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ELECTRIC RADIO

celebrating a bygone era

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Paul Snyder, W8GLW

ELECTRIC RADIO

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Electric Radio is all about the restoration, maintenance, and continued use of vintage radio equipment. We focus mostly on amateur radio,military, and commercial equipment. 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. It is dedicated to the generations of radio amateurs, experimenters, and engineers who have preceded us, without whom many features of life, now taken for granted, would not be possible.

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, e-mail, or call.

Regular contributors include:
Bob Dennison (W2HBE), Chuck Teeters (W4MEW), Jim Hanlon (W8KGI), Tom Marcellino (W3BYM), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Bill Feldman (N6PY), Dave Gordon-Smith (G3UUR), Dale Gagnon (KW1I), Brian Harris (WA5UEK), John Hruza (KBØOKU), Hal Guretzky (K6DPZ)

Editor's Comments

USS Alabama Update

I've received an update from Stan Bryn (AC5TW) about the USS Alabama radio room restoration that I'd like to share:

"...As a result of the ad running in Electric Radio, I would like to update you on the progress of restoring the communications facilities aboard the USS Alabama (BB-60), now part of the Battleship Memorial Park in Mobile, Alabama.

To date I have received several communications from various readers of Electric Radio regarding the project. The interest ranges from direct participation to donations of equipment, all very gratifying to me. A note of interest is that equipment donations can be made as an income tax deduction against gross income. The Park, being a non-profit organization, will issue a certificate of acceptance for such items it receives as a donation, the value of which is to be determined by negotiations between the Park and the donor. I spent a couple of days, 8/3-5, aboard the ship returning equipment restored and picking up a truck load, eight receivers to be exact, that are in need of restoration. The transmitters, located on deck four will have to wait until next spring before I can get to working on them. Ray, this such a fun and interesting project that I would urge any of your readers to look around their area for Memorial Parks containing old WWII/Korean displays that may be interested in having their communications equipment restored with the eventual idea of getting them back on the air via Amateur Radio. ...To put it bluntly 'us old hams can do that'." I am really proud of the way ER readers have stepped forward to help Stan with this project.

A New Vintage CW Net

Listen for The BFO CW Net, meeting every Thursday evening at 7PM local time on the East Coast, 3693 kc. Net control is WY3D from Southern NJ. It is a very informal rag chewing CW Net. Most use a vintage transmitter or transceiver, but any transmitter or transceiver is welcome. 73, Ray, NØDMS

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Cover: Paul Snyder (W8GLW) is operating what appears to be an Eddystone 680-series receiver during February 1961. W8GLW became SK in 1962, and his shack was closed and undisturbed for 43 years. His story, written by Mike Monnier, begins on page 48.

Tinkering[1] with the Hallicrafters HT-6

By Jim Hanlon, W8KGI
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Well, Doc did it again. This time he came down with an FBX, Stancor 20P, and Hallicrafters HT-6 for me to "check out" for him. I barely had room for them! I stacked the two transmitters on the operating desk in my garage, an old post office roll-top that I've had since 1950 and that can hold several tons of equipment, while I checked out the FBX on my workbench. Typical of its breed, the FBX came right to life and took an alignment easily – no parts needed to be replaced outside of the 24A local oscillator tube that was a bit bouncy on 20 meters. And I must say that National's crystal filter in the FBX is a lot better than the Heathkit Q-Multiplier that I have on my FB-7. The Stancor rig needed coils to be wound, but fortunately the manual from BAMA[2] had directions and Doc brought some coil forms so that was no big deal. I'll write more about it in my next article. The HT-6 was last thing to go on the bench, and it was the one that I spent the most time with. Doc wanted to be able to use it on 80, 40 and 20 meters, both CW and phone, and accomplishing that required that I reconfigure the crystal oscillator a little so that it would give output on its second harmonic when called upon. Since I haven't found anything in the literature about doing that to an HT-6, I thought I would share my work with you folks who read ER on the possibility that you might want to do something similar with an HT-6 or perhaps another old time rig sometime.

