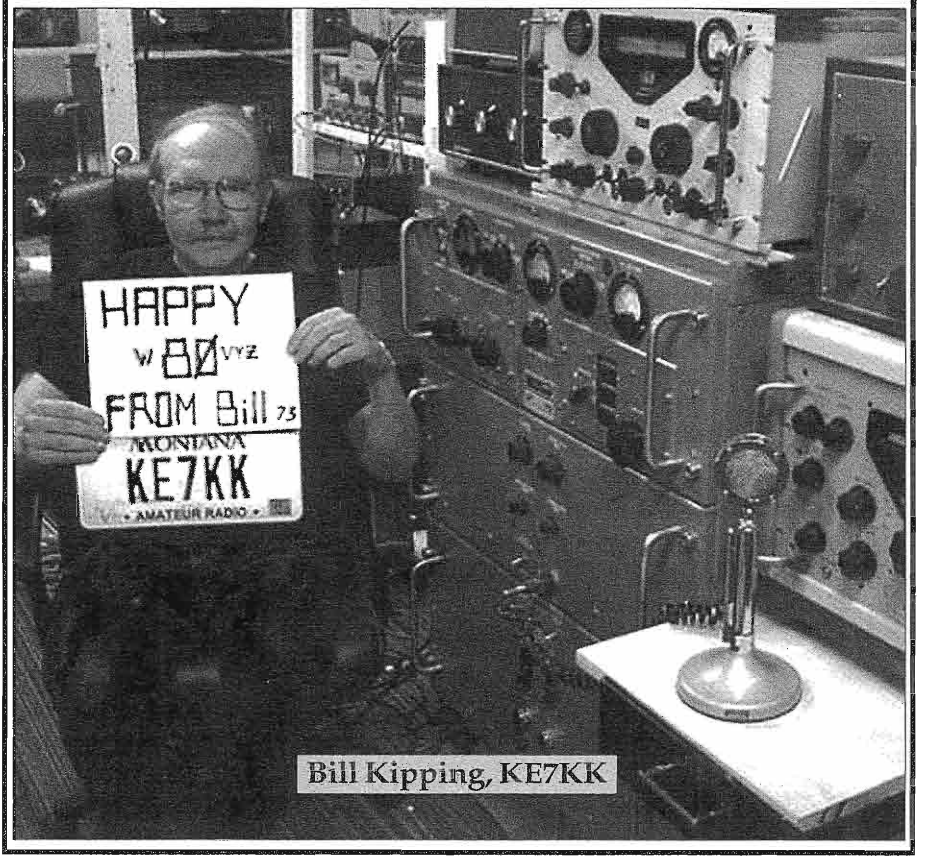
$3.75

ELECTRIC RADIO

celebrating a bygone era

Number 191 April 2005



Bill Kipping, KE7KK

ELECTRIC RADIO

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Editor
Ray Osterwald, NØDMS

Editor Emeritus
Barry R. Wiseman, N6CSW

Electric Radio is dedicated to the generations of radio amateurs, experimenters, and engineers who have preceeded us, without whom many features of life, now taken for granted, would not be possible. Founded in May of 1989 by Barry Wiseman (N6CSW), the magazine continues publication for those who appreciate the value of operating vintage equipment and the rich history of radio. It is hoped that the magazine will provide inspiration and encouragement to collectors, restorers and builders.

We depend on our readers to supply material for ER. Our primary interest is in articles that pertain to vintage equipment and operating with a primary emphasis on AM, but articles on CW, SSB, and shortwave listening are also needed. Photos of Hams in their radio shacks are always appreciated. We invite those interested in writing for ER to write, email, or call.

Regular contributors include:
Bob Dennison (W2HBE), Dale Gagnon (KW1I), Chuck Teeters (W4MEW), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Jim Hanlon (W8KGI), Brian Harris (WA5UEK), Tom Marcellino (W3BYM), John Hruza (KBØOKU), Bill Feldman (N6PY), Hal Guretzky (K6DPZ)

Editor's Comments

2005 Heavy Metal Rally

It turns out that I made a mistake last month when I announced the winner of the 2005 Heavy Metal Rally due to misreading an e-mail. The actual winner of this year's event was Clay Curtiss (W7CE) with a respectable 90 points. Congratulations to Clay, and apologies to John Kaufmann, K9KEU.

Electric Radio Photo Contest

Next month I will be announcing the first annual Electric Radio photo contest. I would like to see this become an annual event, with the winning photos to be used in an annual ER calendar. There have been quite a few requests for Electric Radio calendars. In the May issue I will announce the categories, the time period, and prizes in the contest and how to send in your photos. I hope this will be something fun for everyone to participate in.

A California "Crime"

Apparently, it is a "crime" that radio spectrum in California is not yet polluted. Quoting from a United Power Line Council news release of March 10, 2004:

"...It's a crime that California, home to Silicon Valley, does not have a BPL project, and I want to change that." California PUC Commissioner Susan Kennedy is leading the charge to start a rulemaking whereby the PUC would remove uncertainty by answering in advance many questions about how it would treat BPL. The idea for the proceeding apparently sprang from a dinner conversation with San Diego Gas & Electric's CEO Edwin Guiles, who told her that the "biggest impediment is a regulatory environment filled with risk." Despite those risks, SDG&E has announced that it will deploy BPL, and Kennedy is encouraging PG&E and Southern California Edison to follow suit...The BPL proceeding already has the backing of PUC President Michael Peevey, who was President of Edison International and Southern California Edison prior to his 2002 appointment to the PUC. UTC has invited Commissioner Kennedy to speak about BPL regulatory issues at UTC TELECOM 2005 in Long Beach, California..."

[Continued on page 11...]

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Cover: Bill Kipping (KE7KK) is wishing Bill Dolvin (W8VYZ) a happy 80th birthday. Be sure to pass along your birthday greetings to W8VYZ –Ashtabula Bill–when you hear him on almost any band.

Reproducing Plastic Parts

By Mark Donaldson, WA1QHQ
wa1qhq@yahoo.com

It all started when a Hammarlund SP600 JX21 followed me home from a recent Hoss Traders Hamfest. The receiver was very clean but had one unfortunate accident at some point in its life. The receiver had taken a nose dive onto a hard surface. The result was a bent front panel, bent main tuning shaft, broken meter glass and broken main tuning knob. Triage was performed and the receiver was dismantled enough to remove the damaged bits. Replacement meter glass was found in the junk box, the front panel was straightened using a vise and the Armstrong method. The bent tuning shaft required the attention of a specialist, fortunately there was a small two-man machine shop located in the same building as my employer that straightened it out, and got it trued up to factory specs all for the staggering sum of fifteen dollars. A very long and fruitless search ensued for a replacement tuning knob. The alternative was to repair the damaged knob, in fact, the knob itself was OK. The damage was to the skirt attached to the knob. Fortunately, the band-change knob, which is identical to the main tuning knob, was in good shape. The skirt is attached to the knob with 4 staked-in pins. To remove the skirt, the heads of the pins needed to be ground off, the skirt was then easily separated from the knob. The skirts were removed from both the main-tuning and band-change knobs, the damaged skirt was set aside, and the good skirt from the band-change knob was used as a model to make a mold. The truth be told, I was itching for a good excuse to try this anyway and had a few projects in mind that would require reproduction plastic pieces.

Obtaining Materials

A web search produced an interesting and informative site from a company called Smooth-On, www.smooth-on.com.[1] Their site has a great deal of information on mold making as well as customer starter kits that can only be ordered from the factory. The kits are very reasonably priced ($25 plus shipping) and give you enough product to make a bunch of mistakes and still have material left over to make a few useful molds and pieces from the mold. I ordered the "Pourable Urethane Super Sampler Kit". The kit contains liquid Urethane mold rubber, liquid plastic, mold release and a sealer (used for making molds of porous items), and an excellent instruction manual. I also viewed the CD on mold making that can be purchased through the web site. It basically covers everything that the manual covers and little more, and is not recommended.

Mold Making Basics

The purpose of the mold is to accurately conform around the piece that is being used as a model, to allow easy removal of the model (as well as reproductions) after the mold material has cured, and to accurately conform to the model with a minimum of shrinkage and distortion due to surface irregularities and mold flex. The mold material is usually some type of rubber to allow the flexibility to remove the model and reproductions with a minimum of effort.

There are four types of rubber frequently used in mold making: latex, urethane, polysulfide and silicone. Urethane, polysulfide and silicone are two-part rubbers and require mixing parts "A" and

"B" in the right proportions to have successful results. Latex is a one-part rubber that uses an ammonia additive to promote curing. Latex has to be put on in successive thin coats in order to cure properly and each coat can take up to a day to cure. Thus, a mold of reasonable thickness could take weeks to make. Latex also gives off a mild ammonia odor that some may find difficult to tolerate, especially in areas with poor ventilation. I experimented with latex molds and quickly abandoned the idea. Silicone molds require a vacuum degassing process that takes place in order to remove air bubbles. Unfortunately, not many of us have vacuum chambers handy, so silicone may not be practical for amateur mold making. Also, silicone is the most expensive of the four families of molding rubber. Polysulfides have the advantage of being able to capture fine detail and are very soft and flexible, they are frequently used in applications where the mold rubber needs to be brushed onto a model that has a rough surface with lots of fine detail such as architectural models. They are also not inhibited in the curing process by the presence of moisture on the surface of the model. Deficiencies in Polysulfides include an unpleasant odor that is given off during curing. The requirement for both parts to be mixed by weight rather than by volume means an accurate scale is required. Polysulfides are also more expensive than urethanes and latex but less expensive than silicones. This leaves urethane, which is what I used for my molds. Urethane has the advantage of low cost and the ability to outgas trapped air bubbles at atmospheric pressure. Urethane has a couple of minor deficiencies. It is sensitive to moisture and will not cure properly in areas of high humidity or if there is moisture on the surface of the model. It will stick to almost anything, which is why it is so popular as a paint additive. This is really just a problem when the urethane is in an uncured state, so make sure your model is coated everywhere with mold release or prepare for a messy cleanup job. Urethane will naturally out gas most trapped air bubbles during the cure process which is about 18 hours at room temperature. Catalysts are available to speed up the cure time to a few hours, if necessary. Urethane also will not tolerate high temperatures as well as certain kinds of silicones, but for casting plastic this is not an issue. There are high temperature silicones that will allow you to cast low-temperature metals such as lead and pewter directly into the mold!

Technical Stuff

A few technical terms will allow you to talk the mold lingo like a pro.

Durometer is the flexibility of the rubber or plastic and is measured in Shore hardness using two scales, A & D. The mold rubber is rated on the "A" scale, ranging from 0A to 95A, 0A being softer than skin and 95A being harder than a car tire. The casting plastic is measured on the Shore "D" scale, ranging from 45D which is equal to 95A and going up to 85D which is equivalent to a very hard plastic. You should be concerned about Shore harness when evaluating how flexible your mold needs to be to release from the model. It needs to remain rigid enough to not distort when casting plastic is being poured into it to make reproductions, and a durometer of between 20A and 30A seems to be good for most small molds. Also, the Shore hardness for the casting plastic is important, depending on the application of the part.

Viscosity is a measure of how well the material flows and is measured in centipoises (CPS) with 1 cps being the viscosity of water and 100,000 cps being the viscosity of Molasses. We are concerned about viscosity of mold rubber in the evaluation of its ability to rid itself of air bubbles during the cure process. Ure-

thanes that generally do not need vacuum degassing have a viscosity around 2000 cps where as silicones that do require vacuum degassing have a viscosity of around 20,000 cps, a tenfold increase.

Before You Begin

Go through your kit and read the manual. In addition to what is in the kit you will need mixing cups. Small paper coffee cups are ideal for this, go with the smallest size you can find. You will also need Popsicle sticks and modeling clay which are both available at your local craft supply store. For tools, a sharp knife, a 6-inch measuring scale and a fine-tipped marker are all that you need. The knife is needed for cutting excess mold material away, and in some cases the mold needs to be split to remove the model and reproductions. The scale and marker are used to mark a line on the inside of the coffee cups so that equal amounts of parts A and B of the mold rubber or casting plastic materials will be mixed. Remember, the materials are measured by volume and not by weight. The Popsicle sticks are perfect for mixing the two parts of the mold rubber or casting plastic together.

Making the Mold

To make a good mold you are going to have to insure your model is clean. The quality of the reproduction is only going to be as good as the model, so polish the surfaces with a plastic polish if required. Examine the model and figure out how you are going to remove it from the mold once the rubber has cured. A word of warning: If your model has small through-holes they must be blocked to prevent the model from being locked into the mold once the rubber has cured. The hole plug can be facilitated with a little modeling clay. The hole blockage can be drilled out on the reproduction. As an example, on the Amphenol connector reproduction I made, I plugged the two mounting holes on either side of the connector before a mold was made. Later, it was easy to go back and drill the hole all the way through on the reproduction part.

To make a mold, you must first make a mold box. Begin with a flat, level, smooth surface. I used a piece of sheet metal, but Formica, glass, etc. would also be good. Find the largest flat surface on your model, the side that does not necessarily need to be accurately reproduced, and put this surface facing down against the flat surface (the bottom) of the mold box. Build a wall around the model using modeling clay, leaving at least half an inch of space around and above the model. If the model is large or is a long, thin piece (such as a Collins dial escutcheon) a thicker mold may be required to provide additional support. Insure that the bottom of the clay wall is pressed down against the flat surface to make a good, tight seal with the surface.

Remove the model and thoroughly spray the inside of the mold box and the outside of the model with a light coating of mold release. If it looks like too much mold release is on the model, especially on smooth surfaces, use your finger to wipe off the excess. There will still be enough release material left on the model and the oils from your skin will not hurt anything. The next step is where some educated guess work and a little experimenting and experience will help. Guess at the volume of mold rubber you are going to need to fill your mold box up above the model by at least a half an inch. Now, take a guess at how far up half of that volume would go on the side of the measuring cup and place a mark on the inside of the cup. If you go more than halfway up the cup with your mark you need a bigger cup (you will understand why later). Measure the height of the mark and make a similar mark of the same height in a second cup. Make sure the area where you are going to mix and

cure the mold rubber is at least 70 degrees, otherwise the rubber may not cure properly. Also, make sure the area is not humid. Fortunately, the mold rubber and the mold plastic for the reproductions do not give off any offensive odors, so this can be done indoors without scaring the family out of the house.

Locate the bottles for Parts A & B of the mold rubber and shake the bottles to make sure the contents within each bottle are well mixed. Then walk away for about an hour to allow the air bubbles that you just loaded into both liquids to work their way to surface and dissipate. Now the fun part begins. Fill one mixing cup up to the line with Part A of the mold rubber and then quickly reseal the bottle to avoid moisture contamination. Do the same with Part B in the second cup, and make sure you are accurate in your measurements. Now, slowly pour the contents of one cup into the other, using a Popsicle stick to scrape all the contents out of the first cup. Stir the mixed contents for about 3 minutes.

Warning!

Stirring technique is important! Do not whip air into the liquid when you are mixing the two parts, and if you see air bubbles in the liquid you can sometimes bring them to the surface during the mixing process. Make sure you mix thoroughly and use the Popsicle stick to scrape the sides and bottom of the cup when you are stirring the contents. Air bubbles are your worst enemy. Be aware of them and what is causing them and change your technique to avoid them. The other causes of molds gone bad are not mixing thoroughly or long enough, not mixing in the proper ratios, not using enough or too much mold release and moisture contamination. Except for the moisture contamination, I have been bitten by all of the above and this is why experimenting is required and failures are to be expected even after a few successes.

Once you have mixed both parts pour the rubber into the mold, once again you have to be aware of air bubbles and how to avoid them. Pour the rubber into a corner of the mold slowly and let the rubber flow over to the model and slowly rise as to not trap air bubbles underneath the model. If you misjudged the amount of material required on the low side, just get some fresh cups and mix up a little more rubber and pour it in. It takes about 18 hours for the rubber to cure to the point where the model can be removed. If you did everything correctly, this is an exciting moment. Remove the mold box from the flat surface and pop the rubber mold from the clay walls. Depending on the shape of the model, you may be able to pop it right out of the mold or you may have to place a few incisions into the mold to pop the model out. Try to preserve the clay walls used for the mold box since they will provide good additional support to hold the mold together (when making reproductions) if you needed to separate the mold into two halves. It was necessary for me to do this when making the mold for the Amphenol connector.

Making Reproductions

The next step is the most fruitful, and also the point where most beginner's mistakes happen. The 2-part casting plastic in the Smooth-Cast 300 starter kit has a Shore Hardness of 70D, which is suitable for most cosmetic parts, but probably is not hard enough for high stress items such as plastic gears. I have tried casting plastics similar to the Smooth-Cast 300 from other manufacturers and they all seem to be about the same. Carefully follow the vendor's mixing instructions. In the case of Smooth-Cast 300, the two parts are mixed in equal amounts by volume, follow the same mixing procedure as used for mixing the mold rubber, taking the same precautions regarding air bubbles. The casting plastic is going to react much more quickly than

the mold rubber once the two parts are mixed together. I stir for about 2 minutes, and about 90 seconds into mixing the cup holding the plastic is going to start to warm up. Don't be concerned about the warming because the plastic utilizes an exothermic reaction to cure, and it will cure very quickly. As an exercise, before you do your first casting pour about a half an inch of parts "A" and "B" of the casting plastic into each cup and mix them together as instructed, then stop mixing after 2 minutes and let the plastic cure in the cup. Keep watching the cup. About 3 minutes into the process the plastic will turn from clear to opaque white. In about 10 minutes you can touch the plastic and it should be dry, but still warm to the touch. If it is dry, you just mixed everything together properly and are ready to make an actual reproduction. If it is still tacky, wait about an hour and recheck. If it's still tacky you did something wrong, probably in measuring the two parts or not mixing thoroughly or not mixing long enough. A word of warning is in order at this point: mix too long and the plastic will cure before you have a chance to pour it, don't mix long enough and the plastic will not cure properly. Experimenting and experience will make all the difference at this point. Once you are confident that you can mix the plastic properly, you can pour your first reproduction. Make sure your mold is ready, is on a flat, level surface and that it still has a film of mold release in it. Pour the plastic into the mold slowly in one corner, allowing the plastic to flow through the mold so as not to trap air or create air bubbles. Remember to work quickly. Your pour has to be complete before the plastic starts to cure. Come back in an hour and pop the reproduction out of the mold, and inspect the piece for voids or air bubble pockets. This is also the best opportunity you will have to see how good a job you did in making the mold. Little bumps on the reproduction piece are probably due to air bubbles in the mold, in many cases these can be sanded off of the reproduction. There may have to be a little finish work done on the piece to remove casting flash. Use a knife and sand paper. If, when you go to remove the reproduction you notice that it is still tacky, get it out of the mold and do not leave it in overnight to see if it will cure. I tried this and found that the uncured plastic will attack the urethane rubber mold and cause blisters on the surface of the mold, basically ruining the mold. If you pop the improperly cured piece out within a few hours the blistering will not occur.

Coloring Your Reproduction

As mentioned previously the plastic cures to a opaque white color. Fortunately, the plastic can be dyed to any color you desire. In the case of my knob skirt, I needed the color to be black. I purchased a powerful dye from Smooth-On called So-Strong. Yeah, I know the company has really lame names for its products. The amount of dye you need to introduce to get to your desired shade of black requires some experimenting, so I introduced equal amounts of dye to parts A and B of the plastic before mixing and got good results, although I did end up with a few different shades of gray before figuring out how much was required to get a dark black color. Remember, the as-mixed color shade will lighten up once the plastic cures. If you purchase Smooth-Cast 325, which cures non-opaque, you will have an easier job dyeing the reproduction since the lightening up of the dye color will not happen.

Conclusion

The accompanying photos show two items that are representative of what a beginner can accomplish. The first is the SP-600 knob skirt, and the second is the difficult to find Amphenol connector used in the R-390A audio deck. The connector

mold was made so that connector pins could be loaded into the mold before the plastic was cast; therefore the mold is in two halves and is held together by popping the mold back into the clay walls from the mold box. Other means could also be used, such as tape. Once I started this project I found that it was really a lot of fun, kind of like playing with a chemistry set when you were a kid. Having the skill to make reproductions will open up projects within and outside of Ham radio; there are no limits to the possibilities. You may even want to keep this a secret so people aren't asking you to make copies of everything under the sun. Although I have been referring to the products manufactured by Smooth-On in this article, I have no pecuniary interest in the company and would be interested in hearing from readers about other vendor's products. Please use common sense when playing with chemicals and work in a workspace that is ventilated. You will drip and spill this stuff, so protect the floor and workbench, and if you spill material on your skin wipe it off immediately. Wear eye protection, don't have food and drink in the area, especially coffee. Remember, you are mixing the rubber and plastic materials in coffee cups. Should you grab the wrong cup and take a gulp it would not be a good thing. Stay safe and have fun.

