



RCA MANUFACTURING COMPANY, INC.

A RADIO CORPORATION OF AMERICA SUBSIDIARY

*Harrison, New Jersey*

APPLICATION NOTE No.109  
November 13, 1940

### OPERATION OF FIFTY MILLIAMPERE TUBES BY THE 117N7-GT

The 117N7-GT, a combination rectifier and beam power tube, was developed primarily for use in "a-c, d-c, battery" receivers where a filament string is to be operated by the cathode current of the power output tube. This Note deals with the performance of the 117N7-GT under these stringent conditions of operation. Basic circuit arrangements are shown in Fig. 1, where the filament string comprises four tubes of the 1.4-volt line. The voltage across the filament string is the control-grid bias for the power output unit of the 117N7-GT, i.e., -5.2 volts; this voltage gives a design value per filament of 1.3 volts when the receiver is operated from a 117-volt line.

The filament string for each circuit of Fig. 1 includes an 820-ohm shunt across the entire string, and a 330-ohm shunt across the filament of the 1H5-GT. The 820-ohm shunt is recommended when a 3Q5-GT is switched into use for battery operation. The 330-ohm shunt prevents excessive plate current from entering the 1H5-GT filament. The voltages impressed on the plate and screen of the 117N7-GT must be such that the cathode current develops 5.2 volts across the filament string when all tubes are operating. This condition obtains in circuit 1-a with 84 plate volts and approximately 91 screen volts, the resistance of the choke being 500 ohms. These plate and screen voltages correspond to 96.5 volts across the second filter condenser.

Circuit 1-a may be modified to use a resistance-capacitance filter, as shown for circuit 1-b. The filament string is the same in both circuits. For purposes of comparison, values of plate voltage, screen voltage, and filament string voltage are shown in Fig. 2 for both circuits of Fig. 1 when the a-c line voltage is varied from 105 to 125 volts. Similarly, Fig. 3 shows filament string voltage, power output, and distortion when the load resistance is varied. While the power output curves show circuit 1-b to be somewhat preferable to circuit 1-a, the difference in power output is hardly enough to be an important factor in favor of circuit 1-b. Also, both circuits were tested in a typical receiver for noise and hum. For circuit 1-a, the noise and hum was 47 db below the 600-milliwatt level used; for circuit 1-b, the corresponding value was 44 db.



Since the performance of all tubes in the filament string depends upon the cathode current supplied by the beam power unit of the 117N7-GT, circuits 1-a and 1-b were compared on the basis of filament-string-voltage variations by testing a large number of 117N7-GT tubes in each circuit. The relative merit of these circuits was determined from spot diagrams which showed the filament string voltage for each of the many tubes tested. Comparison shows that the voltage spread for circuit 1-b is 65% greater than that for circuit 1-a. The reason for the better performance of circuit 1-a is that, in this circuit, the combined plate and screen currents pass through the 500-ohm choke and, thus, cause the screen voltage to drop for a high-current tube and to increase for a low-current tube. Consequently, circuit 1-a is preferable for operating a filament string from a 117N7-GT.



### OPERATION OF FILAMENT STRING FROM 117N7-GT

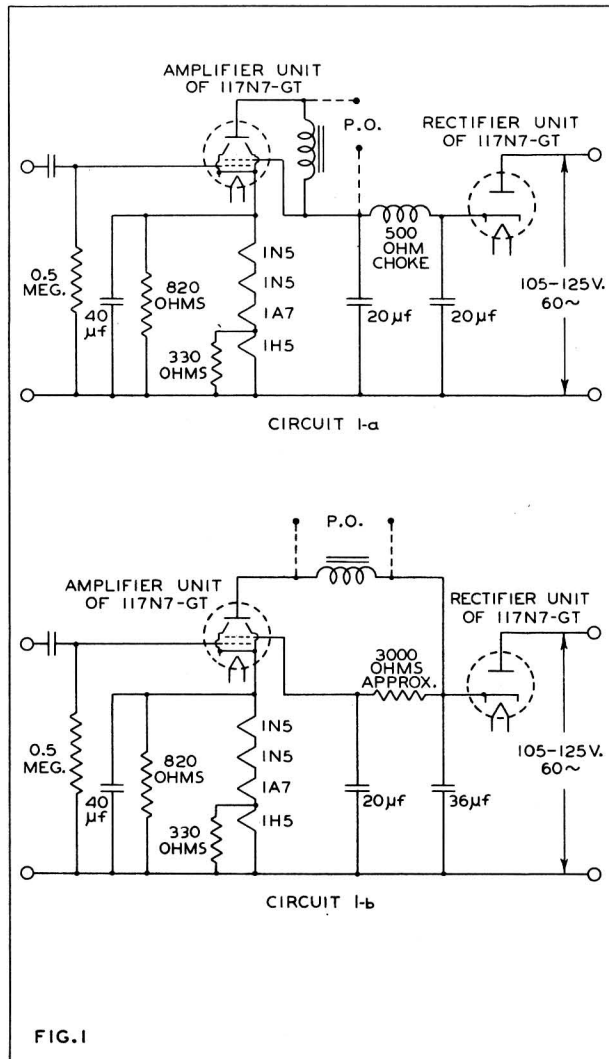


FIG. 1

The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.

OCT. 18, 1940

RCA RADIOTRON DIVISION  
RCA MANUFACTURING COMPANY, INC.