The Hallicrafters HT-6 has been written up a couple of times in ER[3,4]. Mike

Figure 1: Doc's Hallicrafters HT-6. The round meter is not original.

O'Brien spins a great tale about its development, much of it in the words of Bob Samuelson, the Hallicrafters engineer who designed the HT-1, HT-4, HT-6 and HT-9. Chuck Teeters gives quite a few details about the HT-6's design and construction, and he points out several of its idiosyncrasies that any one contemplating using an HT-6 should pay attention to. For readers who have come in lately, I'll describe the HT-6 semi-briefly.

The HT-6 is a nominal 25-watt output, AM and CW rig that can cover the 80, 40, 20, 10 and 5-meter bands. It came out in 1939, selling for $99, and at least according to O'Brien and to Raymond Moore[5], it was built until 1945 or '46. Its RF lineup is simple, a 6L6 crystal oscillator driving an 807 amplifier. The 6L6 is configured as a straight, beam-tetrode oscillator on 80, 40 and 20 meters, and that means that you have to use a crystal at the desired output frequency for each of those bands. For 10-meter output the 6L6 changes to a Tri-Tet oscillator and uses 20-meter crystals to develop 10-meter drive for the 807. For 5-meter output, a 10-meter crystal is used in a separate 6J5 triode oscillator, and the 6L6 acts as a doubler to generate 56-mc drive for the 807. The 807 plate feeds a conventional parallel–tuned tank circuit that is link coupled through the bandswitch to output terminals on the side of the cabinet. There are cathode resistors on both the 6L6 and the 807, so the plate current of both stages is limited to a relatively safe value when tuning or should the crystal stop oscillating. The HT-6 manual recommends that loading be adjusted "by means of flexible leads on each plate coil which may be soldered to the tinned (link) winding so as to include any desired number of fractional turns." The HT-6 is bandswitched – sort of. It can be configured by means of plug-in modules to cover any three bands at a time. There are three modules in a set, a band-specific "crystal adaptor," an oscillator plate tank, and a final plate coil. If you want to change to a fourth band, you will need to substitute another set of modules for one of the sets in place.

The modulator in the HT-6 is pretty straightforward. Doc's rig, serial number 10513, is from a later production run that uses a 6SQ7 speech amp, a 6SC7 amplifier and phase inverter, and push-pull 6L6s in class AB1. The earlier version uses a 6F5 speech amp and a 6J5 driver transformer coupled to the 6L6s. Both versions are designed to use high impedance "diaphragm crystal" microphones such as an Astatic D-104. The 6L6s easily supply enough power to 100% modulate the 807. The HT-6 manual says to adjust the audio gain until the 807 plate current flicks up just a little under modulation. My casual observation of the modulated RF output with a wave-envelope pattern suggests that when the 807 plate current does flick upward you are already exceeding 100% modulation. So, I would recommend that the user adjust the audio gain while watching an oscilloscope attached to the RF output if at all possible, or at least to back the gain off a little bit from the point where the 807 plate current starts to flick upward.

There are two separate power supplies in the HT-6, one for the RF section and the other for the AF section. The RF supply uses a 5Z3 rectifier feeding an 8-mfd, condenser-input filter with a husky 6-Henry, 250-mA filter choke and an 8-mfd filter condenser on the output. I measured 437 volts on the plate of the 807 when it was loaded to 80-mA plate current. There is a total of 42,500 ohms of bleeder resistance directly across the output filter of the RF power supply, so it discharges quickly when the panel-mounted "transmit" switch, which is in the center tap lead of both power transformers, is set to "standby," even when the key is open and the RF tubes are drawing no current. The AF supply also uses a 5Z3 rectifier and an 8-mfd input filter capacitor, but it has no filter choke! The 6L6 plates are fed directly from that

capacitor point, and the 6L6 screens and the remainder of the speech amplifier are fed through a series of dropping resistors and additional filter capacitors. The primary of the AF power transformer is switched through the main power switch and also through a switch on the audio volume control. So, the AF filaments and B+ are both turned off unless the gain control is advanced to turn that switch on. There is no bleeder across the AF power supply, but the load of the 6L6s and the audio amplifier discharge the filter capacitors quickly after the "transmit" switch is turned off, so with that switch off there is no real danger in getting a shock from any undischarged filter capacitors if you are reasonably careful.

