Repairing a Stewart Warner “King”

Gord Rabjohn, February 2023

I received a request from “the web” to repair a 1932 Stewart-Warner “King” radio, model 33K. This is an AM-only 6-tube superheterodyne using 2.5V tubes. The owner told me that “only 1 tube lit up”.

It has a wonderful spacious chassis with a lot of elbow-room, nicely laid out, and mostly original parts, a pleasure to work on. I powered it up with a 100W bulb in series with the line, and the bulb lit up brightly, indicating trouble. I discovered that the cause of this excessive current was a shorted (dead short) electrolytic filter capacitor, one of the few parts that had been replaced in the past. This is why the owner commented that “only 1 tube lit up”; the #80 rectifier tube likely lit up very brightly under extreme overload. He was lucky that he did not destroy the power transformer! Replacing this capacitor (and the two other power supply capacitors) resulted in a dead radio, but at least it was a dead radio that did not smoke.

Figure 1 Stewart-Warner 'King"

I checked tube voltages, and found that the IF stage had no plate voltage. This usually means that the associated IF transformer is burnt out, and I verified this by measuring the winding’s resistance (it was an open circuit). This early radio uses an unusual IF frequency of 177.5kHz. I opened the IF can and found a wooden spool with two windings secured with wax; the dead winding was darker as the wax

had melted. I unwound the dead coil (finding at least 3 breaks or weak spots), counting the carefully wound uniform windings, which added up to about 950 turns! (I was not expecting that many turns, but the lower-than-usual IF frequency means that more-than-the-usual turns would be required). The original winding used thin (0.003”) wire wrapped with cotton insulation, but all I had was enamelled #32 copper “magnet” wire. The outside diameter was almost the same so I used it; my wire offered more copper, less insulation. I was unable to wind it in neat well-organized flat solenoid layers. The technical term for my technique is “Scramble” winding. The finished coil had about the right inductance (measured at 14mH), and had much lower DC resistance, but I was surprised to discover the “Q” of my coil at 200kHz was about half of the other (similar inductance) winding. I attribute the difference to the close proximity between windings (because of the thin enamel insulation) causing current crowding. This is why high “Q” coils are made with “Litz” wire and have wide turn-turn spacing. In principle, the lower Q meant that the IF bandwidth might be a little wider, but there were still 3 other resonant circuits in the IF, so the difference would not be noticeable.

Figure 2 IF transformer before repair

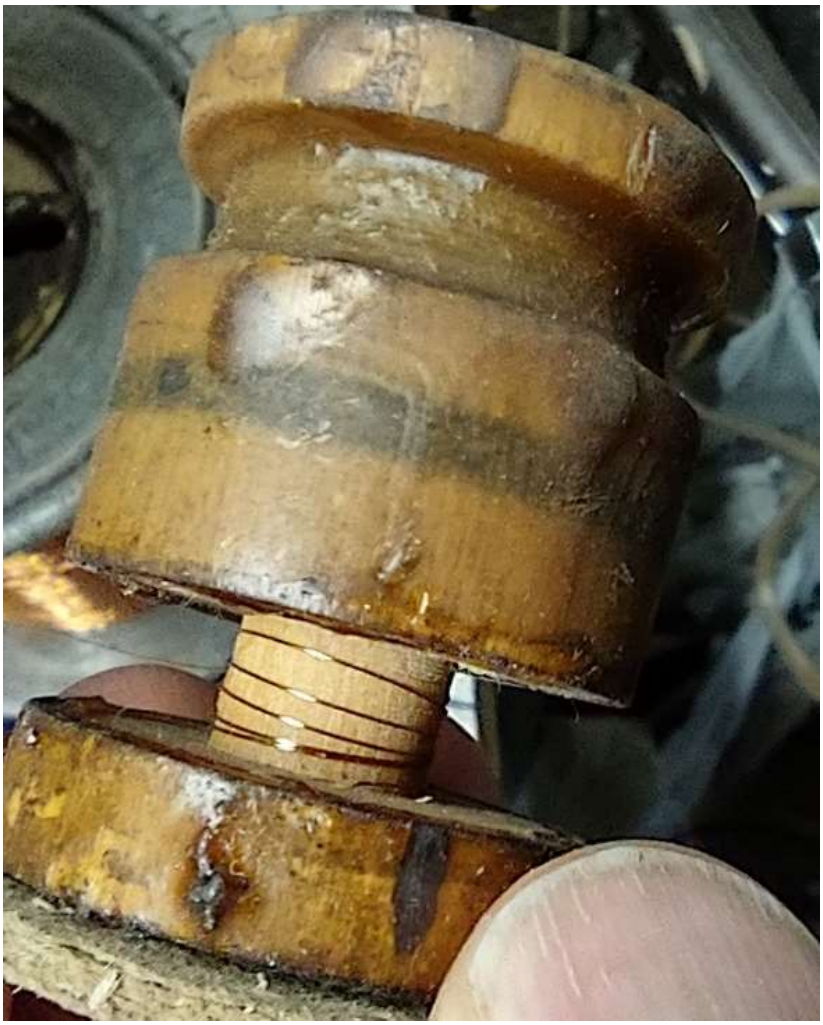

Figure 3 IF transformer with one winding removed

Figure 4 Rewound IF transformer

The repaired IF transformer brought the radio back to life. However, with a new IF transformer winding, an IF alignment was essential. When I adjusted the IF trimmer capacitor with a metal screwdriver, I was literally shocked to discover that the adjustment screws (on the input side of each transformer) are connected directly to the 300V B+. And, the screw is quite close to the grounded bracket, so sparks fly if you slip. The trimmer is quite hard to turn, so my plastic alignment tool was not strong enough. I managed to get it aligned, but I want to share this warning: *When aligning a radio, do not trust that the adjustment screws are at a safe voltage, even in a radio with a good power transformer. 300V grabs your attention and could be lethal!*

I replaced more capacitors, a missing resistor and the power cord, and the radio works very well. In fact, it has better than usual sensitivity, and seems to be less sensitive to EMI sources (light dimmers, switching power supplies) than most radios. I am at a loss as to why the IF transformer overheated. The "live" trimmer screw is on the B+ side, so shorting it to ground would not have damaged the winding. I

thought that perhaps the #58 IF tube had an internal intermittent short, so I connected it to an ohmmeter (measuring from plate to everything else) and shook it around, but found nothing but an open circuit.

I enjoy repairing radios from the early 1930's. By that time, the superheterodyne architecture was becoming the dominant design approach, and these radios were generally built like tanks and worked well. The industry had not yet standardized on one design, so there were still differences that make them interesting. Sometimes even grabbing your attention at unexpected times!