RCA MANUFACTURING COMPANY, INC.
A RADIO CORPORATION OF AMERICA SUBSIDIARY
Harrison, New Jersey

RCA RADIOTRON
DIVISION

APPLICATION NOTE No.56

APPLICATIONOTES

APPLICATION NOTE ON RECEIVER DESIGN

It is often possible for the design engineer to correct an abnormal characteristic of a radio receiver by making one or two comparatively simple changes in the receiver circuit. Usually, these changes do not require any alterations in the basic design and, therefore, their effects can be investigated readily. In this Note, a number of such changes are discussed briefly. Most of this material contains definite suggestions for correcting peculiar behaviors.

The A-V-C Circuit

(a) When separate diodes are used in a-v-c and second-detector circuits, it may be desirable to feed the a-v-c diode from the primary, rather than from the secondary, of the last i-f transformer. With this connection, advantage is taken of the difference in selectivity between the input and output terminals of this transformer. The primary connection facilitates tuning and provides better quality when the receiver is detuned slightly. The voltage-frequency curve taken across the primary of the usual i-f transformer is broader than that taken across the secondary. Thus, when the a-v-c diode is fed from the primary, the a-v-c voltage does not fall rapidly as the receiver is detuned slightly. Because of this characteristic, the high audio frequencies are not overemphasized for slight detuning.

(b) In many radio receivers, the distortion present in the output at low signal levels increases rapidly with the degree of modulation of a signal. The results of a number of tests show that most of this distortion originates in the second-detector circuit and that it can be minimized by changing some of the circuit constants. In order that a diode will rectify a high-percentage modulated signal with little distortion, the a-c and d-c diode load impedances should be nearly equal. Practically, this condition can be fulfilled by making the value of the first a-v-c filter resistor high in comparison to the resistance of the d-c diode load. This practice should supplement the now-established procedure of using an a-f grid resistor which has a value high in comparison to the resistance of that portion of the d-c diode load across which the a-f grid resistor effectively connects.

Multi-Purpose Tubes

(c) A receiver which uses a multi-purpose tube as diode second-detector and first a-f amplifier may have some a-f output when the volume control is set in the zero-output position. It has been found that this output is often due to a small amount of capacitative coupling between the diode plates and the output-plate of the tube; when the signal is strong enough, rectification takes place in the grid circuit of the following tube. To reduce this zero-setting output, a capacitance of about 200 $\mu\mu f$ should be connected from the output-plate of the multi-purpose tube to ground. The effect of this condenser is to decrease the r-f impedance of the output-plate circuit to a small value.

(d) The output of a receiver which uses a multi-purpose tube as diode second-detector and first a-f amplifier may be severely distorted at some definite low setting of the volume control. This distortion is probably due to a small amount of capacitative coupling between the diode plates and the control grid of the tube. When the signal is strong enough, rectification takes place; the resulting a-f output is out of phase with the output due to rectification in the diode circuit. The per cent distortion is, therefore, increased. Since the impedance in the grid circuit determines to some extent the r-f voltage developed across grid and cathode, and since the output is most distorted when the two a-f voltages are equal in magnitude, the distortion is maximum at a certain low setting of the volume control. The remedy is to reduce the impedance of the grid circuit to radio-frequency voltages by connecting a capacitance of about 200 $\mu\mu f$ from grid to ground.

R-F Circuit

(e) The cause of dead spots in the tuning range of many receivers has been traced to absorption of energy from the active tuned circuit by an adjacent unused circuit. This condition is prevalent in three-band receivers that have three r-f coils inside a single shield-can. Usually, two of the unused coils are connected in series and short circuited. The larger of the two unused coils acts as an r-f choke in PARALLEL with the small coil; the small coil is then free to absorb energy from the tuned circuit in use. The remedy in this case is to short-circuit the unused coils individually.

Rectifier Tube Shields

(f) Shields for glass rectifier tubes usually have a number of holes to provide ventilation for the tube. Increase in the size or number of holes decreases the operating temperature of the tube, but at the same time reduces the shielding action. This laboratory has found that black paint on the inside and outside of the shield increases heat radiation to such an extent that fewer holes are necessary to provide bulb cooling.

The 6E5

(g) When the 6E5 is used as a tuning indicator, its grid is connected to the a-f diode through an a-f filter which consists of a series resistor and a shunt condenser. The time constant of this filter is important in determining the rate at which the target shadow increases or decreases. If the time constant is small and the dial is turned rapidly through resonance, the fluorescent area overshoots the value corresponding to slow tuning; if the time constant is too large and the dial is turned rapidly through resonance, the change in area will be less than that corresponding to slow tuning. In either case, it may be difficult to tune to resonance. In general, the time constant of this circuit should be about the same as that of the a-v-c system, so that the voltage applied to the grid of the 6E5 follows the a-v-c voltage.

The 84

(h) The maximum current rating of the type 84 rectifier tube has been increased from 50 to 60 milliamperes for full-wave operation. The current rating for half-wave operation with both diodes in parallel remains at 75 milliamperes, maximum.