There is a framed dial above the Plate Tuning knob with a 0-to-100 scale attached to the tuning capacitor shaft. Further to the right are toggle switches for turning on the AC power and for switching from Transmit to Standby. There is also a key jack just under the Plate Tuning knob on this unit. The key line originally came out on a terminal board in the rear, but a previous owner added this jack and moved the key lead to this more convenient location.

The meter on the left is not the original that came with the rig. The original meter was square to match the dial on the right. Someone had replaced that meter with a round one calibrated to read 200 mA full scale. Unfortunately, that meter would hang up a little under half scale deflection, and it made tuning up pretty difficult. I replaced it with a 1-mA meter from my stash, and I replaced the original Hallicrafters shunts with ones I wound myself. It now reads 20 mA full scale on the PA Grid position and 200 mA full

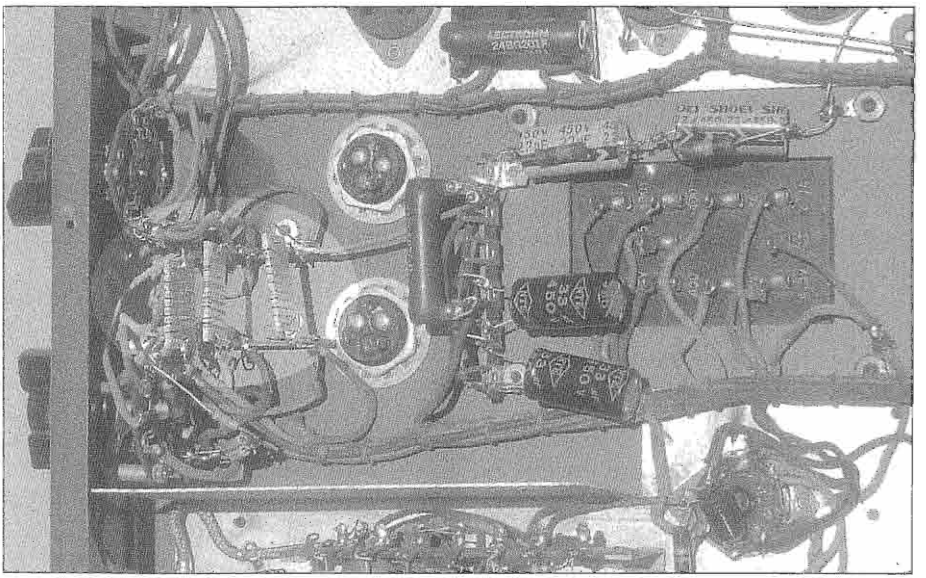

Figure 2: The replacement meter shunts are visible in the highlighted area above, between the two panel-mounted switches on the left and the bases of the two filter capacitors on the right.

The controls on the front panel, from left to right, are Audio Gain, the meter switch, a switch to select CW, Plate Off (useful for tuning the oscillator), and Phone, the three-position Band Switch, and the knob for Plate Circuit Tuning.