[1]Smooth-On, Inc.
2000 Saint John Street
Easton, PA 18042
800-762-0744 (order line)
610-252-5800 (tech help)
(Catalog available by request)

Reproducing the Hammarlund SP-600 Knob Skirt

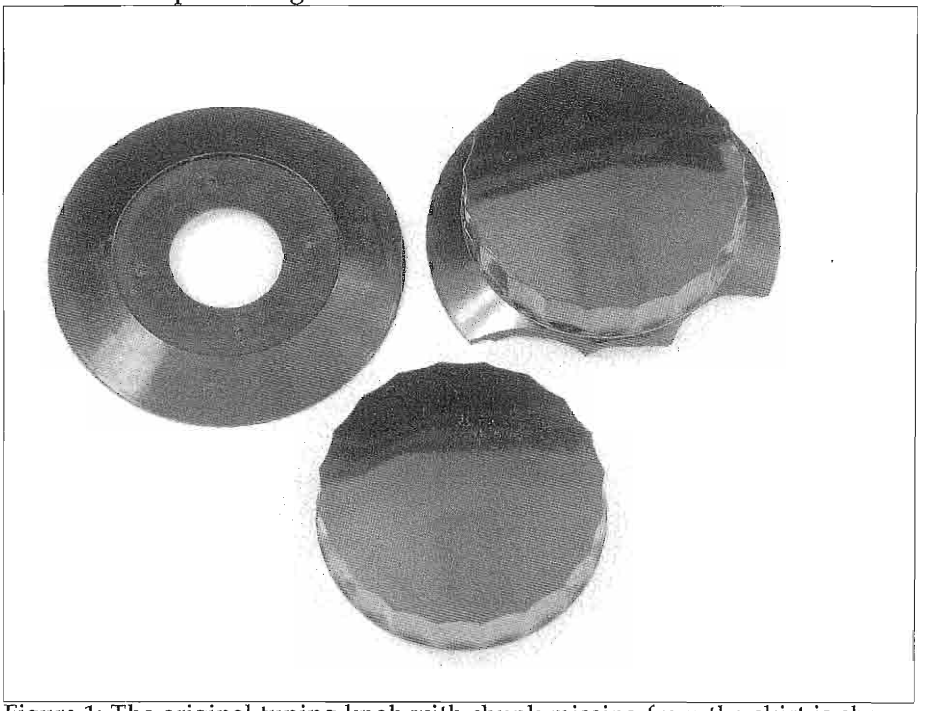


Figure 1: The original tuning knob with chunk missing from the skirt is shown here at the top right. The band spread knob with the good skirt have been separated, the good skirt that will be used for the model is pictured to the upper left.

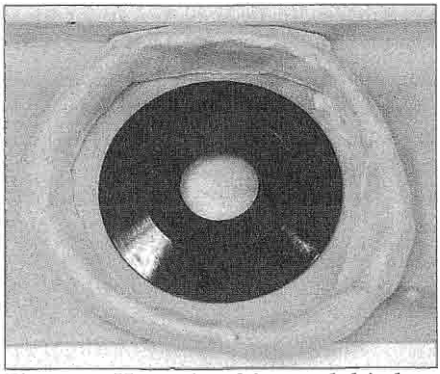


Figure 2: Here, the skirt model is laying on a flat surface with a clay wall built up all around it, ready for the urethane rubber to be poured in.

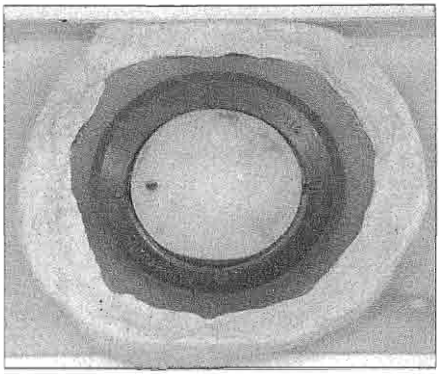


Figure 3: This is how the backside of the mold looks after the urethane has cured with the skirt model still in place.

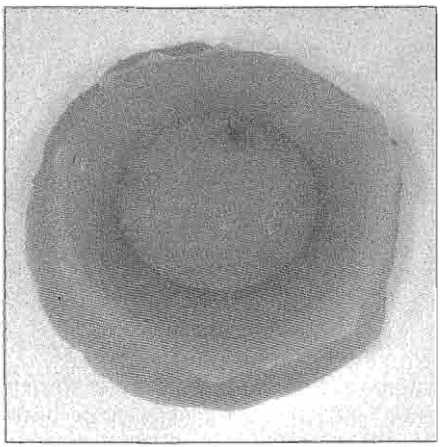


Figure 4: The urethane mold is shown in this illustration after the skirt model and the clay wall have been removed. The mold is ready to have plastic poured in.

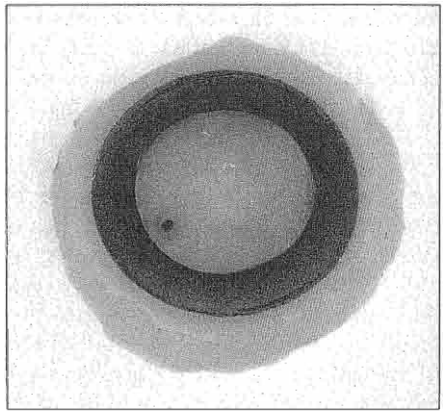


Figure 5: This is what the plastic reproduction looks like after the plastic has cured, and the new part is ready to be removed from the mold. You are viewing the back side of the reproduction skirt.

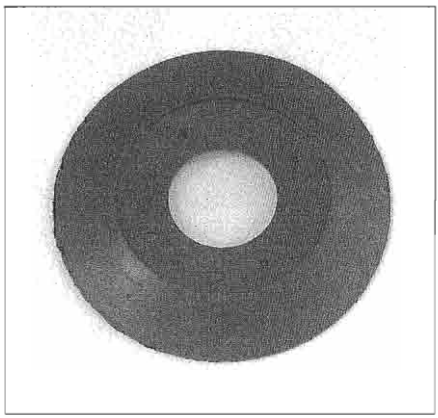


Figure 6: This is the front view of the reproduction skirt before sanding off the casting flash and buffing the new part.

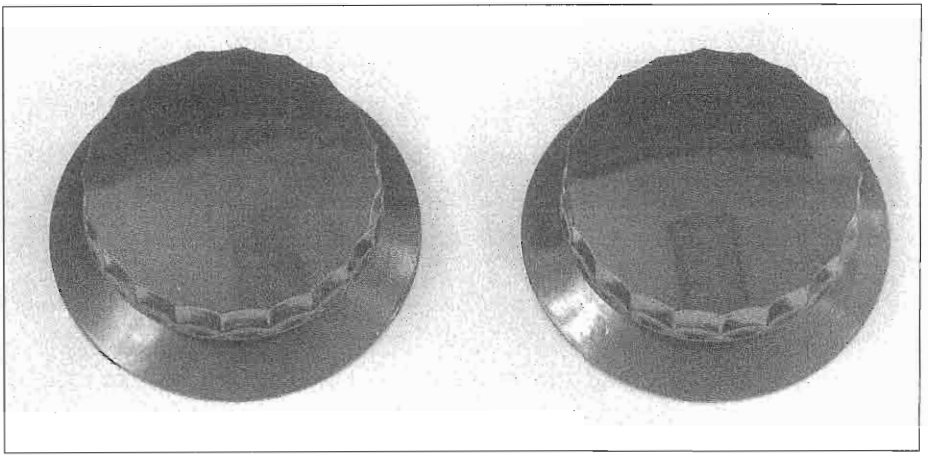


Figure 7: This is the final product. Can you tell which one is the reproduction?

. . . . . .

Reproducing an Amphenol connector for the R-390A Audio Deck

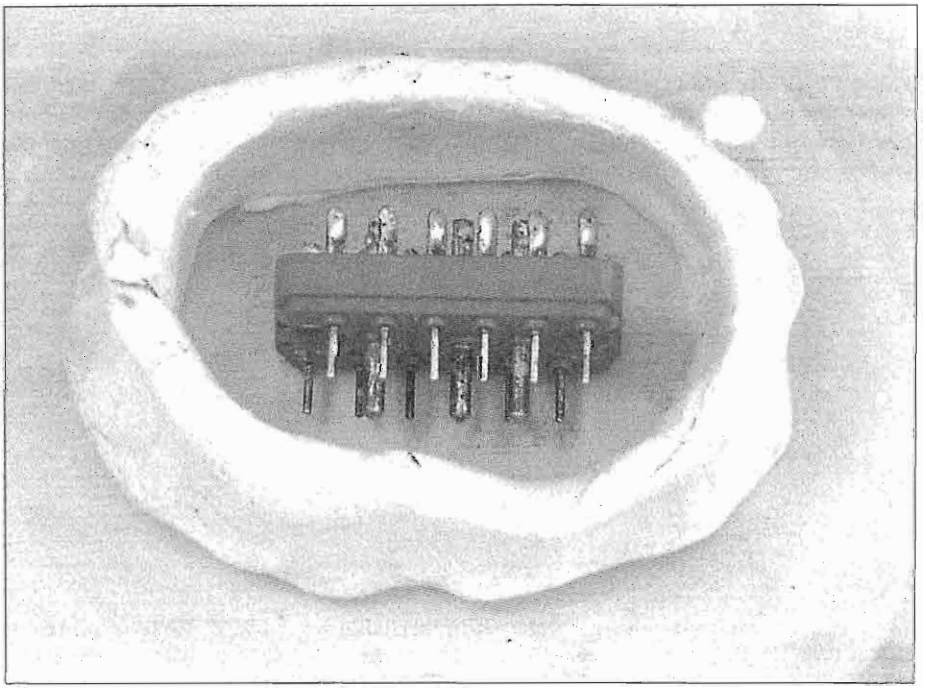


Figure 1: The hard to find Amphenol connector used in R-390A audio deck and T-368 exciter is getting ready to have its mold made. Make sure pins are straight and cleaned of solder and wire, and that the thru-holes are plugged with clay.

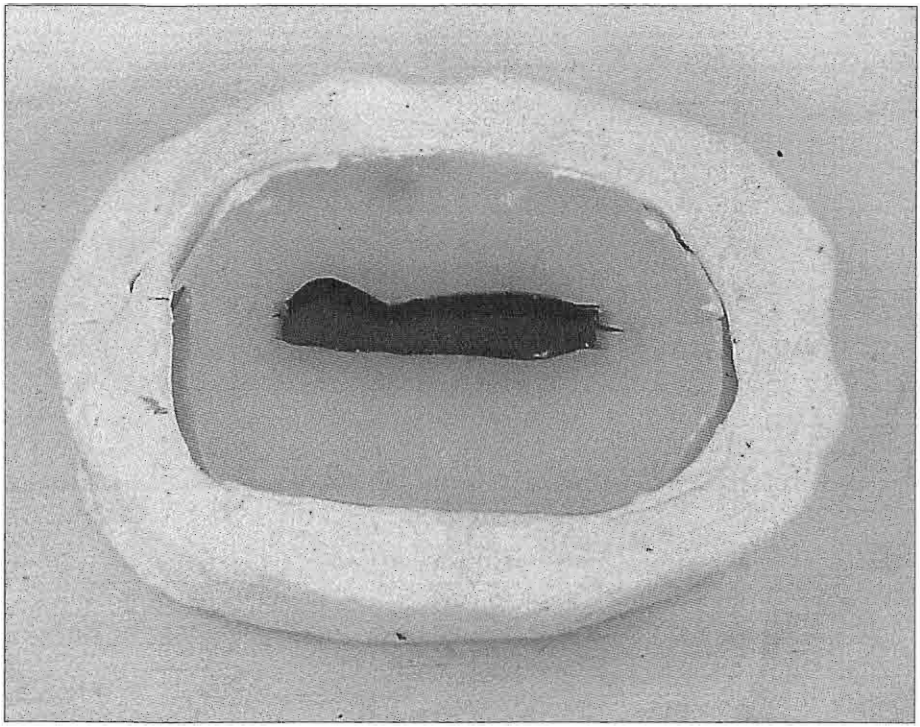


Figure 2: In the photo above, the mold has been separated into two halves, the connector pins are loaded in, and the two halves are pushed together and held together by reinserting into the clay mold wall. Plastic is then poured in thru the slot on the top of the mold to make the new part.

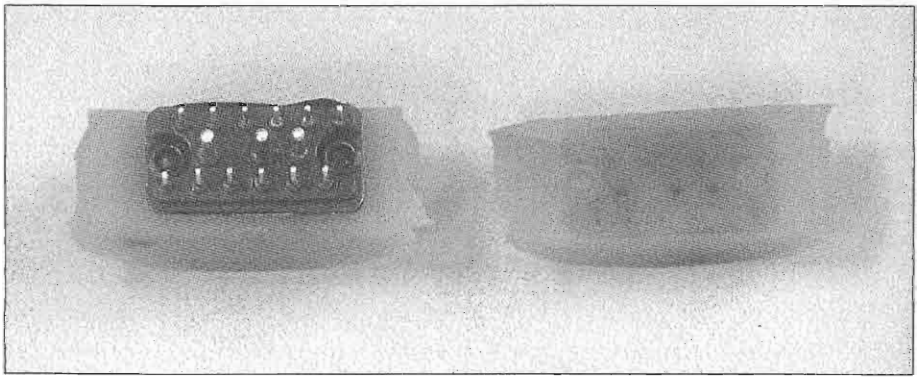


Figure 3: This is what you get after the plastic has cured and the two halves of the mold are separated. There is a little casting flash that still needs to be trimmed and the mounting holes need to be drilled through. The detail in the reproduction is remarkable; pin numbers are still easily readable. The plastic handles heat well, so soldering to the pins is no problem.

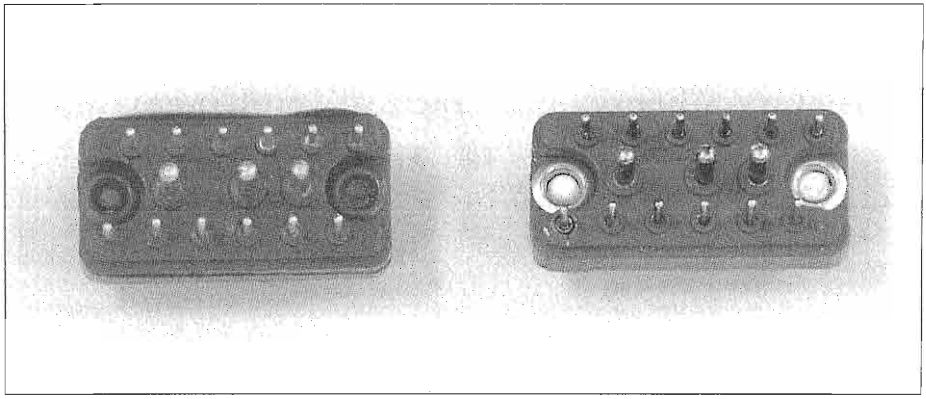


Figure 4: The reproduction is shown on left as it came right out of the mold, and on the right is the original. You can still see the clay plugs that were inserted into the mounting holes on the original piece to prevent locking the model into the mold. Without the clay plugs, it would be hard to tell the reproduction part from the original, and even the pin lettering is reproduced. The mold may be reused many times.

ER

[...Comments from page 1]

Another UPLC news release of March 24, 2005 outlined the industry's position on further BPL Petetions for Reconsideration:

"UPLC Opposes Petitions Seeking Further Restrictions on BPL

The United Power Line Council this week filed its Opposition to Petitions for Reconsideration that seek to impose further restrictions on BPL operations. Specifically, the UPLC opposed petitioners' proposals to ban BPL in certain frequency bands, change the measurement procedures by which BPL complies with the Part 15 radiated emission limits, and provide prior notification to certain licensees about BPL operations. The UPLC countered that petitioners raised the same arguments that they made on the record and had not presented additional facts that would warrant reconsideration of the FCC Report and Order..."

'Minimal Interference'?

From the UPLC news release of March 10, 2005 comes the following quote:

'FCC: Tech Official Notes That The Commission Is In "Good Company" Pushing BPL

Bruce Franca, deputy chief of the FCC's Office of Engineering and Technology, commented during a BPL seminar this month that the FCC had the important support of key officials in its BPL decision. Widespread support within the Administration evident by the "unprecedented" attendance of Michael Gallagher, Administrator of the National Telecommunications and Information Administration (NTIA) and members of the Federal Energy Regulatory Commission (FERC) at the FCC meeting during which rules for BPL were approved. Noting that the Commission was particularly interested in the support of NTIA, Franca stated that the FCC is "in pretty good company with [its] enthusiasm for BPL." Franca also commented on the successes of various BPL projects, including that of Manassas, Virginia. He stated that *the number of interference complaints is "not bad" and mentioned that the Commission has only one outstanding interference complaint.*' [italics Ed..]

ER

Cathode Modulation
History, Theory, and Practical Implementation

Part 2

By David Kuraner, K2DK
2526 Little River Rd.
Haymarket, VA 20169

This simple modulator got its start in the 1939 Dawley article in "Radio Magazine." A version appeared in the 1954 ARRL Handbook and later in the 1959 ARRL "Hints and Kinks," Volume 1, #6, by I.F. Gardener (W6LNN) and modified by P.J. Hart (W8MMK). It was revisited by Berk Berkemeyer (WØREP) in July 1995 "Electric Radio", ER #75. The circuit presented here uses more modern tubes, negative feedback, and PTT control circuitry. In all versions, the modulator receives plate voltage from the voltage drop between the cathode of the RF stage and ground.

In the original design, a pair of 6SJ7s had been used in the low-power audio stages to drive the 6Y6 or 6L6 modulator tubes. Ray Dawley suggests that with cathode voltages of about 300 (such as with tubes above the 100-watt power level), the 6L6 is preferred.

The 1954 and 1959 version used the dual-triode 6SL7. More recent unpublished designs used completely different tubes in a similar circuit. In the version presented here, the 12AX7 is used with the 6Y6.

More recently, others have suggested using the 6080/6AS7 dual triode or sweep tubes such as the 6DQ5 and 6DQ6. I have found that 6L6s do not work well at the 100-watt level, and two 6Y6s in parallel are better than one at any power level. The 1954 handbook suggests using one 6Y6 for every 200 mils of CW current. Dawley suggests one 6Y6 per 70 mils of expected cathode current with the modulator in circuit, and one 6L6 for each 90 mils if used with high-power RF tubes.

I intend to experiment with different CW and SSB transmitters and modulator tube combinations, so the one shown here in **Figure 1**, page 14, was primarily for testing purposes. I had previously constructed the 1959 version with a single 6Y6, and intend on constructing another iteration to match my HB 1625 ammo-tin rig. (This HB rig is another story.) With the experience gained from this beta version, I now know what needs to be included or excluded from the next version.

With all B plus coming from the RF cathode, the choke and electrolytic caps filter out audio going to the screen of the modulator and the plates of the lower-power audio stages. Since the low-power audio stages are operating Class A, some current has to flow in the RF cathode circuit. Therefore, the RF stage can never be completely cut off as in the case of 100% negative-modulation peaks. The variable resistor between the modulator tube and ground provides negative grid bias with respect to the cathode. This is used to adjust the cathode current in the RF stage and the carrier output level.

This beta version includes variable negative feedback and an input RCA jack for an audio signal generator. The 5-k pot in the cathode of the second audio stage permits the feedback to be varied. As an experiment, it was fascinating to observe a sine wave go from distorted to non-distorted by varying the pot. For practical purposes, forget the pot and just use a fixed 4.7-k resistor with the feedback loop going directly to the cathode.

The PTT circuit uses a 12-volt DC relay. The voltage is derived from the separate 6.3-volt filament transformer via a voltage doubler. In normal operation, it switches the oscillator, RF stage, linear amp or antenna relay and mutes the receiver. The spot switch just grounds the oscillator. The PTT line is also brought out to enable the relay to be controlled by some other circuit if desired.

Modifying the Transmitters

Many of the CW-only rigs in the 100-watt class and below employ cathode keying. If this is the case, simply separate the RF cathode from the other stage(s) and bring both circuits out by replacing the typical 4-inch phone jack with a ¼-inch stereo jack. If you still wish to use the rig for CW, just replace the plug going to the key with a stereo one and connect the tip and ring together. If your transmitter uses some other method, you must break into the cathode circuit. Be absolutely sure you have the cathode circuit. The Globe Chief Deluxe I have actually keys the B minus of the power supply!

The HB rig I built was designed for this modulator. It uses the Heathkit HP-23 power supply, and therefore has the maximum rated 750 volts plate voltage on its 1625 (12-volt version of the 807) with respect to chassis ground. Remember that the modulator tube will be taking power from that RF stage, and the voltage from the plate to the cathode will be reduced by about 150 volts. The remaining 600 volts, plate to cathode, works just fine.

Getting the maximum voltage out of the rig's supply is another modification that you may want to make if you only intend to operate AM. Transmitters such as the Globe Chief and DX-20 use choke input on their B-plus supply. It reduces voltage swings while keying to minimize CW chirp. If you place electrolytics at the choke input in addition to the existing filtering, you gain about another 100 volts. Remember that the voltage across the RF tube will still be less than it was originally, but the choke input may still be preferred as explained later.

Modifying the SB-400 or similar SSB transmitters becomes a little more involved, but not by much. Again, you have to break into the RF stage's cathode circuit. However, this transmitter uses fixed bias which will interfere with the proper grid bias you are trying to produce with the series-cathode modulator. The RF stage must be converted to self-excited grid bias. I use a switch to go back and forth. Just be aware that with no fixed grid bias, the finals have no protection against off-resonance conditions. If you tune with the modulator in the circuit, however, you regain this protection.

Voltages within the modulator are quite interesting. Circuit voltages at the plate of the 6Y6 have varied between 100 and 150 volts, depending on the transmitter. Voltages on the 12AX7 plates tended to be from 75 to 120 volts. While everything works fine, just be aware that you could overload the first-audio stages with excessively hot audio. The circuit is designed for crystal or ceramic mike input. I use an amplified D-l 04 which, if not adjusted properly, can overload that first stage.

Operating Conditions

The previous articles mentioned just tell you to tune the transmitter for maximum CW conditions and then connect the modulator to the cathode circuit. If the plate current does not automatically fall to one half of its original value, then adjust the modulator's cathode resistor value until this is achieved. NOT SO! Do not just blindly follow these instructions, although they are at least a starting point.

I have found that the best audio reproduction tends to occur at about 1/3 of the original value. Even under these conditions, downward modulation can often not be avoided, although the audio sounds great. So, if you are not concerned with which way the meters deflect as you talk, go for it! I'm a purist and like to see the upward movements, therefore I will reduce the carrier and input to the point where there positive swings are seen. I suspect that we are dealing with limitations of the power supply. Perhaps with a choke input, the voltage swings would not be as great under modulation. But, you get the reduced voltage and less RF output, so that you tend to be back where you started from when you just reduce the input. Also, the voltages on the low-audio stages are reduced, so you may induce distortion here. It's your choice, and it may depend on just how much carrier power you want or need to drive an amplifier.

