

A dog of a Zenith 3R to make presentable.

I was thrilled to know that Barker Edwards had been able to bid on the set for me at the Mebane Auction House in November of 2016.... He got it for less than \$65 as I recall.



Sort of deceptive when looking head-on to the panel.... Yes, there are two knobs missing and three pointers but how bad can that be? Get it into the shop and start looking closer... I start to itemize the tasks; the list has 25 items! , over a dozen tasks I've never had to face before and I suspect few people have ever taken on these tasks. I take as many close-up pictures as possible from every angle I can figure. These pictures ALWAYS bail me out in the end when I realize that my notes and sketches made for reference have critical omissions.

1. The hard rubber front panel is warped and cupped way too much to be ignored; got to flatten it: With just about any other 1920s radio with a Bakelite or hard rubber panel, all that is necessary is to remove an assortment of screws and lock nuts; not so with this Zenith. There are 9



parts that are press fit brass bushings into large washers. Getting them off without damage is not easy and cannot even be attempted until you deal with pot metal knob shafts that have broken off in the brass bushings.



2. All six pot metal shafts were frozen in their brass bushings and 3 broken off: I had to very carefully drill the pot metal from the bushings finishing up by reaming the bushings to 0.251". I would have preferred to drill out these bushings on the lathe after extracting them from the panel but I feared bushing extraction would be

complicated if there was not a pilot pin going through the bushing while being pressed out. It was one of those 'chicken or the egg' kind-of problem.

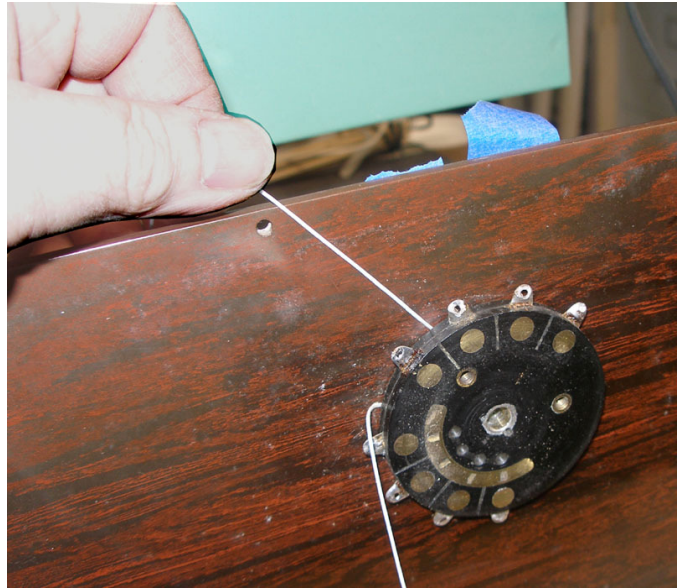


3. The press-fit knob bushings have to be pressed out of the panel so that the panel can be flattened and the press fit washers replated: This was something that had to be done by applying perfectly aligned vertical pressure. Off center pressure would, in effect make the washer inner bore and the contact

point of the bushing elliptical thus destroying the remaining strength of the press fit. Basically I had just one chance to do this operation correctly. An arbor with shoulder was turned to fit exactly in the bushing bore and I used the quill of my milling machine to apply just the right amount of downward pressure to extract the bushings.

The amplifier selector switch presented a special problem. The switch bushing could not be pressed out in the same fashion but had to come apart.

The solution turned out to involve forcing a 0.5mm Kevlar braided cord down between the body of the switch and the panel. The very small deflection of the panel or the switch body was not enough to crack either one. Once the cord was pulled down to the center, another wrap of cord was added and again pulled tightly down to the center. This increases the separation force. After wrapping 6 or 8 turns, the force was multiplied enough to separate the parts.



After stripping off all parts from the panel I tried to use a quartz tube radiant heat fixture to evenly heat the panel to about 150 F. I could not get the panel to heat evenly and was very alarmed when the panel began to cup in the center... I was terrified that the panel might crack; I had to have a more even heat source. That source happened to be about 93 million miles away. I took a cardboard box and mounted the bottom to a little platform that could be attached to a heavy duty camera tripod. The bottom of this box could now be tilted to the sun. I inserted a sheet of 1" Styrofoam into the box bottom and then a sheet of $\frac{3}{4}$ " MDF shelving. On top of the shelving I placed the hard rubber panel face-down against the MDF. I installed a couple of K type

thermocouples in the box and draped the entire box with a thin sheet of polyethylene. (Actually a disposable painter's drop cloth.)

After 20 minutes to ½ hour the air temperature in the box had stabilized at about 140 F when the outside air temperature was about 52 F. I don't actually know what the core temperature of the hard rubber was. Regardless, I quickly removed the MDF board and the hard rubber panel from the box and placed another sheet of the MDF on top to sandwich the panel. I used C-clamps to force everything together. Hours later I found the panel to be perfectly flat.

