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A RADIO CORPORATION OF AMERICA SUBSIDIARY
Harrison, New Jersey

RCA RADIOTRON
DIVISION

APPLICATION NOTE No.89
March 16, 1938

APPLICATION NOTE ON RECEIVER DESIGN

This Note discusses briefly a variety of topics that relate to radio-receiver design. The material contains information on the characteristics of tubes and circuits and also offers suggestions for improving receiver performance. In most instances, suggested changes correct peculiar behaviors and do not require alteration in the basic design of the receiver.

Use of Pentagrid Converter with Separate Oscillator

When a pentagrid converter type of tube is used with a separate oscillator, oscillator voltage is usually connected to the No.1 grid of the pentagrid converter; its anode-grid may be grounded or connected to screen. With anode-grid grounded, a peculiar form of oscillation, which is evidenced by tunable noise in the receiver, may be generated. The remedy is to connect anode-grid to screen, because the oscillation and, hence, the noise are not present with this connection.

Grid-Resistor Value for Partial Self-Bias Operation

Two recommended maximum values of grid resistors for an output tube are usually specified, one for fixed-bias operation and one for self-bias operation. For operation involving partial self-bias, it is suggested that a proportional relation be used:

$$R = R_{fb} + P_{sb}\,(R_{sb} - R_{fb}),$$

where R is the value of grid resistor for the per cent self-bias (P_{sb}) of interest, R_{sb} is the recommended maximum value of grid resistor for self-bias operation, and R_{fb} is the recommended maximum value of grid resistor for fixed-bias operation. P_{sb} is defined as the ratio of the output tube's cathode current to the total current flowing through the bias resistor.

AN-89-3-2-38
Printed in U.S.A.

Cathode Connection of 6E5, 6G5, 6N5, and 6U5

In some receivers, the cathode current of the 6E5, 6G5, 6N5, or 6U5 flows through the cathode resistor of another tube. When the value of this current is an appreciable fraction of the total current through the resistor, changes in the cathode current of the "magic eye" during life may cause a change in bias on the other tube. To avoid difficulties due to change in bias, it is recommended that the cathode of the 6E5, 6G5, 6N5, or 6U5 be grounded.

Grounding No.1 Pin of Octal-Base Sockets

Receivers designed for octal-base glass tubes often use the blank No.1 lug on a socket as a terminal post for B+ or other high-potential leads. When a metal equivalent of a glass tube is inserted in such a socket, it is possible to receive a shock, violate fire underwriters' regulations, and impair receiver performance because the shell of the metal tube is not at ground potential. It is suggested that the No.1 pin of octal-base sockets be grounded in order to avoid these difficulties.

Power Sensitivity of A-F Amplifier in Radio Receivers

Experience indicates that microphonic or hum problems may become serious when the gain of the a-f section of a radio receiver is high. Measurements on a number of receivers of average design indicate that a good value of maximum audio-frequency power sensitivity for battery receivers is 50 mhos and for a-c operated receivers, 200 mhos. Power sensitivity in mhos is defined as the ratio of the power output in watts to the square of the input signal in volts (rms). Values of power sensitivity in excess of these figures may be used when better than average precautions are taken to reduce hum and microphonics.

Hum-Reducing Precaution in Type 6C8-G

When using the type 6C8-G in a high-gain a-f amplifier in which one side of the heater is grounded, it is advisable to ground heater terminal No.7 to reduce hum. A further reduction in hum may be obtained by connecting a 100- to 500-ohm potentiometer across the heater terminals and grounding the adjustable arm. Another suggestion is to use the lowest practical value of resistor in each grid circuit of the 6C8-G. In this tube type, hum is produced at the grids by capacitance coupling between the grids and the heater lead connecting to pin No.7.

Hum Modulation in A-C/D-C Sets

When abnormally high hum modulation is present in a-c/d-c receivers, it is suggested that the heater of the pentagrid converter be located as near chassis potential as possible. In several cases where this condition was investigated, hum modulation was reduced considerably by rearranging heater connections in such a manner that the heater of the pentagrid converter was second from the chassis. The heater of the first a-f tube was located at chassis potential in order to reduce hum introduced in the grid circuit of this tube.