ATWATER KENT MODEL 708 RESTORATION

MODEL DESCRIPTION

The Atwater Kent Model 708 tabletop is a small 8-tube AC superhet circuit radio. It receives the standard broadcast band and three shortwave bands. The radio includes an RF amplifier stage, separate oscillator, and two IF amplifier stages. The RF amplifier stage uses a double-tuned pre-selector on the broadcast band with a 4-gang tuning capacitor. The radio uses 2.5 volt standard based tubes. The RF and IF sections include five type 58 tubes. The chassis is very compact and the radio is extremely difficult to service with all the RF and IF circuits (less the band switch and coils) contained on a sub-chassis that is located on top of the main chassis. Wires from the band switch and coils under the main chassis as well as filament, B+, and signal leads must be disconnected in order to remove the sub-chassis. The schematic for this radio was available on Nostalgia Air.

Atwater Kent Model 708
(Atwater Kent Radio Website)

EVALUATION OF "AS-RECEIVED" CONDITION

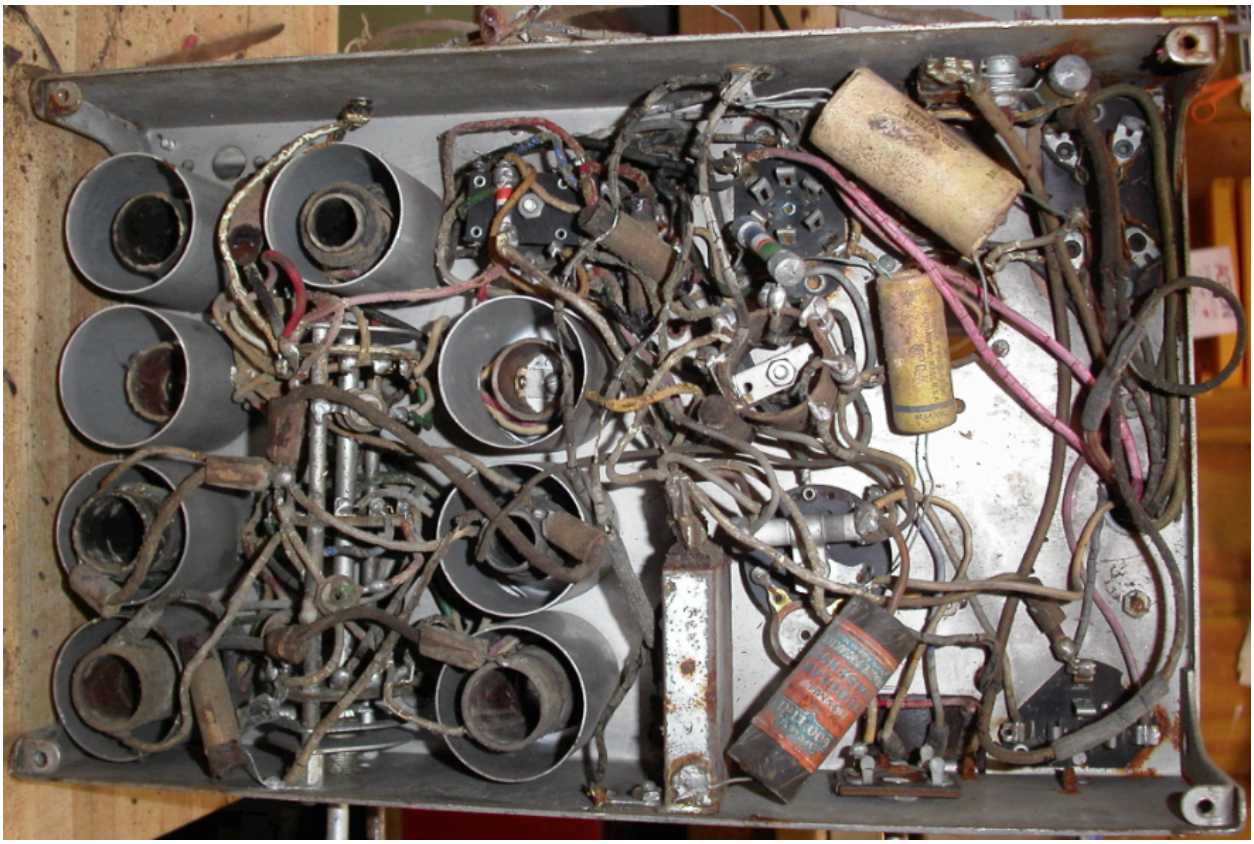
The radio was obtained on eBay for $17.15 in February 2011. The description was accurate. This was purchased with the knowledge that a complete cabinet and chassis restoration would be required. The following pictures show the "As Received" condition.

As Received - Front View

The cabinet consisted only of the base and the front panel. All the remaining cabinet was missing. The front panel had much missing/damaged veneer and the grillwork had delaminated in many places although almost all of it was present. The decorative horizontal molding strip just under the grillwork was missing. The front bottom molding was present, but the side pieces were missing. Two knobs were missing. The base was also delaminating, and came apart into more than six pieces.

As Received - Back/Side View

The chassis was very dirty and the right rear section (viewed from the back) was very rusty and large pieces of the plating were flaking off. The two electrolytic can capacitors (C-20 and C-21) were missing. A dual 8 MFD electrolytic replacement had been installed under the chassis, but only half was connected. An 8 MFD electrolytic was installed as a replacement for the 4 MFD electrolytic (C-19). A .25 MFD capacitor appeared to be installed for the xx MFD (C-XX) in the Multiple By-Pass Capacitor (J14). All the rubber wiring on the top of the chassis was completely deteriorated with bare wire everywhere. The power cord was cracked and exposed wire was present. The plug was not original. The speaker cone had a pretty large hole near the 1 o'clock position with several tears radiating from this hole toward the center. The speaker grill cloth and cardboard backer were both in god shape. The tuning dial was in good shape, but the rubber drive wheel was deteriorated and had been wrapped in adhesive tape. It did not work. The original dial indicator lamp socket was disconnected and an additional dial light socket was wired into the circuit. Not sure why, because the original socket appeared to be in good condition. The NRA label was in good condition, but the Antenna/Ground label was partially missing. One tube shield was missing. One grid cap was smashed. A double 8 MFD electrolytic capacitor was installed under the chassis, but only one side was connected. No other repairs were apparent. The antenna and ground leads were connected to something called a Magna-Aerial which had one lead coming out of it. All of the rubber coated wiring had deteriorated. The underside of the chassis was dirty, but everything appeared to be there.



As Received Chassis – Bottom view

OVERVIEW

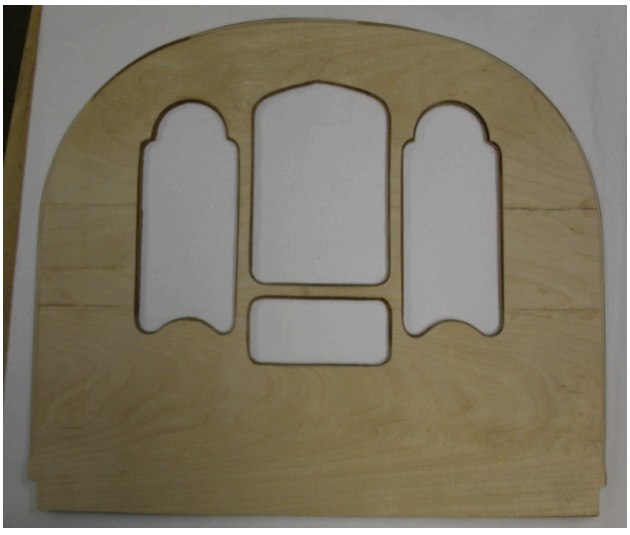
The first challenge was to determine how to reconstruct the cabinet. Internet searches provided several excellent pictures of the cabinet. I decided that the grill work and front panel (at least the core) could be saved. The veneer would have to be redone as well as one layer of the core, but this looked feasible. The grillwork would require gluing all the laminations back together, but should also be feasible. The base would require replacement. The rest of the cabinet would have to be constructed from pictures.

CABINET REPAIRS

The first repair attempted was the grillwork. The grillwork consisted of a 3 layer plywood, most which were delaminating in various places. This required gluing all the layers back together. I was able to match most of them back in place pretty closely, but water damage had caused some distortion and not all the layers were able to be matched perfectly back together. Careful filing/sanding after gluing resulted in obtaining a pretty close appearance to the original design. All cracks in the grillwork were then filled with wood putty, sanded and sprayed with several coats of sanding sealer to provide a smooth surface for the black lacquer finish.

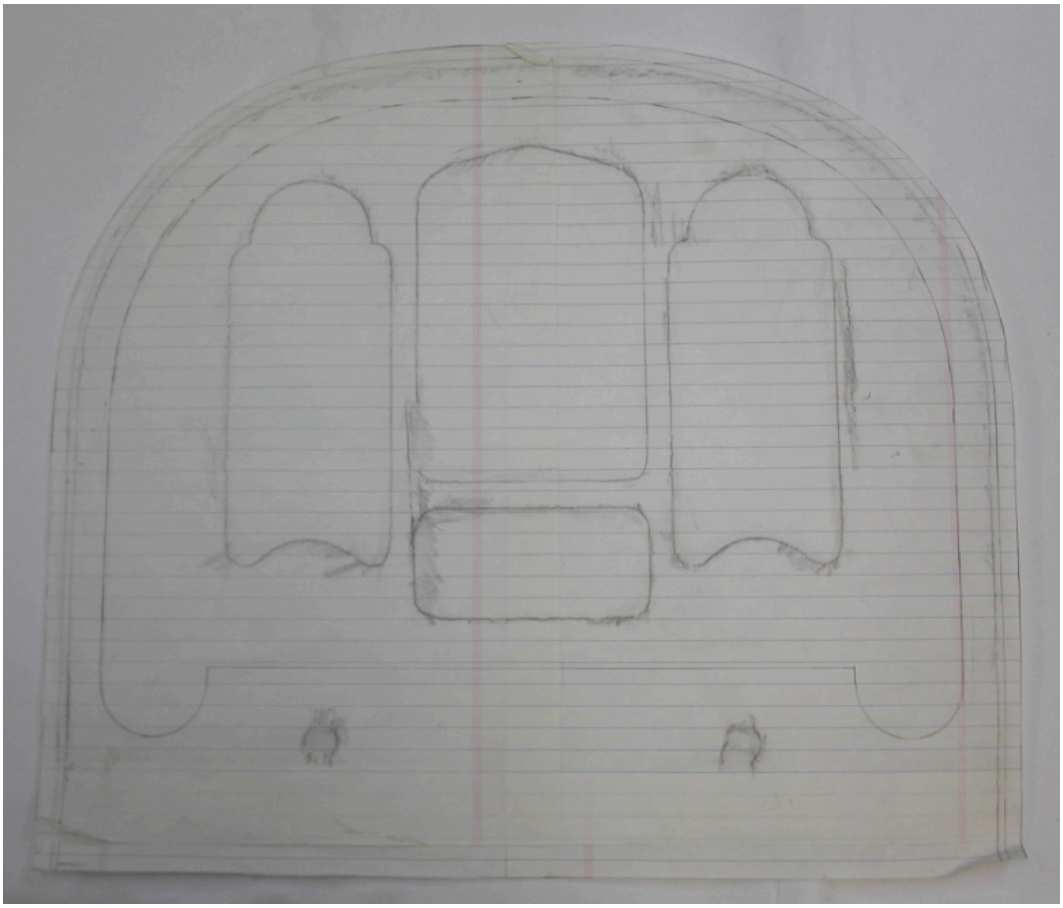
Grillwork Before Re-gluing (Backside)

The next phase addressed the front panel core. The top layer of the core (just under the veneer) had nearly completely separated from the core, so I finished the job, removing this layer and all the veneer. The rest of the core was pretty solid. The removed top layer was replaced with a birch veneer and the grill cutouts made.