On the subject of amplifiers, I use SB-

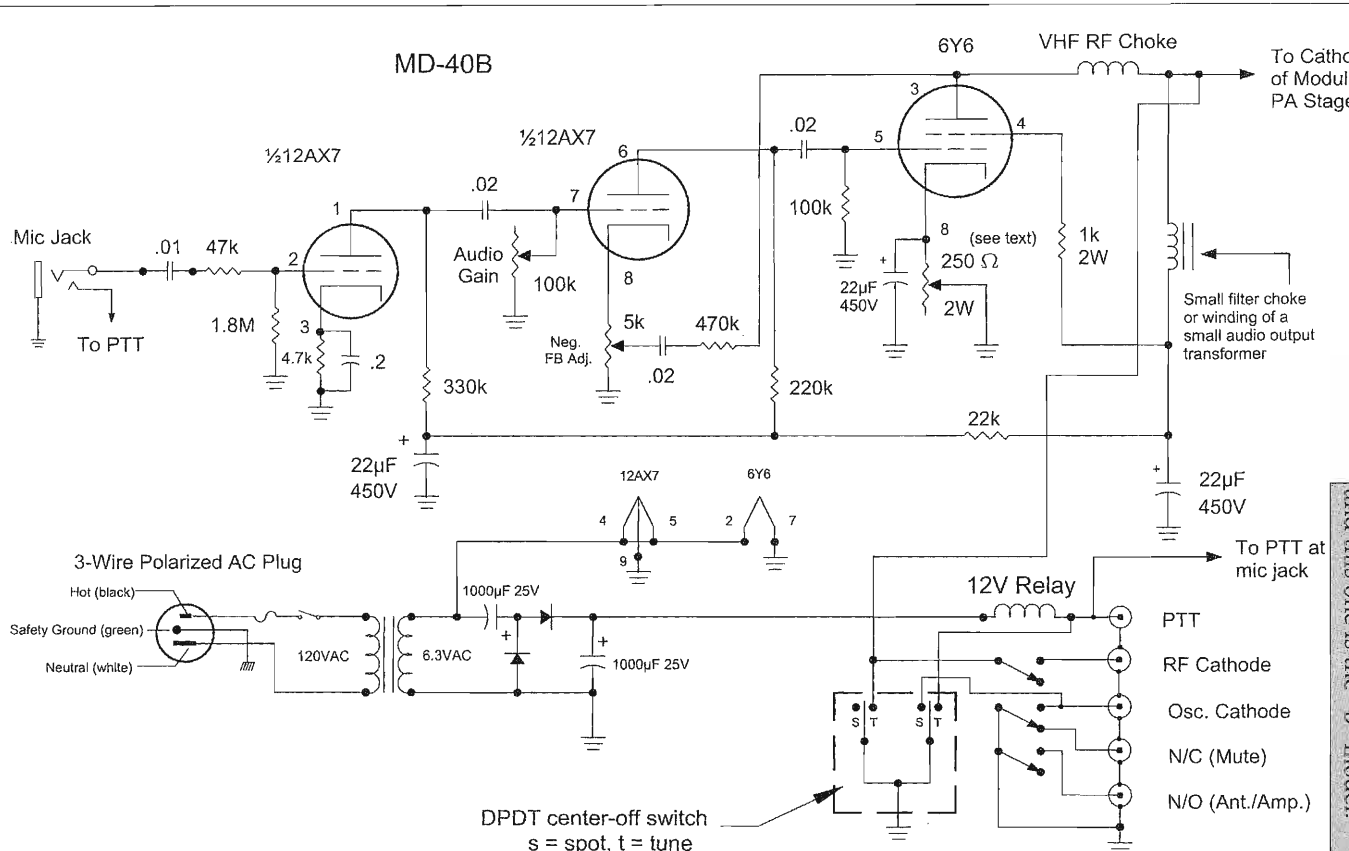


Figure 1: The MD-40B modulator, so-called because I started it 40 years ago, and this one is the "B" model.

200s and a Clipperton L. Driving these with about 15 watts of super-clean, upward-modulated carrier yields from 150 to 225 watts output. The highest output from the exciter is going to be about 25 watts. It is far better to make up the minor dB loss with good, clean, positive-audio peaks.

Another interesting tidbit comes from the Orban Optimod 9000A operating manual. This book claims that by limiting your negative peaks to 85% and letting the positive peaks achieve 100%, you only lose 1.5 dB of audio recovery, but gain significantly lower distortion. If true, 1.5 dB is imperceptible by the human ear. And, this is about what happens with this modulator since it can never produce anymore than 90% negative peaks. Truly an amazing little device, since you can now emulate the Optimod limiter.

The disadvantage of employing the little 10-watt Bogen PA unit mentioned in Part 1 is that there is no protection against over modulation. Also, the modulation was again downward when I attempted to get any output above 25 watts from any of the rigs. More extensive trials where conducted with the SB-400. Over 100-watts output was produced with fully negative, but severely downward modulation. The power supply just could not handle it. When drive was reduced (the internal fixed grid bias is used), with resulting reduced input and output, the modulation pattern was beautiful but we were back to the 15-to-25 watts of output. Again, use just enough input to drive a linear for about 200-watts output. Again, I must stress that with no audio limiter, 10 watts of audio can mess up your signal and the entire band with splatter. The conclusion on this one is that if you have plenty of power supply reserve and want maximum power from the modulated stage, traditional cathode modulation is an option.

Last thoughts on tune up: use a scope! I have found that drive, loading, tuning and carrier control from the modulator tube's cathode resistor will all effect output and linearity. I prefer to initially tune with the modulator in line to protect the final. I aim for maximum output, as the plate or cathode current is limited to about 20% above resonant conditions. You will most likely find that tuning changes if you remove the modulator and tune for maximum CW conditions. The filaments of this modulator should be at operating temperature before applying B plus to the RF stage.

Conclusion

I have had plenty of fun experimenting and learning about this unique method of amplitude modulation. The many hours on the bench have increased my understanding and appreciation for those pioneers who developed that which we today take for granted. I am pleased to share what I rediscovered and relearned from these pioneers as a result of my own trials and experiments.

The modulator described will provide a fool-proof means of successfully amplitude modulating a low-power CW transmitter. And, the audio will hold its own next to my Collins 20-V and Optimod 9000A. OK, so there's this major difference in carrier level, but with a big enough linear amplifier that too can be resolved.

My first AM-phone rig as a teenager was close to 45 years ago. It was an ARC-5 for 40 meters modulated with the 1959 "Hints and Kinks" circuit. And, let's not forget that Argon or Calrad crystal mike! I can remember my first QSO with all the nervousness and excitement as if it happened a few minutes ago. I was actually broadcasting my voice to untold millions of listeners just like a real radio station! The ARC-5 is long gone. The HB 1625 is a reiteration of the first novice CW rig I ever attempted to build. (It took over forty years to finally get that one right!) I now have my own very personal time machine. But, now in addition to knowing that teenager future, I have a complete understanding of why things worked and didn't work back then.

I invite you to try it and experience the thrill of using your old novice CW rig on AM while receiving most complimentary audio reports.

ER

A Custom Remote Control Panel for the RCA BTA-1R1 Using Silk Screening Techniques

Some Ideas for your Heavy Metal Rig

By Larry H. Will, P.E., W3LW
1055 Powderhorn Dr.
Glen Mills, PA 19342

Introduction

Some time ago (ER #172, September 2003, page 25) I presented an article on restoring my RCA BTA-1R1 for use on 160 meters. Since that time, the rig has performed flawlessly, even making it from its normal 1945 kcs to 1885 kcs for Heavy metal Night 2005. The rig is located in what was my garage and I needed a means for not only controlling the transmitter but getting necessary status and meter readings down into the basement "shack". The custom remote control panel discussed here is the result of that effort. It includes my first attempt at silk screening and while the work was not perfect (I need more practice) it sure beats press-on labels by a mile. I'll have more on the silk screening later.

The BTA-1R1 was designed for remote control by either a simple extension of cabling to mimic the front panel controls, or for those broadcast stations with studios some distance from the transmitter site, a standard broadcast type remote control system generally utilizing a single telephone line as an interface. Since my rig is about 35 feet from the operating position, I elected to use, as much as possible, a 24-VDC control system with a panel of suitable relays mounted within the transmitter cabinet and located near the terminal strip providing access to the control circuits. Since probably not many ER readers operate a lot of RCA rigs but many may have a broadcast rig of some

Figure 1: Front view of the completed, custom-built BTA-1R1 remote control panel that is mounted in an accessory cabinet at the AM operating position. The transmitter is operating at full power, but the VSWR meter is not yet connected.

manufacturer, this article is more generic in nature and is not a step by step construction project. I can provide a hand drawn schematic for my particular setup for anyone who might want that level of detail.

Figure 1 shows the view of the completed remote assembly with the transmitter operating in the high-power mode. The upper portion contains 4-1/2" rectangular meters for Plate Voltage, Plate Current, and Power Output/VSWR. The style of these meters is of the later RCA "new look" style introduced around 1964 and used only in the later BTA-1R3 transmitters. The labels on the original meter bezels were removed and the labels shown were silk screened on during construction. The meters selected were used here primarily because they were readily available in my junk box. The BTA-1R1 provides low potential points for remote PA plate voltage and PA cathode current. The remote meters are simply calibrated with series pots to match the corresponding transmitter front panel meters. The cable for these meters is a simple 2 conductor shielded cable with the shield returned to cabinet ground. The power output/VSWR meter is from a similar vintage RCA television transmitter and features an expanded scale. When this picture was taken, all of the required wiring to the panel had not been completed. The circuitry behind that meter requires dissimilar directional couplers and 6AL5 detectors to match the scale calibration and won't be covered here. The RCA VSWR circuit would only be of interest for someone with very similar meters on hand. The "official" power output indicator for the BTA-1R1 is a 0-5 ampere RF current meter mounted on top of the transmitter. As I have said before in the transmitter article, a thermocouple RF ammeter has an advantage of ignoring reactive power. So long as the resistive component value of the transmitter load is known the power output can be read with good accuracy, certainly within 3-5% of full scale if the meter is carefully calibrated. Since I also have a Harris AM-80 and an RCA 66-F modulator monitor, the relative carrier level "Set to 100" meter also serves as an uncalibrated go-no-go indicator for power output. The VSWR indicator is used to confirm correct setup of the balanced antenna tuner used on 160. I plan to motorize this tuner in the future as it is also some distance from the operating position.

The scale on the available remote plate voltage meter was correct as found as the BTA-1R1 has a nominal 3100-volt power supply. It is a 1 mA movement and a 5k-ohm pot in series with a 4.7k-ohm, ½ watt resistor, to slow down the rate of change during calibration, and is connected in series from the transmitter remote HV takeoff point and ground. The Plate Current Meter I used was a generic 0-100 scale meter with a 20-microampere movement. I scanned the scale of the plate current meter at 600 dpi and then, using Adobe Photoshop®, I relabeled the meter for 0 to 1 ampere and put in the "Amperes" and "Direct Current" labels to match that of the transmitter internal meter itself. The revised scale was printed and with artist's spray mount from the office supply, simply glued back onto the meter face. For this meter, I needed a 50k-ohm pot in series with a 47 kohm ½ watt resistor connected to the remote PA plate current takeoff point and ground. The RCA "meatball" below the meters was from another small parts unit and the art deco broadcast logo was made by first scanning the full size cast emblem from the front of the transmitter. The size was reduced to a convenient size to fit on the meter panel and printed on clear transparency film for the master for the silk screen. I elected to use black since this panel is painted standard Bud grey. The controls for calibrating the remote meters are mounted immediately

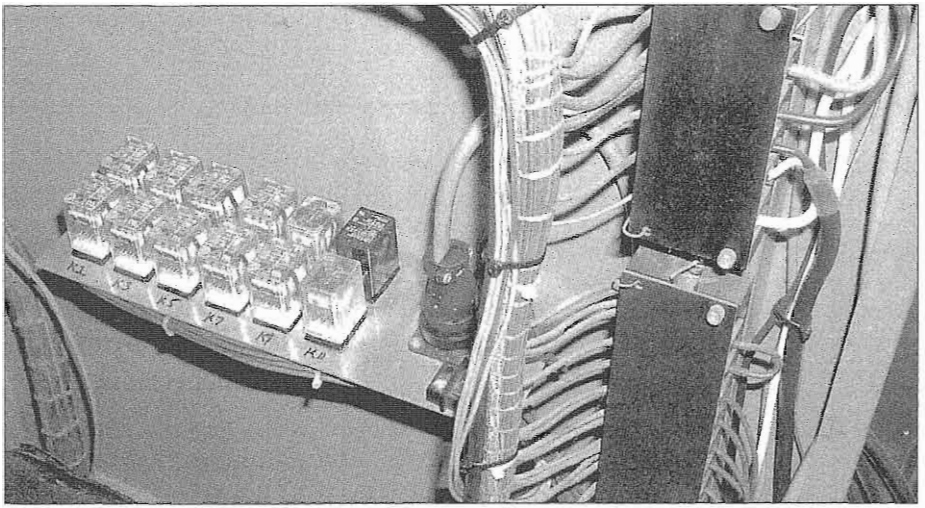


Figure 2: View of the completed interface relay panel installed in the rig.

below the meters and this panel is painted RCA Dark Umber gray. The silk screening of this panel needs to be redone as I inadvertently sprayed some grey over the completed letters! I picked up the wrong spray can.

The lower unit is the actual remote control panel. For the BTA-1R1, the controls include transmitter "On-Off", "Day-Night" (really high-low power preset latches) key switches, a rotary switch and a "Take" button to switch up to 3 crystals, the "Plate On-Off/Overload Reset" key switch, and finally the "Power Raise-Lower" key switch. Standard jewel pilot light sockets indicate the various modes. I did not remote any indication of which crystal is in use because only "Xtal 3," the "Conelrad" position had a front panel light to indicate the transmitter was in emergency "Conelrad" mode. The remote panel is a standard 3-½" 2-RU [rack unit] aluminum panel painted RCA Light Umber gray and silk screened with the various labels. Again, these labels match those on the transmitter front panel. While most of the labels turned out fine, some of them on my first attempt do not look good enough and I'll explain why later.

Figure 2 shows the homebrew transmitter relay panel installed in the transmitter. A multiconductor cable using Amp® Type CPC, series 1, 16-pin plastic circular connectors was used for the low voltage interconnect. A standard 4-pin Cinch-Jones rectangular connector handles the 120-VAC circuits. The relays are surplus Potter and Brumfield plug-in style 24-VDC and 110-VAC miniature 4-pole, double-throw units. Since all the front panel key switches operate as momentary and the remote control interface expects similar momentary commands, I used some extra key switches like on the BTA-1R1 front panel for the remote unit. I had to make my own bat handle knobs and I did this by turning hard wood dowels on the lathe and dipping them in the rubber compound used to coat tool handles and usually available in auto parts stores. One switch had the handle broken off, so a new one was fabricated from a 10-32 brass screw and soft soldered to the switch body. So far it has held up, but it really should be brazed. The finished handles are hard to tell from the originals. **Figure 3** shows the rear of the remote panel and the Amp® and Cinch-Jones connectors.

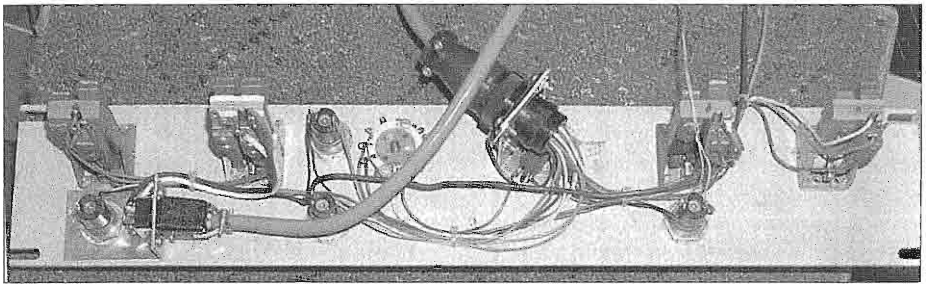


Figure 3: Rear view of the completed remote panel showing the key switches, pilot lights, connectors, and the wiring.

The RCA transmitter "Day-Night" latching relays remain energized when the transmitter is turned off either from the front panel or from the remote. Since it is off a lot more than on, I did not want those relays humming away night and day. I added a 30-A, AC contact rated, 24-VDC coil, 2-pole AC contactor in a suitable NEMA enclosure in series with the AC power from the breaker panel to the transmitter. An on-off switch at the AM operating position turns on the 24-VDC supply and when on, the contactor is energized so either the local or remote "Transmitter On-Off" key switch will then start the rig.

The only special area was the "Day-Night" (high-low) indicators and controls. These all wanted 120 VAC. I had completed the relay panel by this time and did not want to add more relays so I used 120V keying on a separate cable to switch day and night. The remote indicators are 24 VDC, but one 120-VAC relay in the new panel in the transmitter switches the +24 V from the night to the day indicator. The indicator control source here actually is 240 VAC, so an 8-k ohm, 7-watt resistor in series operates the 120-VAC coil on the relay with the correct coil voltage.

Reading Those Broadcast Schematics

I thought I would include a brief discussion on the control system for the

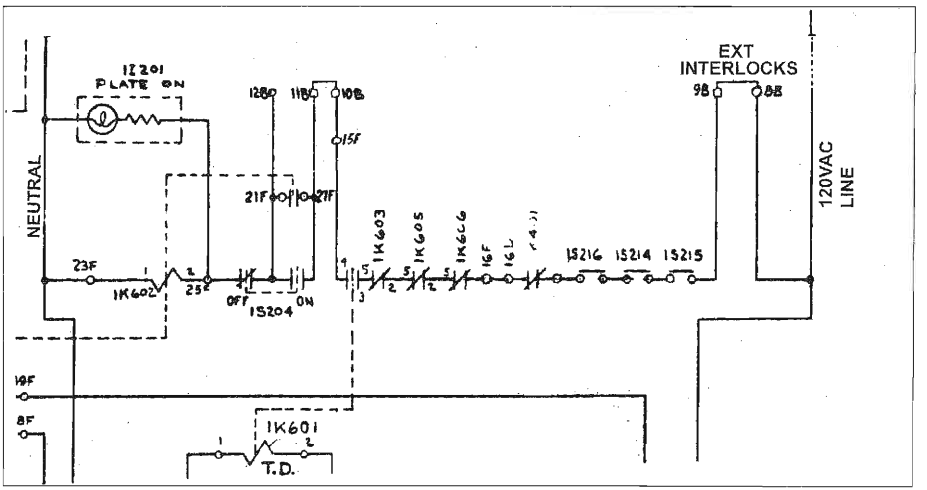


Figure 4: Examples of typical industrial control schematic relay symbols used by RCA, and also a portion of the PLATE control ladder. See text for details.

BTA-1R1. The schematic symbols for the control system, commonly called the control ladder, especially as it applies to relays, may be unfamiliar to some readers. Unlike amateur transmitter schematics which show relay contacts like standard toggle switch contacts, the broadcast transmitters (and some two-way radio transmitter systems) used a totally different symbol system that is always seen in industrial control systems like motor starters and HVAC systems. **Figure 4** shows examples from the "Plate On" control ladder of the BTA-1R1. The schematic was scanned from a copy of the original manual and I have touched up portions of **Figure 4** in Photoshop® for this article but it still has some areas that are difficult to read. Normally-open contacts look like a capacitor as shown on the "on" side of 1S204 and normally -closed contacts look like a variable capacitor as shown in 1S204 "off" and the contacts for 1K603, etc. The associated relay coil may or may not have a dotted line to all the contacts. You will notice 1K601 time delay (TD) does have the dotted line. Sometimes, only the designations on the schematic tie the coil to the contacts, which can be scattered all over the schematic as is the case with 1K603 and 1K605, etc. It takes some getting used to, but after awhile should be no problem following. **Figure 4** also shows another feature usually always used in commercial equipment. The "Plate Off" circuit, here 1204, is usually a normally closed contact in series with the "Plate On" line that must be opened to shut down. This is done to account for the fact that very often several relays have to be de-energized, and also the fact that all interlocks (here 1S214-216) usually are in series with the "Plate On" command, thus any interruption to the "Plate On" (HV On) control line kills the high voltage by unlatching the electrically latched "Plate On" Relay 1K602 in this case. The "Plate On" relay is electrically held energized so when power is interrupted or an overload occurs, that relay drops out and will not reenergize until overloads are cleared and "Plate On" is selected. By using a single key switch, these functions are mutually exclusive and add to the overall safety.

Silk Screening The Panels

Some time ago, I decided to try my hand at silk screening. A search on the Internet found some sites offering small trial kits for sale, so I ordered one. The kit came with a "standard" and a "fine" 8-½ x 11" screen as well as a black surface with a clear flip cover layer to "sandwich" the fresh screen and artwork together for exposure. The process is similar to making a contact print in the darkroom. The undeveloped photo screens can be handled in normal to subdued lighting indoors. There is no requirement to have a darkroom. The screens are photo sensitive but very slow in speed and can be exposed with indoor fluorescent light or sunlight. Sunlight is much quicker, however, requiring only a 30 second exposure in bright sunlight. Shelf life of the undeveloped screen, as specified by the supplier, if stored in the refrigerator, is about 1 year. Developing is done with cool running water. The process removes the photosensitive matter in those areas that are blocked from the light, thus the need to make the letters or shapes black on clear transparencies.