4. Refinish the engraved front panel: The filled engraving was almost complete and in good shape. The hard rubber panel was originally a glossy faux mahogany grain finish.



The effect is created by extruding the sheets using lumps of varying color hard rubber. i.e. The color goes all the way through like industrial vinyl floor tile. Unfortunately the mixture of materials does not present the exact same aging characteristics, especially regarding its resistance to cleaning with water based cleaning solutions. The net results are that the surface becomes rough.

You do not want to use any water based cleaners on hard rubber. I begin with a cleaning of Go-Jo waterless hand cleaner. I have found that you do not want to leave it in contact with the panel for more than a few minutes... Put it on, rub vigorously with terry cloth or 0000 steel wool and then wipe as much of the material off as possible. Finish off by rubbing with a cotton cloth very slightly damp with mineral spirits. In the case of this panel I found that it needed further polishing. I did it with materials in a Turtle Wax automotive lens restoring kit. Be aware that this does have some risk of imparting a faint white haze to some parts of the panel. If

there is a better abrasive paste to use with dark colored panels like this, I would like to hear from you.

5. I had to make two knobs: I've made silicone molds and cast urethane knobs to mimic hard rubber before. I had made silicone rubber molds for the Zenith knobs some 35 years ago and still had them. However on inspection, I found too many flaws in the way I had cast the molds to meet my current standards. My current method for making molds is pretty easy. The most critical thing is to make sure that there are no bubbles in the liquid rubber. The Zenith knob has a deep recess in its face. Air bubbles can (and will) get trapped in this area and will rise up against the surface of the part. The liquid rubber must be degassed with a good vacuum pump. On curing two things will happen: Either the bubble will be torn open when the sample knob is withdrawn leaving a hole in the wall of the mold. Or if the bubble remains intact very close to the surface and virtually invisible at the mold surface; when liquid resin is poured into the mold and begins to cure, it heats up. The heating causes the trapped bubbles to expand. The net result is that the cast part will have concave recesses where the bubbles expanded. Not good....



The Zenith knobs are made of hard rubber and were originally glossy black. However over time the surface oxidizes and turns brown. I know of no effective way to color the surface of the knob with a black dye, although I have tried many ways. I think I tried spray painting the knobs with black lacquer one time. My

recollection is that the paint did not adhere to the hard rubber surface and did not look good on the flutes of the knob. (The surface tension of the paint giving a decided rounding of surfaces at the many sharp edges of the knob flutes.)

My solution is to use a two part, polyurethane casting resin colored by a blend of black and brown dyes made especially for the resin. I use Smooth-Cast products. To get the right coloration requires careful measurement of the weights of your resins on a gram scale. The dyes come in bottles with a dropper nozzle. You very carefully squeeze-out the number of drops of each dye for the given weight of resin. (You need to be aware of the room temperature. The droplets will be larger for materials in a cold room. Most resin performance is specified for a room temperature of 73 F.) With some experience, you can determine the correct volume and combination of dye droplets to get the desired color after casting two or three parts. These casting resins require the same vacuum degassing after mixing as done with the silicone rubbers. After the degassed resin is poured into the mold, the mold is placed in the vacuum chamber and degassed again and the vacuum relieved before the resin starts to harden.

These knobs are actually held in place by the pot metal pointers. The pointer has two countersunk #4 screw holes. So you have to tap the knob for two 4x40 flat head screws in the back of the knob.



6. One small pointer and two large pointers were broken off short or missing completely: The originals are nickel plated die cast pot metal. Others have made replacement pointers from aluminum; I did this as well. Cutting out the blanks is no big deal. The real pain is in filing the

sloped edges of the pointer with jeweler's files. In my desire not to spoil the blanks by too much file work, they are not quite slim enough to match the originals. So I will admit there is room for improvement here.

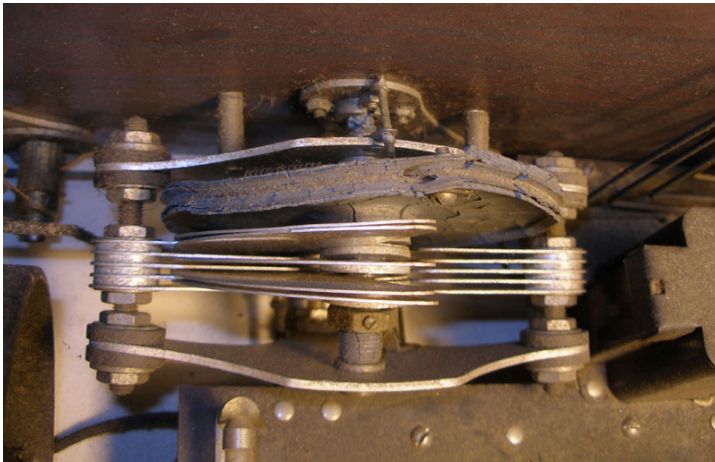
Coloring aluminum in the shop to match the five surviving pointers is difficult. Anodizing in the home shop is possible but definitely takes time and money to set up and the chemicals required are hazardous. My solution was to spray the aluminum with decorative nickel lacquer and follow by applying a tiny amount of black aniline dye with a gauze pad to daub on to the part and rub to achieve the right look. Since these parts are not subject to abrasion, they ought to look pretty good for a very long time.

