Replacing Audio Interstage Transformers

by Brian Belanger

There have been two recent articles in Radio Age about the ubiquitous Stancor Model A-53-C audio transformer. This small, inexpensive transformer with a center-tapped secondary is available from several antique radio dealers. It is frequently used to replace defective audio transformers in old battery sets where frequency response need not be very good. In the April 1990 issue of Radio Age (p. 8), Dave McClellan reported measured data on the frequency response of the A-53-C. The results were better than expected at low frequencies. But in the June 1990 issue of Radio Age (p. 8), Jim Farago wrote that McClellan's data were probably overly optimistic, because his tests did not include dc plate current in the primary of the transformer. The problem, as Farago correctly noted, is that in a small transformer such as this, the dc plate current can easily be sufficient to saturate the iron core, leading to poor frequency response and distortion. In a larger transformer with more iron, saturation does not occur and the frequency response, especially the bass response, is correspondingly better.

I recently had to replace an audio interstage transformer in a friend's Westinghouse WR-8. This is a large, circa-1930 ac radio with push-pull type 45 tubes in the audio amplifier, a large electrodynamic speaker, and a good bass response. I did not have a replacement transformer comparable in size to the original, but I did have one of the A-53-C transformers on hand. Farago's article in Radio Age suggested that the A-53-C would not be a good replacement in a radio like mine, but being naturally curious, I wanted to see for myself. I hooked up the A-53-C with clip leads just to hear how it would sound. While the radio worked, the bass response was very poor—nearly as tinny as an old battery set with a horn speaker. I have a WR-8 of my own in good working condition with the original transformer, so I knew how well this radio was capable of performing.

I related my experience to MAARC's Vice President Ed Lyon, one of MAARC's best technical experts on radio repairs. He commented, "You might have success with the A-53-C transformer if you could keep the dc plate current out of the primary winding." Never one to pass up the opportunity for an interesting experiment, I followed up on Ed's suggestion. Fig. 1a) shows the original circuit and Fig. 1b) shows my modification. (Additional components in the actual circuit that didn't affect this modification are not shown.) Capacitor C prevents the dc component of the detector plate current from flowing through the transformer primary; all of it passes through resistor R. The ac audio-frequency signal current will split, with some of it flowing through the resistor and some through the series combination of the capacitor and transformer primary.

The capacitance of C should be sufficiently large so as to present a negligible impedance to the ac signal current—the larger, the better. I had plenty of non-electrolytic 2.2 mfd capacitors in my junk box, so that's what I used, although a smaller value would probably have been adequate. The optimal value of resistor R will depend on the particular detector tube and the B+ voltage in the set being repaired. If R is very small, most of the audio current signal will flow through it instead of through the transformer winding, and the reduced signal voltage across the transformer will lower the stage gain. If R is too large, the dc plate current flowing through it will cause such a large voltage drop that the plate voltage at the tube will be too low and the performance of this stage will also suffer.

I connected a resistance decade box for R in order to determine the best value. I found that 15,000 ohms gave the best combination of gain and frequency response, so I soldered in a permanent resistor of this value. (In a different radio, the best value for R could differ significantly.) The plate voltage at the type 27 detector tube was decreased from its original value only very slightly.

I compared the performance of my WR-8 with the original transformer to the one with the A-53-C and R-C modification. The bass response and stage gain were slightly better with the original transformer, but the R-C modification resulted in a dramatic improvement in performance relative to the A-53-C without the modification. While I would have preferred to replace the transformer with the original type, I felt that the performance with the circuit shown in Fig. 1b) was in the acceptable range. With interstage transformers becoming increasingly scarce, the alternative described here is worth considering.

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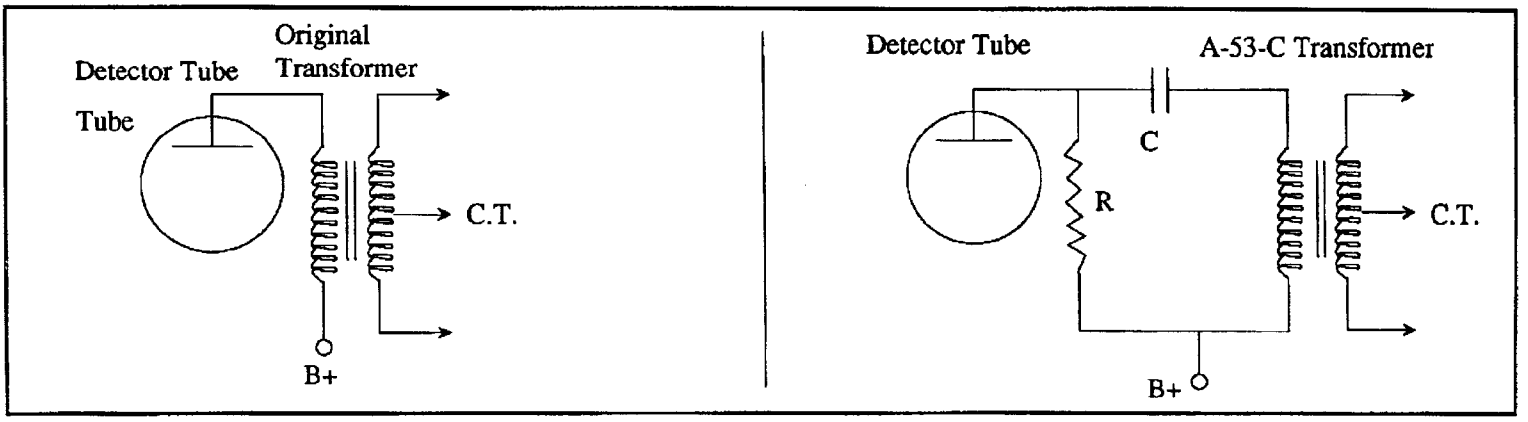

Figure 1. a) Original Circuit. b) Modified circuit with R & C added.