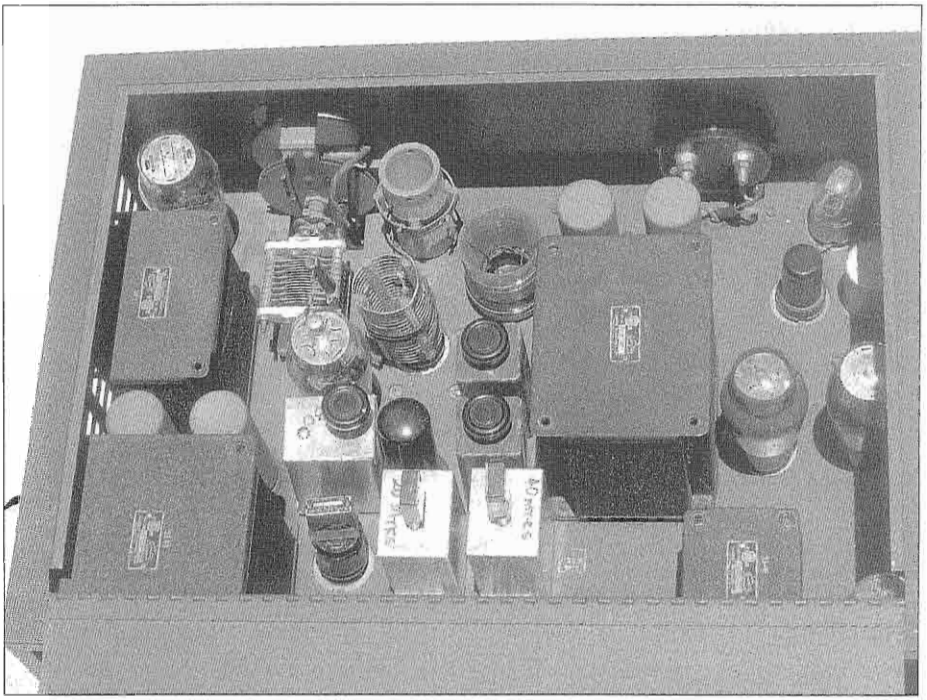

Figure 3: The inside topside. RF power supply is on the left, RF section in the center, and modulator and its power supply on the right.

scale on the other positions. You can see my shunts if you look carefully in **Figure 2**. There are four of them under the chassis and to the right of the meter switch and the CW-Phone switch knobs, although one is in the shadows on the left, and they are wound from #30 or #36 copper wire on rectangular pieces of perfboard.

Figure 3 is a look inside at the topside of the chassis. The front panel is at the top of this picture. The RF power supply components are on the left. Moving to the right, in the upper part of the picture you see the final amplifier tuning capacitor, the three plug-in final amplifier coils, and the 807. The coil on the ceramic form is the 20-meter coil, a Hallicrafters original. The self-supporting coil made from B&W Miniductor is the 40-meter coil. It is homemade, and it came with the rig when Doc acquired it. The coil furthest to the right on the plastic form is the 80-meter coil. I wound it on an old pill bottle, and embedded a four-pin tube base in the bottom so that it would plug in to the socket. Just down from the 807 and its coils you see the 6L6 and clustered around it the three oscillator plate tank assemblies. They are the ones with the knobs on top of the cans. The upper can on the right is for 40 meters, the lower one is for 20 meters; both are Hallicrafters originals. The shiny can to the left of the 6L6 is a Bud Box tank for 80 meters that I built. Below the 6L6 are the three crystal adaptors. The center and right-hand ones, again built into Bud Boxes, are Colpitts adaptors for 20 and 40 meters that I built. On the left is an original Hallicrafters adaptor for 80 meters. The Hallicrafters unit has a 6-pin socket on top to match the larger, prewar crystals. An adaptor is plugged into it to accept the more modern FT-243 or Bliley AX-2 type crystals with smaller pins and

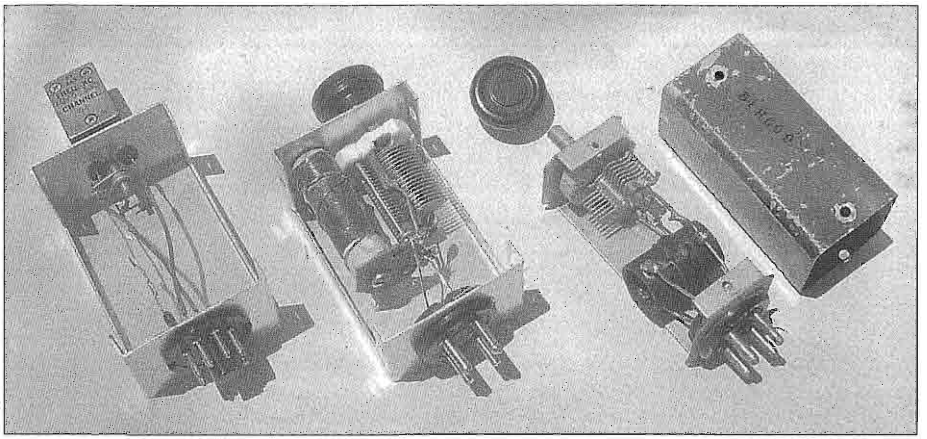

Figure 4: This is a look inside a Colpitts crystal adaptor, the homebrew 80-meter oscillator plate assembly, and the Hallicrafters 40-meter oscillator plate assembly.