7. The pot metal secondary tuner pointer shaft bushing has crumbled apart: The pointer was still OK and I wanted to keep it if possible. I was able to mount it in the lathe and machine off the remains of the crumbled bushing and drill and ream a true 3/8" diameter hole. I used a length of 1/2" diameter brass rod to make a new part that could be swaged onto the old pointer.



8. The two 3-5/8" dia. pot metal pulleys are totally useless. Others have machined parts from aluminum; I did the same: I took the extra time to duplicate the finer points of the part profile. When

finished, I decided to paint the parts to make them look more like the die cast original parts; something others don't seem to do. I wonder why? It is easy to do.



9. Fabricate a new brass spindle for the tuning capacitor: The original spindle was part of a die cast part and totally destroyed. It took some extra time to figure the true dimensions required because the expanding pot metal badly bent parts of the capacitor. A good bit of time

was spent just in flattening the parts.

10. The gold plate on all the tuner wiring has been lost due to oxidation of the copper underneath. The remaining gold flakes off on any attempt to clean the wire. The 12 gauge gold plated buss wiring was a sales gimmick for Zenith. Unfortunately it appears that the gold plating was made directly over the copper core. In modern



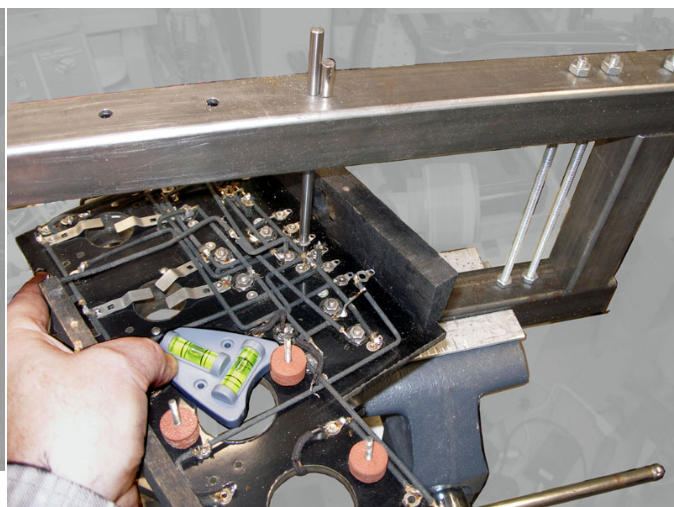
times, people who know something of printed circuit board fabrication know that you really must nickel plate the copper and then plate gold. The nickel barrier prevents gold diffusion into the copper and seals the copper most completely from atmospheric oxidation of the copper. I discovered that 12 gauge, copper-core, gold plated wire is used in jewelry crafting. It is advertised as a copper core plated with silver and then plated with gold. That was good enough for me... A 25 foot roll was available on-line, delivered in the mail for under \$39. I replaced all the wiring. It

required 13 feet of the wire meaning that I would be one foot short of enough wire to rewire another model 3R...



Each wire was carefully removed and new replacements bent to precise dimensions. As I recall, there were about 28 lengths to fabricate.

11. There are more than 40, 1/8" dia. semi-tubular rivets used in the radio. More than 30 of them cracked where they were staked or break off easily if touched. I made up a punch and die frame from 1 1/2" square heavy wall steel tubing to set the rivets. The exact rivets were available from an e-Bay seller for less than \$9 per 100.



12. The small fuse-like ballast resistors were severely corroded and had to be rebuilt or replaced along with re-plating of their clips. There are two versions of this ballast. If you are using ¼ Amp tubes like the 01-A, the resistor is marked with red paint. If they have no paint, they are for using UV-199s in adapter sockets. My parts had no trace whatever of red paint. It was possible for me to take the units apart, put in the ultrasonic cleaner to get rid of the corrosion, nickel plate and put back together. I was a little surprised that none of the glass tubes broke during disassembly.

