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#166

1852

Television Amplifier Pentode

RCA-1852 is a heater-cathode type of metal tube intended for use by the amateur and experimenter in experimental television receivers. It is recommended for use in the r-f and i-f stages of the picture amplifier of such receivers as well as in the first stages of the video amplifier when several video stages are employed. The 1852 can also be used as a mixer and makes a good oscillator in low-voltage applications.

The electrode assembly of the 1852 is the same as that in the 1851, but a special shielded lead construction has been employed in the 1852 to permit bringing out the control-grid lead to a base pin rather than to a pin cap. With this construction, it has been possible to keep the grid-plate capacitance as low as that of this tube with capped construction. From a circuit standpoint, the proximity of grid pin to cathode pin simplifies wiring and decreases the size of the inductance loop connecting the input circuit to the tube. These are features important at high frequencies because they provide decreased feedback and improved circuit stability.

TENTATIVE CHARACTERISTICS AND RATINGS

HEATER VOLTAGE (A.C. or D.C.)	6.3	Volts
HEATER CURRENT	0.45	Ampere
DIRECT INTERELECTRODE CAPACITANCES: °		
Grid to Plate	0.015 *max.*	μμf
Input	11	μμf
Output	5	μμf
MAXIMUM OVERALL LENGTH	2-5/8"	
MAXIMUM DIAMETER	1-5/16"	
BASE	Small Wafer Octal 8-Pin	

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

PLATE VOLTAGE		300 *max.*	Volts
SCREEN VOLTAGE		150 *max.*	Volts
SCREEN-SUPPLY VOLTAGE		300 *max.*	Volts
PLATE & SCREEN DISSIPATION (Total)		3.4 *max.*	Watts
SCREEN DISSIPATION		0.38 *max.*	Watts
TYPICAL OPERATION and CHARACTERISTICS:	*Condition I* *	*Condition II* **	
Plate Voltage	300	300	Volts

° With shell connected cathode.

* Condition I with fixed screen supply gives a sharp cut-off characteristic.

** Condition II with series screen resistor gives an extended cut-off characteristic for applications where gain is controlled by variation of grid bias.

Suppressor Voltage	0		0	Volts
Screen-Supply Voltage #	150		300	Volts
Screen Series Resistor	-		60000	Ohms
Cathode-Bias Resistor ##	160	*min.*	160	*min.* Ohms
Amplification Factor (Approx.)	6750		6750	
Plate Resistance (Approx.)	0.75		0.75	Megohm
Transconductance	9000		9000	Micromhos
Plate Current	10		10	Milliamperes
Screen Current	2.5		2.5	Milliamperes

The d-c resistance of the grid circuit should not exceed 0.25 megohm when the screen voltage is obtained from a fixed source. When a series screen resistor is used with full cathode bias, the d-c resistance in the grid circuit may be made as high as 0.5 megohm.

Screen-supply voltages in excess of 150 volts require use of a series dropping resistor to limit the voltage at the screen to 150 volts when the plate current is at its normal value of 10 milliamperes.

INSTALLATION

The *base* pins of the 1852 fit the standard octal socket which should be installed to hold the tube preferably in a vertical position with the base either up or down. Horizontal operation is permissible if the socket is positioned so that Pins No.2 and No.7 are in a vertical plane.

The *heater* of the 1852 is designed to operate on either a.c. or d.c. When a.c. is used, the winding which supplies the heater circuit should operate the heater at its recommended value for full-load operating conditions at average line voltage. When d.c. is used on the heater, the heater terminals should be connected directly across a 6-volt battery. Under any condition of operation, the heater voltage should not deviate more than plus or minus 10% from the normal value of 6.3 volts.

The *cathode,* when the 1852 is operated from a transformer, should be connected through a bias resistor either to one side or to the electrical mid-point of the heater circuit. In the case of d-c operation from a 6-volt storage battery, the cathode circuit should be tied through a bias resistor to the negative battery terminal. The potential difference between heater and cathode should be kept as low as possible.

In some installations having automatic bias control which provides a fixed minimum bias adequate to limit the plate current to 10 milliamperes, and also using a 60000-ohm series screen resistor, the cathode may be connected directly to ground, or it may be connected through an unby-passed resistor to ground. This resistor may conveniently form a portion of the fixed minimum bias. Such an arrangement serves to minimize changes of input capacitance and input conductance, as explained under Control-Grid Bias.