New Front Core Showing Added Birch Veneer

The front panel veneer consisted of six different veneer pieces. The center piece surrounding the speaker cutouts was mahogany. The lower section was walnut burl or crotch. Of the four pieces surrounding the center section, the two side pieces appeared to be mahogany crotch and the two top pieces appeared to be mahogany straight grain cut with the grain running at about a 60 degree angle. Separating these veneers is a 1/16” wide groove that is black in color and slightly penetrates the first layer of the core. A tracing of the front panel was made by using tracing paper and rubbing the edges of the original front panel with the point of a pencil to produce an outline.



Tracing of Front Panel

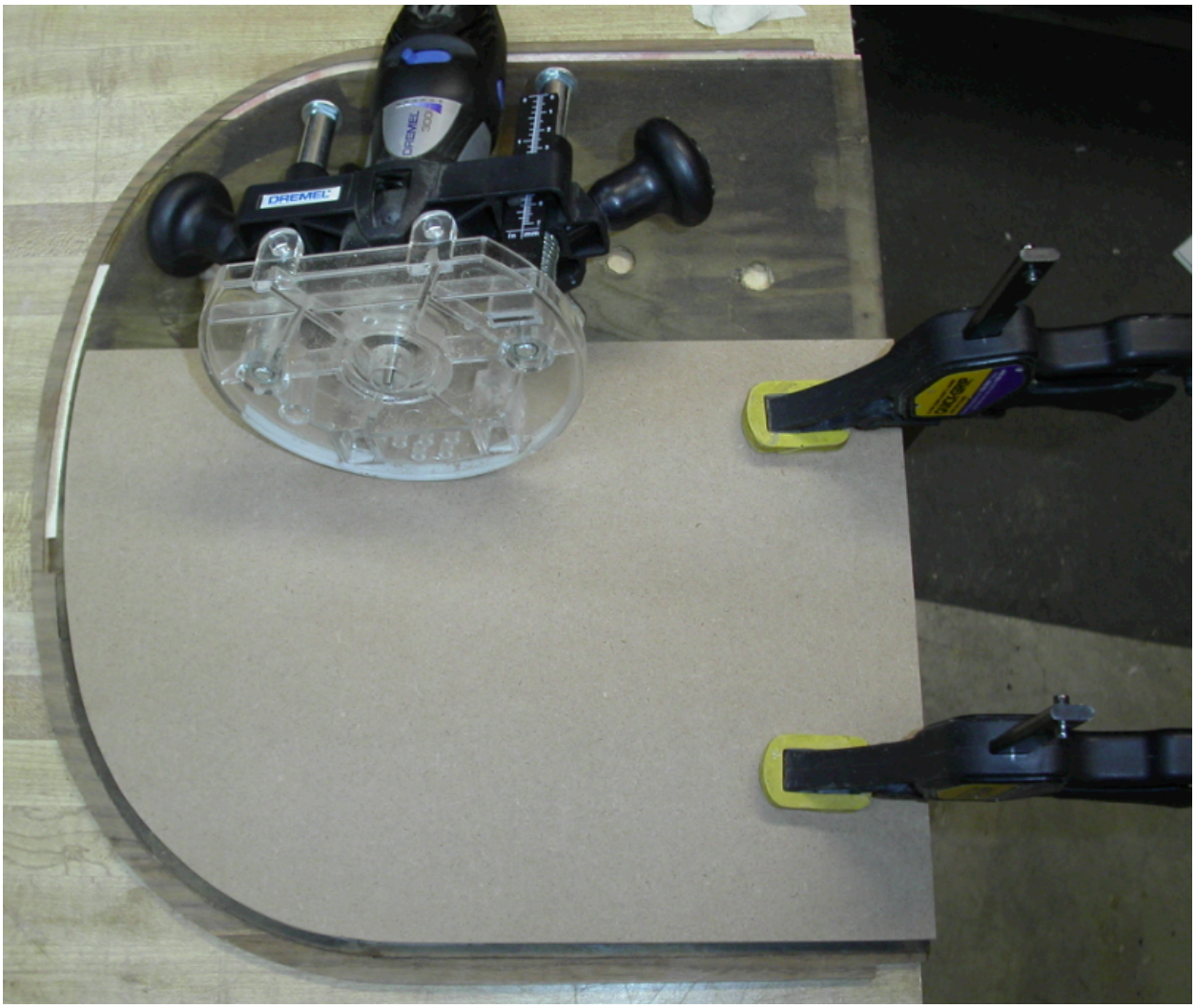
For those portions that were missing, a flexible curve was used to match a corresponding section on the front panel and then transferred to the tracing. The veneer pieces were all cut to match the tracing and veneer tape was used to hold them all together for gluing to the front panel core.

Veneer Pieces All Taped And Glued To Front Panel

A pressboard pattern was then made to match the tracing offset by 3/16 inches to allow use of a Dremel router with a 1/16" straight bit and a 3/16" router guide. The depth was set to just penetrate the core. It was hoped that careful matching of the veneers to the groove tracing and a very accurate template would result in the grove being cut exactly at the veneer joints matching the original perfectly. I was 90% successful. The left side vertical groove and the circular grove surrounding the shaft opening were slightly off. I believe that the router bit was not centered exactly in the router and not keeping the same side against the template resulted in the mismatch. Also because of the way I had mounted the template, I had to reposition the router to cut the top of the groove resulting in a slight mismatch of the groove at the top of the face. I considered various ways to fix these problems and finally decided to remove and replace the side mahogany crotch piece and a portion of the top curved straight grain mahogany. Since the walnut at the bottom was book matched, I couldn't remove that piece because I would have had to do the other side also so I decided the best course of action for that piece would be to insert a small patch. These repairs proved successful and the patch is nearly invisible. The groove was dressed up where the new pieces were installed using a small square file. The grillwork openings were then

cut out and the edges contoured using a small grinding wheel in a rotary tool with some additional hand sanding to match the contours of the original openings.

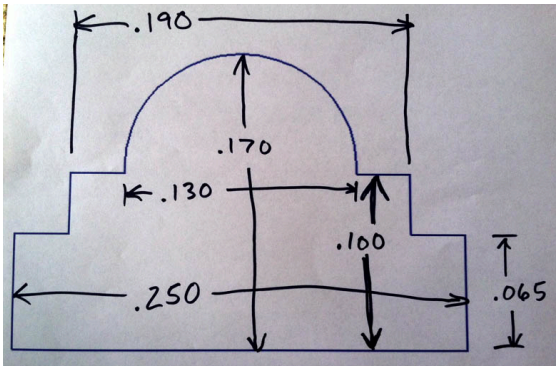
The back of the front panel needed repair to the core and veneer that exists outside the groove for the case. The core in this area was build up with birch veneer and a walnut finish veneer to match the rest of the back veneer. A template was made from ¼" hardboard to act as a guide to use the Dremel router with a 3/16" bit to route the groove in the back of the front panel to accept the cabinet case.

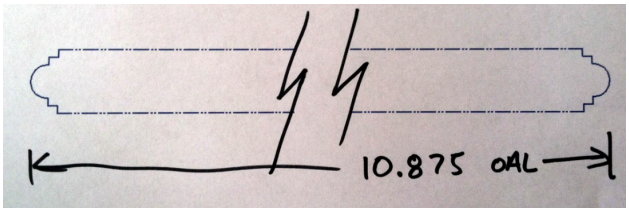


Routing Grove In Back Of Front Panel

Since I didn't have the horizontal decorative trim piece that separates the bottom walnut section from the top mahogany section, I looked for pictures on the internet that I might be able to get the shape and dimensions. Although I found several pictures that gave me a general idea of the shape, I couldn't be sure. Several pictures had email addresses for their contributors and I emailed them and asked them to see if they could provide me a diagram of the profile and dimensions. I got responses from two providing close-up pictures and very similar detailed measurements and profile descriptions.

Close-up of Trim Piece
(Provided by Dave McClellan)



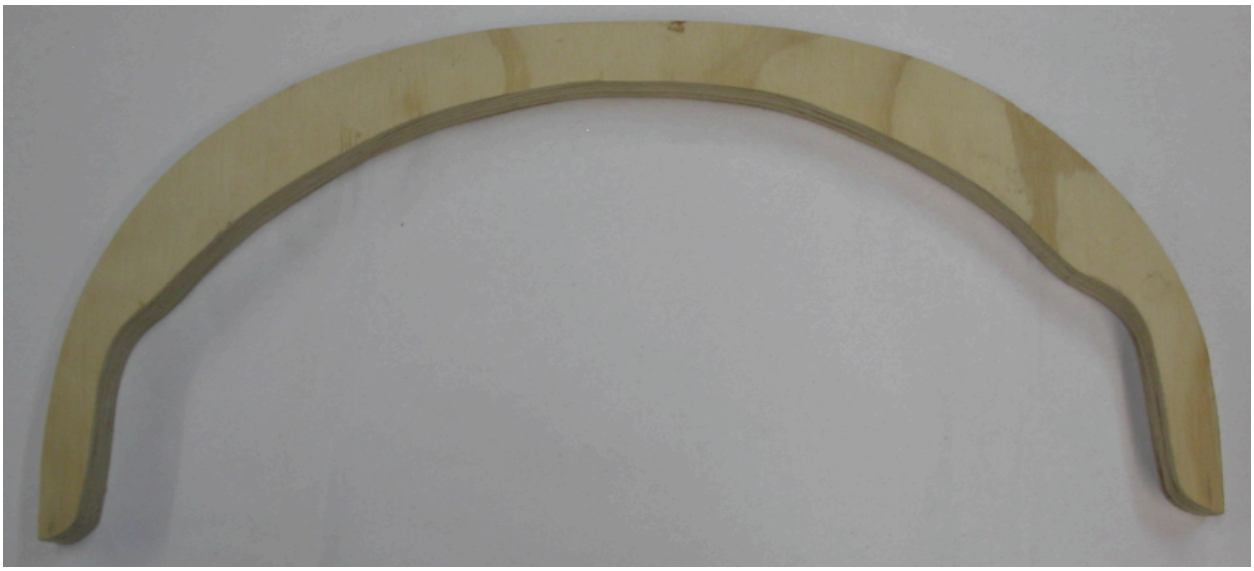


Trim Piece Profile/Dimensions
(Provided by Howard Mariotti)

I decided based on these measurements to create the piece by building it up from four separate pieces of wood cut to the required dimensions and glued together. The top edge was rounded over by sanding and the semi-circular grooves were made in the rounded edge using a small X-Acto U gouge. This piece was sprayed dark walnut lacquer, the top edge sanded lightly to remove the dark lacquer and provide the highlights and finally finished with a gloss clear spray lacquer.