13. There is a thin mahogany strip along the front-bottom of the cabinet that is missin:. I fabricated a reproduction using furniture grade poplar. Fortunately I found great photos of the set in a e-Bay listing. The scale of the part is such that the difference in the kind of wood makes little difference, all that matters is getting the red mahogany coloration close enough to correct. I was not in a position to fabricate the exact profile without ordering a special router bit, however it seems to look close enough so as not to not attract attention to it being wrong.



14. There is no mating Jones plug for the battery connection socket. A reproduction plug was fabricated. These mating plugs are scarce. Maybe a clue to their scarcity is the fact that, at least in the case of Zenith, the battery connection cable was made with plain rubber covered wires. I suspect that many people over the years would

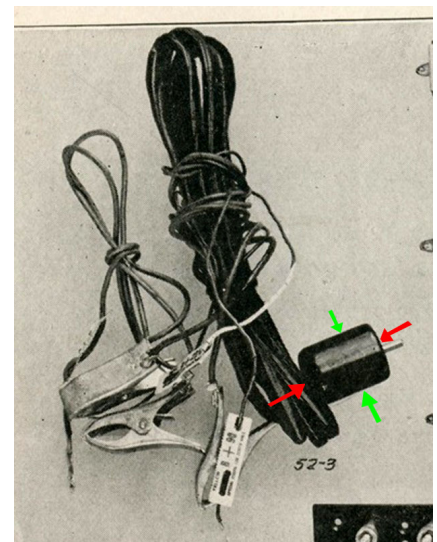


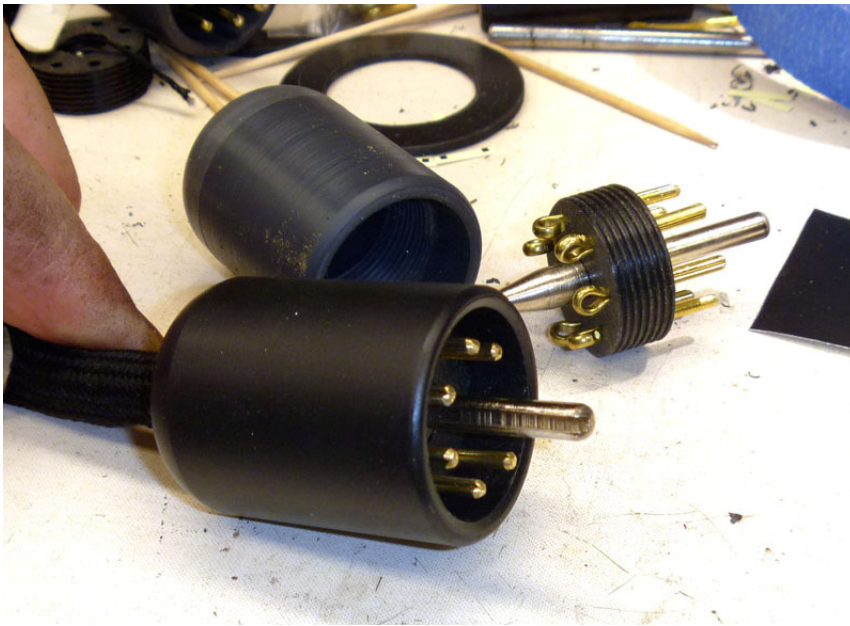
Photo from Zenith Parts List

have found a cable full of crumbling rubber wire as something to toss in the trash. I have one of these cables missing the Bakelite shell for the plug. But at least it gives me dimensions for the plug components. A correspondent on Antique Radio Forum provided me with a photo of the shell and there is a Zenith parts manual that shows the complete cable. I have made 8 of these replica plugs.



The one detail that has not yet been resolved is how the button in my vintage plug assembly (the part that holds the 7 pins) was retained in the outer shell. As mentioned, the outer shell is missing on my old cable. Note that the old button has a 1/8" groove around the button. Was a spring steel ring forced into the groove and snaps into a groove cut in the inside wall of the shell? That is about the only thing I can figure. That could complicate disassembly; I eventually decided to scrap my first shells shown above to make new shells that are tapped 1"x 20 UNEF machine thread. This is like a plug photographed by an ARF Forum member. Maybe Jones decided that a spring ring scheme did not work well. It could also be that, initially, they were trying to avoid the expense of threading the parts.





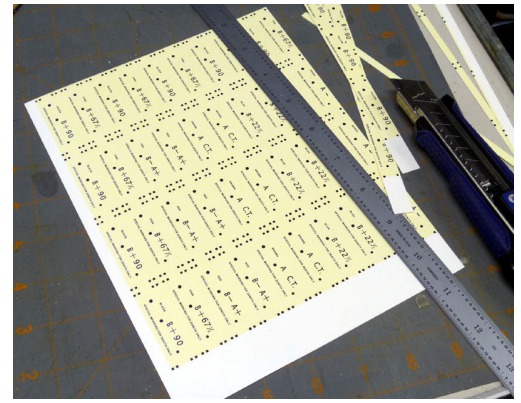
Rubber insulated wire is not available. Modern insulations do not resemble the dull rubber luster. What to do? My best solution to date is to strip the insulation from 18 or 16 gauge stranded wire and replace it with polyolefin shrink tubing. Certain brands of the thin versions of

this tubing come very close to the look of rubber. The only downside is that two layers are required to build the insulation diameter up to the correct size. This is a tedious process.