Control-grid bias for the 1852 may be obtained by means of a cathode-bias (self-bias) resistor adjusted to give a plate current of 10 milliamperes.

In tubes such as the 1852, with an exceedingly high value of transconductance, there are pronounced changes of input capacitance and input conductance with plate current. In order to minimize these changes when the 1852 is used as an r-f or i-f amplifier, a portion of the cathode-bias resistor may be left unby-passed. Reducing the changes of input capacitance and input conductance in this manner, however, is accomplished with some sacrifice in effective transconductance and with some increase in effective grid-plate capacitance. To prevent excessive effective grid-plate capacitance, precautions should be observed to keep the external capacitances between plate and cathode leads at a minimum. It should be observed that with this method of minimization, the cathode is not at a-c ground potential. Because of this fact, the most favorable connection of the tube electrodes will be obtained when screen and suppressor are at a-c ground potential, as shown in the circuit R-F or I-F AMPLIFIER on page 5.

In video stages, the cathode-bias resistor should not be by-passed if it is desired to have degeneration and freedom from distortion. When, however, no degeneration and maximum amplitude are desired, the cathode-bias resistor should be by-passed with a large condenser (350 μf).

The *screen* voltage in Condition I may be obtained from a potentiometer or bleeder circuit across the B-supply source. This operating condition is suitable when the gain is fixed and the signals are not too large. For applications where bias adjustment is used to vary the gain, either manually or automatically, an extended cut-off characteristic may be obtained, as shown in Condition II where the screen voltage is obtained from the B-supply through a series screen resistor. This arrangement permits the handling of somewhat larger signals.

The *suppressor* should be connected in r-f and i-f stages directly to ground, in order to minimize feedback.