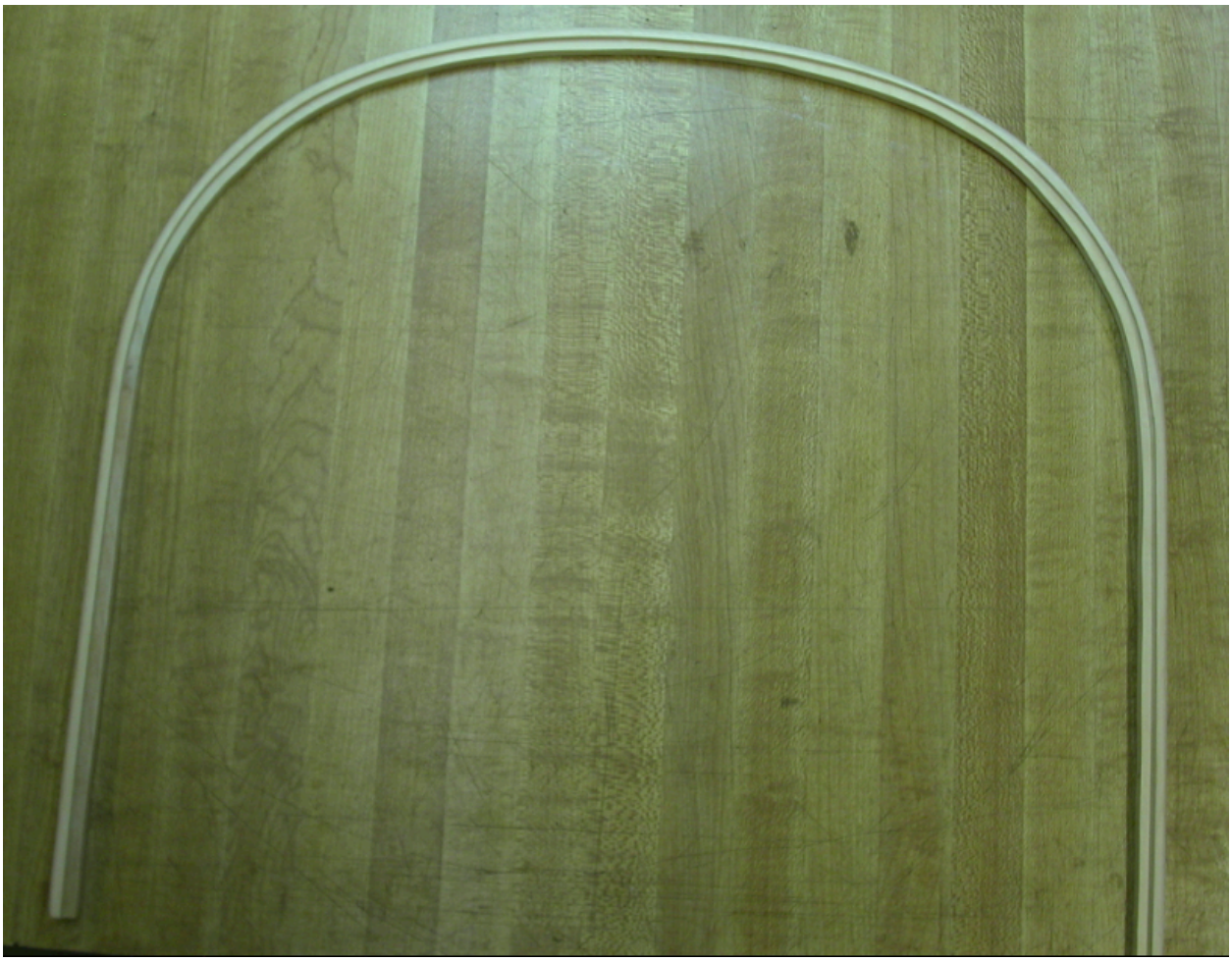
Completed Trim Piece

The next step involved making a new base, which was the simplest of all the repairs. A piece of five ply ¾" birch plywood was cut to the dimensions of the original base. The rear brace was next made by using the previous tracing of the front panel to trace the outline of the curve on another piece of 3/4" plywood. A 3/16" offset was drawn inside this curve to provide for the back of the cabinet shell. The bottom edge design of the brace was defined by using cabinet photos and estimating dimensions by using ratios from the length and width of the cabinet. This piece was then cut out on a bandsaw.



New Rear Cabinet Brace

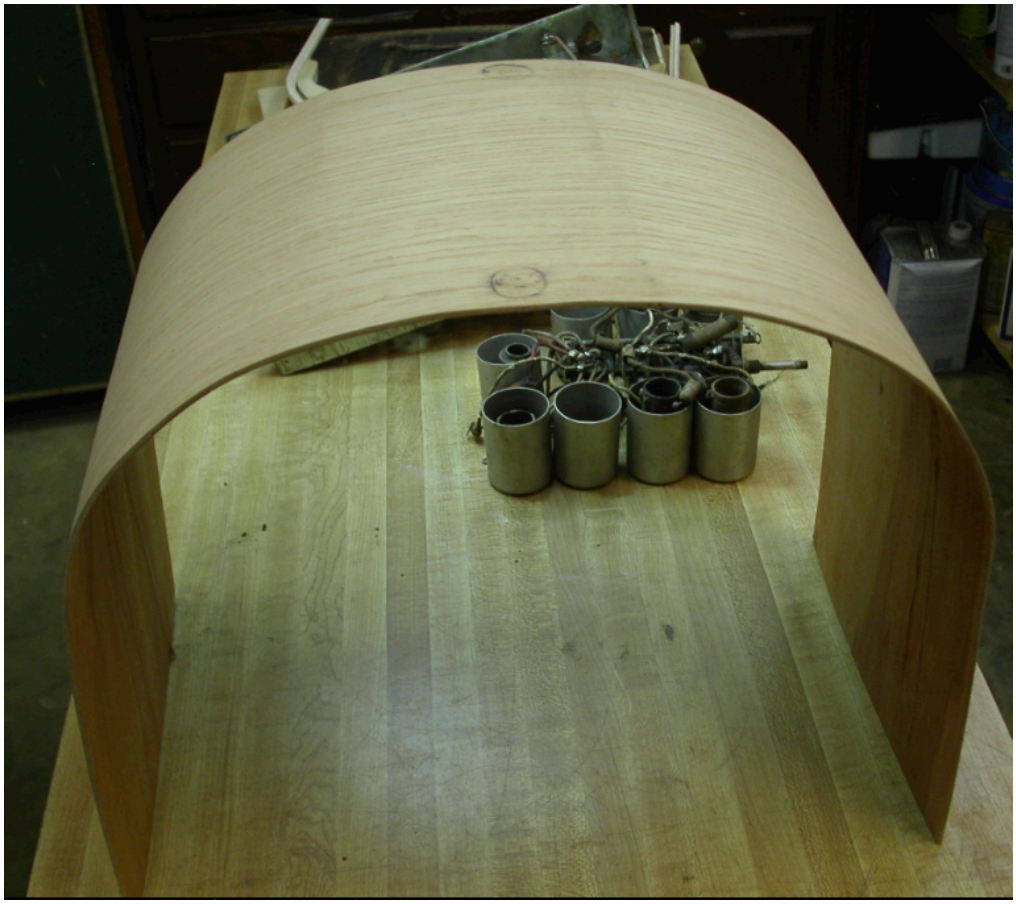
Next the rear trim was made by using the same tracing of the front panel. The outside edge was traced onto a piece of 3/8" plywood. The hardwood template was positioned to provide for a ¼" edging outside the top of the cabinet shell, a 3/16" groove for the cabinet shell and also account for the 5/8" router guide. A3/16" straight router bit was set to provide a 1/8" deep grove and routed using the template. The outside edge of this piece was then cut out on the bandsaw and the inside edge was cut on a scroll saw exactly along the inside edge of the groove. The outside edge was then rounded over to match the profile in the AK708 pictures seen on the internet.



Rear Cabinet Trim Piece

A piece of 1/8” plywood was cut to 9” x 35” to form the cabinet shell. A form was made from 1-1/2” dimensional lumber. The plywood piece was soaked for about an hour or so in hot water in the bath tub after verifying on a test piece that water would not cause the plywood to delaminate and that it provided enough flexibility to bend. The plywood was then clamped around the lumber form and left to dry for several days. When unclamped the form remained and matched the grooves in the front and back edging.

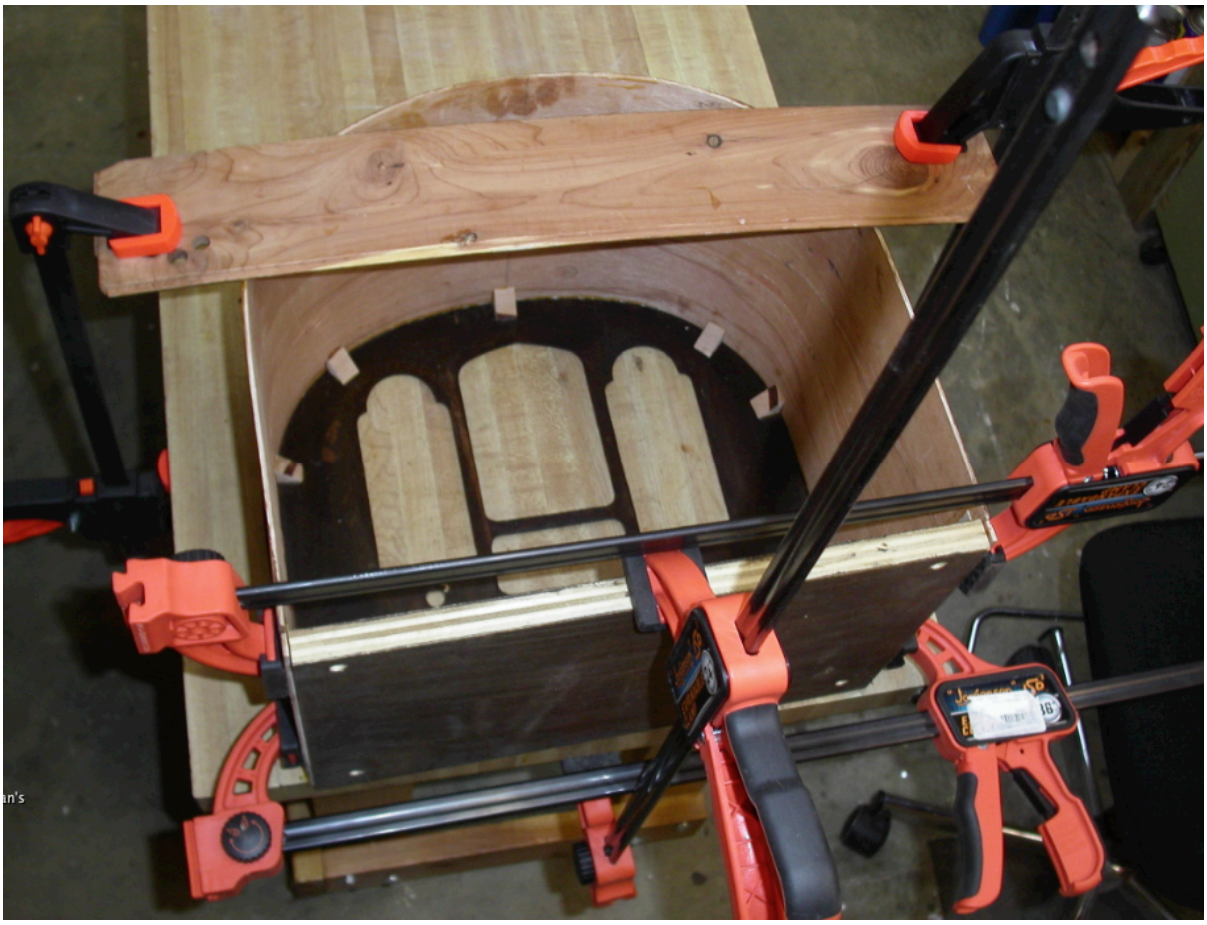
Forming Cabinet Shell



Formed Cabinet Shell

Finally, the cabinet shell was covered with a piece of mahogany veneer. This didn't turn out to be as easy as I thought because I couldn't clamp the rounded sections sufficiently. If I do this again, I would find glue that does not soften in water (I was using Titebond II and it softens when soaked in water) and veneer the shell first before forming it.

The veneered shell was glued to the base and front and when dry the rear brace and trim piece were glued to the shell. I wasn't able to do it all at the same time (not enough big clamps).



Gluing Cabinet Front To Shell

Although I had the front bottom molding, I needed to make the two side molding pieces in two steps. The first was to cut a straight rabbit, and then a round over bit was used to cut the curved cutout. These were made from ½" walnut to matching the design of the original front molding. The bottom edge cutout was made using a scrollsaw. After carefully looking at the internet photos again, I decided the side molding must be thicker than the front molding. I contacted Dave McClellan again and he provided pictures of the side molding and bottom. The side molding was ½" vice 3/8" and there was an additional ½" strip matching the bottom molding cutout on the bottom. This also revealed that the bottom was probably only ½" plywood vice the ¾" that I had used. I removed ¼" from the bottom using the dado head on my table saw. This reduced the base thickness to allow gluing of a ½" red oak strip on the bottom. I also added a 1/8" walnut strip to the side molding. The moldings and bottom braces were glued into place. The final step was gluing the trim piece on he front of the cabinet.

The entire cabinet received several spray coats of lacquer sanding sealer and sanded with 320 grit paper between each coat. The cabinet was masked and the molding and edges then sprayed with several coats of extra dark walnut lacquer. The entire cabinet was then finished with several coats of gloss spray lacquer.