The cable has an outer cotton braided sleeve. Braiding machines were originally developed for making rope. By the 1890s the machines had been adapted for braiding coverings for flexible electrical wiring. In fabricating these cables, wires were soldered onto the connector pins and inserted into the button. The button assembly was fed into the center of the braiding machine and the covering was braided around the rubber wires.

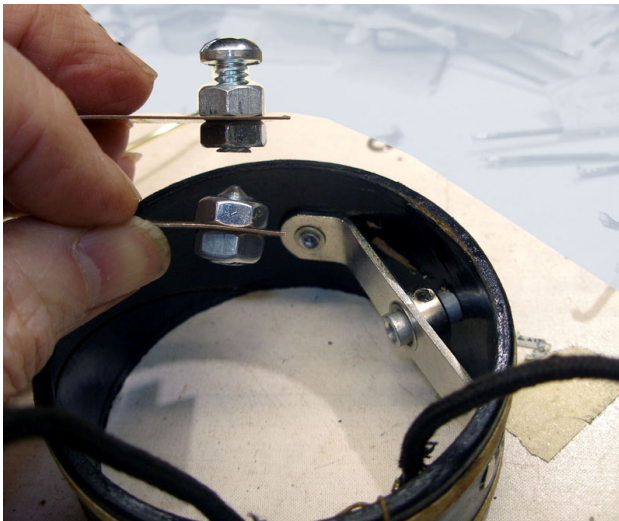
Unfortunately I don't have a 100 year old braiding machine (or a new computer controlled one for that matter). My only solution to date is to use a tubular shoelace woven of cotton. The largest size made (1/2" wide) is just the right size to fabricate the cable for the Zeniths. The longest length available is 72" which is not long enough to cover the cable bundle that is braided for a length of 72". (The effective length of the shoelace shrinks about 30% when drawn over the wires.) So I have to splice two lengths with black embroidery floss using a common 'rope whip' technique. Fortunately it does not draw much attention. This is also not a fun process.

There is one more mystery to be resolved. The Zenith photograph shows that the black rubber wires were identified with white tags that could have been celluloid. You can read the large font on one tag and it says B + 90 and in smaller font YELLOW in block letters that may have been done by hand. There are five other words in a smaller block font that I think say “SPECIAL MARKING FOR ZENITH ONLY”. The colors refer to paint applied to the side of the female sockets of the receptacle on the radio; a different color for each circuit. With some research I found you can buy waterproof synthetic paper in 7 & 10 mill thickness. It is incredibly strong and If you laser print a graphic with a slightly yellow background, it looks very much like vintage celluloid.



The original cable came with three large alligator clips that measure 2 1/4" from tip to end and are a nominal 1/2" wide. I have two of them on a Balkite trickle charger. These were for connection to a 6 Volt lead/acid battery. The third clip attached to the jumper between the first and second cells to provide a 2 Volt bias for the RF grid circuits. I have yet to locate any old stock of these clips. As an interim solution I have used Chinese copies that are unfortunately of very, very poor quality.

15. This battery cable connects to an assortment of batteries and many years ago I found a Zenith dry cell battery box as shown here in this exhibit. There is no doubt it is authentic. There is a reason I have not refinished the box to match the pretty looking cabinet of my 3R. To date, no collector I know of has ever seen an example of this battery box. If it is the only surviving example, extra ordinary care must be taken to preserve the artifact details. In this case, at least for now, I have only provided a minimal amount of cleaning.