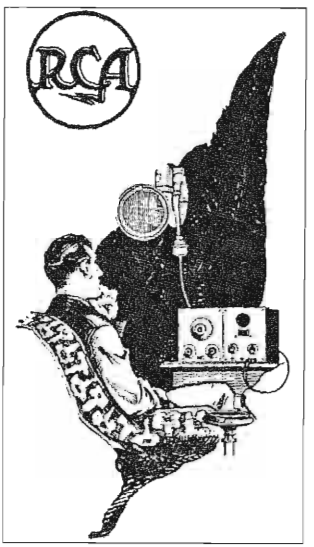
To make the masters, I printed the labels with the desired font and letter height in Word® and printed them out on the clear transparency material using the transparency setting during printer setup. For best results, the letters should be printed in reverse (right to left) as this does two things. First, it places the printed side of the transparency against the undeveloped, sensitive side of the screen for best contact during developing. Second, after developing when flipped over to read correctly, the smooth side of the screen is now towards the panel surface

while actually painting the letters. I didn't do this at first, and the letters were not as sharp as when it is done correctly. The transparency should be checked very carefully for coverage. Any voids in the black of even a small portion of a letter will show up as a "problem" after developing the screen and painting on the panel. The same applies to the developed screen. Holding to a light, you should be able to see through all parts of the portion of the screen forming each letter. Keep checking while developing and continue as necessary. I also found that I had better results with the "standard" screen material. With the "fine" screen, it was difficult to get all the material out of the desired area during developing and cleaning, and, if the screen was to be reused, which can normally be done with care, getting the paint out of the mesh after printing the panel. I used a good quality latex paint and you should have a container of water handy to wash the screen as soon as it is removed from the panel and before the rather thin coat of paint dries. The screen can be affixed to the panel for painting with a light coating of artist's spray mount. A small amount of paint is dropped along the end of the label on the screen to be printed and "squegged" over the screen with the supplied rubber block. The screen can, and should be, removed immediately after the paint is applied. Lift carefully and slowly, and if you see voids you can carefully replace the screen and hit it with another pass of paint. If it still is not right, quickly clean off the paint on the panel and recheck everything and try again, something I have had to do several times. Remember however, once the paint dries, it is about impossible to clean the screen for reuse. The manufacturer recommends a good quality, non shedding natural sponge to "dab" the screen while the developing is occurring. This prevents damage to adjacent areas on the screen near the desired label where the material should not be removed. I should also state that I made a number of test runs on a scrap panel to get a feel for the process before I started on the panels discussed here. Get some materials and have some fun with silk-screening. Now there is no excuse for not getting your broadcast boat anchor on the air and operating reliably.

ER

[The PhotoEZ line of silk screen materials is available from several places but W3LW used this one: http://www.gwengibson.com/photoez.htm.

The Photo EZ owner's mailing address is:
Gwen Gibson
216 Bayview Street
San Rafael CA 94901...Ed]



The Lafayette HA-350 Receiver

By Bruce E. Stock, AB7YD
Ab7yd@earthlink.net

The HA-350 was one of several Asian-built tube-type receivers offered for sale by Lafayette Radio in the '60s. I'm sure many of you saw their ads and will recognize its appearance from **Photo 1**. The radio was manufactured for Lafayette by Trio, and it has the distinction of being one of the first commercial receivers, other than a Collins, to have a mechanical filter in its IF. The HA-350 was priced considerably below competing US-made receivers, and it probably seemed like a pretty good value to Hams of that era.

I had the good fortune to pick up one of these receivers at a recent swap meet, and I found it to be an interesting refurbish/repair/modify project. In this article I plan to cover the HA-350's basic design, plus provide some troubleshooting and modification ideas that should be applicable to other receivers besides the HA-350.

HA-350 Design

Figure 1 is the block diagram the HA-350. A total of 12 tubes and 4 diodes are employed to cover 80 through 10 meters, plus a WWV range. The receiver uses a crystal-controlled first mixer injection, using 5 crystals to cover the 8 bands. The use of some crystals for more than one band has the usual (and annoying) side effect of having to read the frequency dial left-to-right on some bands and right-to-left on others.

The receiver has a 455 kcs mechanical filter made by Kokusai Electric to establish a 2.1 kc passband that is used for both AM and SSB reception. But because the skirts of the mechanical filter aren't as sharp as modern filters, it sounds more

Photo 1: The Lafayette HA-350 was an imported receiver that was available from 1964 to 1968.

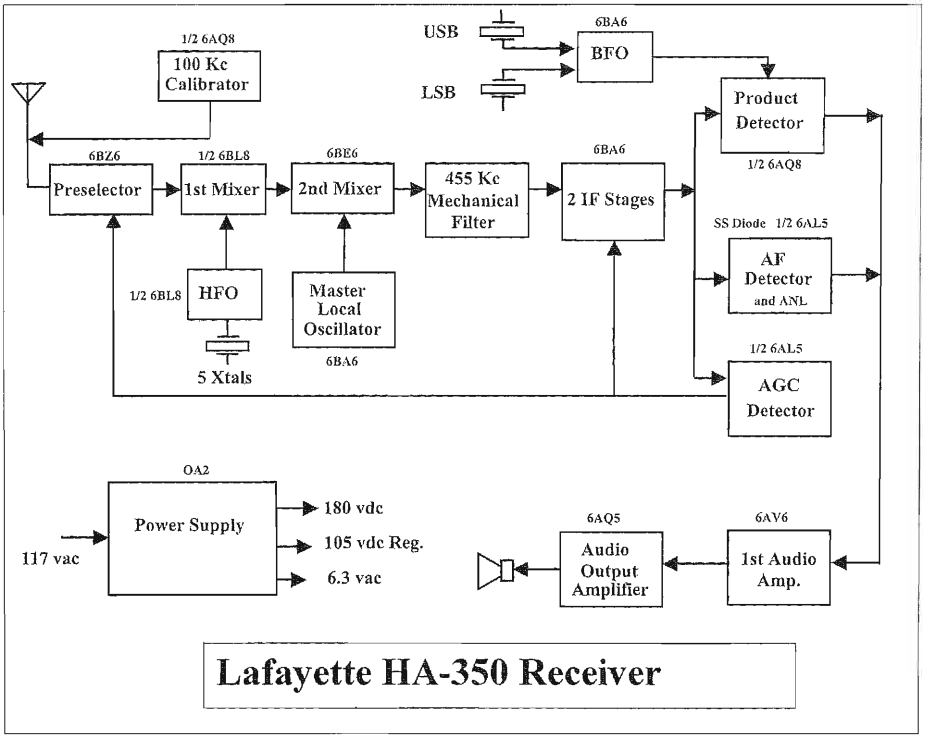


Figure 1: Block diagram of the Lafayette HA-350 HF receiver.

like a 3 kc passband to the listener. That is still quite a bit narrow for AM, but you can tune off frequency just slightly to pick up more highs. Later, I'll show how to open it up more for really good-sounding AM.

Internally, the HA-350 is a single-conversion receiver that tunes from 3.5 to 4.1 MHz. The other bands are all down-converted to that range by the first mixer. On the 80-meter range the first mixer receives no HFO injection and thus functions as a second RF amplifier on that band only.

The receiver manual, including the schematic, is available at the Boatanchor Manual Archive (http://bama.edebris.com/manuals/lafayette/) and also at http://wa2iac.com.net/ha350.html. From a brief look at the schematic, you get the impression that the receiver has promise, and indeed that is borne out by the largely positive original reviews in CQ magazine (February 1965, page 60) and QST (December 1964, page 50). For more comprehensive information on the receiver's design and operation, interested readers should see the original reviews.

As I searched the web for information on the HA-350, I found that there were some recent evaluations of it on the Eham web site (http://www.eham.net/reviews/detail/2631). The consensus of these evaluations was uniformly negative: "What a Dog!!" However, this is not the conclusion of the favorable reviews of the original production receivers in QST and CQ. I think that the conclusion to be drawn from these opposing views is that the HA-350 just doesn't age well, but perhaps that is something that we can improve.

Troubleshooting

I first did the basic cosmetic cleanup

and then formed up the receiver's electrolytics by bringing it up on a Variac over a period of 3 hours. At this point it received signals, and I went through a brief preliminary alignment. My initial impression at this point was that the Eham evaluations pretty much matched what I was hearing from the receiver. The receiver seemed "oversensitive" or "hot" to the point that the RF gain control had to be reduced frequently to prevent overload, but at the same time it was fairly deaf on other bands.

Whenever I encounter a receiver that seems to be too sensitive, I have learned that there is a good chance that something is wrong with the AGC, such as leaky capacitors or gassy tubes on the AGC buss.

To make a long story short, my receiver had some of both problems. With regard to the capacitors, I eventually found I had to replace all 5 of the Nichicon brand capacitors in the radio, as all were leaky. Two of them were employed for the fast and slow AGC time constants, and they were preventing the AGC from being very effective.

When bringing up any receiver, it is a good idea to put a VTVM on the AGC buss while doing a bit of listening. If the AGC voltage barely makes it to a couple of volts negative, and very strong signals cause distortion, it is a strong indication of a problem in the AGC circuit. You should check or replace the AGC time constant capacitors if you have any cause for concern about the AGC action.

AGC action can also be affected by gassy tubes, which can pull the AGC buss in a positive direction, reducing its ability to prevent overload. The good news is that you can easily check for this without needing a tube tester. The grid circuit of each tube on a typical AGC buss is fed by an isolating resistor in the range of 100 k to 1 Megohm. With power on and the antenna disconnected, use your VTVM to check the voltage at both ends of each isolating resistor. Both ends of the resistor will be at the same voltage if there is no leakage through the tube. Gassy tubes will draw a little current through the resistor so that the end toward the tube is less negative than the buss end. Anything more than a barely noticeable difference means that the tube should be replaced.

With these items fixed, my receiver was behaving properly on AM, but still seemed to overload on SSB. I'll cover the reasons for the SSB problem and its solution in the modifications section.

As noted in the Eham evaluations, the receiver sensitivity was not very spectacular from 20 meters on up. I think that the design of the preselector, and the way it has been aligned (or misaligned), contributes strongly to this. Basically, the preselector covers two ranges: 3.5 to 7.6 MHz and 14 to 29.7 MHz. You have to be very careful to get the tracking right, and you may have to compromise the adjustment at one end of the range in order to perk up the performance at the other end. Take your time in aligning the preselector and you'll get the best performance out of it.

Another item requiring care is the alignment of the 3.5 to 4.1 MHz passband filter at the output of the first mixer. The manual says to just peak it up at 3.5 MHz, but it works much better if you peak it up on 3.750 MHz, since this produces a much more even gain distribution across the tuning range.

The main dial calibrations on my receiver refused to converge until I reversed the directions given in the manual and aligned the coil (L04) at the upper end of the range and the trimmer capacitor (TC1) at the lower end.

Another problem in my radio was a broken and stuck tuning slug in one of the IF transformers. Rather than take the chance of destroying the transformer by attempting to force the slug free, I found an easier workaround. I clipped out the internal 150 pf capacitor that was used to resonate the winding with the broken

slug. I then put an external 130 pf capacitor in parallel with a 7-47 pf ceramic mini-trimmer across terminals of the damaged section. That way I could use the trimmer to peak up the section with the stationary slug, and it worked beautifully.

With that work out of the way, the receiver was now working much like the original reviews had described.

Modifications

The modifications described here will improve both the AM and SSB reception of the receiver. I'll going to cover the AM changes last, because of the way they integrate with the SSB changes.

The HA-350 has a typical AM AGC design. While this is fine for AM, it causes overload of the product detector on stronger sideband signals because SSB has a much higher peak-to-average ratio than an AM signal. What is needed for SSB is usually called a "fast-attack, slow-release AGC".

The easy band-aid for this receiver (and many other similar receivers as well) is to switch in a diode across the series resistor of the AGC RC filter when SSB reception is desired. The diode provides a low resistance charge path for the AGC capacitor, causing it to quickly charge up to the peak of the SSB signal, rather than to the average. It is a "poor man's" fast-attack, slow-decay solution.

The diode needs to be connected on SSB but not on AM, and we would prefer not to have to add a new switch to ruin the cosmetics of our radio. The approach I've used before on several other receivers is to use a relay to do the diode switching. Then I locate an existing set of switch contacts in the receiver that can be "appropriated" to control the relay.

For example, in the HA-350 there is a nice pair of contacts on the "Function Switch" that switch in the slow AGC time constant capacitor when the switch is set to the SSB mode. If we instead use those contacts to switch power to our relay, we can use one set of contacts on the relay to automatically switch in the new diode for SSB reception and use another set of the relay's contacts to replace the original switching in of the slow AGC capacitor. That way we can seamlessly incorporate our new function into the receiver without adding a new switch.

For minimum physical impact on the receiver, I use very small 6 or 12-VDC relays that are available at Radio Shack and other suppliers. They are about the size of 2 cubes of sugar placed side by side. You can mount them "dead bug style" (legs up) under the chassis with double-backed tape or a few of dabs of hot glue. That way some future custodian of the receiver can easily remove them if he desires to. **Photo 2** shows two such relays mounted near the mechanical filter in the HA-350. The relays draw so little current that you can just rectify the 6.3-VAC filament voltage to provide about 8 VDC to power the relays. I find that even the little 12-volt relays will usually pull in on just 8 volts.

The schematic for these modifications is shown on the left hand side of **Figure 2**. You will notice that I've also changed the original fast and slow AGC capacitor values to .01µf, and .1µf. There is also a new 56k-resistor in series with the slow AGC capacitor. It is there to allow the AGC detector to quickly increase the AGC voltage on strong signals, preventing an annoying pop on the first syllable of a strong SSB signal.

The last thing we need to work on is the product detector. In my radio it was getting too much signal drive from the IF and too little injection from the BFO, causing additional overload and distortion on stronger signals. I increased the BFO injection at the cathode of the product detector from .5 volts p-p to 2 volts p-p by paralleling a 220 pf capacitor across the existing 50-pf coupling capacitor. The drive coming from the IF stage was reduced by replacing the 30-pf coupling capacitor to the product detector grid

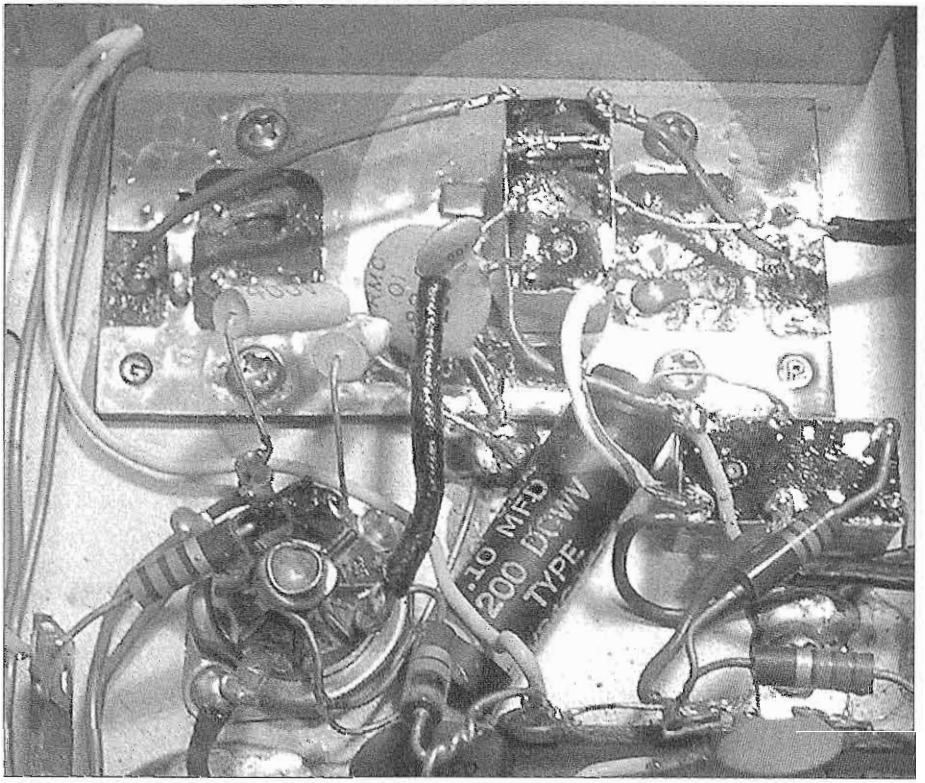


Photo 2: In the highlight area the mounting method for the second DPDT relay is shown. Just below the highlight is the first relay.

with a 1 or 2 pf "gimmick". The "gimmick" is just a couple of short lengths of insulated solid wire twisted together for about α inch to make a homemade low-value capacitor. With these simple changes the SSB detection quality is finally as good as it ought to be.

OK, finally we are ready for the AM modifications. As I said earlier, you really can get by with the original single IF bandwidth solution, but if it annoys you, all you need to do is add another small relay to make it automatically switch from the 2.1 kc filter on SSB to a roughly 9-kc bandwidth on AM. That is the purpose of the upper relay in **Photo 2**. Basically, you just use a second DPDT relay to switch the mechanical filter in for SSB and out for AM. The right hand side of **Figure 2** shows the circuit. Be careful with lead layout when wiring up this relay, so as to ensure the shortest connections and minimal capacitive coupling from the input to the output of the mechanical filter. You will notice that the receiver gain is now much higher on AM with this change, and that is due to getting the insertion loss of the mechanical filter out of the circuit. Excessive loss in that filter could also be the reason some HA-350s are described as "deaf".

I couldn't resist the notion of being able to select both wide and narrow bandwidths on AM, for those situations where QRM demands more selectivity. That is the reason for the added switch, as shown in **Figure 2**. I used an existing hole on the rear apron of the receiver to mount a

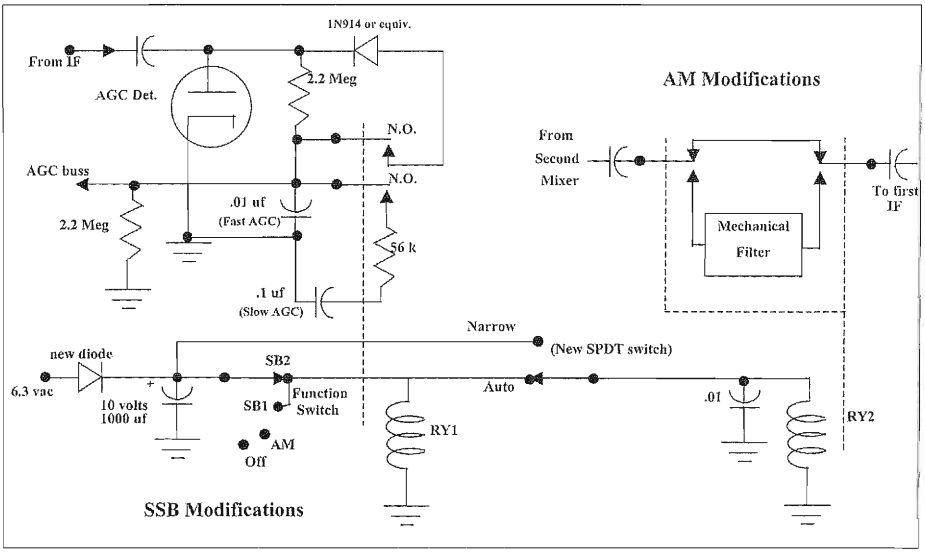


Figure 2: Schematic diagram showing the SSB and AM modifications to the HA-350 receiver.

miniature SPDT switch. That hole originally allowed access to the 14 MHz trap, but once that trap is adjusted the hole is free for our use. In one position of the switch the receiver automatically changes to the appropriate bandwidth when changing between SSB and AM modes. In the other position the receiver selectivity is always fixed at the narrow width.

That completes the modifications to the Lafayette HA-350. With these changes and proper attention to thorough troubleshooting and alignment, I have found it to be a very nice little receiver to use. Also note that the SSB AGC enhancement described above can be used to improve the SSB receive capability of many other vintage receivers as well. I've used it successfully on my NC-300, SP-600, and Heath Comanche.

ER

The KDØZS Equipment Notebook

The Essential National NC-183D, Part 1

By Chuck Felton, KDØZS
PO Box 187
Wheatland, WY 82201
Photography by Greg DePrez

The National NC-183D receiver is a perennial favorite with Hams and SWLs alike. Produced in rather large numbers from 1953 to 1958, it would cost $5,000 in today's money if adjusted for 1954 dollars. High-quality parts were used throughout, and several changes can be made to the NC-183D to turn it into an outstanding HF performer. When you have completed the work I describe in this article, the NC-183D will have outstanding large signal handling capability and high sensitivity. For example, I can comfortably listen to 1360 kc, a station with a weak signal of only few microvolts at my location, and not be bothered by a 1 kW broadcaster on 1340 kc that is located just 2 blocks away! Sensitivity will be outstanding as well. At 29 Mc I measured the sensitivity as:

CW, 2 xtal position: -142 dBm (.01 μV)
AM, 4 kc BW: -137 dBm (.03 μV)

At 11 Mc, the large signal handling is the best I have measured for any receiver so far. With a +12 dBm signal modulated 90%, there is no noticeable audio distortion. +12 dBm is almost 2.5 *volts* peak-to-peak at the antenna terminals!

The National NC-183D is a widely known HF receiver that may still be obtained for a reasonable cost. Spending a little time improving its electronics will result in a receiver that outperforms most modern designs.

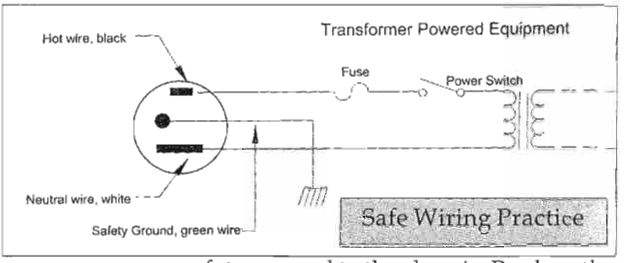
First Steps

If you are just starting the restoration of a '183D, the first thing to do is clean the entire radio. Check all the tubes, and replace any that are questionable with a tube that is as good as a new one where appropriate. Clean and lube all the pots, switches, variable capacitors, and the dial mechanism. Clean the tube sockets.

If you don't want to completely dismantle the dials, a paper towel wetted with Windex® and stiffened with card stock can be shoved down between the dial and the dial glass. Rotate the dial mechanism to clean and polish the dial and inner portion of the glass. In one receiver I worked on, intermittant dial operation was caused by a wire fragment that was stuck in the dial pinch roller.

Electrical Work

In **Figure 1** below, replace C-62 and C-63 with .01-µF, 600-volt or greater Mylar capacitors because they are across the 120-volt line. Replace the power cord with a 3-wire polarized plug and cord as shown in the safety diagram. Wire the 120-volt hot side to F1, the 2-amp line fuse. Wire the white neutral conductor to terminal 7 of T1, and attach the green safety ground to the chassis. Replace the bias supply filter capacitor, C-65, with a new 100-µF, 75-volt unit to get AC ripple off of the bias line and greatly reduce hum. Check the power supply filter capacitors (C-64 A and B) and replace them if they have high leakage.