I removed four feet from another Atwater Kent cabinet, replaced the felt cushions and installed these on the base of the cabinet. Four brass nails were cut down and installed around the band switch shaft opening. The final finishing touches included stripping and refinishing the knobs in walnut stain and gloss lacquer, and reinstalling the refinished grillwork and grill cloth.
The speaker grill cloth was in pretty good shape. It had no tears but was only a little faded, so I decided to re-install it as is after a little brushing and cleaning with water.

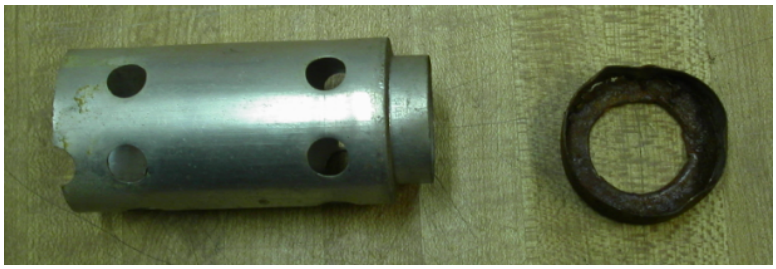
Completed Cabinet

ELECTRONIC REPAIRS

The first effort was to remove the components on top of the chassis so that the rusted areas could be repaired. The dial plate and tuning mechanism were removed first. The shaft for the tuning mechanism had been cut off and was about an inch shorted than it was supposed to be. A new shaft of the correct length was made from a piece of ¼" steel rod. The rubber drive wheel will have to be replaced. The extra dial light was cut off and discarded. The sub-chassis was

disconnected next. The wires to the tuning capacitor were unsoldered. The wire bundle containing the filament and other leads (8 total) were unsoldered. This allowed the sub-chassis to be rotated enough to unsolder the wires going to the Oscillator and RF Amplifier tubes.

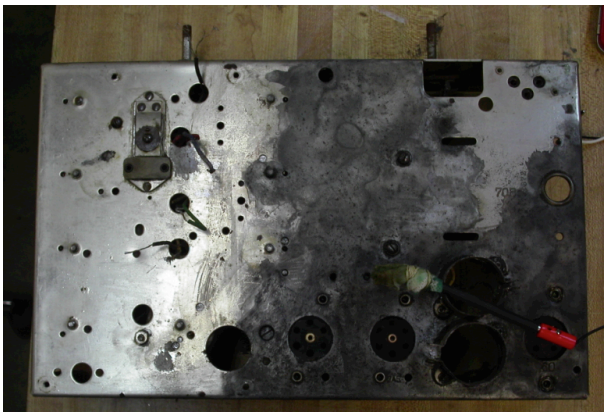
The transformer was disconnected next and then the volume control and switch. This cleared the top of the chassis. The tube shield for the 2A6 tube was rusted to the mounting bracket. In attempting to remove the tube shield the mounting bracket separated from the chassis. The bottom of the tube shield mounting bracket had rusted through. The diameter of the mounting bracket and tube shield was 1-5/8 inches. I had no replacement, so I looked for and alternative. An unused aluminum tube shield of unknown origin was found to have the same diameter. I cut off the top of the tube shield and was able to form two tabs which allowed me to insert the tube shield between the top of the tube socket and bottom of the chassis. While this mechanical connection is pretty firm, I intend to provide a positive electrical connection between the tube shield and chassis with a copper wire to ensure the tube shield will be electrically connected to the chassis when installed.



Tube Shield Used To Make New Tube Shield Mounting Bracket

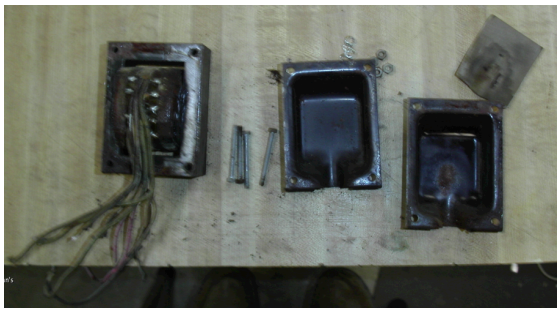
The rust was then cleaned from the chassis. The chassis was first washed with a degreaser and then Naval Jelly was applied to all rusted areas and a stainless steel wire brush used to remove the rust. Several applications were required. The rust had severely pitted the chassis in places so I used a wire brush wheel on a dremel tool. This still wasn't able to get rid of all the rust, so I then used a small grinding wheel on the dremel. This persistence finally paid off. After washing down the cleaned areas, I used a Caswell nickel plating Plug-and-Plate Kit. While this plated area of the chassis is not as shinny as the rest of the chassis, it has an antique look and should not be subject to further rusting.

Chassis Before Cleaning/Re-plating



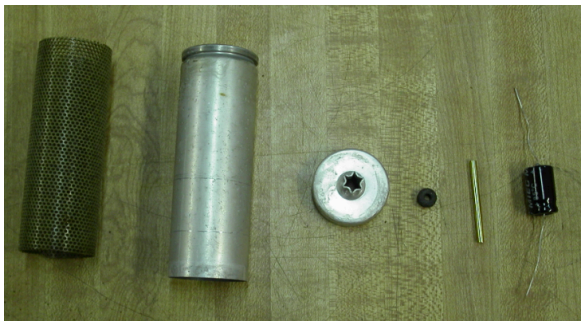
Chassis After Cleaning/Re-plating

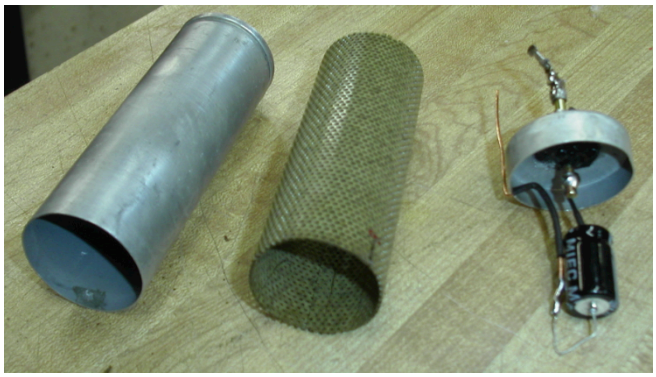
The transformer was opened up and new leads were soldered to the windings. The case was cleaned of rust and painted black. After removing the rust from several areas of the laminations, the transformer laminations were sprayed with insulating varnish and reassembled.

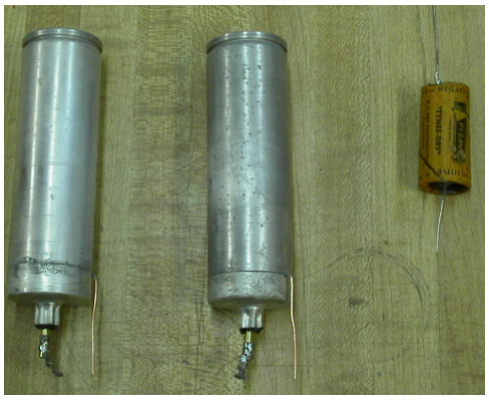


Transformer Disassembled

The Electrolytic capacitors (C20 and C21) that were missing were replaced with a couple of discards from other chassis. Each can was opened up about ½ inch from the bottom using a scroll saw, cleaned out, and the center aluminum rod replaced with a brass rod to which the positive end of a new 8 MFD 450VDC electrolytic capacitor was soldered. A copper wire was soldered to the negative end and led out through a small hole was drilled in the bottom of the can in order to ensure a positive connection to the negative end of the electrolytic. The plastic insert inside the can was reinstalled and epoxied in place providing a means of joining the can back together. This joint is hidden inside the mounting bracket. The cans were reinstalled in the mounting brackets and the wire from the negative end was soldered to a nearby grounding point. Capacitor (C19) a 4 MFD 50V electrolytic capacitor was re-stuffed in a similar manner. The only difference being this capacitor also had a paper sleeve over the aluminum can.



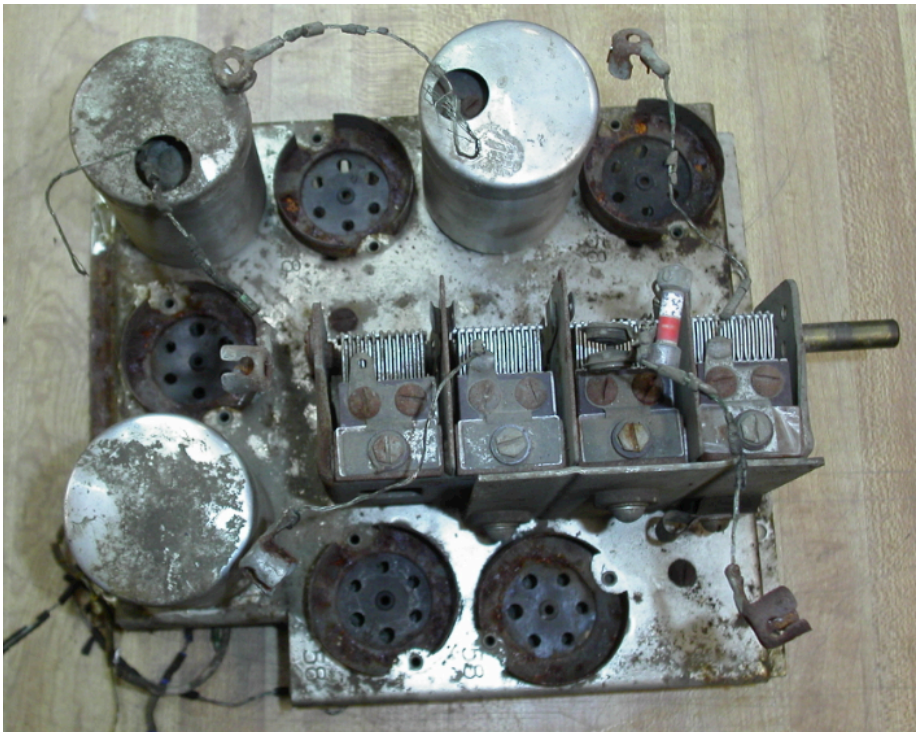




Electrolytic Condenser Rebuilding

I then decided to work on the sub chassis as the next step.

Removed Sub-chassis (Bottom View)



Sub-Chassis Top View

First I compared the wiring to the Riders AK 708/808 schematic on Nostalgia Air. Several differences were noted. I also looked at the AK 808A schematic. This matched the wiring closer in some respects, but there were still differences.

The following shows the differences in the parts list for the two models.

AK708/808		AK808A	
Part ID	Value	Part ID	Value
NA		C5A	.01 MF
NA		C8A	8 MMF
NA		C12A	.05 MF
C19	4MF 20 V elec	C19	10 MF 25 V elec
NA		C23	.005MF
NA		R1A	3300 Ohm ½ W
R11	Flexible 800 ohms	R11	Flexible 200 Ohms
NA		R11A	Flexible 160 Ohms
NA		R11B	Flexible 160 Ohms
R13	10,000 ohm ½ W	NA	
R17	250,000 Ohms ½ W	R17	1 Megohm 1/3 W
NA		R23	10,000 Ohms ½ W
NA		R24	50,000 Ohms 1-1/2 W

Looking at the sub-chassis, R11 was 200 Ohms vice 800 ohms but was not connected to the cathode of the 1st IF tube as indicated on the AK 708/808 schematic, instead it was connected to a flexible resistor (R11A ?) and a yellow wire that was connected to the cathode of the 2nd Det Cont/1st AF (2A6) on the main chassis. This flexible resistor (R11A ?) was connected to the cathode of the 1st IF. This resistor was open, so I couldn't determine its value, so I am guessing it was R11A which matched the AK 808 schematic. But the AK808 schematic had R11A connected to the cathode of the 2nd IF, to R11B, and to C12A. The existing arrangement matched neither the AK 708/808 nor AK 808A schematic. The remainder of the components and wiring appeared to match the AK708/808. There was no R11B flexible resistor or C12A installed on the sub-chassis.