1/2-inch spacing. Moving further to the right, the larger transformer is for the modulator power supply, the smaller one is the modulation transformer. The 6SQ7 speech amp is on top, the 6SC7 is the metal tube below that, and the two 6L6G modulators are the next ones down. You can just see the audio 5Z3 rectifier in the

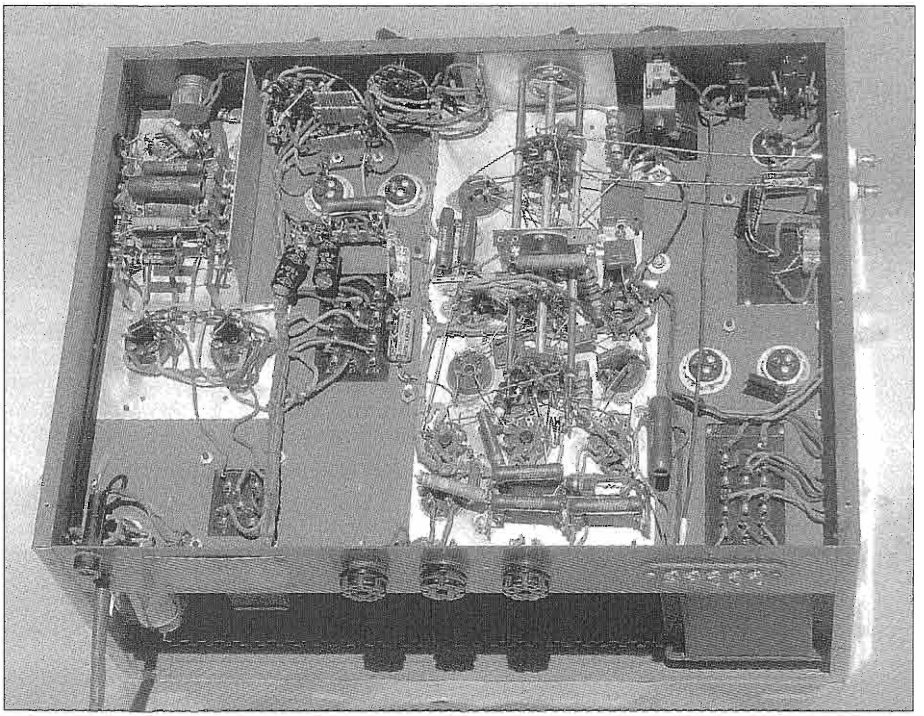

Figure 5: Looking underneath the chassis, the modulator is on the left, the RF section is the center, and the RF power supply is on the right.

lower right-hand corner.

In **Figure 4** you can see the inside of the Hallicrafters 40-meter oscillator plate assembly on the right, of my home-brew, 80-meter oscillator plate assembly in the center, and of my Colpitts crystal adaptor on the left. I built the 80-meter oscillator plate assembly using a coil, capacitor and knob lifted from a BC-610 plug-in tuning unit, so it too has genuine Hallicrafters parts.

The under-chassis photo, **Figure 5**, shows that Hallicrafters built the modulator, now on the left, and the RF deck, in the center, on separate sub chassis and then mounted them in the larger cabinet. The power supplies are built directly on the main chassis. If you look carefully you will see that the original filter capacitors have been disconnected and replaced with modern electrolytics – two in series with 1-Megohm equalizing resistors across each of them to help split the nearly 500 volts equally across them. Three of the original filter capacitors were still functional, although somewhat leaky, according to my Heathkit C-3 capacitor checker, and the fourth had lost its capacitance but was not shorted. Under the circumstances, Doc and I thought it would be wise just to replace all four of them with new units, although we left them in place for cosmetics. Notice also the primary power fuse in the lower left, a nice touch especially for a rig that was built on a pretty tight budget.