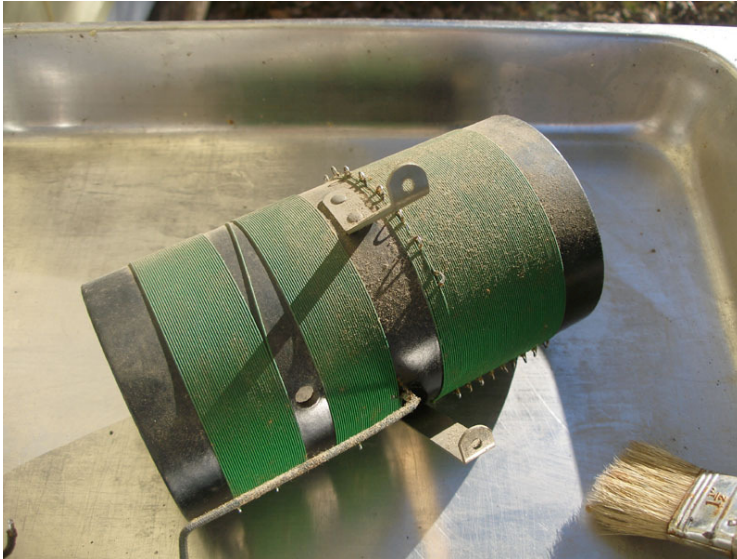


16. The steel bracket of the feedback coil was corroded and I cleaned and re-plated the part. In order to rivet the part back in place, I had to machine down two of the semi-tubular rivets to the proper length and then fabricate a custom punch and die to set the rivets.

17. All metal parts were run through the ultrasonic cleaner.

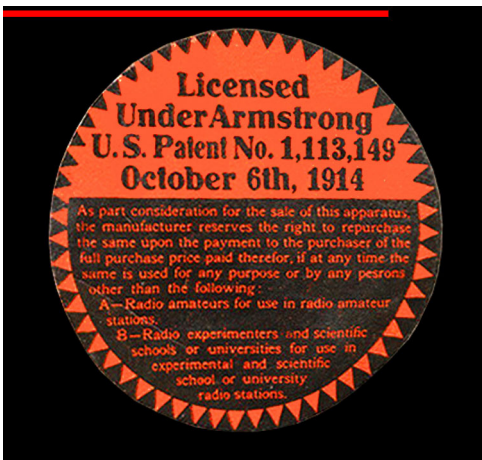


18. Antenna, Ground and Loudspeaker terminals and numerous screws and nuts were nickel plated.



19. The tuner coil was pretty heavily soiled. I used my new-found technique of washing the coils in plain mineral spirits; only employing a minimum amount of brushing with a hog bristle brush to bring more mineral spirits up to cascade over the coil. The real cleaning takes place when I set my air gun at

about 30 p.s.i. and blow the spirits off the coil in a fine spray. It appears that this ballistic removal of the spirits carries away much more soil. I repeat this operation three times. It only takes a few minutes. The end results can be dramatic.



20. The Armstrong license tag pasted to the inside wall of the cabinet was missing. Only a small film of backing paper remained to cover the spot. I had a couple of clear snapshots from e-Bay listings. Fortunately Photoshop has tools where the elliptical distortion caused by not photographing the label perpendicular from the center of the label can be

corrected to a large degree. A laser color copy was made and given a coat of amber tinted lacquer to 'age' the appearance.

21. All shafts had two kraft paper, oil soaked washers between surfaces: just one more annoying little task to take care of. Fortunately I have a set of gasket punches for the task.

22. Refinish the solid mahogany cabinet: I have photographs of this model where there is a large Zenith logo decal placed on the

top-center of the cabinet. I have seen other cabinets that appear to be in fine shape that do not have the decals. Back in about 1976, R. H. G. Mathews one of the founders of Zenith attended the Antique Wireless Association conference. At the time he was well into his 70s and had a reputation for being a brusque personality. I asked him about the decal. He responded "We didn't put a god damn decal on the top of our sets!" Oh-Kay.... (So who did?) My experience says he was wrong about some of the production runs. I very carefully examined my cabinet and could find absolutely no trace of a decal on the top of the cabinet even though the finish was very sound in that area. I would LOVE to place a decal there (which I have) but cannot justify doing it based on my photographic evidence. Collector Gary Alley has early and late versions of the Zenith 3R and 4R. He reports that his 3R sets do not have a zenith decal on the top but both of the 4R receivers do have the decal.

I made a big mistake.... I completely misjudged the condition of the original finish. I thought that the finish was very thin and there was nothing left to really improve by buffing. I WAS WRONG!

I began to strip the cabinet and found that there was considerable body to the finish... Unfortunately, too late to do anything but continue to strip the cabinet. After the stripping, I gave it a very light sanding and scraped with a cabinet makers scrape to yield a very smooth finish.

I used a Min-Wax mahogany oil stain to brighten the color of the old growth mahogany from which the cabinet is made. (It is very dense, heavy wood.) I did not have any appropriate mahogany grain filler. I thought the grain to be tight enough to maybe look OK with just several coats of clear lacquer. I applied two coats and let dry for more than a day. I then used 600 grit waterproof sandpaper wetted with water to sand flat any dust debris and worked with 0000 steel wool to dull the whole finish. A third coat of lacquer was applied. After that coat had had two days to dry, buffed the gloss off with very light strokes of the 0000 steel wool

again followed by a rub-out of the finish with Constantine's non-blooming rubbing oil and a tight woven cotton rag. Later I will use Carnuba paste wax

On discovering the mistake I had made in stripping the cabinet, I decided to see what would happen if I did not strip the back door of the cabinet. For the door, I wet sanded the old surface very lightly and then dulled the whole surface with the 0000 steel wool. I applied two coats of gloss lacquer followed with the same very light wet sanding and steel wool technique from before spraying. I then finished with a rub-out with oil and cotton cloth. The back cover is very slightly darker but not so much that the difference draws attention.