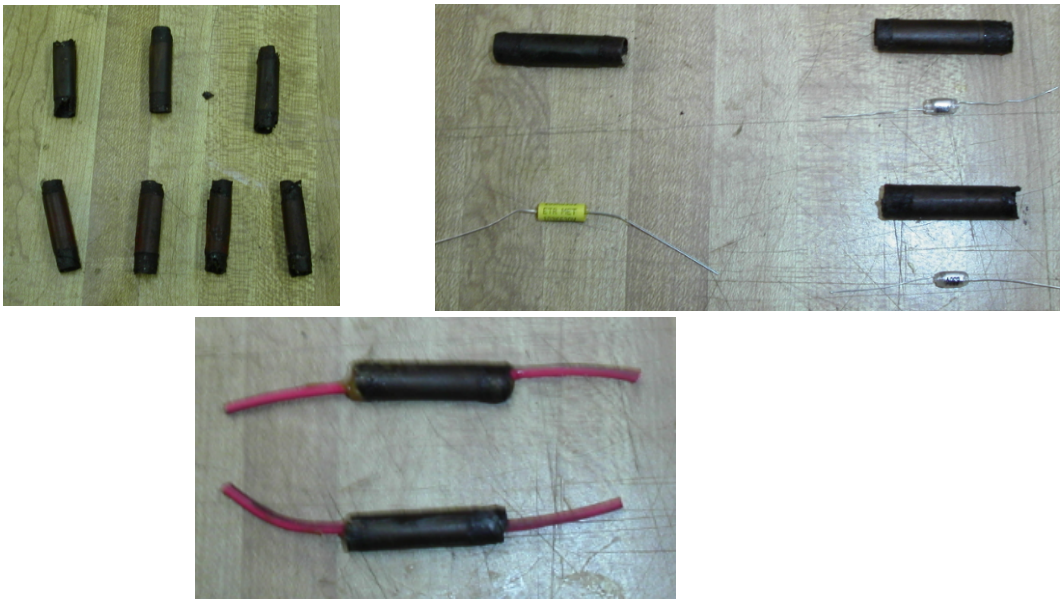
On the main chassis, the C19 installed was a 8 MFD 450 V electrolytic. This did not match either the AK708/808 or AK808A schematic. R17 was a 250,000 K resistor which matched the AK 708/808 schematic. R13 shown on the AK708/808 schematic was not installed. R23 and R24 shown on the AK808A parts list were installed, but not shown on either schematic. R23 was installed between the 2A5 plate and Capacitor C (.007 MF) of the Multiple By-pass Capacitor J14. R24 was installed between the 2A5 screen and ground. C23 also in the parts list of the AK808A, but not on the schematic, was installed between the 2A5 plate and ground.

A change to the schematic was also published in Riders that replaced the Quality Capacitor (C) (.007 MF) in the Multiple-Bypass Capacitor J-14 with a 10,000 Ohm resistor and a .025 MF capacitor. It is not clear if R23 and C23 are associated with this change, since the value for C23 is different (.005 MF vs .025 MF).

A note on the AK 808A schematic indicated there were three types of quality filters employed in the plate of the 2A5. The first type used a .007 MFD condenser; the second used a .005 MFD condenser; and the third used a 10K ohm resistor (R23) in series with a .03MFD condenser. The chassis as found appears to have used the third method employing the .03MFD condenser (F) contained in the Multiple By-pass Capacitor (J-14). Taking into account the change page which specified using a 10 k ohm resistor in series with a .025 MFD condenser separate from J-14, I chose to rewire the chassis in this manner.

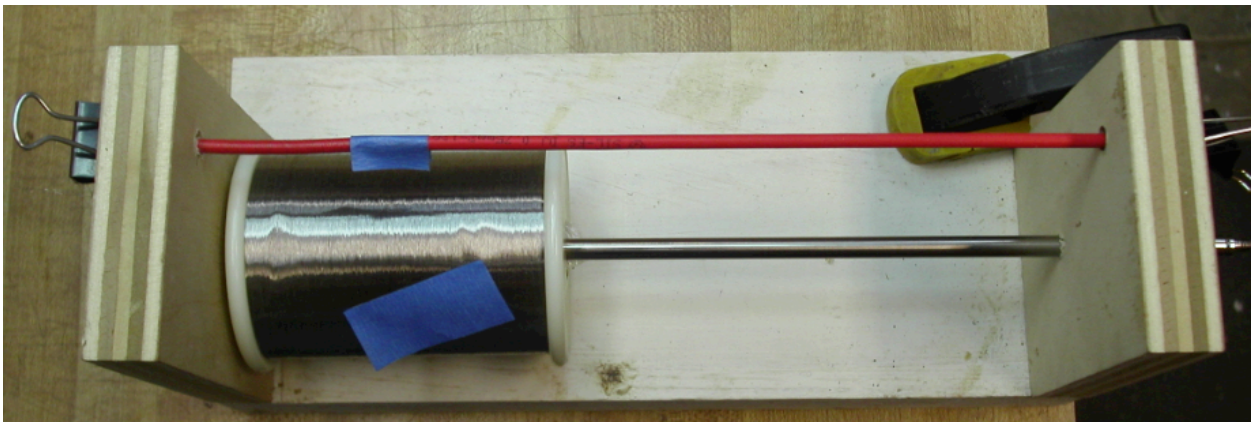
Rewiring of the sub-chassis was begun. First I removed all the flex resistors and the paper capacitors. I removed the variable capacitor from the sub-chassis. This was cleaned using a degreaser and then flushed with hot water and dried using a heat gun. All the grid cap wires were replaced and the grid caps cleaned and polished to bright metal with a wire brush on the Dremel. The rubber mounting grommets were still in good shape so were not replaced. A little wheel bearing grease was placed in the front bearing. The sub-chassis was cleaned and re-plated in a similar manner to the main chassis. The effort was mush less extensive and the plating actually stayed shiny vice darkening as it did on the main chassis.

The paper capacitors were re-stuffed with appropriate value 630V polypropylene capacitors. This was harder than normal since all the capacitors had leads coming out the side vice the end of the paper tubes. While removing the internals even after cutting all the wire leads, most of the ends of the tubes were damaged. I wound paper around a pencil and added an insert to rebuild the ends. These were inserted and holes drilled through the sides with a 1/16” drill. The new capacitors were then carefully inserted with leads coming out the new holes and glued in place with a hot glue gun. The ends were painted black and when dry, beeswax was melted and poured in the ends to match the originals. One .01 MF capacitor (C11) required a new paper tube, which was made the same way as the inserts and was painted and assembled as previously described. A new label was made using Microsoft PowerPoint. I first peeled the label of the original capacitor, then scanned it and copied it into PowerPoint. This allowed me to match the font, spacing and background color.

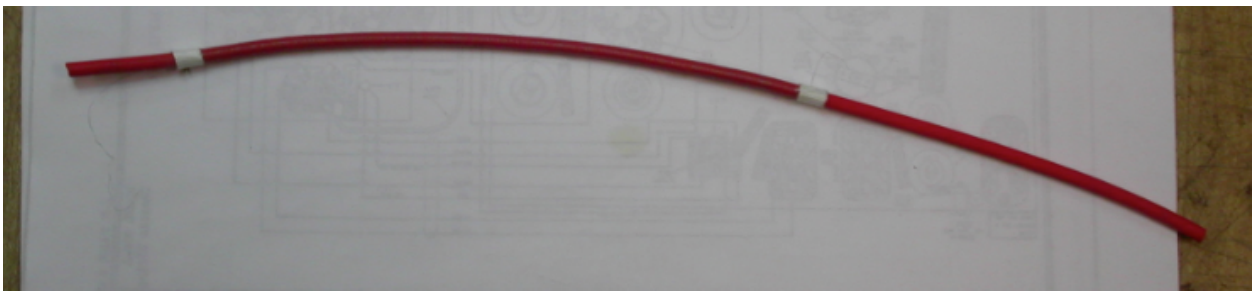


Paper Capacitor Re-stuffing

Next came the flexible resistors. I had previously read most of these fail because the nichrome wire is only crimped in the terminals. I removed the terminals by first splitting the lead collar and then prying open the crimped terminal. Measuring resistance on the bare nichrome wire still indicated the resistor was open. I decided to try and recreate a flexible resistor. I had a spool of nichrome wire with a resistance of 128 ohms/ft. I build a simple jig that enabled me to stretch a piece of silicone covered stranded 18 gauge wire about 1 ft long through a hole in two end wooden support pieces which also had an axle to hold the spool of nichrome wire. The 18 gauge wire was held in place using two "bulldog" clips which allowed the wire to rotate. I wound the nichrome wire over the silicone core wire. I periodically measured the resistance until I reached the value needed. I then removed the core wire from the jig and taped over the nichrome wire with glass cloth electrical tape. I cut the ends of a brown shoelace, opened it up and threaded it over the taped wire. I crimped a new electrical terminal on each end, wrapped the nichrome wire around each terminal and used silver solder to make a permanent connection. A piece of shrink tubing was secured over each terminal and over the ends of the cloth shoelace covering. The cloth covering was then dipped in beeswax. While the resistor is slightly larger in diameter than the original, it is a very fair reproduction. This process, with minor variations based on the learning experience, was used to redo all the flexible resistors which were reading open. Instead of wrapping in glass cloth electrical tape, I covered the nichrome wire with heat shrink tubing. I drilled a small hole in each connector that I removed from the original flexible resistors and used a very small rivet in the hole, wrapped the nichrome wire around it, secured the rivet and then silvered soldered it to ensure a good connection.

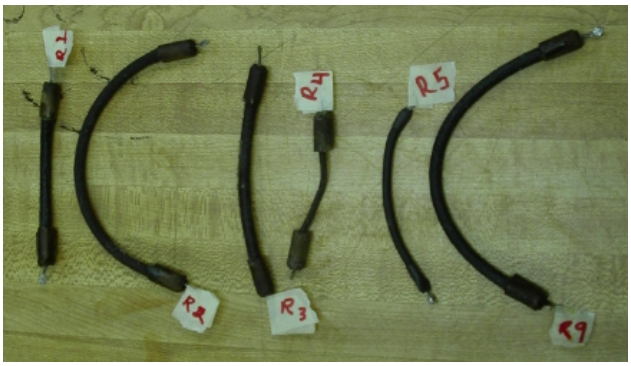


Winding Jig



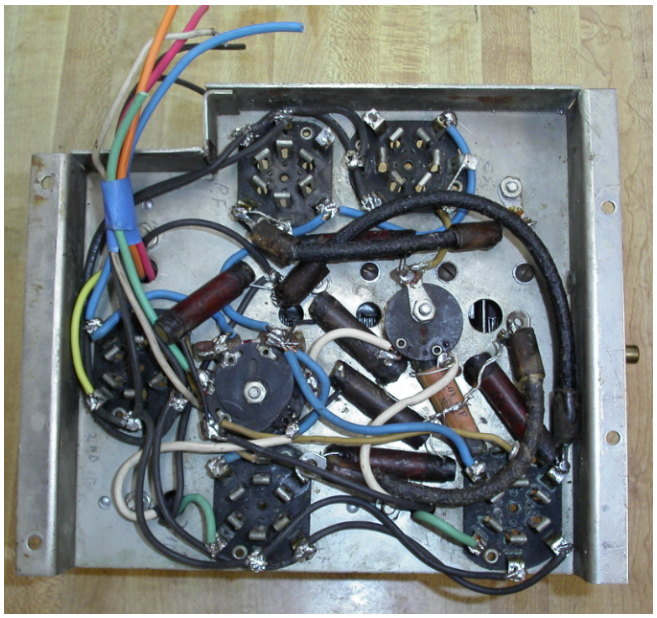
Rubber Core After Winding with Nichrome wire

Flexible Resistor Components Ready To Be Assembled



Assembled Flexible Resistors

The rubber coated wiring that had become brittle was all replaced. The leads to the three I.F. transformers were either completely replaced by soldering new leads on where possible or by soldering a splice inside the can and covering the splice with shrink tubing. Because the reproduction flexible resistors had a slightly larger diameter and were longer than the originals, they had to be rerouted to fit, but hopefully this will not affect performance.