92C-6236

A PLATE SUPPLY RESISTOR OF NOT LESS THAN 15 OHMS IS RECOMMENDED FOR THE RECTIFIER UNIT OF THE 117N7-GT.



PERFORMANCE OF 117N7-GT IN CIRCUITS 1-a & 1-b OF FIG.1  
LINE VOLTAGE AS VARIABLE

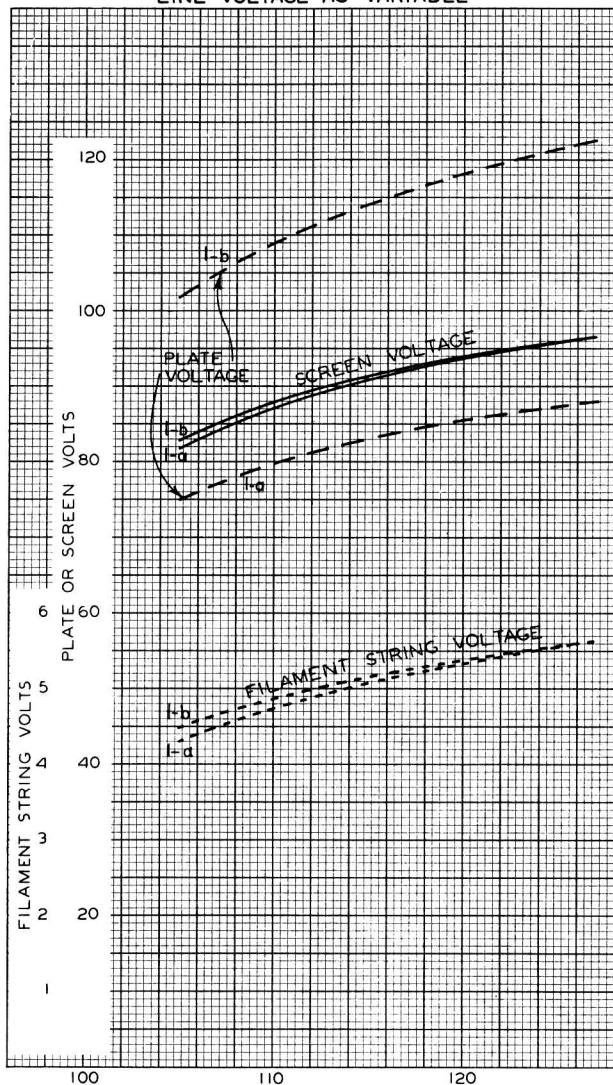


FIG.2  
OCT. 21, 1940  
RCA RADIOTRON DIVISION  
RCA MANUFACTURING COMPANY, INC.  
92C-6237



PERFORMANCE OF 117N7-GT IN CIRCUITS 1-a & 1-b OF FIG.1  
LOAD RESISTANCE AS VARIABLE

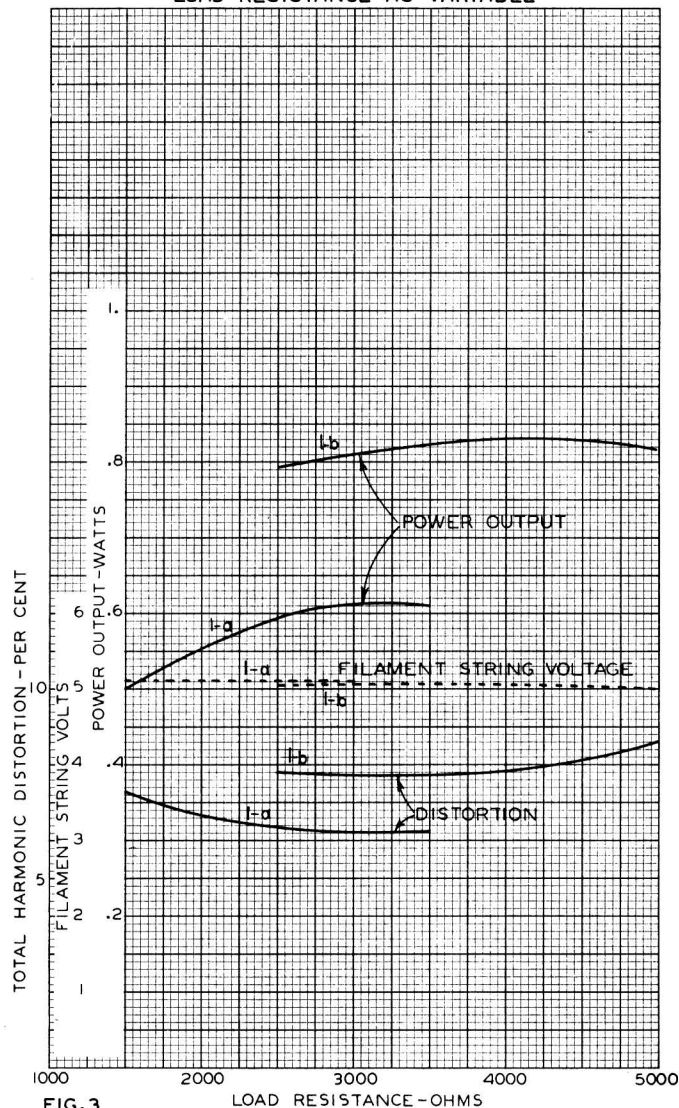


FIG.3  
OCT. 21, 1940  
RCA RADIOTRON DIVISION  
RCA MANUFACTURING COMPANY, INC.  
92C-6238