament voltage is 2.5 volts. When inserted in a socket designed for CX-371A the tube

will either burn out or will burn out the filament winding of the power transformer. The filament is of the rugged coated type requiring 2.5 volts and 1.5 amperes. This filament has been especially designed to withstand the normal line voltage fluctuations and will give satisfactory life when operated between 5 percent above the normal rating of 2.5 volts and 5 percent below the normal rating.

BULB

The bulb provided for the CX-345 has a maximum diameter of $2 \frac{3}{16}$ " ; the maximum overall length from the end of the contact pins to the top of the bulb is $5 \frac{3}{8}$ ".

FILAMENT

The filament rating is 2.5 volts 1.5 amperes. The current required will normally be supplied by a 2.5 volt winding on the power transformer which should be so designed that the voltage across the filament does not at any time exceed 2.63 volts.

ELEMENTS

The plate and grid are similar to the plate and grid of the CX-371A. The collar construction used on the CX-350 is not used in this type since the maximum voltage applied to the plate does never exceed 250 volts; the maximum rating.

BASE

The standard large four prong base is employed.

MOUNTING

It is preferable to mount the tube in a vertical position and provision should be made for free circulation of air around the tube to prevent overheating. The plate of this tube should never show any visible color due to heating.

OPERATING CONDITIONS

Filament Volts	2.5	
Filament Amperes	1.5	
Plate Volts	180	250
Grid Voltage (A.C. Fila.)	-34.5	-50

AVERAGE TUBE CHARACTERISTICS

Plate Voltage	180	250
Grid Voltage (A.C. Fila.) . .	-34.5	-50
C Bias Resistor	1380	1470 ohms
Amplification Factor	3.5	3.5
Plate Resistance	1900	1750 ohms
Mutual Conductance	1850	2000 micromhos
Plate Current	27	34 milliamperes
Undistorted Output	780	1600 milliwatts

USE

The plate voltage on CX-345 must not exceed our maximum recommended value of 250 volts. When the power obtainable from one tube is insufficient for volume requirements, two tubes can be used in the conventional push-pull circuit. Operating push-pull with the maximum voltage of 250 volts the power output obtainable is 3200 milliwatts which is equivalent to the output obtained from one CX-350 operated at 400 volts. The distortion in the push-pull circuit with output load resistance of 8000 ohms is less than one-half of one percent.

The plate and grid voltage can be conveniently supplied from one CX-380 rectifier obtained at an input voltage of 350 volts per anode. Because of the high voltage and the high plate current an output coupling device either transformer or choke-condenser is recommended.

This tube is particularly free from gas and may be operated with the grid circuit resistance of one megohm or less. Because

of this condition the tube may be operated in a resistance coupled amplifier.

This tube must not be operated without a "C" voltage and precaution must be taken to prevent the loss of negative grid voltage which will cause the CX-345 to become overloaded and also the rectifier tubes supplying it.

As will be the condition in most cases, it is desirable that the bias required by the tube be supplied from the drop across the resistor in series with the minus "B" return, as shown in Fig. 7. It will be found that this connection compensates almost completely for the changes in plate voltage which may occur as a result of line voltage variations, as an increase in plate voltage causes a small increase in plate current which in turn raises the applied "C" bias sufficiently to compensate for the new value of plate voltage.

CURVES AND DATA

(Pages 73, 74 and 75)

The curve of Fig. 1 shows the average filament current of type CX-345.

Fig. 2 gives the average plate current over a range of plate voltages at zero grid bias.

Fig. 3 shows the amplification factor (μ), plate resistance (r_p) and mutual conductance (G_m) plotted in relation to grid voltage at plate voltage of 180 volts.

Fig 4 shows the amplification factor (μ), plate resistance (r_p) and mutual conductance (G_m) plotted in relation to grid voltage at plate voltage of 250 volts.

Many times it is convenient to know the tube characteristics when the plate current only is known at an approximate value of plate voltage. For this reason we have included Fig. 5 which shows the various characteristics plotted against plate current. At the normal operating current there is little difference between the various values, but at the lower plate currents the variations are somewhat greater.