Completed Sub-chassis Restoration

The main chassis was tackled next. The Multiple Bypass Capacitor (J-14) was removed first and re-stuffed. This involved heating the capacitor on my outdoor grill at about 250 degrees F until all the wax was removed. I was able to pull the guts out in one piece with a little effort. The foil was unwrapped and the three fish paper dividers were set aside. These would be reused. The tin case was cleaned but still had many darkened spaces (rusted??). I decided not to try and re-plate the case.

Removed Bypass Capacitor

Disassembled Bypass Capacitor

The capacitor was rebuilt using polypropylene and "Orange Dip" capacitors. Since capacitors (D), (C) and (G) - .04 MFD, .007MFD and .04 MFD respectively are not used, I left them out. Even then the space was tight and the capacitors installed barely fit. I was able to use the original fish paper and mount the capacitors on it soldering their leads to the appropriate connectors installed on the two outside pieces of fish paper.

New Bypass Capacitors Installed

The correct color leads were soldered to these connectors and the entire assembly was placed back in the tin can. Hot glue was used to seal he end. The rebuilt capacitor was reinstalled and the leads connected.

The tracking capacitor (C6) was removed. The values were checked using an EICO Model 950 Resistance-Capacitance meter and found to be somewhat out of tolerance compared to the schematic, which I thought unusual for mica capacitors.

Removed Capacitor (C6)

After heating the capacitor in my outdoor grill, I removed the four mica capacitors from the paper cover. I rechecked the tolerance and they now read pretty close to the schematic values. I therefore decided to just clean these up and reassemble the capacitor even though I had a set of replacement mica capacitors which I could have re-stuffed the paper case. I used new cardboard separators and filled the void spaces with bees wax. Checking the capacitance again, I found no change, so it was reinstalled in the chassis.

The filament flexible resistor was removed and all the hardened rubber coating was removed. The terminal edges were filed down slightly to allow new rubber tubing to be slid over the terminals and cover the wire. I placed shrink tubing was placed over the terminals and the ends of the rubber tubing to secure them in place and reinstalled the resistor.

Removed Flexible Filament Resistor

The pilot light flexible resistor had its hardened rubber coating remover and most of the yellow cloth covering had also deteriorated. The cloth covering was replaced with a new yellow cloth covering obtained from a piece of new cloth covered wire. This was stripped off the new wire and slid over the flexible resistor, a piece of rubber tubing slipped over the cloth covering, and knots made in the appropriate places.

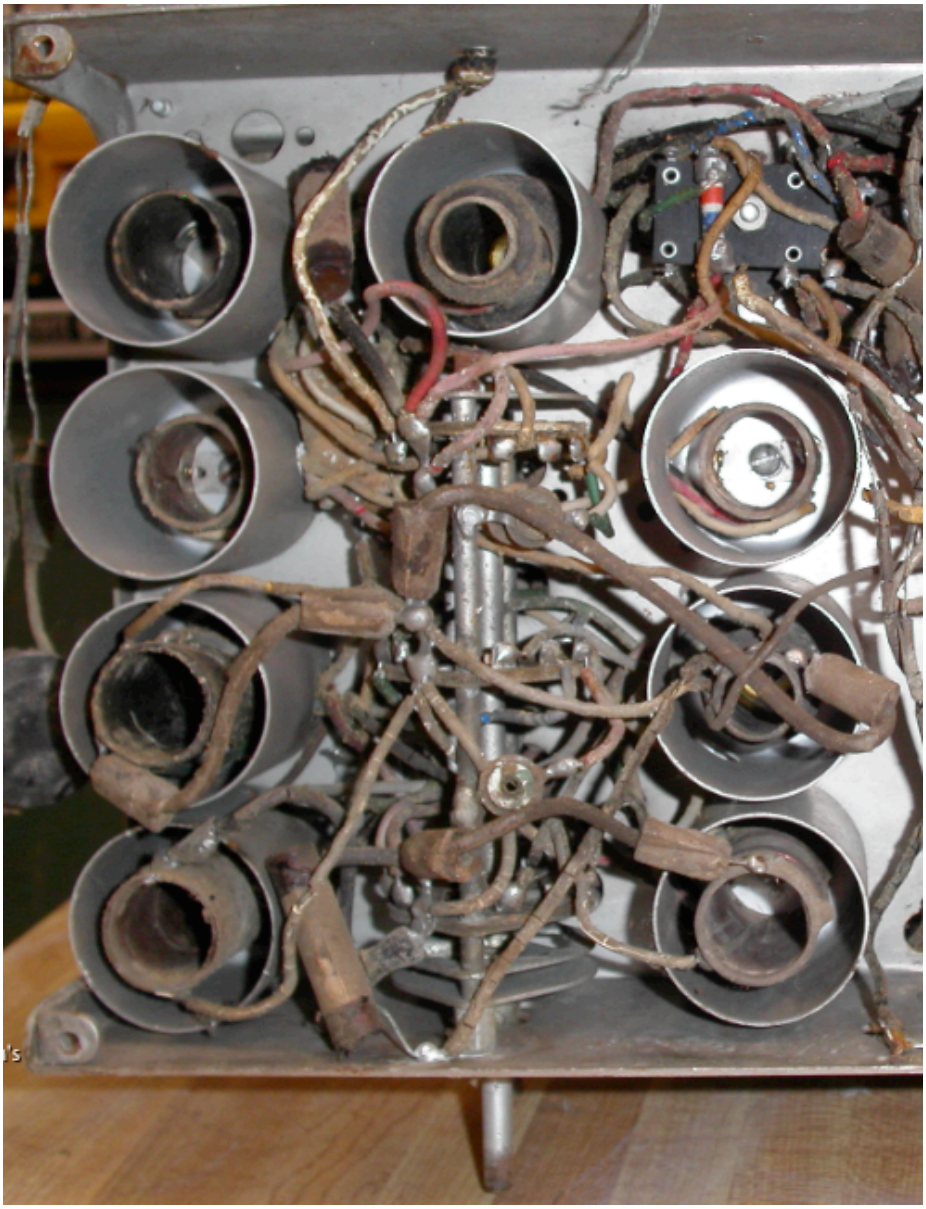
I removed resistor (R24) and its connection to the screen of the 2nd AF amplifier since it does not appear in the schematic or on the parts list for the AK 708.

Capacitor (C20) one of Atwater Kent's metal capacitors was found to be faulty. I opened up the capacitor removing all the thin metal plates and mica sheets. I installed several metal sheets and mica back in place and then inserted a .003 MF mica capacitor in between the reinstalled metal/mica components. I cut down several more of the metal sheets so I could insert the ends only and make the rebuilt capacitor more closely resemble the original. The metal sheets were soldered together and to the new capacitor terminals. A check using an EICO 950 Resistance-Capacitance Comparator Bridge showed the capacitor to be functional.

The volume control was non-functional. I removed it and opened it up by taking the switch off. I sprayed it with contact cleaned and put a drop of oil on the shaft. It now rotated and I got a resistance reading across the fixed terminals and the wiper terminal. The resistance was nearly 2.5 Megohms however, and the schematic value is specified as 500K ohms. I reassembled the volume control, but was able to obtain a 500K ohm potentiometer from another chassis. I made a

new cardboard sleeve from a Christmas wrapping paper tube, painted it black and covered the volume control to preserve the look of the original installation.

The next challenge was replacement of the rubber coated wiring on the band selector switch and eight coils along with the four flexible resistors and two paper capacitors. After a long deliberation among the possible choices including (1) disconnecting and replacing the wires for each coil individually, (2) removing the switch and all the coils at the same time and then disconnecting all the wires, or (3) removing the switch and coils all at the same time and then replacing wires on one switch segment at a time, I choose option three. One of the problems was that drove me to this decision was that the switch connects were very dirty/corroded and they would need cleaning.

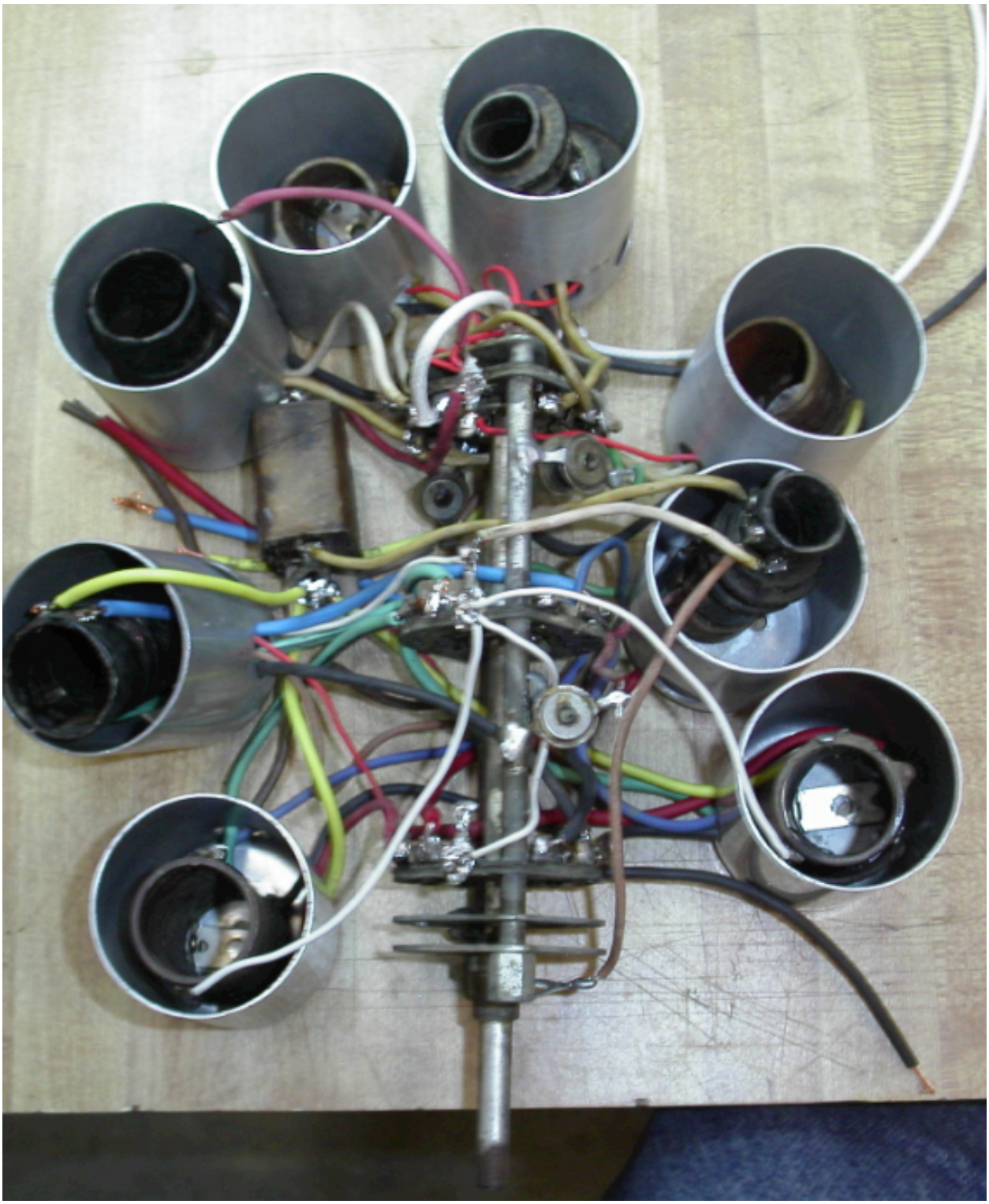


Band Switch And Coils As Received

There were only two wires still connecting the switch and coils to the main chassis so that wasn't a problem. Removing all coil mounting screws and two screws holding the switch allowed me to remove the entire switch/coil assembly intact.