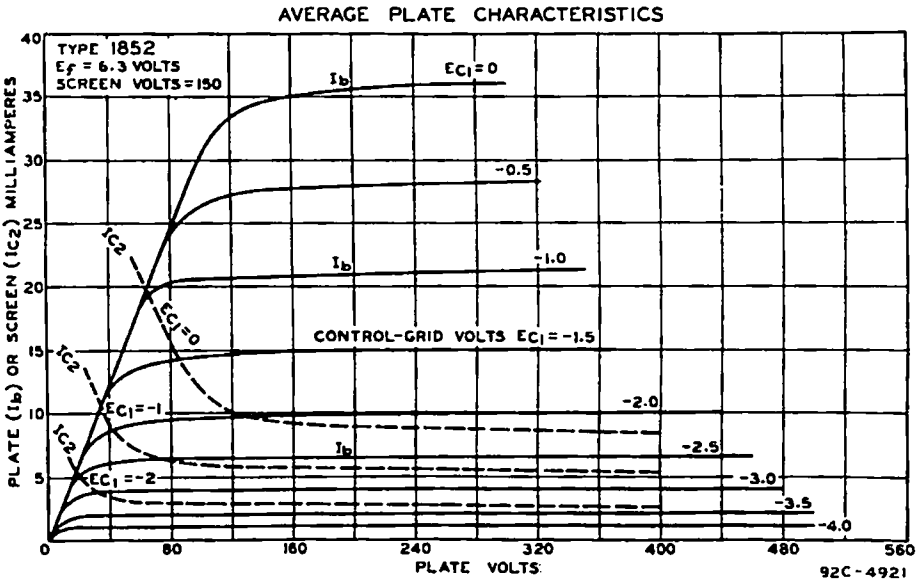
APPLICATION

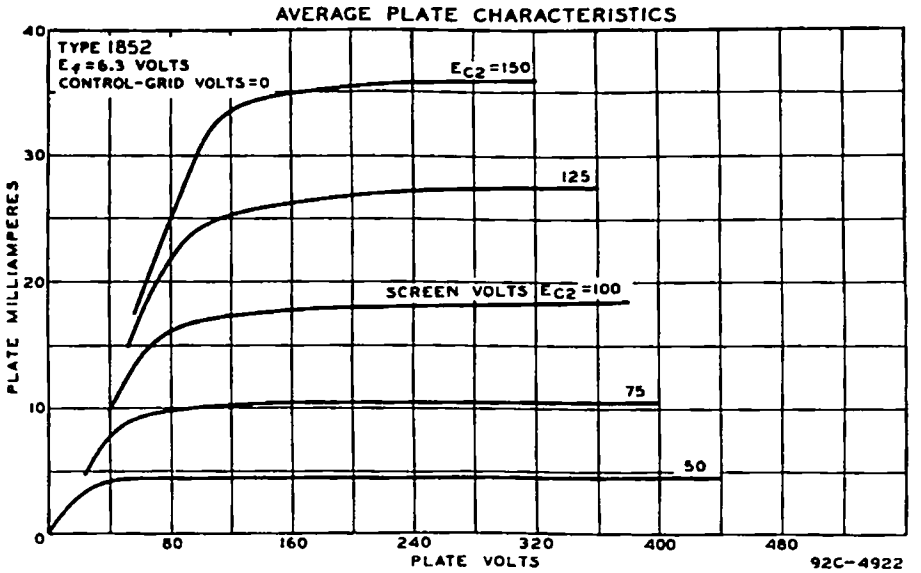
As an *amplifier*, the 1852 is especially suited for use in the r-f and i-f stages of the picture amplifier of experimental television receivers, and may also be used in the first stages of the video amplifier when several video stages are used in such receivers. The use of the 1852 as a high-gain audio amplifier is not recommended unless the heater is operated from a battery source.

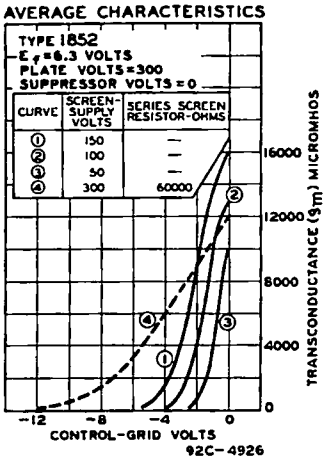
When minimization of changes in input capacitance and input conductance is not accomplished by leaving a portion of the cathode-bias resistor unby-passed, it will be found advisable to operate the 1852 with circuits heavily loaded by resistance and capacitance. Although such circuits minimize the effect of the relatively small variations in tube capacitance and conductance, they also cause some sacrifice in gain.

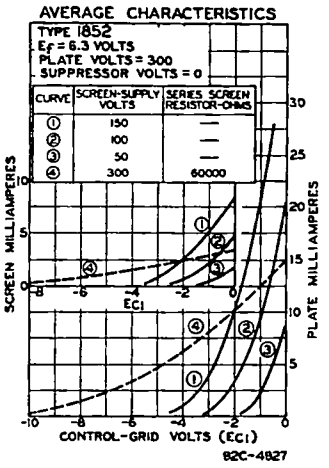
When the gain of the r-f and i-f stages as well as that of the video stages is controlled automatically, it is recommended that the series-screen-resistor method be employed for obtaining screen voltage. This method of obtaining screen voltage from the plate supply is satisfactory for the 1852 because its suppressor practically removes the effects of secondary emission phenomena. With this method, the screen-to-cathode voltage will rise as the control-grid voltage is varied from minimum to maximum. This rise of screen-to-cathode voltage above the normal maximum value is allowable because the screen and the plate current are reduced simultaneously by a sufficient amount to prevent damage to the tube.

Several schematic circuits illustrating the use of the 1852 are shown on pages 5 and 6.