The entire cabinet is at least as big as a receiver of its vintage, 20 inches wide, 9 inches high, and 15 inches deep. The rig tips the scales at 65 pounds. While that's pretty hefty by modern standards, the HT-6 was considered to be a "portable" in its day, and it includes connectors on the back to use an external 6 volts for the filaments and a dynamotor or vibrator pack for B+.

As I said when I began this tale, Doc wants to use his HT-6 on 80, 40, and 20, and he would like to be able to use postwar FT-243 crystals, principally in the 80 and 40-meter bands, to accomplish this. He would very much like to be able to double in the plate of the 6L6 oscillator, but the original HT-6 oscillator was just a straight, beam-tetrode circuit that did not do this on any of those bands. So, my job was to find a way to change the oscillator into one that would double, but also to do as little damage to the original HT-6 as possible.

Figure 6 [page 8] is a schematic of the original HT-6 oscillator stage. In many respects it is conventional, but it has a few tricks worthy of note. The plate circuit is the usual parallel-tuned tank, capacitor coupled to the control grid of the 807. It is unusual in that there is also a link, coupled to the plate coil, which is in the ground-return path for the crystal. This would certainly introduce more feedback into the oscillator circuit, something usually not needed and not found in a typical 6L6 beam-tetrode oscillator, but this is not quite your "usual oscillator" circuit in at least one other significant way. Normally, a 6L6 crystal oscillator with 400+ volts on the plate would be able to generate at least 10 watts of power output, enough to drive the socks off an 807 that needs only about .22 watts of drive. But note the three series resistors feeding the 6L6 screen grid and the resistor from the screen to ground. This combination of resistors, when they are all in the circuit, reduces the 6L6 screen voltage far below its rated 300 volts and nicely turns the 6L6 gain down as well to a point where it develops only a little more output than the 807 really needs. I measured the 6L6 screen voltage on 20 meters, where the crystal adaptor has a short across its pins 1 and 2 which shorts out R3 in the screen resistor string, and it was only 61 volts to ground and probably about 53 volts to the cathode taking into account the drop across the 400-ohm cathode resistor. With R3 in the string on 40 and 80, the screen voltage and thus the tube gain would be even lower. I strongly suspect that the additional feed-

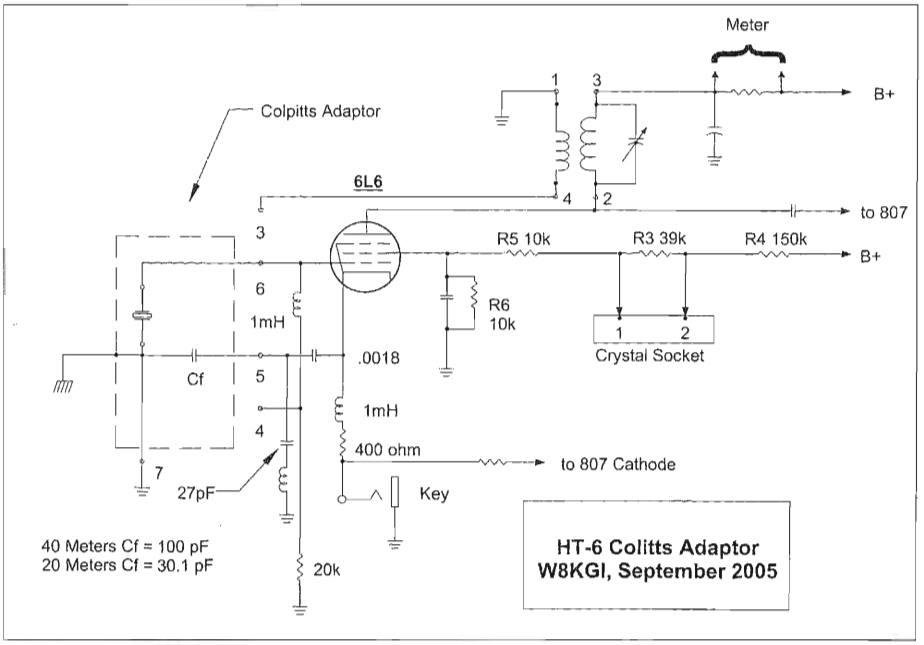

Figure 6: The HT-6 oscillator schematic.