Removed Band Switch and Coils

I carefully drew wiring diagrams for each switch segment and coil combination before disconnecting anything more. I then started with the rearmost segment and disconnected the wires both from the switch and coil/etc. and replaced them with new rubber coated wires after I cleaned this segment's switch contacts, and followed a similar repair on the rest of the coils and switch segments. In this process another discrepancy between the AK 708/808 and AK 808A schematic became evident. Two of the windings on T8 (No.2 H.F. coil, 3rd range) had their connections reversed on the two schematics. The connections as found matched the AK 808A schematic. I remade these connections in the as found conditions after conferring with members from the Mid-Atlantic Antique Radio Club (MAARC). Testing after completion will show if this was the right decision.



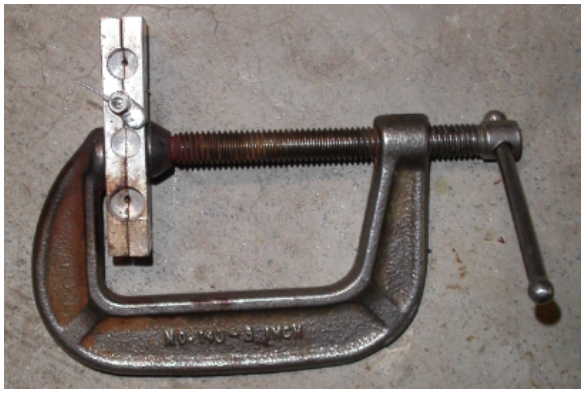
Rewired Band Switch And Coils

After all the coils and switch were cleaned and rewired, I reinstalled the assembly back on the main chassis and reinstalled the flexible resistors.

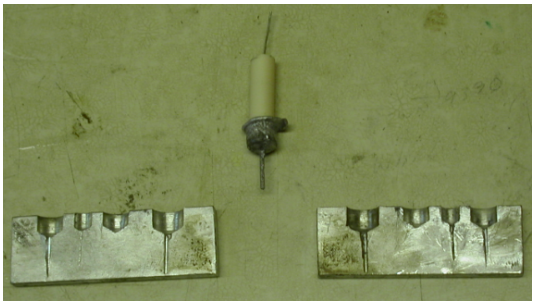
The rubber coated wiring and the paper capacitors on the rest of the main chassis were replaced in a similar manner as previously described. Resistor R17 was discovered to be 1 Megohm

(matching the AK 808A schematic/parts list) vice the 250K ohm (matching the AK 708/808 schematic/parts list). Again I decided to return to the AK 780/808 schematic and therefore needed to build a new resistor. This was accomplished by using a piece of ceramic tubing with an I.D. of 0.156" and a 250K ohm metal film ½ watt resistor. I built a mold out of two pieces of ¼" aluminum plate. I clamped the two pieces together and drilled a 19/64" hole in the joint between the two pieces that matched the size of the metal end cap on the original resistor. I then placed lead fishing shot in the drilled hole and used a blowtorch to melt the lead. When the lead was molten, I inserted the resistor in the ceramic tube and quickly plunged one end of the ceramic tube into the center of the molten lead. When cooled, I unclamped the two halves and removed the ceramic tube with a nearly perfectly formed metal end cap. I repeated this process for the other end using small files cleaned up and shaped the end caps. I used hobby paints to paint the ceramic with the proper stripes for the resistance value. The resistor that had to be added for the modification to improve the tone quality as specified in the AK708/808 schematic was made in a similar manner.

Materials Used To Make Reproduction AK Ceramic Resistors



First Resistor End Poured



First Resistor End Out Of Mold

Completed Resistors Painted To Match Originals

Finally, the sub-chassis was reinstalled and all wires reconnected to the main chassis. A final wire by wire check against the schematics and my connection diagrams was made, and all appeared to be correct.

FINAL REPAIRS

The speaker had a fairly large hole in it and a tear from the outer edge to the center. The metal pieces surrounding the outer edge were also severely rusted and the insulation on the rubber-coated wires from the audio transformer was hard and cracking off. The wiring to the speaker plug was in good shape. I originally was going to only patch the speaker cone, but in checking the resistance of the field coil, I found the coil was open. This meant disassembly of the speaker to try and determine why the coil was open.

Speaker As Found

Previously, I have found that sometimes the solder connection between the coil and the connecting wires is corroded. After removing disconnecting the wires from the audio transformer, unsoldering the voice coil leads, removing the speaker cone, and unbolting the frame, the field coil was slid out. Inspecting the connections to the field coil revealed they were all good. I removed all the paper covering from the coil and the coil looked good. Another problem I found during some of my previous repair efforts was that the winding had corroded wires on one of the ends of the coil. I carefully removed the top and bottom cardboard pieces covering the ends of the coil. The top side of the coil had several tiny blue/green spots indicating copper corrosion. I used some copper cleaner (Copperbrill) to clean the corrosion off using a Q-tip stick (stiff, but not hard enough to damage the fine wire). This revealed 3 broken wires. I cleaned the broken ends, and soldered a short piece of enameled copper wire to bridge the

breaks. I measured the resistance of the coil and it now read 2200 ohms. This matches the field coil resistance of 2000 ohms on the schematic pretty close. I felt confident that there were no shorted turns. I taped the connections with glass cloth electrical tape and sprayed the ends with insulating varnish. I reinstalled the cardboard end pieces, covered the coil with fish paper, taped everything in place with more glass cloth electrical tape and sprayed the whole coil with insulating varnish.

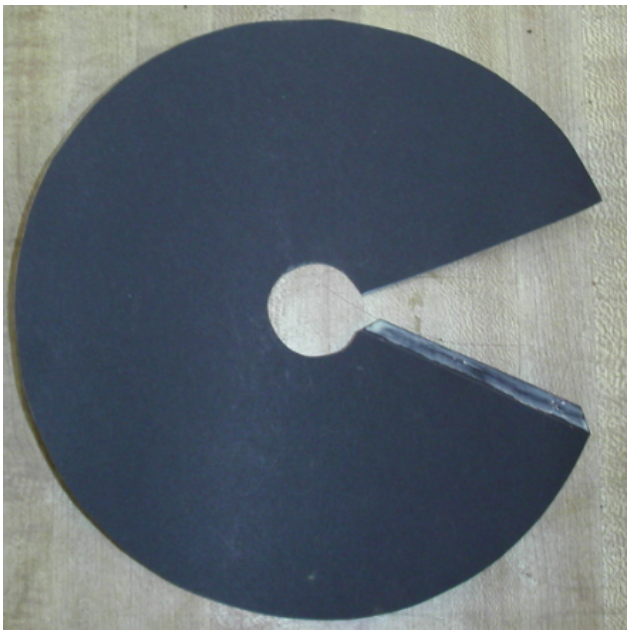
Field Coil With Corroded Windings

Repaired Field Coil Wires

Restored Field Coil

Since I had the cone out, I decided to also re-cone the speaker. I calculated the dimensions of the new cone following the procedure described by Larry Weide in the article "Replacing early Paper Speaker Cones" which was published in the Colorado Radio Collector's "The ***Flash!!***". This was found in the Resources section of *Nostalgia Air*. I also made a second set of

calculations following the procedure described by Mark Palmquist in an article entitled “Speaker Cone Math” which was published by the Southeast Antique Radio Society. The calculations

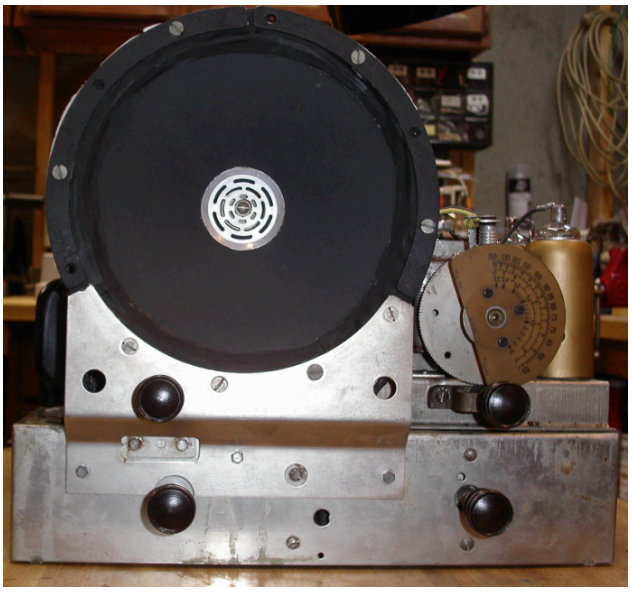


New Speaker Cone

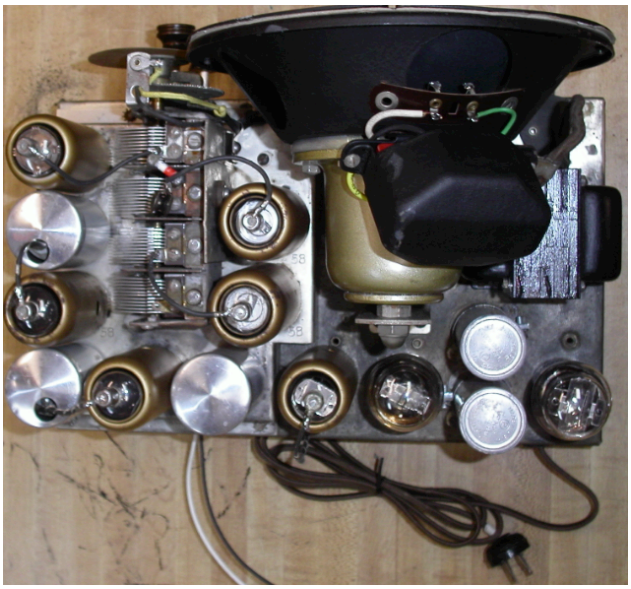
came out with slightly different results. I made a cone using each set of calculations and placed each over the original cone to see which matched best. Both were close, but the cone angle was a little off. I opened on of the test cons, firmly held it against the original cone, taped it together and then used this cone to cut a duplicated out of black .0114 thickness poster board paper.
I carefully remover the spider and voice coil from the old speaker cone. The glue and paper were cleaned from the metal edges. The new cone was glued together and left to dry overnight. The voice coil and spider were glued into the new cone. The frame, speaker outer edge mounting brackets, and field coil housing were cleaned and repainted. A new cardboard ring for mounting the outer edge of the speaker was cutout. The audio transformer resistance readings were good, It was cleaned and then sprayed with insulating varnish as a precaution. The black and white rubber coating on the wires to the bucking coil were replaced with rubber tubing. The yellow rubber wire was replaced. Silk athletic adhesive tape was used to secure the outer edge of the cone. This was painted black. The speaker was reassembled using six 1/32” thick wood shims to center the electromagnet in the housing. The voice coil was glued into the speaker cone and when dry the voice coil and cone was centered in the in the gap in the electromagnetic using .0044” thick celluloid shims. I then attached the spider and glued it to the cone. When it was dry, I temporary attached the cardboard ring to the frame and then attached the silk adhesive tape pieces to the speaker cone and cardboard ring using some extra glue. When this was dry I attached the cardboard ring to the frame with the metal segments and attached the mounting brackets. This enabled me to keep the voice coil centered in the electromagnet. The shims were then removed and cone gently pressed to ensure it was free and the voice coil was not rubbing. All appeared good. The audio transformer was mounted to the frame and the voice coil, audio transformer, electromagnet leads, and speaker plug were all connected.

