Repairing a Ducretet Radio

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I purchased a Ducretet model D2923 radio at the October auction. I liked its very compact size, the fact that it uses “Rimlock” tubes, and the fact that it was made in France. I thought that it might be interesting and unusual, and I was right.

Figure 1: Cute and compact radio

The radio is very compact inside, with parts quite close together. However, the IF transformers are enormous, more like the size one might find in a radio from the 1930’s. There is no variable capacitor; tuning is accomplished with ferrite rods that slide inside coils (one for the antenna, one for the oscillator). This is referred to as “permeability tuning”, and is often used in car radios, though car radio designs that I have seen are much more “rugged and solid” than this radio. It is a 2-band radio featuring a long wave band in addition to the usual Broadcast Band. Tuning all the way to the end of the band flips the band-select switch. This does not seem to work very well.

Figure 2: Top of chassis. Note huge IF cans.

Figure 3: Permeability tuning

Figure 4: Slide-rule Tuning

Rimlock tubes are miniature tubes made with 8 evenly spaced pins. They look similar to 7- and 9- pin miniature tubes that we are familiar with, but the socket indexing is done with a protrusion on the side of the tube's base that lines up with a slot in a rim that surrounds the socket in the chassis. A big advantage over miniature tubes is that they can be inserted by "feel" (like octal and loctal tubes); to insert the tube, you can close your eyes and spin the tube in the socket rim until you feel the protrusion fall into the slot. The button base makes them work well at high frequencies. This type of tube is quite uncommon in North America, and is found only in imported sets. This particular radio uses a UCH41 converter, UF41 IF amp, UBC41 detector + first audio, UL41 audio output and UY41 rectifier. These filaments add up to 117 volts, and take only 0.1A, which makes them run cooler than the standard "All American 5" line-up. (There is a 0.1A American miniature tube line-up but it is fairly uncommon.) By the way, the OVRC tube stock has very few Rimlock tubes; if you have any extra, I welcome them! Generally, Rimlock tubes have a "4" as the first numerical character in the European tube number.

Figure 5: Rimlock tubes

This radio had been skillfully recapped, and the cabinet restored by a previous owner. All the paper and electrolytic capacitors were replaced with modern capacitors. However, the radio did not work (in fact, it was sold as “not working”, so no surprises there).

I powered it up slowly with a Variac, and measured some voltages. The B+ was quite low, which suggested a weak rectifier. I tested the tubes and all were fair-to-good, and to my surprise even the rectifier was only marginal; but replacing it (with a UY42, which is a drop-in replacement. A UY41 is intended for 220V operation and a UY42 is for 110V operation, so the UY42 is a good choice) brought the DC voltages up to where they should be. However, still no reception. Probing around, I discovered that one of the freshly replaced capacitors in the audio path was open. Replacing this brought some noise, but still no reception, not even if a strong modulated IF signal was injected into the converter.

Digging further, I found that the IF transformers were not tuned correctly. These were tuned with ferrite slugs, and the ferrite slugs were held in with glue or caulking that had come loose, and in fact one of the slugs was missing. The slugs did not “stay put” in the IF transformer, there was nothing in there to grip the threads. I took the transformers apart (which was probably unnecessary but I wanted to make sure they were intact inside). I wedged a piece of insulation between the slugs and the inside of the IF coil form, and that kept the slugs in place and allowed me to tune them. I had to whittle a tuning wand out of wood for the three original slugs because I did not have any non-metallic tools for this rather large slug.

I wanted to verify that the IF transformers worked. To do this, I attached an RF generator directly to the primary (the generator has such a low impedance that it kills the “Q” of the parallel-tuned primary circuit), and an oscilloscope via a high impedance probe to the secondary. The secondary slug was tuned until the peak response as seen on the oscilloscope was at the right frequency (in this case, 472kHz). The primary slug had little effect. I repeated the above exercise with the primary and secondary swapped to tune the primary slug. If the transformer and associated capacitors are working, the response will exhibit a pronounced peak over a very narrow bandwidth. Note that these slugs will have to be retuned once the IF transformers are returned to the circuit because the stray capacitance will be different.

Making a long story short, I removed and retuned both of the transformers, replaced the missing slug, replaced them into the radio, and found that the radio came alive. I believe that the last person who attempted to repair this radio was fooled by the dud coupling capacitor and tried to tune the IF transformers in a last-ditch attempt to get it to work.

Now the radio worked well, but only with an antenna. It seemed to me that it should work better. Please watch for an upcoming article where I ponder what to do with these marginal radios.

The tubes in this radio exhibit “Filament Flash”. The bottom part of the filament, the part between the heater pins and the cathode, lights very brightly upon turn-on. To me it is very disconcerting, because I imagine that this would reduce the life of the filament from thermal fatigue. It happens because the thermal time constant of the exposed filament is smaller (it heats up faster) than the rest of the filament. Tube filament’s peak current when cold is about 3 times larger than the hot current because the filament resistance increases when it is hot. So, when most of the filament is still cold, the hot part gets even hotter (because the low resistance causes the current is higher than normal). Some tubes exhibit filament flash even when the filament is supplied from a constant voltage source, but series filament strings are even worse. It can be reduced by turning the voltage up slowly, or allowing a low current pre-heat time. I often see filament flash in series sets, but I think Rimlock tubes tend to be worse (the web thinks that European tubes are worse in this respect, which may be true). The wisdom of the web does not seem to be too concerned about this.

I am very happy with this radio, because it is so different than the usual American radios of this vintage, and it fits nicely on small shelves.