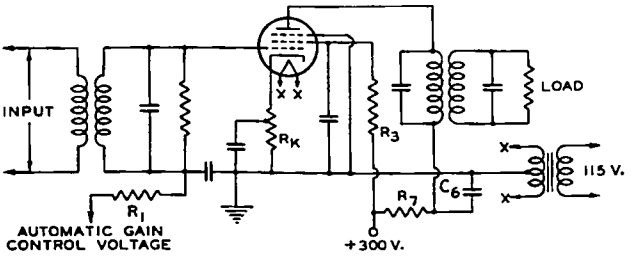




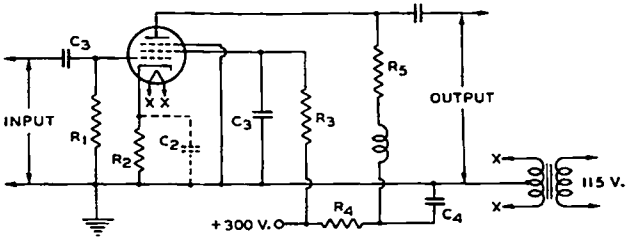




R-F OR I-F AMPLIFIER



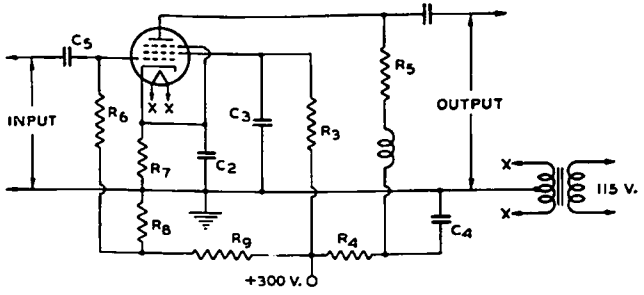
VIDEO AMPLIFIER



NOTE: THE CATHODE BY-PASS CONDENSER C_2 IS USED WHEN MAXIMUM SIGNAL AMPLITUDE AND NO DEGENERATION ARE DESIRED. OMISSION OF C_2 PROVIDES DEGENERATION AND GIVES LESS DISTORTION.

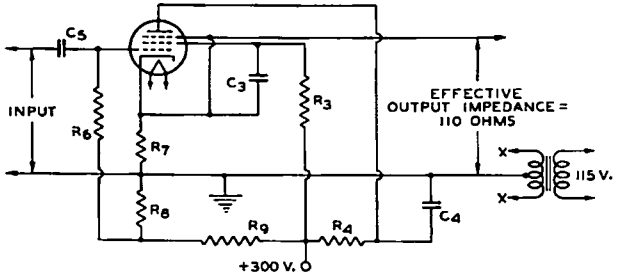
FOR VALUES OF CIRCUIT PARTS, SEE NEXT PAGE.

VIDEO AMPLIFIER
WITH HIGH-RESISTANCE INPUT COUPLING



NOTE: THE USE OF R_6 = 1.0 MEGOHM IS PERMISSIBLE IN THIS CIRCUIT BECAUSE OF THE REGULATING EFFECT PRODUCED BY R_7. THE BIAS VOLTAGE APPLIED TO THE GRID BY MEANS OF THE CATHODE RESISTOR R_7, AND THE BLEEDER RESISTORS R_8 AND R_9 SHOULD BE ADJUSTED TO GIVE A PLATE CURRENT OF 10 MA. NOTE THAT THE VOLTAGE ACROSS R_8 BUCKS A PORTION OF THAT ACROSS R_7.

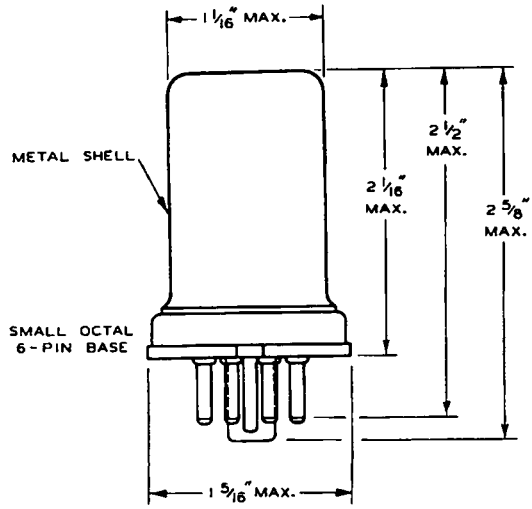
IMPEDANCE TRANSFORMER
FOR USE BETWEEN HIGH-IMPEDANCE CIRCUIT AND LOW-IMPEDANCE CIRCUIT



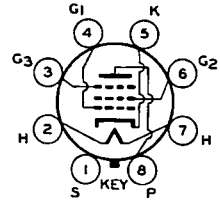
C_1 = 0.1 μf
C_2 = 350 μf
C_3 = 1.0 μf
C_4 = 12 μf
C_5 = 0.25 μf
C_6 = 0.05 μf

R_K = 160 OHMS, WITH TAP AT APPROXIMATELY 35 OHMS FROM CATHODE END
R_1 = 0.25 MEGOHM
R_2 = 160 OHMS
R_3 = 60000 OHMS

R_4 = 5000 OHMS
R_5 = 2000 OHMS
R_6 = 1.0 MEGOHM
R_7 = 1000 OHMS
R_8 = 9000 OHMS
R_9 = 250000 OHMS



BOTTOM VIEW OF SOCKET CONNECTIONS



G_1 = CONTROL GRID
G_2 = SCREEN
G_3 = SUPPRESSOR
H = HEATER
K = CATHODE
S = SHELL