23. Refinish the brass plated steel spring hinges for the back door: I have never set up to plate brass. Caswell Plating has plating kits starting above \$100. I could not justify the expense for just two hinges. I therefore cleaned them in the ultrasonic cleaner, applied 'rust converter' to get rid of the rust and finished by painting with bright gold metallic lacquer.



24. Clean the chassis: This was the easiest of tasks. I just use Go-Jo with cotton balls, gauze pads or cotton terry cloth.

25. Some of the tube socket nickel plated parts were heavily oxidized; these parts are riveted to a Bakelite body. I determined it too risky to drill out these small rivets and then stake back after plating the parts. So I cleaned away some of the oxidation, gave the metal a coat of lacquer and considered the job done.

Was all this worth it?

Well sometimes you see a challenge and just wonder if you can 'make a silk purse out of a sow's ear'.

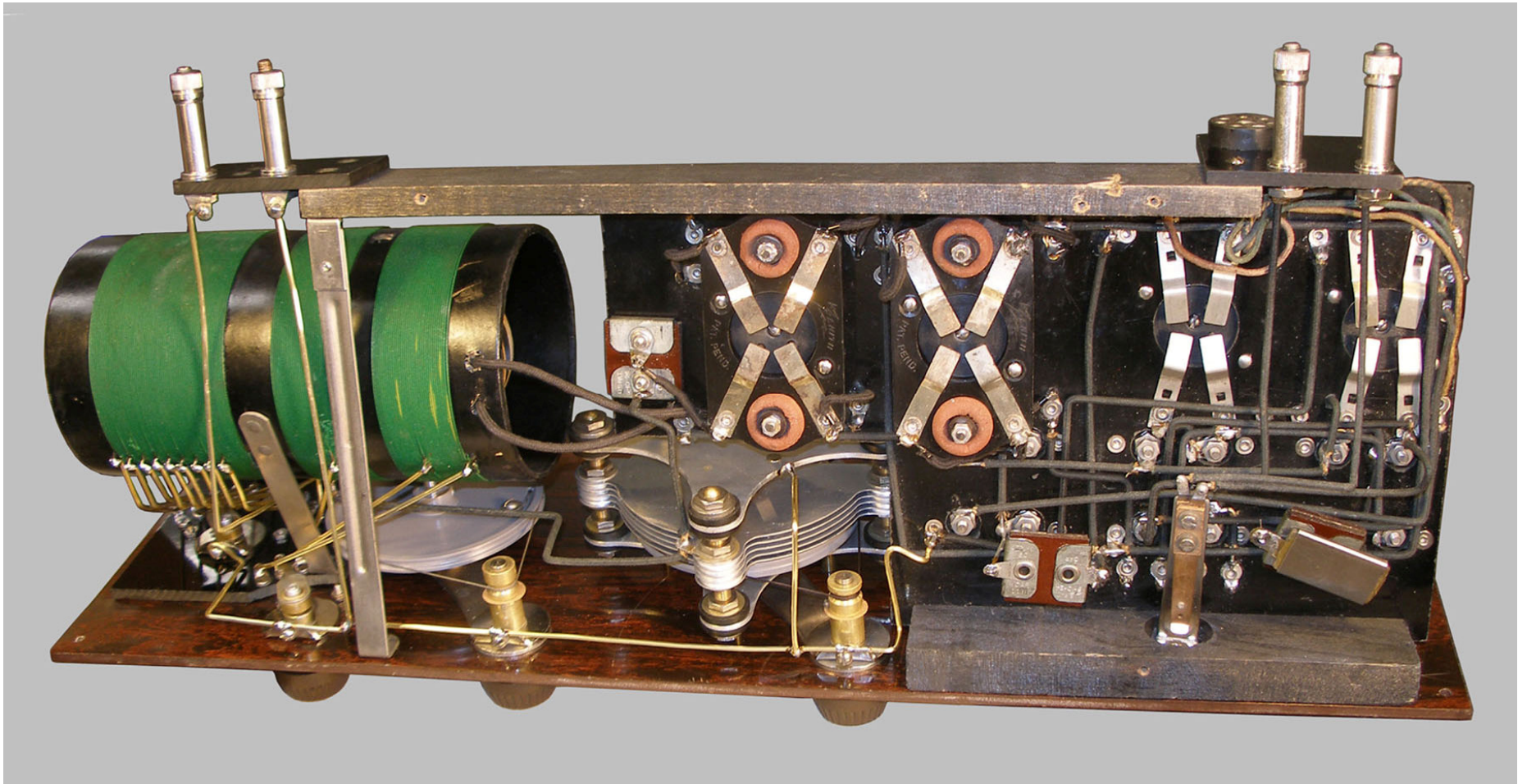
Will it give you the opportunity to test new process ideas? Maybe.