Restored Speaker Parts Ready For Reassembly

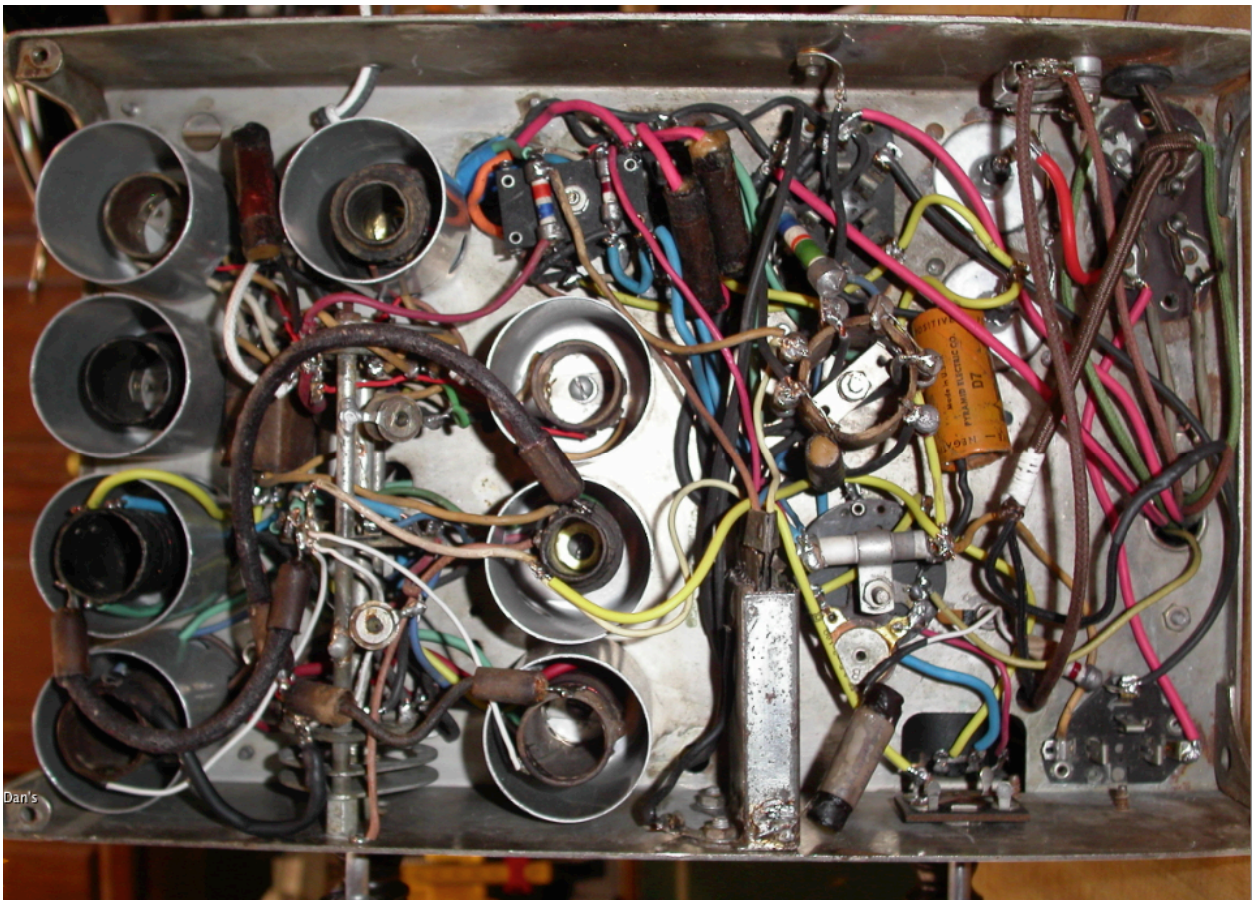
Speaker Electromagnet Centered In Housing



Completed Chassis-Front View



Completed Chassis-Top View

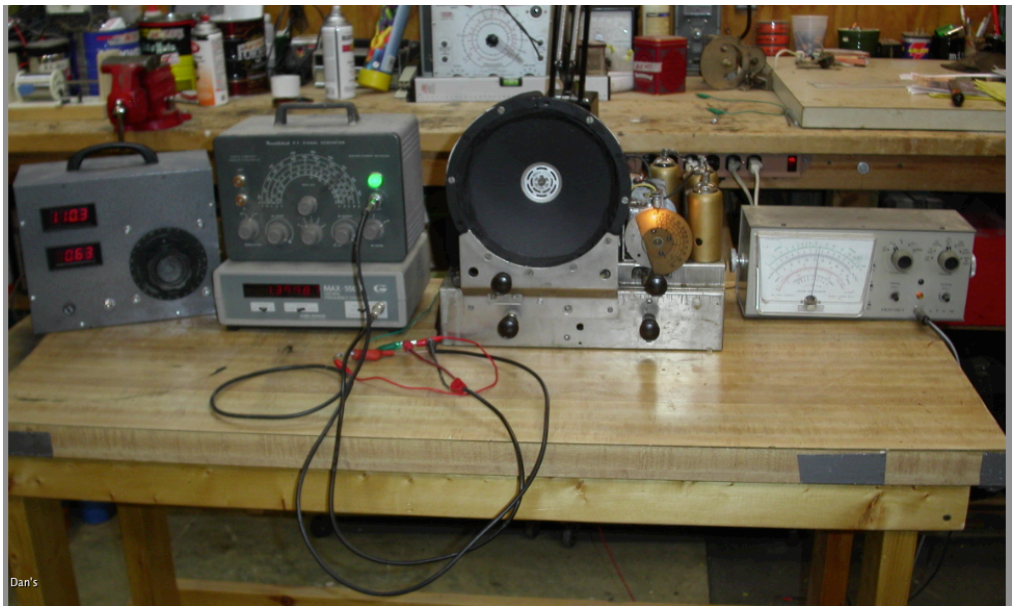


Completed Chassis-Bottom View

Testing was next on the agenda. The 2A6 and 80 tubes were missing from the original chassis, but surprisingly all the 58's and the 2A5 were good. They were wiped off with a wet cloth and one 58 needed the grid cap re-soldered. A small piece of copper wire was soldered to the broken end at the top of the glass nib and a hole drilled in the brass grid cap to lead this wire out. Epoxy was used to re glue the cap in place and then the wire was soldered to the top of the cap.

TESTING AND ALIGNMENT

The tubes were all removed and the chassis energized through a Variac with the voltage slowly brought up to 110 volts. The transformer voltages all looked good. The tubes were replaced and again the voltage was slowly brought up with the Variac, stopping about every 25 volts and taking voltage measurements of the voltages on all the tubes. The plate, filament, and screen voltages seemed normal as the voltage was increased. The voltages are higher than the ones that I could read on the schematic, but I was using a digital voltmeter and I believe this is normal. I left the radio energized for several hours looking for any overheating. I was surprised that although I had some clicks from the speaker, during the process of taking the voltage measurements, I didn't have any hum or hissing. I then started testing by following the procedure outlined in "Elements of Radio Servicing" by William Marcus and Alex Levy. I used a Heathkit R.F. Signal Generator, checking the frequency setting with a Global Specialties Max 550 frequency counter, and a Heathkit IM-28 VTVM to measure the output of the 2nd A.F. Amplifier.



Testing Setup

The checks of the 2nd A.F. Amplifier stage (2A5) were good. When I tested the input to the 1st A.F. amplifier (2A6) at the grid, I got no response. I had response at the plate. The trouble shooting guide narrowed it down to a grounded grid lead, and sure enough, when I crimped the ground wire that is wrapped around the grid lead, I broke through the insulation and shorted the grid lead to ground. I corrected this and now got good response. I also had a very slight hum in the speaker. Quickly cycling through the band switch. I had signals on the broadcast 1st and 2nd short wave bands, but it seemed abnormally quiet on the 3rd short wave band. Further investigation will be warranted. Selected to the broadcast band, checks of the detector, oscillator,

and R.F. stages all seemed good. I next did an alignment if the I.F. circuits, adjusting the 3rd I.F. trimmers first, then the 2nd, and finally the 1st. I set the dial scale using a station near 1500 KC and then adjusted the oscillator trimmer at 1500 KC. I then adjusted the trimmers for the 1st Detector, R.F., and Antenna stages. There is another trimmer in the 2nd broadcast transformer, but I could not find any information on adjusting that.
The next step was to check the short wave band that did not appear to be working. Following additional guidance from MAARC members, I measured oscillator grid voltage with an isolating probe made with a 250K ohm resistor. The voltage appeared to be good on the broadcast band and the first two short wave bands. I got a steady 0.5 volts on the 3rd short wave band. This band is associated with the T8 transformer that I had connected to match the AK808A schematic. First I thought that maybe one of the coils were open, so I checked continuity of all the coils on this transformer as well as on the T4 transformer which is also part of this band circuitry. All showed good continuity. Next I reversed the yellow and blue leads and checked the oscillator grid voltage again. There was no change. I reversed the other two leads that I had originally reversed so that the transformer was now connected as in the AK 708/808 schematic. I now had a oscillator grid voltage that varies as the tuning capacitor was rotated. The voltage is still significantly lower than on any other band. I attached the Heathkit Signal Generator to the aerial terminal through a 250Pf capacitor and was able to tune in got a weak signal at various frequencies across this band. While activity is low on this band (1.7 MHZ to 4.0MHZ), I thought I should have been able to pick up a local weather station at 1700KC and the Canadian Time Station at 3.3 MHZ. Further discussion with MAARC members recommended additional trouble shooting including shorting out the flexible resistor and looking for an increase in the grid voltage. While the voltage did increase slightly, it is still extremely low (-2 volt max) and drops to -0.5 volts at the high frequency end of the band. The next step is to use a Grid Dip Meter to check the coil for shorted turns, but my workbench doesn't have this test instrument. For the time being, the radio is working well on three of the four bands.

FINAL THOUGHTS

What did I learn, and what would I do differently?
Regarding the cabinet restoration, I should have tried contacting those who had posted pictures of their sets on the internet earlier in the process. This would have eliminated some of the extra work I had to do because I did not know what the side moldings and bottom looked like. I also should have veneered the cabinet before forming it into the correct shape. Veneering after it was formed made it too difficult to get enough pressure on the veneer to make it flat.

Regarding the electronic restoration, I would have checked all of the coils for continuity and shorted turns when I had them removed from the circuit and also checked continuity through the band switch contacts while it was removed instead of just cleaning it. Failure to do these two steps led to much more difficult troubleshooting of the one short wave band and has resulted in the band being inoperative at the current time.

For my most embarrassing goof during this restoration, I have to say after remaking the two AK resistors (10K and 250K ohm), I mixed them up when I painted the Atwater Kent colors on them and got them installed in the chassis in the opposite positions. This was found by accident when I was troubleshooting the short wave band problem. I just picked on of these resistors to check my

multimeter resistance scale and discovered that the resistor was the incorrect value. Checking the other resistor confirmed I had them installed in the wrong places because I had painted the colors wrong.

RESTORATION COMPLETE

Restored Atwater Kent 708 - Front

Restored Atwater Kent 708 – Back

Restored Atwater Kent 708 - Left Front Side

Restored Atwater Kent 708 – Left Back Side

RESOURCES

1. Schematics – Nostalgia Air (www.nostalgiaair.org)
2. Atwater Kent Information – Atwater Kent Radio Website (http://www.atwaterkentradio.com)
3. Veneer – www.woodcraft.com
   www.certainlywood.com
4. Rubber Coated Wire – www.testpath.com
5. Ceramic Tubing – Scientific Instrument Services (http://www.sisweb.com)
   Omega Engineering, Inc (http://www.omega.com)
6. Nichrome Wire – (http://jacobs-online.biz/index.htm)
7. Wood working Supplies (Glue, Plywood, Stain, Lacquer, etc.) – (http://www.woodcraft.com)
8. Speaker Restoration – Nostalgia Air (www.nostalgiaair.org)
   Southeast Antique Radio Society Club
(http://www.sarsradio.com/Documents/SARS Summer 2003 Newsletter.PDF)
9. Electroplating Kit – (http://www.caswellplating.com)
10. Glass Cloth Electrical Tape – 3M Scotch 27
11. Capacitors – Just Radios (http://www.justradios.com)
12. Servicing Information – "Elements of Radio Servicing" by William Marcus and Alex Levy, McGraw-Hill Book Company, Inc, 1947 (Available online at Antique Radios (http://www.antiqueradios.com/archive.shtml)
13. Insulating Varnish – Sprayon Red Insulating Varnish EL601 (www.grainger.com)
14. Copper Cleaner – Mauviel 1830 Copperbrill (www.surlatable,com)