This receiver runs very hot and has a tendency to drift quite a bit because of poor cabinet ventilation. A simple fix is to leave the bottom cover off and prop up the top so it stays open about 1 inch.

The rest of the electronics work will be completed stage-by-stage following the text and the drawings. Be sure to document your changes so that the next guy down the line knows what's been done.

RF Stages

The first thing to do in the second RF stage is add a 220-ohm resistor from pin 7 of V2 to ground, see **Figure 2**. Do not bypass the resistor. This change will improve gain distribution and will increase the large signal handling capability of the front end. At the junction of R-9 (100k) and R-8 (470k), add a .047µF capacitor to ground and a 470k resistor in series with the AGC line. These changes form an AGC attack-time divider. Remove R-68 at L-14.

The 80-meter, band-D antenna coil only resonates with the antenna trimmer control at, or near, minimum capacity. This is caused by excess "C" to ground in the original design layout, and the coils are overcoupled. There is no gain in the coils because of this. The primary

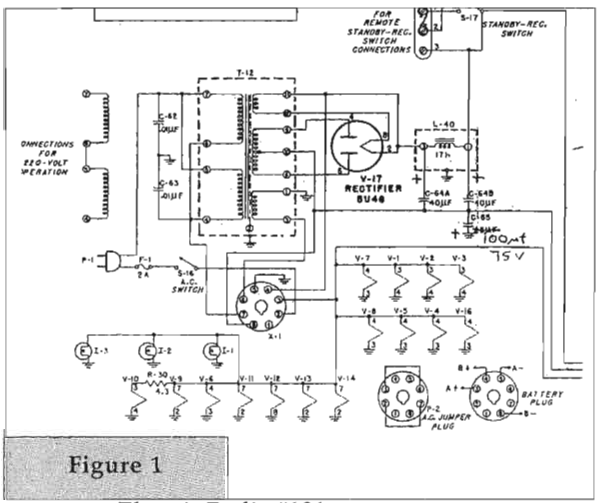


Figure 1

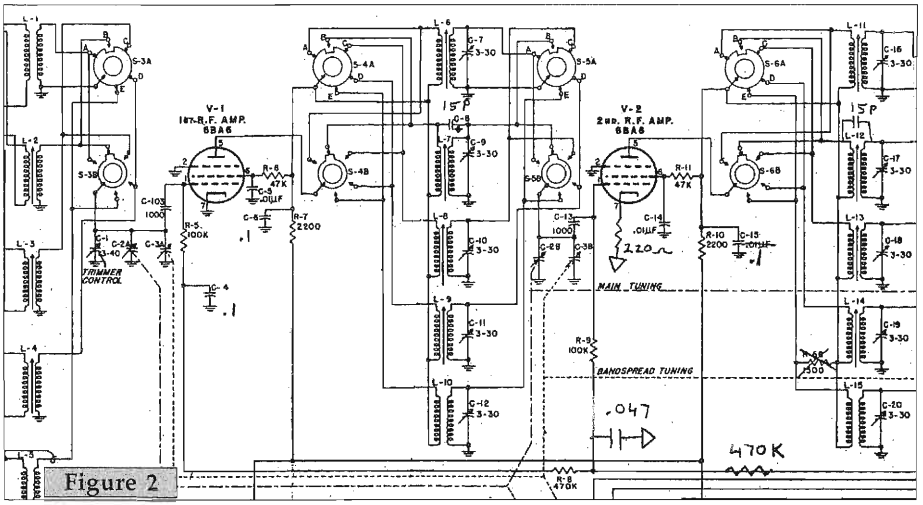


Figure 2

leads run up inside right against the secondary winding. To fix this situation, remove Band D coil, and remove the primary leads from the top of the coil form and also remove about ½ of the total turns from the primary winding. Referring to **Figure 4**, page 31, solder a new terminal strip to the secondary ground lug at the bottom of the coil form, next to the chassis. Run the primary leads to this new terminal strip, rather than up through the coil form. Now the 80 and 160 meter bands will peak up sharply about in the middle. Also, glue a piece from a ferrite slug from your junk box inside the coil form near the hot end of the secondary winding as shown in the drawing. This provides more initial inductance which helps you during final alignment for a compromise in coil track-

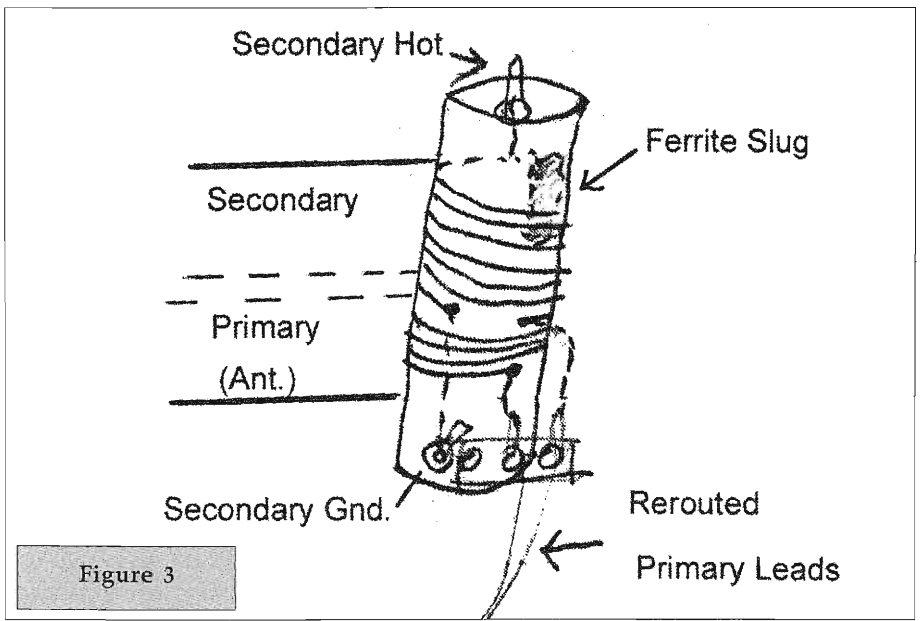


Figure 3

ing . These changes also provide more sensitivity in the RF stage on those two bands.

For higher gain on Band "B," place a 15-pf, silver mica capacitor across L-12 as shown in **Figure 2**. A more ambitious change in L-12 is to rewind it for 27 to 30 µH. This will increase the sensitivity on band B by about 10 dB. Increasing gain in the coils is a good way to increase the receiver's sensitivity because only the gain goes up, and not tube noise. The total signal-to-noise ratio is significantly higher, but newer-production NC-183Ds may not need this.

1st Mixer Stage

There is a big mess in the wiring on the side panel, and you need to completely rewire the B+ distribution to the IF strip to avoid IF instabiltiy, stray coupling of signals around the IF stages, and BFO feedthrough. Go to a single-point grounding scheme, and be sure each stage is properly isolated from the B+ line. Install high-quality, .1-µF, 600-volt Mylar bypass capacitors at the appropriate tube sockets wherever possible with short leads, directly to ground. Make sure the blue IF plate leads don't stray over adjacent IF transformer cans in the IF strip or the IF strip will regenerate.

Note the changes around V3, the 6BE6 1st mixer, shown in **Figure 4.** To improve stability, R12 is changed to 47k, and the the screen voltage is isolated with a new 2.7k resistor. Note also the new B+ wiring to S-10. The existing 10k resistor, R70, is removed. The screen bypass capacitor, C22, is removed and a new bypass capacitor, .1µF at 600 volts, is added directly at the screen terminal, pin 6.

Second Converter, V-4

See **Figure 5**. The conversion from the high first IF (1720 kc) to the low second IF (455 kc) needs higher screen voltage at V-4 for improved signal handling and gain, so R-26 is changed to 2.7k. Change C-53 to .1 µF (a better screen bypass), and change to a higher value grid-leak resistor, 100k at R-28 to improve oscillator efficiency. Finally, add a new 100-ohm resistor between the V-4 cathode and the coil tap in T-6. The 100-ohm resistor absorbs harmonic energy reaching the front end.

[Next month, part 2...Ed.] **ER**

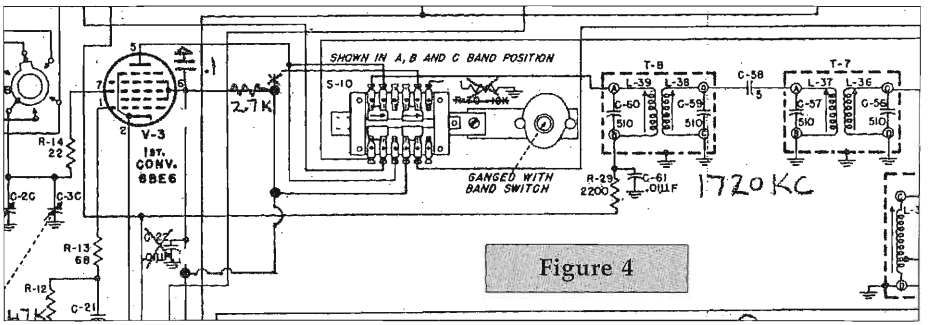


Figure 4

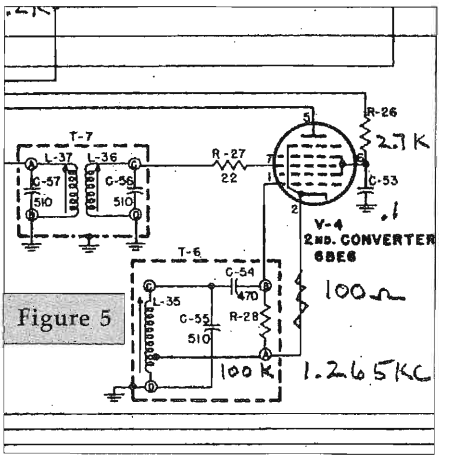
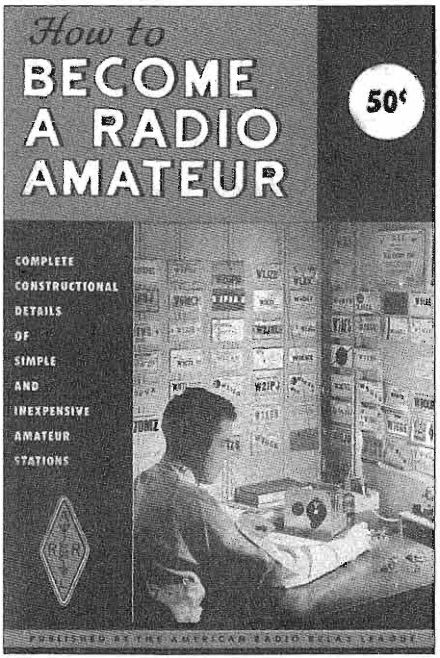


Figure 5

The Simple Novice Station

By Breckinridge S. Smith, K4CHE
104 Brookfield Drive
Dover, DE 19901

Acquiring a novice license in 1955 was a relatively simple manner. You were administered the code and a written test by a General or higher class amateur. However, acquiring a station to operate in 1950s was a complex matter. Ask my wife—she was dating me at the time. The League attacked this problem (the equipment problem, not my dating problem) by their publication of "How to become a Radio Amateur" which contained "complete constructional details of simple and inexpensive amateur stations." The early issues had no index and forced the reader to thumb through the pages to find out how to acquire a license and contained a quick review of the amateur bands and theory.



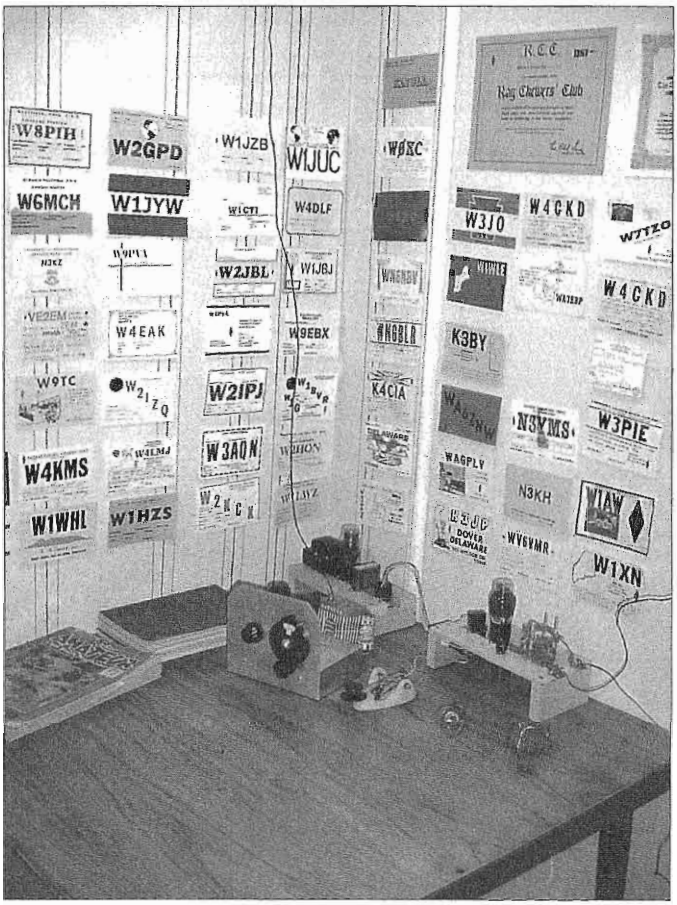
The ARRL's 1956 edition of "How to Become a Radio Amateur was inspiring for many future operators.

On the first page of the 1956 edition was a paragraph titled "Adventure!" The Adventure paragraph described "Each night's operation as a new advent into space." The "How To" publication was one of ARRL's greatest creations, and for four-bits it was a bargain to purchase and was cheaper than the three bucks for a Handbook and much easier for a young teenager to digest.

You have to remember that in 1955, time was of the essence because the license clock was running the day the license was issued and the one-year license term had started. You could not renew the Novice license; it was upgrade or out. In addition, a frustrating part of the license process was that Novices often received their licenses 6 to 8 weeks after the issue date.

A lot of us spent hours studying the pages of this manual and either built some of the equipment or used the simple construction techniques to build other similar pieces.

I stumbled across the 1956 issue of the primer at a East Coast Hamfest, I remember standing there at the seller's table scrutinizing the picture on the front of the manual, the picture of the amateur operator sitting at the table with the key in his right hand, and the home brew wooden-chassis transmitter and single-tube regen receiver in the background. For a while, I drifted back to a simpler and exciting time—amateur radio was a big deal then. I looked at the picture. QSLs were on the wall, and the station was neat, tidy, and simple. Even now, just looking at the picture to me still



The reconstructed 1956 Novice station at K4CHE.

suggests adventure. I purchased the manual and took it home to digest. It sat there on the workbench trying to tell me what to do. I then decided to model the complete station that was on the cover.

Modeling the station

The decision was made to model the complete station in order to present a full and complete vintage station appearance. I decided to construct my Novice station in the corner of the shack next to a window so that the receiver and transmitter wires could easily be fed through a window to the outside. The "Novice Station" uses two antennas, one for the transmitter and one for the receiver. A simple regenerative receiver of this type does not like having the antenna switched back and forth. Regens are sensitive and they don't even like for the wind to move the antenna, anyway that is the reason for two antennas.

If you look carefully at my station you will notice that a lot of the QSLs are the same as the original photograph. I acquired several call books and researched the addresses, trundling back into history and decided to try and dupe some of the designs of the cards. During the QSL research, it was interesting to note how many times W1AW changed their layout over the years. The old QSLs were better and were handwritten personal communications between two operators exchanging station and personal information, confirming not only their operating skills but in many cases confirming their skills in equipment construction. This was a much better method than the impersonal computer-generated cards of today that mention only rice boxes. The RCC certificate and ARRL membership certificates are mine.

The batteries were fabricated by covering the D cells with a Burgess cover to give them that familiar red and white stripe appearance. The B battery is a band aid box turned upside down that is covered with a Burgess cover and is stuffed with 9-volt batteries in series. Binding

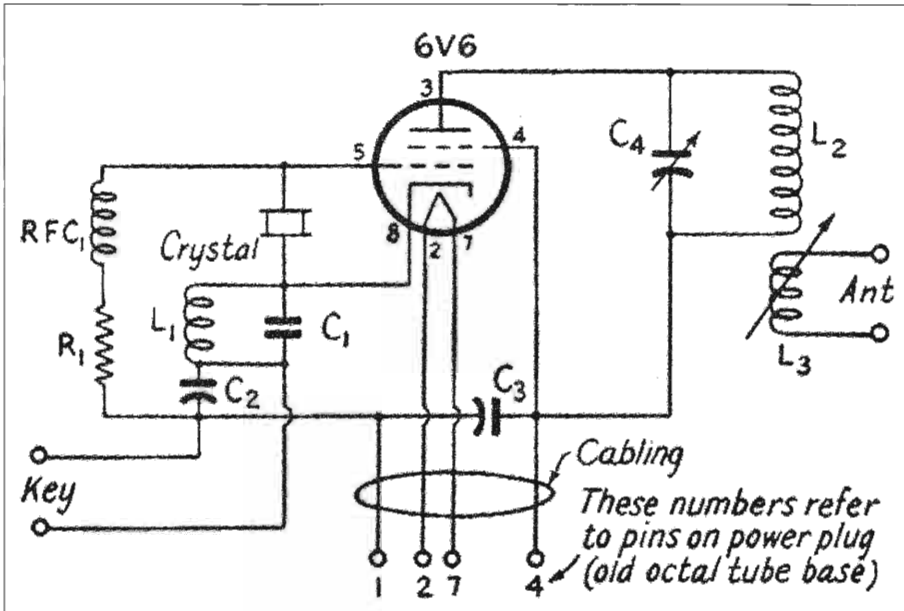
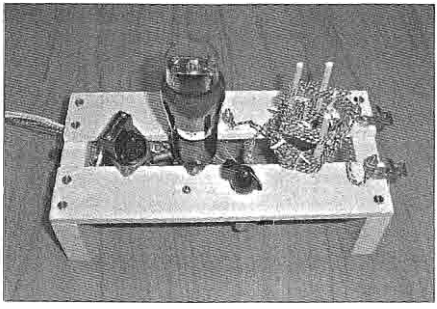


***Fig. 14* — Schematic diagram of the wiring of the little transmitter.**

posts were added for the connections. The McElroy hand key was restored by Ed Bitter (NS3E) and is, as far as I can tell, the same type of key that was used in the original station as pictured on the cover of the manual.

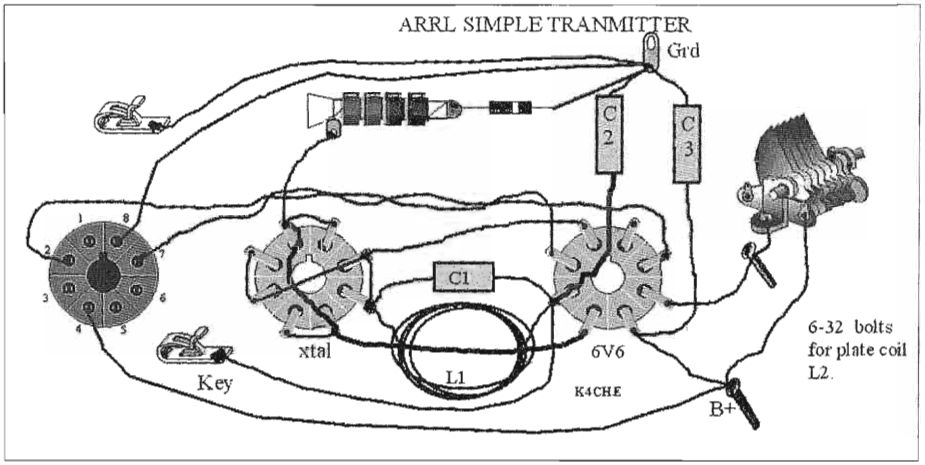
Transmitter Construction

The original construction and design was by Don Mix, W1TS. A discussion of Don and his league activities was made by Lew McCoy in the April 1997 Electric Radio #96, with references at the end. Don used 1- ¾ X ¼ X 9¾ strips of wood for the construction of the top portion of the chassis. The ends were 4½ X 2½ X ¾. The ¾ stock wooden stock was also used in the power supply. Wood stock that fitted the thickness and width was available at my local home supply store as well as the wooden dowels to hold the plate and antenna coils. The 8-pin octal tube socket was originally wired so that the crystal could be plugged into two different positions. I wired this socket so that the crystal could be plugged into any position, and I now have 8 possible combinations. Well, I had to change something, and wiring the octal socket that way is still a neat trick today if you do not have a crystal socket handy. I first saw a socket wired this way was in "Hints and Kinks," see the references.



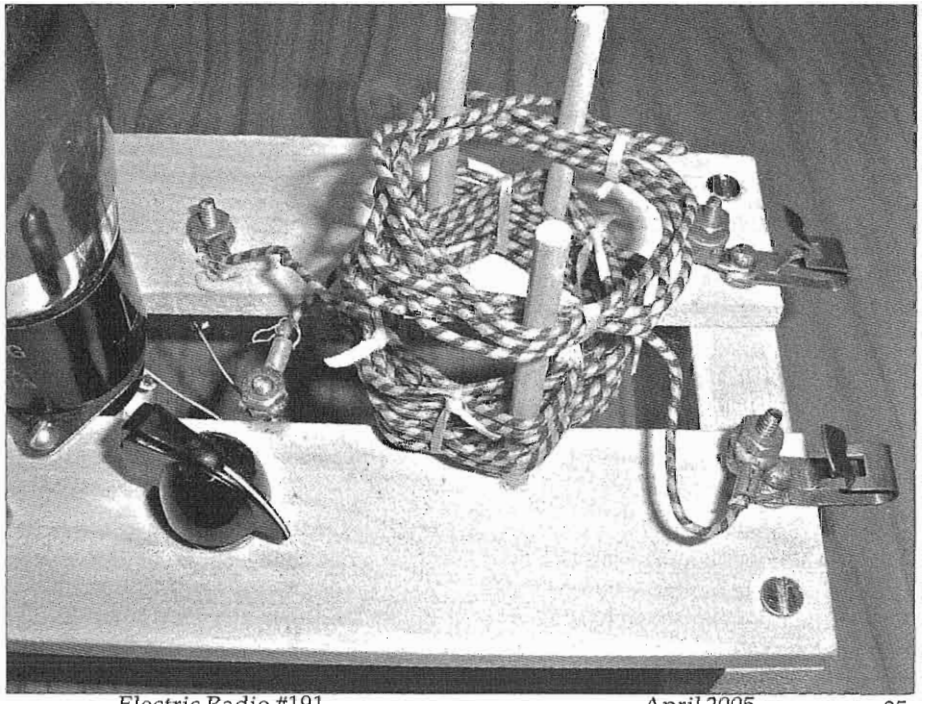
Top view of my completed 6V6 transmitter, described in the text.