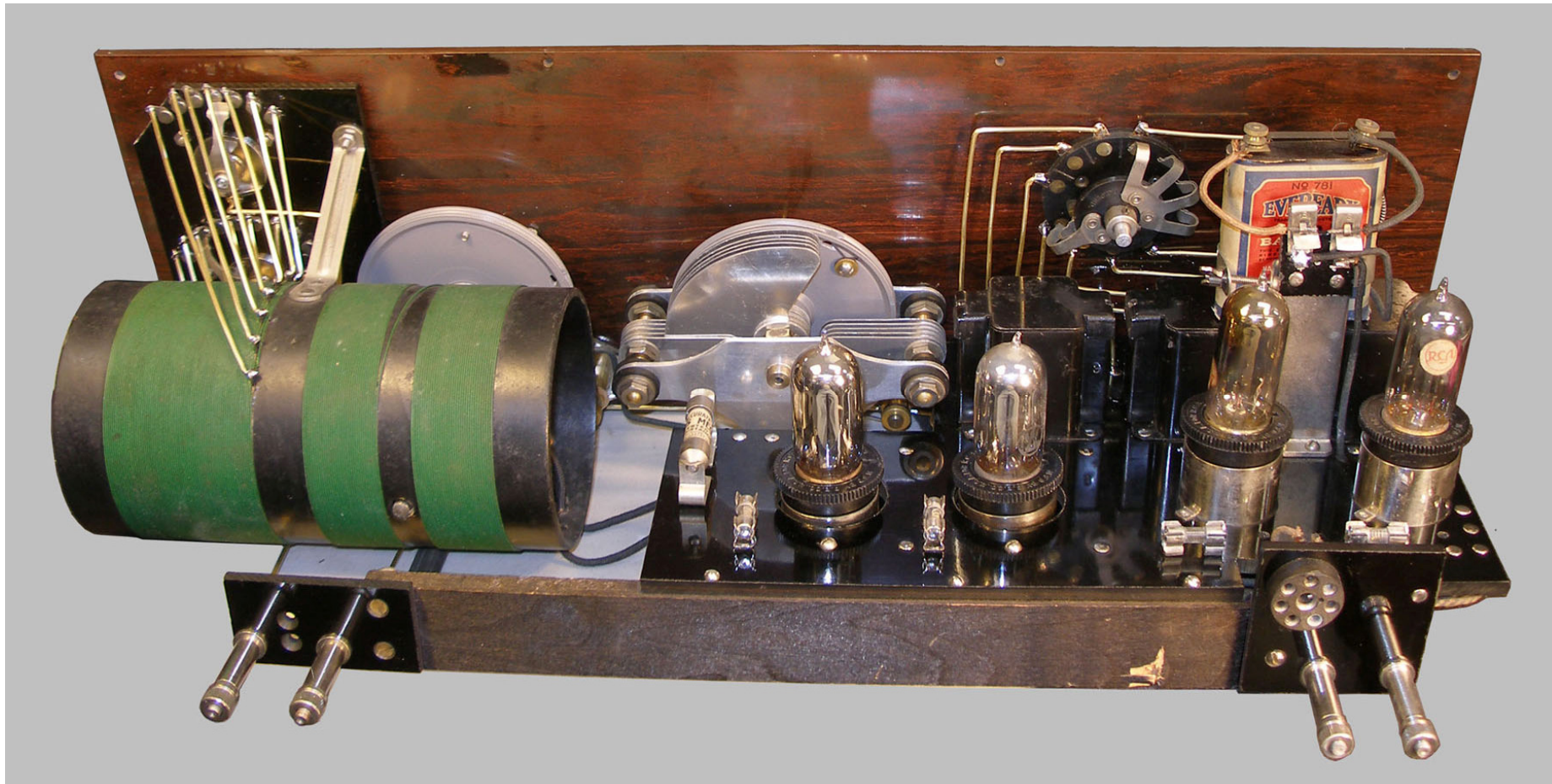
Will the challenge prove a showcase for your restoration or conservation skills? I hope so....

From the collection of:
Robert Lozier – KD4HSH
Kd4hsh@carolina.rr.com

Photo Gallery







Many other in-process photos exist. Send an e-mail to: kd4hsh@carolina.rr.com