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A RADIO CORPORATION OF AMERICA SUBSIDIARY

Harrison, New Jersey

APPLICATION NOTE No.114

June 2, 1941

USE OF CUSHIONED SOCKETS IN SMALL RECEIVERS

Microphonics present important problems in the development of small portable receivers because the loud-speaker, chassis, and tubes are in close proximity, and because dry-battery tubes are inherently more microphonic than heater-cathode tubes. In particular, the advent of miniature tubes for small portable receivers has emphasized these problems.

Microphonic feed-back, evinced by the familiar "acoustic howl" or by a prolonged "ring", involves a mechanical transmission of vibromotive force from the loud-speaker to a vulnerable part of the receiver. A component part of the receiver is said to be vulnerable when its vibration results in enough physical deformation of the part to change its electrical properties in a manner which reinforces the vibration at the loud-speaker. For example, the vibration of end-plates of oscillator tuning condensers may cause the intermediate frequency of the signal to vary enough to give rise to a sustained howl. Although a complete explanation of this phenomenon is complex and beyond the scope of this Note, the acoustical result of a mechanical cause by electrical effects is readily evident.

In small portable receivers, the vulnerable component is often a tube because the filaments of the dry-battery tubes are necessarily small, non-rigid, and therefore, susceptible to vibration. Although the plate, screen, and grid-electrodes can and do vibrate when a mechanical shock or a sustained vibromotive force is transmitted to the tube socket, the filament produces the most serious vibration. To complicate matters in small receivers, the close spacings of loud-speakers and vulnerable parts often result in highly efficient mechanical (and acoustical) transmission linkages.

An analysis of the causes of microphonics in small receivers would involve theoretical consideration of many factors. In some instances, a modulation of transconductance by the vibration of the filament might be the essential factor, while in other cases the cyclic variations in tube capacitances might be the important factor. The important point

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for any case is that the difficulty can be alleviated by reducing the vulnerability of the tube. For example, in the RCA miniature types 1T4 and 1R5, a "damper bar" is provided to minimize filament vibration. The "damper bar" is a small piece of wire, sprayed with insulating material, and welded to one of the grid No. 1 side-rods. This insulated member touches the filament at approximately the center of its length, and thus damps any vibration of the filament involving appreciable motion at its center.

The damper-bar construction used in these RCA miniature tubes has been quite effective in suppressing microphonics in small receivers, but the problem of minimizing mechanical coupling via the chassis to various tube sockets needs further attention during the equipment development period. This problem has been accentuated by the recent trend to 90-volt operation of miniature tubes in small receivers, since this higher voltage results in more sensitivity, more power output, and consequently more difficulty with microphonics. Furthermore, the advent of the 3Q4 power output tube, with its high power sensitivity, augments microphonic feedback problems because of its relatively large power output.

The chief purpose of this Note is to encourage the use of cushion-mounted tube sockets in small receivers as a practical method of solving these problems. Cushioned sockets help to isolate the tube from the chassis, insofar as serious vibration is concerned. Of course, the acoustical path for possible microphonic feedback is not severed by the cushioned sockets. These should not, therefore, be regarded as a panacea for microphonics. However, the observed efficacy of cushioning lends strong encouragement to its use, particularly when flexible wire is used for all leads to the tube socket.

Cushion-mounted sockets in all stages except the power output stage are desirable, although not always absolutely necessary. The general use of cushioned sockets, however, avoids excessive chassis and circuit development work, and, more important, provides a safe-guard against microphonics which may be experienced in field production receivers even though not encountered in laboratory models. Moreover, microphonic problems are still further augmented by the use of larger and more efficient loudspeakers in small receivers. In cases where such a design change is probable, the full use of cushioned sockets is desirable.

Naturally, experimentation with an individual receiver often reveals that only one tube need be provided with a cushioned socket and flexible leads. This tube is likely to be the 1S5, as ordinarily used in the first a-f stage. However, when a strong carrier is applied to the receiver, either on or slightly off resonance, the 1R5 converter or the i-f tube may be found to require cushioning after the first a-f tube has been cushioned; microphonism involves only one mode of feedback at any one time. Likewise, an r-f stage may require a cushioned socket.

Although the number of cushioned sockets can sometimes be held to a minimum by careful development work, the use of cushioned sockets in all amplifier stages except the power output stage should be encouraged for most satisfactory results with small receivers utilizing miniature filament-type tubes.