A problem with the overall transmitter construction is that Mr. Mix used unused pins on the tube sockets for tie points



The drawing above shows the transmitter wiring, and was called a "hookup" diagram years ago. Below is a closeup of the coil winding method.

and did not offer a real detailed parts layout, which was confusing to the Novice builder. I would consider using the unused pins an advanced technique for the experienced builder. There really was no detailed diagram pictorial of the parts layout, a process which really became popular in the Popular Electronics magazine articles and the Heathkit manuals. So, I have made up my version of a pictorial diagram of the parts layout for the simple transmitter and the schematic is furnished courtesy of the ARRL. Thanks to Gary (WD4NKA) for the use of some



of his "Tube Pad" components used in the pictorial.

The hardest part in the construction was acquiring the wax-covered, red and white solid bell wire, which was used for the coils, but I finally located a small amount. The coils were then fashioned in the same manner as described in the manual using nails arranged in a 2-inch diameter circle and weaving the coils back and forth between the nails. Lacing was used to keep the coils together. I abandoned the use of pin 1 of the 6V6 octal socket for the tie point for the B minus and used a solder lug. However, I did use pin 6 of the 6V6 socket as a tie point for L1, C1, and the keying lead.

Fahnestock clips were used for the key and antenna leads and an octal plug was made out of an 8-pin tube base. There was much consternation when it came time to choose a donor tube for the octal plug. See **Figure 14**, page 34 [QST Figure 14]. Note: Schematics of the station are from the original manual "How To Become a Radio Amateur," 1956, by ARRL, and "Figure 14" is from this book. See the references at the end of this article.

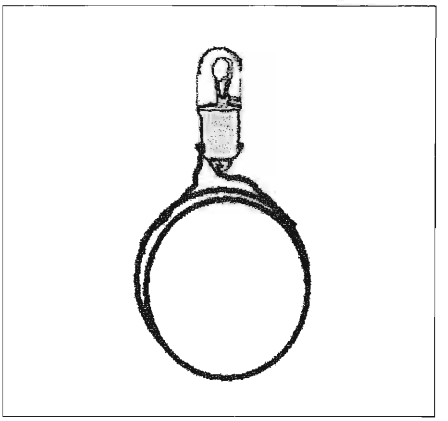


Figure 1: Filament bulb with a two-turn loop, used for testing.

sured 4 X 1½ X ¾. An 8-pin octal socket was used for the power connector. The writer explained some power supply theory as you read the article and included the usual precautions on discharging "the filter condensers by closing the key for a second or two." However, if you did not wire up the transmitter properly, which was a distinct possibility for the new Novice builder, a hazard existed with this procedure of using a key to discharge the filters. You also have to

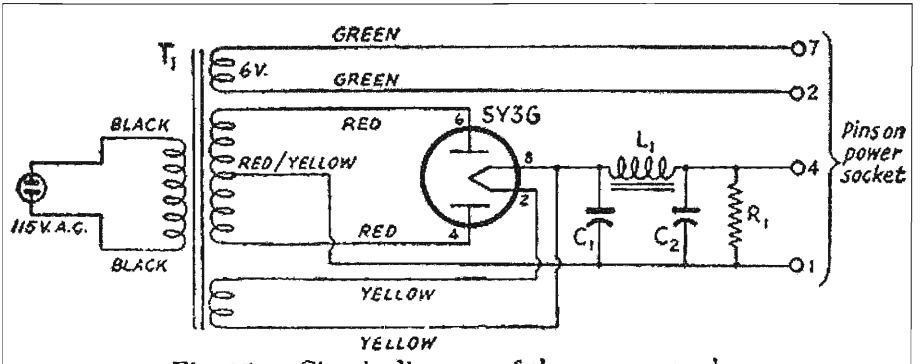
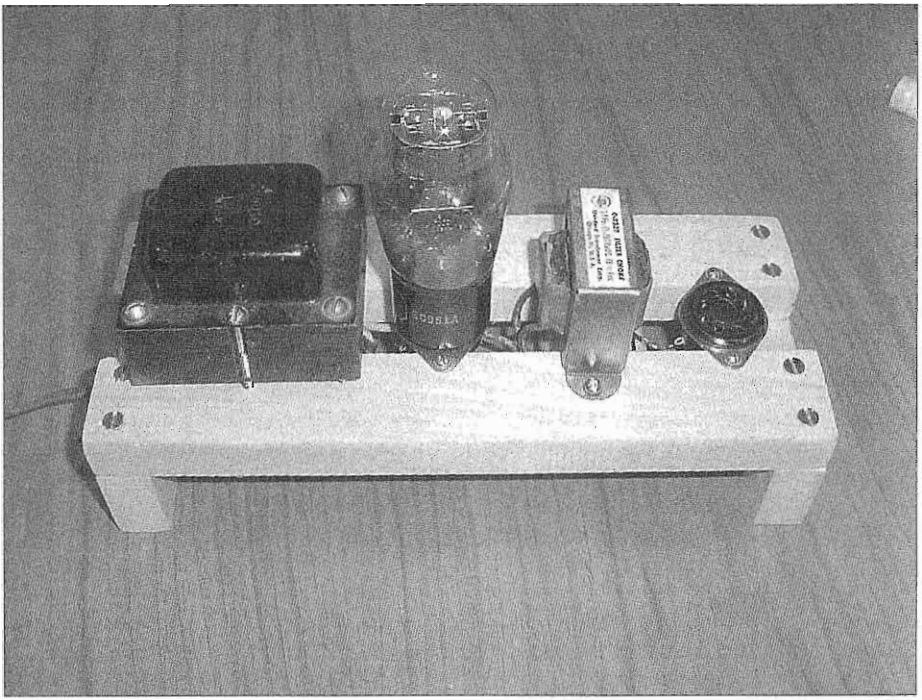


Fig. 17 — Circuit diagram of the power supply.

Power Supply

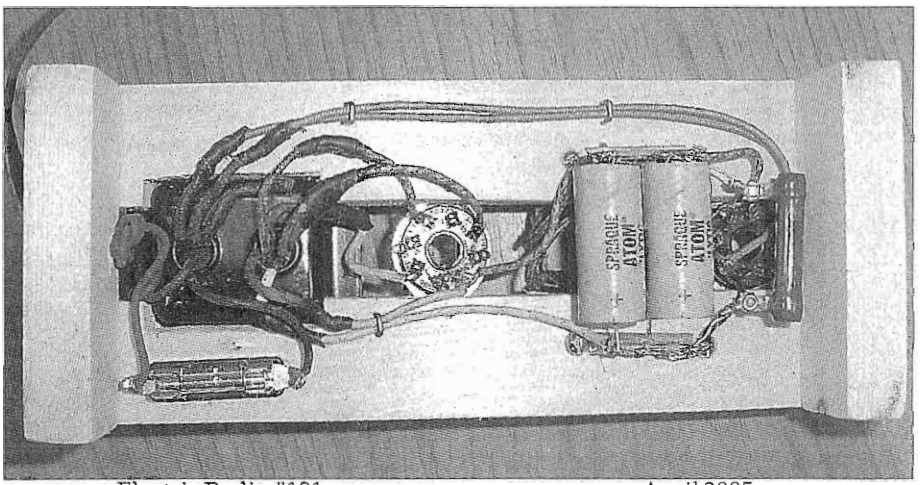
The 5Y3 power supply was also constructed using the famous wood slat technique to form the top of the chassis using 10 X 1½ X ¾ wood stock. The ends were made out of the same stock and measured 4 X 1½ X ¾. An 8-pin octal socket was used for the power connector. The writer explained some power supply theory as you read the article and included the usual precautions on discharging "the filter condensers by closing the key for a second or two." However, if you did not wire up the transmitter properly, which was a distinct possibility for the new Novice builder, a hazard existed with this procedure of using a key to discharge the filters. You also have to consider that with the transmitter design, when changing the plate coil, you have to remove it from the two exposed bolts on top of the chassis. R1, the bleeder, was a power resistor and was 25,000 ohms so this provided some measure of



Above, a top view of the 5Y3G power supply and its wooden chassis, and below is a peek underneath the chassis that shows the "works."

protection. There was no fuse included in the original construction and I added one.

The transmitter testing paragraphs included some old tricks that are worth repeating. First it was suggested that a small 10-watt bulb be connected to the antenna output clips and then tune for maximum output. This was described as a "dummy load." What they didn't tell you was that you could reach across half of Lexington, Kentucky with that light



bulb load and do some bootleg practice QSO's while waiting for the license that took six to 8 weeks to arrive! It was also mentioned to just touch a neon bulb to the bolt of the plate end of L-3 for signs of oscillation and output. Look carefully at the original picture and you will see the neon bulb and, of course, there is one in the model.

The wooden dowels that support the coils allow easy movement of the antenna coil for best coupling. But the best tip of all was the suggestion of inserting a flashlight bulb in series with the antenna lead and tuning for maximum glow, this of course assisted the operator in tuning for maximum current, an excellent suggestion for today's operators who spend endless hour adjusting tuners and SWR bridges in search of the sacred 1:1 SWR reading. Some tricks that they didn't mention were the use of a carbon pencil to draw an arc and the use of a bulb with a two-turn loop for coupling to the final coil for testing. See **Figure 1**, page 36. All of these "tricks" need to be used with caution and should not be used higher-powered transmitters. No mention of the possibility receiving RF burns was made in the article; it left that new and interesting experience unexplained.

Receiver construction

Whether or not Don Mix designed the receiver is not known, perhaps the whole lab team worked on it. Looking at the ARRL QST articles index, it appears that Mix was more of a transmitter man, but he did publish a couple of receiver articles including a battery receiver in 1940 using a 1T4 and 1S4 combination. However, the single-tube receiver design in this manual using a 3S4 had no audio amplification. Only the very strong signals could be heard. My rough test without trying to exactly match the output of the signal generator indicated that the very minimum detectable signal by my ear was around 20 microvolts using a pair of 2000 ohm headphones and the room had to be very quiet. So, the question is, did that operator in the picture actually have a QSO with those W7's and W6's that have their QSLs on the wall? But, I guess if that young novice could hear a station, then his 4 watts could be heard by the other station.

When constructing the receiver, leave the coil windings slightly loose on the 1-inch diameter coil form. This will allow you to make minute adjustments on the coupling. I tried a lot of combinations and could never get a single coil to cover both 80 and 40 meters, so I constructed two coils.

The additional of a band-spread cap is a must, and allows a nice coverage of the bands. On 40, I wound up with 45 dial divisions on the National BM dial to cover the entire band. The "gimmick" cap on the

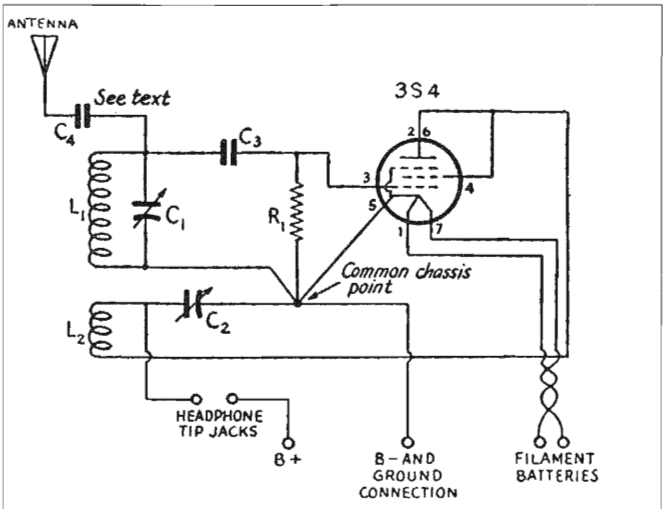
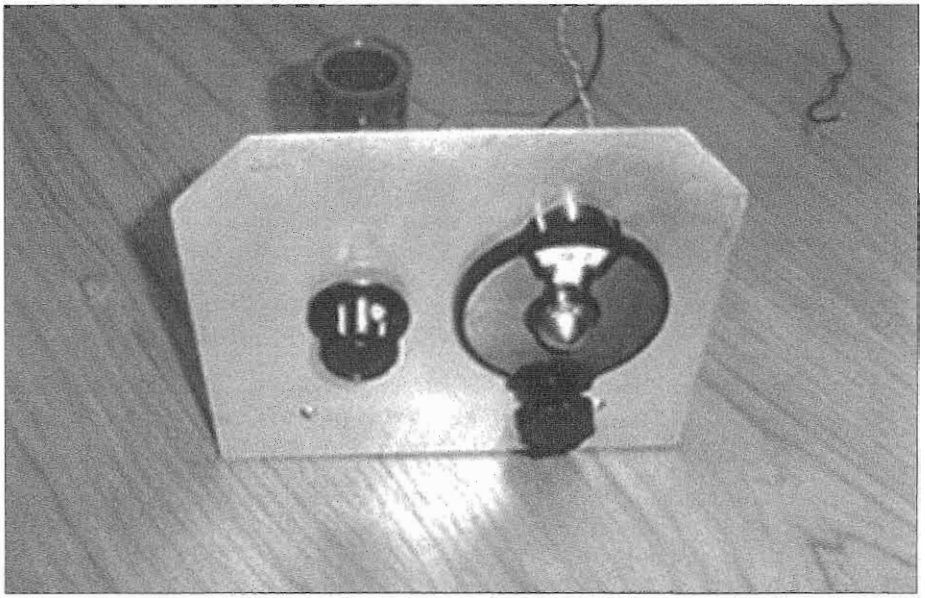
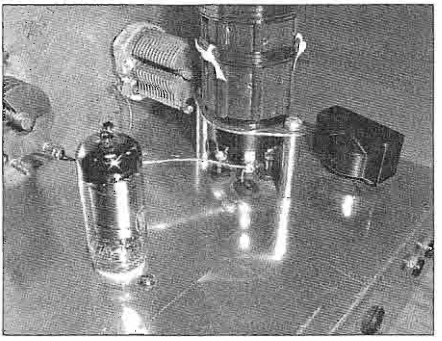


Fig. 9 — **A schematic diagram of the wiring of the simple regenerative receiver.**



Above: The front view of the 3S4 receiver with its vintage National BM main tuning dial and the bandspread tuning adjustment on the left side of the panel.

Below: A look behind the panel shows the coil and tube locations, and also the leads that connect to the antenna, power supply, and headphones.



Above: A closeup photo of of the 3S4. Below: Underneath the receiver chassis.

antenna line can be adjusted for best response and should take a couple of turns. Be sure and have a "common chassis point" designated on the receiver. The receiver chassis photo shows the detail of mounting the coil socket and above chassis components. Under the chassis is fairly simple and direct point-to-point wiring is used.

Overall, modeling and duplicating the station was an enjoyable experience, it was pleasant drifting back a few years. Some unanswered questions are: Who was the operator, as no one seems to know? Did the station really exist, or was it just thrown together for the photo? Since there were no Novice QSL cards present on the wall it must be assumed that the photo was taken either before the Novice license, or the home brew equipment was not operated as a novice station at all.

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1. "How To Become A Radio Amateur", ARRL, 1956, Pgs. 13-24.
2. "Looking Back", Lew McCoy, W1ICP, Electric Radio #96, April 1997, pg. 2.
3. "Crystal Socket Hint". "Hints and Kinks", Joseph Unterkofler, WN3WZX, QST, June 1954, pg. 42.
4. "Tube Pad 5.0", Gary Johanson, WD4NKA, http://www.qsl.net/wd4nka/form.html
5. "Compact Battery Receiver for Station or Portable Use". Don Mix, W1TS, QST, Feb. 1940, Pg 18.

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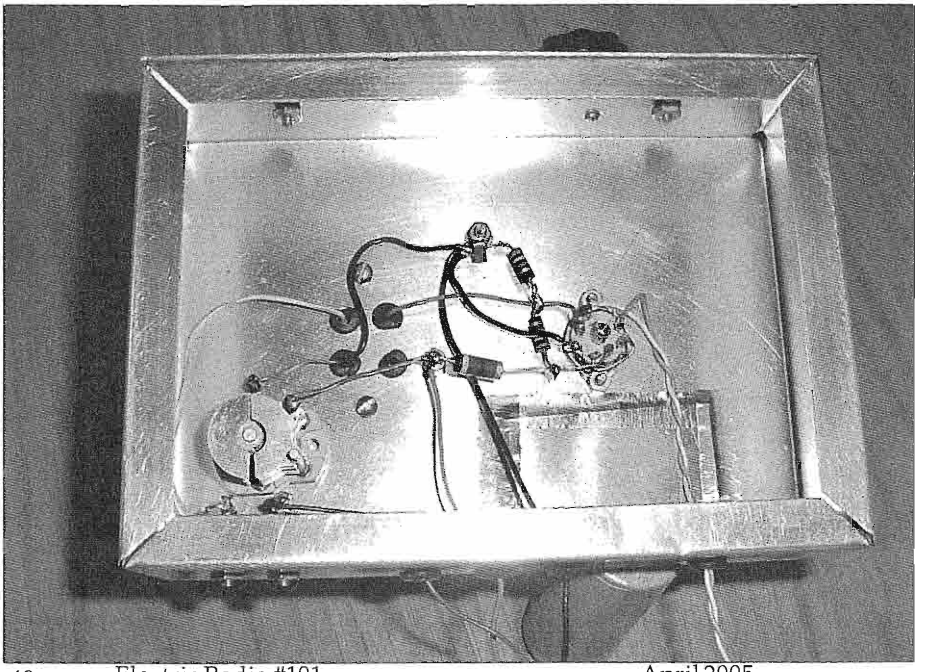


A Classic Transmitter-Controlled Computer

By Towers, J. H.
and
Duncan, J. M.

Introduction

Classic rig enthusiasts are frequently looked upon as being out of step with technology and not following the spirit of amateur radio by advancing the art. The authors have addressed these issues by developing a transmitter that represents the finest classic rig heritage while balancing it with modern computer technology. However, since the authors approached this from the perspective of a classic rig, not a computer, the transmitter embodies several unusual characteristics. So the elegance of this integration approach can be more easily appreciated, a simple single band crystal controlled oscillator and straight through amplifier (MOPA) form the heart of the transmitter. The rig is shown in **Figure 1**, Classic Transmitter Controlled Computer (CTCC)

Technical Information Transmitter

The transmitter is based on the tried and true MOPA configuration using a crystal-controlled 6V6 oscillator driving a 6L6 amplifier. It is patterned after the well-known "Longfeller" transmitter first presented by David Middelton, W2OEN in the July 1946 issue of QST. Since this article concerns the integration of a computer with this classic transmitter, the reader may review the details of the transmitter in Middelton's article.

Computer

The computer selection was made considering both the desire to use the latest technology and recognizing that the role of the computer was to support the transmitter, not the opposite as is seen in many modern day rigs. The overall requirement for the computer is simplicity of operation – the computer should not get in the way basic operations such as keying the oscillator or dipping the final.

The computer is specifically designed for this application and has no other functions. It does not include Solitaire, will not do word processing nor connect to the Internet. This design approach was taken to assure that whenever the Ham wants to use the rig, there would be no competition from a harmonic wanting to do homework or the XYL wanting to play games or look up sewing information.

The primary computer functions are discussed below. Because the computer implementation is so straight forward, no specific technical details are provided here – they are left as an exercise for the reader.

Controlling and indicating primary power. The most straightforward of techniques is to control the power to the computer through the transmitter power switch. This is contrary to the modern conventional wisdom seen in many computer-controlled rigs today in which the transmitter cannot be turned on unless the computer is on. Due to the authors' transmitter-to-computer design philosophy, the computer cannot be turned on unless the transmitter is turned on.

Assisting in Tuning the Transmitter to Maximize Output.

Since the transmitter is not shielded, nor is the computer, proper component placement allows development of a distinctive pattern on the computer screen that is a direct function of the output of the RF energy from the transmitter. Extensive research by the authors into reverse engineering of RFI control techniques provided guidance on making this a reliable indicator. To facilitate implementation of this feature and to maximize integration, the transmitter was built into the top of the computer case. Mounting the tubes on top of the case allows the operator to enjoy the glow of the filaments and facilitates tube replacement if that would ever be necessary.

Monitoring Transmitter Parameters

There are a number of critical elements

Figure 1

that must be operating properly for the transmitter to function so the computer is used in monitoring these. The first is the filaments of the tubes. A small infrared sensor is located near each of the tubes so the filaments can be viewed. (A thermocouple is used on the 6L6 since the filament is not visible through the metal tube.) The output of these sensors is then converted to binary data for the computer and processed through appropriate software to determine if the filaments are on and, if so, generates an icon on the computer screen resembling a tube with the filaments lit. Notice how this design is consistent with the authors' philosophy of not letting the computer interfere with the operation of the transmitter. Another parameter monitored is the 6L6 plate current. An appropriated shunt is placed in the B+ line and an a-to-d converter is used to convert the voltage drop across the shunt, which is proportional to the current, into a digital word which software in the computer will translate into the number of milliamperes flowing through the shunt. This will be displayed on the computer screen in a graphic resembling a moving vane meter.