CX-345 AVERAGE CHARACTERISTICS

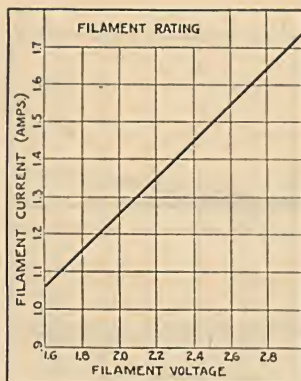


FIG. 1

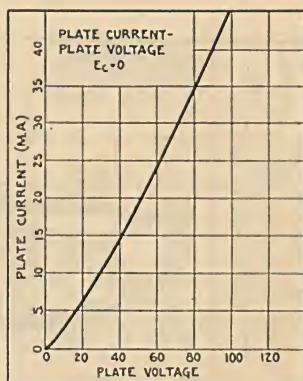


FIG. 2

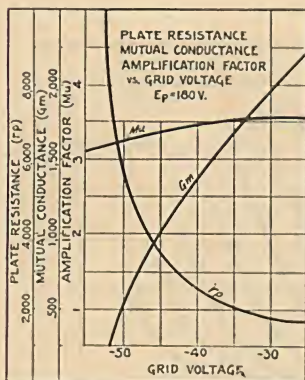


FIG. 3

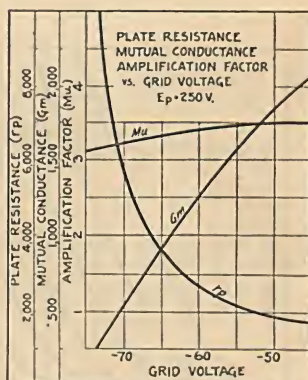


FIG. 4

CX-345 AVERAGE CHARACTERISTICS

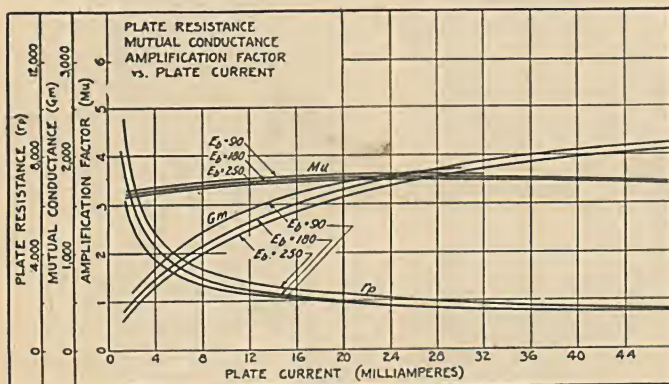


FIG. 5

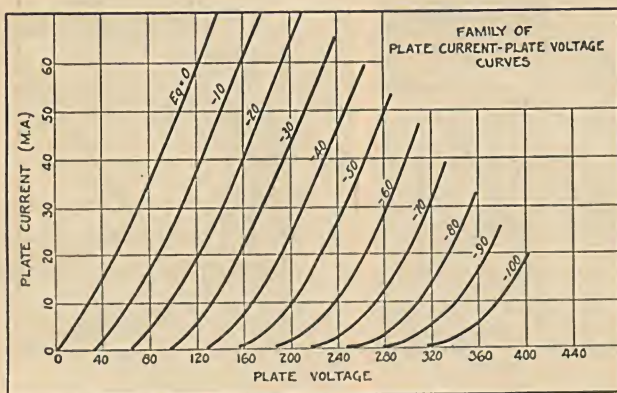


FIG. 6

Fig. 6 shows the family of plate current-plate voltage curves which are useful in calculating power output and determining the proper "C" battery voltages for definite plate currents. If A.C. filament operation is used, add 1.5 volts to the grid bias values given on the curves.

Fig. 7 shows a suitable circuit arrangement for type CX-345. With 250 volts plate voltage, R should be 1470 ohms. With 180 volts on the plate R should be 1380 ohms. This gives the proper "C" voltage at the average plate current.

Fig. 8 shows the typical output circuits which are recommended.

2ND AUDIO FREQUENCY AMPLIFYING STAGE

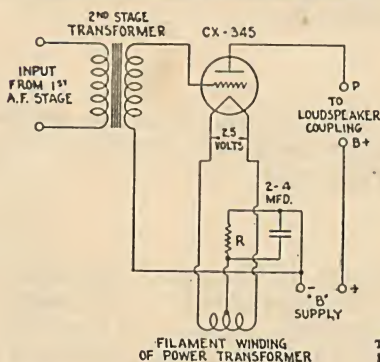
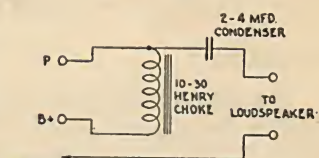


FIG. 7

LOUDSPEAKER COUPLING



FIG. 8A



TO CENTER TAP OF
FILAMENT WINDING

FIG. 8B