Redundancy

The reliability of computer-controlled equipment has always been a concern. Recall that on some US space vehicles the computers are quadruple redundant – four computers just to be sure one works! Classic transmitters however have a greater sense of reliability about them. The only time one sees redundancy in a classic transmitter is when two tubes are in parallel and that is really to just increase the output. This sense of confidence is understandable given the mature and proven nature of the classic rig technology and the age of the components in the average ham's junk box. As an example, recall the computer display of the plate current on a graphic resembling a meter. The transmitter design includes an external meter measuring the plate current. In this way, if the computer is not functioning due to a virus, you can still tune the rig using the meter. There is a possibility of failure in the somewhat complex method used by the computer to provide an indication that the filaments of the tubes are heated. Locating the tubes on top of the computer case so the Ham can just look at them or, in the case of the metal tube, touch it to see if it is hot compensates this for. Also, recall that the computer display is used as an output tuning aid using the reverse engineered RFI techniques. To allow for the possibility of computer failure, an NE-51 neon bulb is located near the antenna terminal on the transmitter to facilitate tuning.

Conclusion

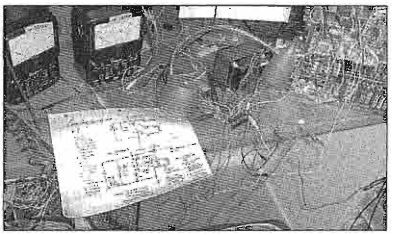
The authors' undertook this challenging project to demonstrate that even the most dyed-in-the-wool classic rig en-

thusiast could embrace modern technology and successfully integrate it with vintage technology. The design approach assures that the computer does not interfere with the operation of the rig thus overcoming a major difficulty many operators experience with modern day rigs.

We enjoyed this project and look forward to hearing from anyone that attempts to follow in our footsteps and develop their own classic transmitter controlled computer. All feedback will be accumulated and published next April 1st.

ER ☺

The Restoration Corner



Tips from the Workbench

By Bruce Vaughan, NR5Q
504 Maple Drive
Springdale, AR 72764

Some sage once said that the most unexpected event in a man's life is old age. I suppose I too was caught by surprise. During the past year I notice that radios that once took me two weeks to build now seem to take forever. Suddenly I realize that the radio building part of my life is drawing to a close. I am currently working on a radio I call my 'Swansong' receiver. This is my last large project. I intend to stop building entirely later this year.

As I pondered this decision I got to thinking that perhaps some things I have learned during my 70 plus years of building and repairing radios might be of value to the younger generation of builders and/or radio collectors.

Tuning capacitors: Several years ago I built a receiver which almost drove me nuts. It worked, and worked well, but it was intermittent. A jolt to the table, a gentle tap to the front panel, almost anything might produce a burst of static, and then silence. Cold solder joints can happen, but they have not been a problem with me for years—yet this is exactly what the radio seemed to have.

I'll skip the chase as it lasted three days, and get right to the point. I was using a beautiful NOS, brass plate, SLF, (straight line frequency) tuning capacitor, circa 1925. There was corrosion between the stator plates, and the 'all thread' 8/32 brass rod that was used to mount the stator plates. The cap looked OK, and tested OK, but occasionally this corrosion resulted in a high resistance connection. Disassembly followed by a thorough cleaning and reassembly cured the problem. Lesson learned—just because a part looks good, and tests good, is no guarantee the part is good.

Years ago when I worked on the service bench at least 9 hours a day I thought I was a reasonably competent radio repairman. As such, my income was in direct proportion to my speed in locating problems, and completing the necessary repairs. It really hurt when a simple radio took a lot more time to repair than you could charge the customer for. This was in the golden years of the 'All American Five" type radio—12SA7, 12SK7, 12SQ7, 50L6, and 35Z5. I remember getting one on the bench that literally ate up most of a day. The IF tuned up beautifully. That eliminated everything but the front end. The trouble had to be in the 12SA7 cir-

cuit. It can't take long to test everything there, yet I could not get the set to operate. Finally I aimed a strong light at the variable cap and saw ONE DROP of something between the plates. It looked like oil but I seriously doubt that oil is a good enough conductor to kill the signal. Whatever it was, it kept the set from operating. I tore off a small piece of paper towel and slipped it between the plates to absorb the oily-appearing substance. Operation was restored.

And of all things that will run you up the wall is small dust-like particles of metal between the rotor and stator plates. I have no idea where they come from, but they are not all that rare. Maybe they are a leftover from the factory where the set was built. My custom years ago was to take the set outside and pour a liberal dash of carbon tetrachloride through the capacitor plates. That was before we knew carbon-tet was pure death to use. I bought it by the gallon at the corner drugstore—$3.50 per gallon.

I found the best way to clean such a capacitor was to vaporize the dust-like metallic particles. Disconnect the capacitor from the circuit, and apply voltage across the capacitor and apply voltage—12 volts DC usually did the job. On especially bad cases I have resorted to higher voltages. Of course, this was when dollars were not easy come by, and most service shops did not have the luxury of a good air compressor.

Pilot light replacement: Today I bought two #47 pilot bulbs at Radio Shack for $1.59. With our 9% sales tax, that adds up to almost 90 cents per bulb. When I closed my shop I was paying 78 cents for a box of one dozen. At that price, we could afford to be unconcerned about dial bulb cost. Today it is different. Frequent bulb replacement can become costly as well as an inconvenience. For years it has been standard routine in my shop to solder a 10-to-15 ohm resistor in the 6-volt supply to dial bulbs. Doing so greatly prolongs the life of a bulb. Bulbs, when run at reduced voltage, seem to almost never need replacing, and they still are bright enough for most uses.

OK, here is where our long suffering Editor gets mail—especially from serious-type collectors. When replacing fixed capacitors or resistors in a circuit, they are often tied to a tube connection lug, or other common soldering point. Years ago we were all taught to first make a good mechanical connection—then apply solder. Fifty years of printed circuits have proven the fallacy of this nonsense. In the 'good old days' the boys at National, Hallicrafters, Hammarlund, and many other manufacturers not only made a good mechanical connection—they took pride in mechanical connections so secure that they refuse to yield to any normal amount of persuasion. Very often, when trying to unsolder a component, you will do damage to other parts—some of which may be difficult to replace. Therefore, my method is to clip the leads of the part to be removed, leaving at least ¼ inch of lead remaining to the 'good mechanical connection' point. Take a length of #20 or #22 solid, tinned wire and wrap about a dozen turns or more around a slightly larger piece of wire than the lead on the component to be installed. Clip off ½ inch of this coiled wire—it looks like a small spring. When your replacement leads have been trimmed to proper length slip this spring over the ends of the two wires to be joined. It takes solder beautifully and don't look at all bad. Best of all, you have not damaged a tube socket, control lug, or whatever else was used as a tie point—and you have a very solid connection. You can buy tinned connection sleeves at Radio Shack but all I have found are far too large.

A few years ago I discovered JB Weld®. How I wish someone had told me about it long ago. I suppose it is common epoxy cement, but you cannot believe how well it works. The uses on the workbench are unlimited. It seems I discover a new use for it weekly. JB Weld® comes in a two-tube package and costs about $3.00 at auto supply stores, home supply stores, discount stores, even large supermar-

kets. To use, squeeze out equal amounts from each tube, mix thoroughly, apply to almost any clean object, and press it against a clean surface and forget it for 24 hours. When it is fully set up it makes a permanent bond. I use it quite often to mount surface mount fuse holders in older radios. I dislike drilling holes in a radio chassis because of the darn metal chips. Use of JB Weld® takes the work out of many radio component mounting problems. I have salvaged a number of variable capacitors that had broken ceramic insulators.

Speaking of fuses—I don't like to modify older radios. Most modifications leave the radio much less desirable than it was before modification. I make an exception when it comes to fuses. Very few older sets, especially BC sets, came from the factory with a fuse installed. It costs less than a dollar, and takes about five minutes to install a fuse in the 120-VAC line. Such a modification is almost 100% sure to prove cost effective. I use a surface mount fuse holder, and two 'dabs' of JB Weld® to attach the holder to the chassis. You probably have discovered that some very reputable manufacturers of Ham gear deliver their lower priced models without a fuse. I cannot understand this practice as the cost of adding a fuse holder and fuse is less than one dollar. While you are at it install a similar fuse holder on the chassis topside, near the back. Put a spare fuse in this holder. Nothing is so exasperating as to blow a fuse, and find that you do not have a spare in the shack.

Don't throw old volume/tone controls away. Break them apart and salvage the threaded bushing. These make ideal ¼" shaft bushings. Older controls will have enough threads to go through a plywood or bakelite panel.

How many times have you skinned a knuckle and used inappropriate language trying to mount one of those tube sockets that use the wavy spring clip to hold the socket in place? For years I thought I was doing something wrong—nothing could be that difficult to use. Be that as it may, I finally got a handle on the problem. I simply take my file and knock off a little of the tube socket lip thus allowing another 1/32" of room for the clip. They hold tightly enough, take seconds to install, and you don't end up with a bunch of scratches in your pretty aluminum chassis.

National ACN dials are getting old—they have not been made for years. The paper scales are quite often dirty, yellow, and/or ragged. When you get one in fair to good condition, take it to your local copy shop and have a dozen or so copies made on white heavyweight stock. They can increase contrast and drop out a lot of the damage that shows up on the original.

Old radio dials with 0—100 markings are often available at Hamfests or on eBay. 99% of the time they are missing the little panel mount marker that goes above the dial. Take a 6/32 or 8/32 by ½" slotted head screw; spray the head with black paint. When dry, rub white toothpaste into the slot and let dry. The results are very professional appearing.

I am sure you have encountered a need to drill another hole in a chassis when a project is well underway. There are sure to be metal chips on the chassis underside when any hole drilling or filing is necessary. One easy way to remove such metallic particles is to pick them up with masking tape. Tear off a short section of tape and press the sticky side to the area and it will pick up the small metal particles.

One last thought. There is a lot of test equipment on the market, most of it useful. However, the very best aid in repairing or building a radio is past experience. If it is something you only do occasionally do not expect a miracle, and do not become discouraged. I never start building a radio with any negative thoughts. I know the thing will work when finished—only two questions remain. When will it work, and how well will it work?

ER

VINTAGE NETS

Arizona AM Nets: Sat & Sun: 160M 1885 kc @ sunrise. 75M 3855 kc @ 6 AM MST. 40M 7293 kc 10 AM MST. 6M 50.4 Mc Sat 8PM MST. Tuesday: 2M 144.45 7:30 PM MST.

Boatanchors CW Group: QNI "CQ BA or CQ GB" 3546.5, 7050, 7147, 10120, 14050 kc. Check 80M winter nights, 40 summer nights, 20 and 30 meters day. Informal nightly net about 0200-0400Z.

California Early Bird Net: Sat. mornings @ 8 AM PST on 3870 kc.

California Vintage SSB Net: Sun. mornings @ 8AM PST on 3860 +/-

Colorado Morning Net: Informal AM'ers on 3875 kc Mon, Wed, Fri, Sat, and Sun@ 7 AM MT. QSX KØOJ

Canadian Boatanchor Net: Daily 3725 kc (+/-) @ 8:00 PM ET. Hosts are AL (VE3AJM) and Ken (VE3MAW)

Collins Collectors Association (CCA) Nets: Tech./swap sessions every Sun. on 14.263 Mc @ 2000Z. Informal ragchew nets meet Tue. evening on 3805 kc @ 2100 Eastern time, and Thu. on 3875 kc. West Coast 75M net is on 3895 kc 2000 Pacific time. **10M AM net starts 1800Z on 29.05 Mc Sundays, QSX op 1700Z. CCA Monthly AM Night:** First Wed. of each month, 3880 kc starting @ 2000 CST, or 0200 UTC. All AM stations are welcome.

Collins Radio Association nets: Mon. & Wed. 0100Z on 3805 kc., also Sat 1700Z, 14.250 Mc.

Drake Technical Net: Meets Sun. on 7238 kc, 2000Z. Hosted by John (KB9AT), Jeff (WA8SAJ), and Mark (WBØIQK).

Drake Users Net: Check 3865 kc, Tue. nights @ 8 PM ET. QSX Gary (KG4D), Don (W8NS), and Dan (WA4SDE)

DX-60 Net: Meets on 3880 Kc @ 0800 AM, ET on Sun. QSX op is Mike (N8ECR), with alternates. The net is all about classic entry-level AM rigs like the Heath DX-60.

Eastern AM Swap Net: Thu. evenings on 3885 kc @ 7:30 PM ET. Net is for exchange of AM related equipment only.

Eastcoast Military Net: Sat. mornings, 3885 kc +/- QRM. QSX op W3PWW, Ted. It isn't necessary to check in with military gear, but that is what this net is all about.

Fort Wayne Area 6-Meter AM net: Meets nightly @ 7 PM ET on 50.58 Mc. Another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.

Gulf Coast Mullet Society: Thu. @ 9PM CT, 3885 kc, QSX control op W4GCN in Pensacola.

Gray Hair Net: One of the oldest nets, @44+ years ,160 meter AM Tue. evening 1945 kc @8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn

Hallicrafters Collectors Association Net: *Sun.* , 14.293 Mc, 1:15 PM EST/EDT. *Sat.* , 7280 kc, 1:00 PM EST/EDT. *Wed.* , 14.315 Mc, 6-8:00PM EST/EDT. QSX op W8DBF.

Heathkit Net: Sun. on 14.293 Mc 2030Z right after the Vintage SSB net. QSX op W6LRG, Don.

K1JCL 6-meter AM repeater: Operates 50.4 Mc in, 50.4 Mc out. Repeater QTH is Connecticut.

K6HQI Memorial Twenty Meter Net: This flagship 20-meter net 14.286 Mc running daily for 25+ years. Check 5:00 PM Pacific Time, runs for about 2 hours.

Midwest Classic Radio Net: Sat. morning 3885 kc @ 7:30 AM, CT. Only AM checkins. Swap/sale, hamfest info, tech. help are frequent topics. QSX op is Rob (WA9ZTY).

Mighty Elmac Net: Wed. nights @8PM ET (not the first Wed., reserved for CCA AM Net), 3880 +5 kc. Closes for a few summer months QSX op is N8ECR

MOKAM AM'ers: 1500Z Mon. thru Fri. on 3885 kc. A ragchew net open to all interested in old equipment.

Northwest AM Net: AM daily 3870 kc 3PM-5PM winter, 5-7 PM summer, local. 6M @50.4 Mc. Sun., Wed. @8:00 PM. 2M Tues. and Thurs. @ 8:00 PM on 144.4 Mc.

Nostalgia/Hi-Fi Net: Started in 1978, this net meets Fri. @7 PM PT, 1930 kc.

Old Buzzards Net: Daily @10 AM ET, 3945 kc in the New England area. QSX op George (W1GAC) and Paul (W1ECO).

Southeast AM Radio Club: Tue. evening swap, 3885 @7:30 ET/6:30 CT. QSX op Andy (WA4KCY), Sam (KF4TXQ), Wayne (WB4WB). SAMRC also for Sun. Morning Coffee Club Net, 3885 @ 7:30 ET, 6:30 CT.

Southern Calif. Sun. Morning 6 Meter AM Net: 10 AM on 50.4 Mc. QSX op is Will (AA6DD).

Swan Nets: User's Group Sun. @4PM CT, 14.250 Mc. QSX op Dean (WA9AZK). Technical Net is Sat, 7235 kc, 1900Z. QSX op is Stu (K4BOV)

Vintage SSB Net: Sun. 1900Z-2000Z 14.293 & 0300Z Wed. QSX op Lynn (K5LYN) and Andy (WBØSNF)

West Coast AMI Net: 3870 kc, Wed. 8PM Pacific Time (winter). Net control rotates between Brian (NI6Q), Skip (K6LGL), Don (W6BCN), Bill (N6PY) & Vic (KF6RIP)

Westcoast Military Radio Collectors Net: Meets Sat. @ 2130 Pacific Time on 3980 kc +/- QRM. QSX op Dennis (W7QHO).

Wireless Set No. 19 Net: Meets second Sun. every month on 7270 kc (+/- 25 Kc) @ 1800Z. Alternate frequency 3760 kc, +/- 25 kc. QSX op is Dave (VA3ORP).

CLASSIFIEDS

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MANUALS FOR SALE: Military Radio manuals, orig. & reprints. List for address label & $1. For specific requests, feel free to write or (best) email. Robert Downs, 2027 Mapleton Dr., Houston, TX 77043, wa5cab@cs.com

FOR SALE: URM-25D signal generator, excellent, 10 kc–50 Mc $40 OBO. BC433A Radio Compass $30. 281-996-5835 TomN5aca@juno.com

FOR SALE/TRADE: 2 Gates BC1-F's, one running on 160 meters with modulation problem, one still setup on broadcast band, spare Raytheon plate and modiron, Gates modmonitor, Gates Yard mixer, Harris audio Processor System mixer, SP400 with brand new power supply, NC300 with band Spread Knob, aluminum 8 foot rack. Illness forces selling, cost $3000 or Trade for T368/75A4 etc.; complete set of QST bound Dec 1915 to date with many bound spares 20's, 30's, 40's, 50's $4500.00, trade, BO; SP600JX14 $450.00. Office phone 330-427-2303, nursing home phone 330-270-8350 ext. 7031, K8CCV. Buyer pickup.

FOR TRADE: Collins TCS-12 package w/ AC PS. Museum quality Western Electric 353-E1 BC xmtr on 1925kHz. Hammarlund RBG. Signal Corp Control Unit C-113A/TRA-2 (for AN/TRC-3). Globe King 400B. Gary, WA9MZU, 209-286-0931 (CA) or ghal@ix.netcom.com.

FOR SALE: Electronic keyer, Ten-Tec KR-50, no manual. Excellent, $50. Len Gardner, 458 Two Mile Creek Rd, Tonawanda, NY 14150. radiolen@att.net

FOR SALE: Collins R390A S/N 1543, covers, clean, $1,395. Johnson Viking 500 $3,200 nice. Palomar Skipper 300 linear amp, $265 exc. Heathkit HW-100 $85. MFJ 981 3-kw tuner $195. National NC-188 $175. Ron, MI, 517-374-1107.

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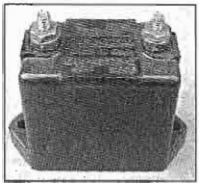
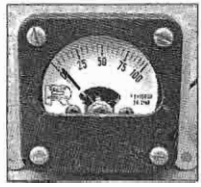
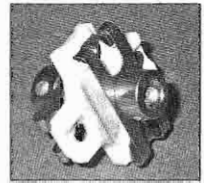
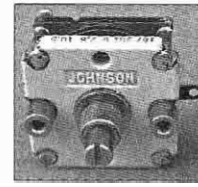

Aerovox 0.0011 mfd 5000 volt, mica transmitting caps - $15.00
DeJur 0-100 microamp, panel meter, 1.75" square. (Removed from equipment) Many of our customers have used this meter to make a carrier level meter for their R-390 receivers. - $10.00
Johnson 250 ceramic shaft couplers 1/4" to 3/8" - $10.00
Johnson 167-201-6, 2.8-10.5 pf air variable - These are new but the equipment manufacturer we got them from cut off two of the 4 terminals - $8.50
Johnson 124-311 tube sockets for 8122, 8121 etc - missing pins 2 & 10 - $8.00
Millen 39001 flexible, insulated shaft couplers - $8.00
National HRP knobs - bakelite - $0.75
Stancor 230 v to 117 volt, 150VA autotransformers - $15.00
Thordarsen 21F09 117 volt primary, 6.3 volt CT - $5.00
Door-knob capacitors, 500 pf 15 KV - $4.00
Two-section 270 pf air variable capacitors - $5.00
Signal DL 68-6, Dual 120 prim, dual 34V CT sec @ 6 amps - $20.00
McGill 3PDT toggle switches - $2.50
7 pin minature tube sockets - $1.30
Octal tube sockets - $2.00
Ceramic coil forms 3/4", brass slug tuned - $3.00
Amphenol 11 pin sockets (R-390) - $5.00
Amphenol 9 pin sockets - power cable connectors for Collins 51S-1 - $10.00

Tube Specials

Tubes, tested pulls	Tubes, New Old Stock
4-250 $50.00	0D3 $3.00
4-400A $75.00	2C40 $35.00
4X150A $15.00	2E26 $5.00
6AU6 $1.25	3V4 (ballast) $8.00
6C4 $1.00	6-4B(ballast) $6.00
6DC6 $5.00	6AC7 $4.00
6SG7 $3.00	6AG7 $5.00
6SH7 $1.50	6E5 $20.00
6SK7 $1.50	6V6 $11.00
6SJ7 $2.50	7A8 $3.00
803 $20.00	615 $3.00
811 $20.00	816 $20.00
813 $22.00	1629 $12.00
805 $50.00	5651 $3.00
8008 $25.00	5755 $5.00

We have thousands of parts and tubes. If you need something, give us a call or check our website. Or pay us a visit — Leeds is only 20 minutes from midtown Manhattan by subway, and we're open Monday, Tuesday, Wednesday, Friday, and Saturday. Find a bargain or a treasure!

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718 963-1764, www.leedsradio.com

FOR SALE: Gates High Watter 2890 frequency monitor, neat, has oscillator, crystal oven, several tubes, power supply, good overall condition, part of AM broadcast transmitter; Motorola FM TRU 140 B, FM mobile police type transceiver, good condition, has remote head, connectors and cables. Will trade, sell for cash. See our want ad this issue. Ward Kremer, 1179 Petunia Rd., Newport, TN 37821, Ph/Fax: 423-625-1994, Please note new email: witzend99@bellsouth.net

FOR SALE: Sony 350 reel to reel, exec. Condition, with 23 seven inch tapes. $45 + UPS. Johnny Umphress, 1415 Moore Terrace, Arlington, TX 76010, 817-915-4706

FOR SALE: Hammarlund HQ-140X, excellent condition, works good, with original speaker and original manual, I'm 2nd owner. $150 + shipping. Jerry, K5ULB, 918-724-8272

FOR SALE: Cleaning house and selling out after 70 years a Ham. LSASE for extensive list of equipment new and used. John Snow, W9MHS, 1910 Remington Ct., Andover, KS 67002 or 316-733-1856

FOR SALE: Cushman Service Manuals for CE-4/CE4B Comm. Monitor $25, CE-15 spectrum monitor, $20 shipped. 864-855-9570, k4deejim@aol.com

FOR SALE: Rare Heathkit HX-11 transmitter, see ER#72, like new, $200. Stuart T. Carter, W4NHC, 680 Fernwood Dr, Melbourne, FL 321-727-3015

FOR SALE: Johnson Challenger $130. National NFM83 $45. National XCU300 $55. Field phones TA32PT $45. All plus shipping. Bill, 989-848-5002

FOR SALE: Hickock Signal Generator Model 288X, needs work, $25 plus shipping. John, W2PRR, 585-671-4228 or jandjm130@peoplepc.com

FOR SALE: Heathkit Apache $30. 60" rack $50. Pick up only. Herb, K9GTB, 618-362-6539

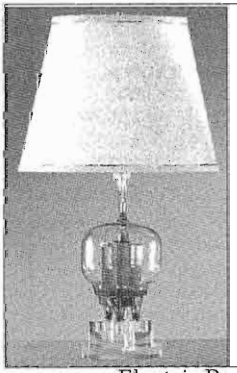
FOR SALE: Hammarlund Telechron clock plastic face covers, crystal clear, new reproductions, $15 plus shipping. Rick Cutter, WA3MKT, 814-725-9490, richard_cutter@lord.com

FOR SALE/TRADE: Mobile rig manuals: Babcock, Lysco, Sonar, Stancor, Subraco, Morrow, Johnson, Elmac, Gonset, Clegg, other. NI4Q, POB 690098, Orlando, FL 32869. 407-351-5536 ni4q@juno.com

FOR SALE: Ameco PT preselector (6EH7 amplifier) and AC distribution center. 1.8-54 Mc, 4 band, $20 + shpg. H. Mohr, 1005 W. Wyoming, Allentown, PA 18103-3131

CRYSTALS FOR SALE: AM and CW FT243 CRYSTALS - NEW LIST: 1885, 1900, 1930, 1945, 1970, 1985, 3721, 3837, 3855, 3870, 3875, 3880, 3885, 3890, 7018, 7050, 7123, 7143, 7250, 7255, 7260, 7280, 7285, 7290, 7293, 7295, 8400, 10106, 14286 kc. Many others available - See list at http://www.af4k.com/crystals.htm or call Brian, AF4K on 407-323-4178 af4k@hotmail@com

QSLs FOR SALE: Your old QSL card? Search by call free, buy find at $3.50 ppd. Chuck, NZ5M, NZ5M@arrl.net



BUSINESS FOR SALE

Classic Tube Lamp Collection business for sale. All tubes, lamp parts, and sales flyers are included. For complete details please contact Donna by telephone at 973-751-2591 or by e-mail at Dloc111111@aol.com. My FAX number is: 973-751-8553.

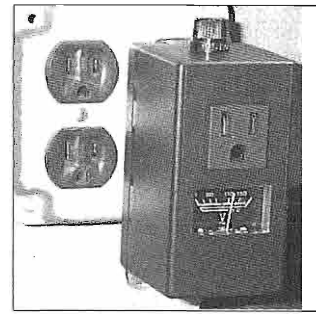
Left: WWII-era Western Electric Transmitting Triode

Right: WWII Radar Tube Formerly Classified "Secret."

Inrush Current Limiters are now available from the Electric Radio store! These inrush limiters were reviewed in the September, 2004 issue of Electric Radio and are available in two versions:

ModelAB-1M (With Voltmeter) $34.95
Model AB-1 (With Pilot Light) $29.95
Shipping $4.95
(4 or more limiters are shipped for free for U.S. orders.)

The Inrush Limiter provides a gentle, slow startup for your vintage equipment in the 150-watt range. They also reduce the line voltage to original design values. Both models come with a full money-back guarantee.



Model AB1-M

FOR SALE: Crosley model 51 tube rcvr $100. Swan 250C 6 meter rig w/PS, spkr, ext. VFO, orig. manual $175. 2 Allied FM rcvrs #2589: 30 to 50 Mc and 152 to 175 Mc $25 each. Heath Two'er $25. 3 Astatic mics $25 ea. Heath sig gen SG8 $25. Heath VTVM V9A $25. 2 Allied FM rcvrs $25 ea. 2 telegraph sounders $25 ea. Hallicrafters Super Skyrider $35. AK horn spkr Type M good, $125. 1927 Radio Operator's guide $25. 12 bound volumes of Popular Mechanics articles $60. ARRL handbooks 40s to 70s $25 ea. Many issues of Radio and The Horn Speaker. All + shipping. Vern Snyder, 5 Parkview Dr., Winder, GA 30680 1-770-307-1459

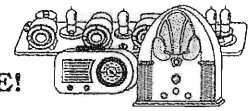
FOR SALE: Simpson 374 DC Microammeter, $60.00. Simpson 378 AC milliammeter, $60. Ross Wollrab, 229 N.Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385. REWollrab@aol.com Ross Wollrab, 229 N. Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385.

FOR SALE: Military whip antennas. EH Scott RBO-2 rcvr, needs can capacitor, $225. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777 989-595-6483

FOR SALE: Heathkit Apache transmitter model TX1 like new w/manual $300. Hammarlund HQ-170A receiver like new w/manual $300 OBO. Hallicrafters SX71 extra fine condx $300 OBO. Hallicrafters S53A like new $60. Hallicrafters S20R fine shape $225 OBO. Hallicrafters S22R fine shape $200 OBO. National model SW54 like new w/head phones $100. Layayette HE-80 like new w/speaker $180 OBO. Layayette HE30 like new $120. Hammarlund HQ-129X fine shape $200 OBO. Heathkit HW 100 w/ power supply, fine shape, $125. Heathkit HW 101 w/ power supply fine shape $125. Robert, K8VVG, 195 Ruth Ave, Logan OH, 43138. **740-385-2860** mac195@adelphia.net

DRAKE INFO FOR SALE: Drake C-Line Service Information. Hi-Res Color photos of boards and chassis with parts identified. CD also includes Hi-Res scans of R-4C and T-4XC manuals, various version schematics and more. Garey Barrell, K4OAH@mindspring.com, 4126 Howell Ferry Rd, Duluth, GA 30096. 404-641-2717

FREE SAMPLE!



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FOR SALE/TRADE: HQ-145 $150. Drake/ TR-4 w/ps $150. T-784/GRC-109 w/ps $150. RT-66/GRC $100. **WANTED INFO:** Radiomarine T-408/URT-12/USCG/1955. Sam KF4TXQ PO Box 161 Dadeville, AL 36853 stimber@lakemartin.net 256-825-7305

HALLICRAFTERS PARTS: Hallicrafters SX101/101A reproduction main tuning knob. Includes silver inlay and set screws. $35.00 Mike Langston KL7CD, 1933 Diamond Ridge Drive, Carrollton, Texas 75010, 972-392-5336

mlangston@hcpriceco.com

FOR SALE/TRADE: Transmitting/ Receiving tubes, new and used. LSASE or e-mail for list. WANTED: Taylor 204A, 211, TR40M and Eimac 500T. John H. Walker Jr., 13406 W. 128th Terr., Overland Park, KS. 66213. PH: 913-782-6455, E-mail: jwalker83@kc.rr.com

DRAKE SERVICE FOR SALE: R.L. Drake repair and reconditioning, most models including TR-7's, 35 years experience. Jeff Covelli, WA8SAJ, **440-951-6406** AFTER 4 PM, wa8saj@ncweb.com

FOR SALE: QUALITY LETTERPRESS QSLs LIKE IN THE OLD DAYS! Send $1 for samples. Smokey, W9STB, 8679 Pinkhurst Drive, Minocqua, WI 54548.

FOR SALE: QRP transmitter kits. Step-by-step instructions. Wood model, up to 5 watts 40/80M $15. "Tunatin" one watt 40M $10. You furnish crystal and power. Robert Larson, 1325 Ridgeway, Medford, OR 97504 W7LNG@arrl.net

FOR SALE: R-390A's, R1051's, Harris RF-550's, URM-25D signal generators, military 28VDC gas generators, AS-2851 antenna kits. Call, Lots more stuff! S. Daniels, 636-343-5263

FOR SALE: The Radio Handbook, 1939 edition, make offer. Fred Clinger, 417 Beechwood Dr., Galion, OH 44833 419-468-6117 after 6 PM.

FOR SALE: Gonset G12, Xcvr , citizens communicator. 4 ch. has 12 prong male receptacle on back. Heavy.$30. Lafayette HA 225 5 band rcvr clean $95. Stomberg

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SERVICE FOR SALE: Repair, upgrade, performance modification of tube comm. & test equip. Accepting most military, all Collins & Drake, & better efforts from others. Radio specific modification packages available, call. Work guaranteed. Chuck Felton, KDØZS, Felton Electronic Design, Box 187, Wheatland, WY 82201. 307-322-5858 feltondesign@yahoo.com

REPAIR! Radio repair reasonable charges. Manuals for sale. I buy Radios. J. Dan Rupe 998 Whipple Ave, Grayland, WA 98547 360-267-4011 W7ddf@yahoo.com

FOR SALE: Free list TT for obsolete Triplett transformers, chokes and manual copies. USA only. Bigelow Electronics, POB 125, Bluffton, OH 45817-0125

FOR SALE: Naval Receivers RAK, RAL, RAO, RBA, RBB, RBC, RBL, RBM. Some checked, pwr splys available. $75-$450 depending on condx. Many other types. Carl Bloom, 714-639-1679. carl.bloom@prodigy.net

FOR SALE: MFJ 1040B deluxe RF preselector II, $25. Gonset G-76 xcvr w/ homebrew PS, manuals $75. TenTec digital readout model 244, manual, $75. National NC-33 parts radio, $25. Jerry Whitmore, K9HAW, 1706 Hillcrest Ct, Mendota IL 61342, 815-539-7519

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TUBES FOR SALE: Tested good globe 201A $14, 226 $15, 227 $10 and others. Slightly weak tubes guaranteed to work in early radios ½ price shown. Write or email: tubes@qwest.net for a new price list or see www.fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281, 480-968-7686. Toll Free 877-307-1414

SERVICE FOR SALE: Vintage Radio Service. We repair radios, record changers, radios home, auto, tube & transistors. 1930-1980. Ken Hubbard, KA9WRN, POB 792, Beloit, WI 53512. 608-362-1896

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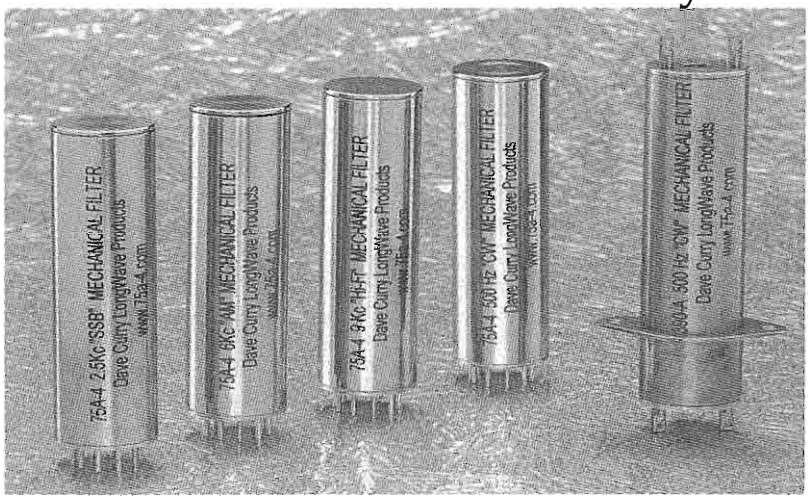
BOOKS FOR SALE: Radio books, magazines, catalogs, manuals (copies), radios, hi-fi, parts. Send 2 stamp, LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857. ka1edp@juno.com

The Collins Filter Family



By Application, Left to Right:
75A-4 2.5Kc 75A-4 6Kc 75A-4 9Kc 75A-4 .5Kc R-390A .5Kc

by Dave Curry Longwave Products

These are exact duplicates of the original filters using the latest, modern design Collins mechanical filters. The electrical specifications exceed the original Collins design.

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* SSB - 2.5 kc
* AM - 6 kc
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This Auction will offer many hard to find items that would enhance any collection, and will include:

A beautiful "Voice From the Sky" Speaker, Burns Tortoise Shell Orange Horn Speaker, Bristol Horn Speaker, Dictogrand, Jewett, Magnavox M1, Magnavox R-3, Riley-Klotz Auto Horn, Franklin, Kodel Microphone-Speaker, many other Speakers. Kodel Crystal Set, Martian Big 4, Martian Special, Fada, Pacent, Deforest DT-600 Crystal Set, Aeriola Jr. Crystal Set, Crystal Set on a Marble Base, a Wireless Specialty 1P-501, NESCO CN-240 – with the Lid – Browning Drake in a Glass Case, other Sets.

Deforest Interpanel Set, Deforest F-5, Deforest D-10 with Loop, Deforest D-17 with Loop, Deforest SP-2, Deforest R-4 (Original), Kennedy Type 110, Kennedy Type 220, Kennedy Type 521, Kennedy Type 525, Kennedy Type V, Kennedy Type VI, Kennedy Type 331 Portable 1 Tube Receiver, Air-Way Type 41, Airway Type F, Martian Beauty 1 Tube, Federal 61, Federal 57, Federal 110, Federal 102, Radiola I, Radiola II, Radiola III, IV, V, 25, 26, 24, 28 w/Loop, Atwater Kent Model 84 Cathedral, Atwater Kent Model 10 Breadboard, Model 12, Model 9, Model 8 Kit Type, Model 5 not factory, Grebe CR-8, Grebe Rork, Grebe CR-9, Grebe MU-1, Western Electric 7-A Amp, Magnavox AC-2 Amp, Magnavox AC3, Baird S.W. Converter, Etherphone RX-1, Melco 4 Tube, ACS-6 Tube Receiver, Pandora 5, Adler Royal 3 Tube, Paraco 1 Tube, Mercury Super 10, Sleeper 5 Tube made for RH Macy Co., Radio Craft D-4 Receiver, Radio Craft D5 Amp, Zenith Type 3R, Zenith Type 4R, Michigan 1 Tube Receiver, Two Tube Amp, Tri City 1 Tube, Jewett 5 Tube, Crosley Pup, Crosley Ace, Crosley Trirdyn new in the box, Crosley RFL, Crosley 50, 51, 52, V, VI, 51A.

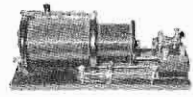
Amrad 2596 Tuner, Amrad 2634 Amp, National Monodyne 1 Tube w/Box Model GT1, Meteor Loose Coupler, Wm. Duck Loose Coupler, Gilfillian 3 Tube, Tuska 225, Harkness Counter Flex 3, Cutting Washington Type II, Silvertone Loose Coupler w/Detector, lots of other Battery Sets, Parts galore – some New Old Stock!

RA-DA, Kennedy 1000, Charlie McCarthy Radio, Lager Beer Bottle Radio.
Lots of Cathedral and Tombstone Style Radios, many beautiful Floor Model Console Radios!

This collection has more early Books, Magazines and Catalogs than we have had since the "Muchow" Auction.

We will be sorting these and getting a list ready.
This will be a Sale you will want to attend! Hope to see you there!

Terms: Cash/Check/Visa/MasterCard; 5% Gallery Fee



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ACCESSORIES FOR SALE: KWM2/S-line metal logo pins. Meatball or winged. Excellent replica of the original. Put one on your hat, badge, or replace a missing logo on your panel. $6.25 shipped. W6ZZ, 1362 Via Rancho Pkwy, Escondido, CA 92029. 760-747-8710, w6zz@cox.net

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BOOKS FOR SALE: Used technical books: radio, electronics, math, military, magazines, etc. List: $1 (stamps OK). Softwave, 2 Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

NOTICE: Visit Radioing.com, dedicated to traditional Ham radio & vintage radio resources. Let's Radio! Charlie, W5AM. http:/ /www.radioing.com.

BOOK FOR SALE: Heath Nostalgia, 124 page book contains history, pictures, many stories by longtime Heath employees. (See ER Bookstore.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028

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MISC FOR SALE: Vintage equipment at the K8CX Ham Gallery Classified Ads section. Visit the largest Antique QSL Card Gallery http:/ /hamgallery.com

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BOOKS FOR SALE: Lots of old radio & related books. Eugene Rippen, WB6SZS, www.muchstuff.com

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PARTS FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. 631-653-5350

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ACCESSORIES FOR SALE: Spun Aluminum Knob Inlays for most Boatanchors. Collins Dial Drum Overlays. Dakaware Knobs. Charlie Talbott, 13192 Pinnacle Lane, Leesburg VA 20176-6146. 540-822-5643, k3ich@arrl.net

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PLANS FOR SALE: Build your own "Midget" bug replication by KØYQX, ca 1918, featured by K4TWJ in CQ Magazine, May '98. 10 detailed blueprints. FAX: 507-345-8626 or bugs@mnic.net

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PARTS FOR SALE: Parts, tubes, books, ECT. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761 letourneau@wiktel.com

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SERVICE FOR SALE: Collins restoration. Everything inside & out to make it as Art Collins built it. 50 yrs experience. W9OJI/ N4FZ, IL, 815-734-4255 or N4PZ@aol.com

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PARTS FOR SALE: Complete hardware set to connect Collins PM2 to KWM2 - $19.95 ppd. Warren Hall, KØZQD, POB 282, Ash Grove, MO 65604-0282.

PARTS FOR SALE: New Release. For details send 2-stamp LSASE to: Olde Tyme Radio Co, 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910

EQUIPMENT FOR SALE: Military and commercial communications items. Murphy's Surplus, 401 N. Johnson Ave., El Cajon, CA 92020. 619-444-7717 www.Murphyjunk.com

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FOR SALE: IC730 $325 mic & book. Bill, K5WJB, 281-540-9866

TUBES FOR SALE: Tube list, new & used, wide variety audio, and Ham. Recently expanded. SASE 52c. Bill McCombs, WBØWNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212

ACCESSORY FOR SALE: RIT for Collins KWM-2/2A; No modifications needed. $79.95 SASE for details. John Webb, W1ETC, Box 747, Amherst NH 03031

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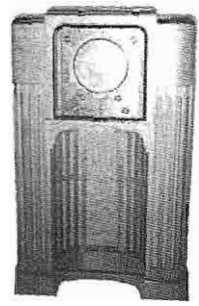

25 Tube Zenith Stratosphere

This beautiful radio will sell to the high bidder at our April 16 Radio Auction.

Chassis and Power Supply Serial Numbers match. Very good chrome on the chassis, all the Tube Shields are still with the set. Veneer on the Stratosphere Cabinet is in excellent condition. There are no speakers – they were discarded by the original owners.

This is a *Beautiful Radio* – it will be featured on our web page after April 1. ***A Rare Find!*** We will have a 4-hour preview the day before the auction (April 15). This will give everyone time to look it over and ask questions before the auction.

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WANTED: Collins R-389 LF receivers, parts, documentation, anecdotes, antidotes. W5OR Don Reaves, PO Box 241455, Little Rock AR, 72223 501-868-1287, w5or@militaryradio.com or www.r-389.com

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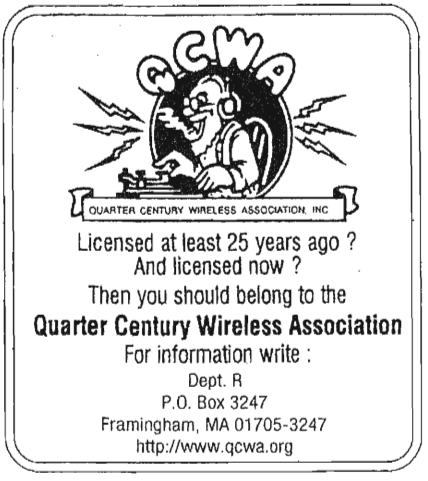

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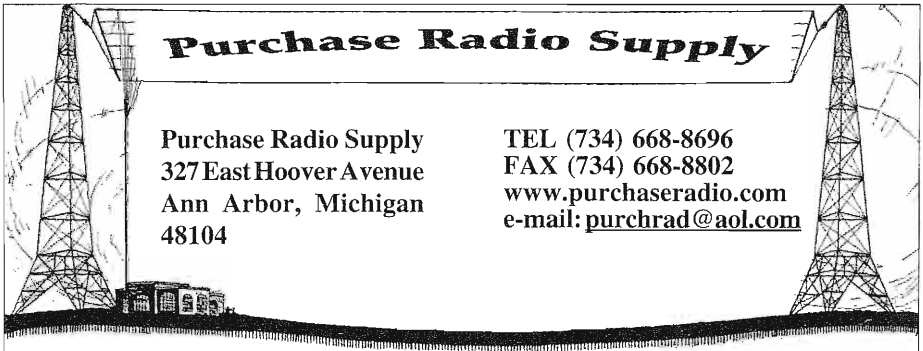

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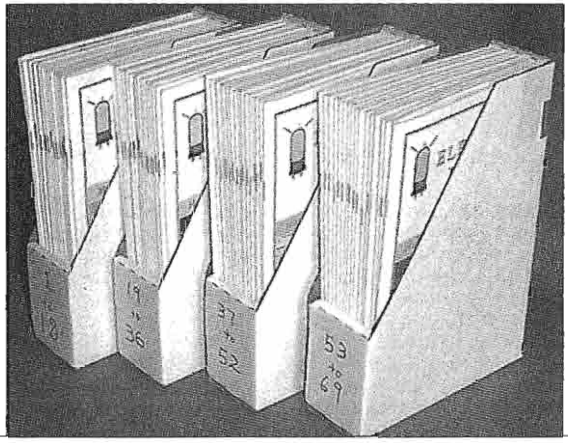

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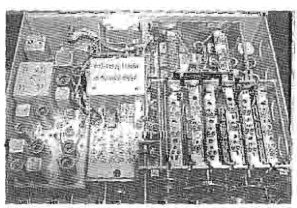

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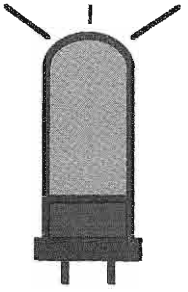

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