back provided by the plate tank link was necessary to make the 6L6 oscillate reliably at these low levels of gain.

The cathode circuit of the 6L6 is keyed to ground through a 1-mH RF choke and a 400-ohm resistor, so it is floating with respect to RF. The cathode is coupled to pin 5 of the crystal adaptor socket through a .0018 mfd capacitor, pretty much a "short" to 80 and 40 meter RF. There is a small 27 pf capacitor in series with a 2-1/4 turn inductor to ground from pin 5 of the crystal adaptor socket. At 80 and 40 meters the reactance of the inductor can probably be neglected, so the net effect of that branch is just the 27 pf capacitor to ground.

The control grid of the 6L6 is tied to pin 6 of the crystal adaptor socket. There is also a series 1-mH RF choke and 20-k grid leak resistor to ground. The junction of the choke and the resistor is attached to pin 4 of the crystal adaptor socket, and the HT-6 schematic shows that this resistor is shorted to ground inside of the Hallicrafters crystal adaptors and also by the bandswitch on bands 2 and 3. Apparently, the grid leak resistor was used only on band 1 and then only when the 5-meter plug-ins were in place.

The original Hallicrafters crystal adaptors connected the crystal between pin 6, the 6L6 control grid, and pin 3, through the link winding on the oscillator plate coil to ground. This makes the oscillator circuit into a straight beam-tetrode oscillator with a little extra feedback from the plate link. As a beam-tetrode oscillator generates output only at the fundamental frequency of the crystal, this means that you had to use an 80-meter crystal for 80-meter output, a 40-meter crystal for 40-meter output, and a 20-meter crystal for 20-meter output. For 10-meter operation, the Hallicrafters crystal adaptor converted the oscillator into a Tri-Tet circuit, with the crystal connected between adaptor pins 6 and the top of a tuned circuit inside the adaptor, the 6L6 cathode at pin 5 attached to a tap on that tuned circuit, and the bottom of the tuned circuit attached to

ground at pins 4 and 7. The Tri-Tet is a very good harmonic generating circuit, and it was a favorite in the 1930s when the HT-6 was designed. At first, I considered using it for my homemade 40 and 20-meter crystal adaptors as well. But, with a 6L6 oscillator tube, the Tri-Tet is not appropriate for fundamental frequency output. It can generate dangerous levels of crystal current if mis-tuned, and oscillation will usually stop when the plate circuit is tuned exactly to resonance at the fundamental. A 6L6 Tri-Tet is usually equipped with a switch to short out the cathode tuned circuit and turn it into a straight beam-tetrode oscillator when running on the fundamental frequency.

To make the 6L6 into a more foolproof harmonic oscillator (sorry about that, Doc), I decided to try an adaptor that turns it into a "Colpitts" or "Grid-Plate" oscillator. By the later 40s, this was the oscillator circuit of choice for the majority of the rigs found in the ARRL Handbook, although it generally used a "well screened" 6AG7 rather than a 6L6. In the Colpitts oscillator the crystal is connected from grid to ground, with a small (~ 10 to 25 pf) feedback capacitor from grid to cathode and a larger one (~ 100 to 220 pf) from cathode to ground. This circuit is capable of good fundamental and harmonic output without making any changes other than the tuning of the plate tank. After a bit of cut-and-try, I found that the circuit worked reasonably well with both 80 and 40-meter crystals when generating 40-meter output with no additional capacitance between the grid and cathode beyond that already in the wiring of the HT-6 and the 6L6 interelectrode capacitance, and with 100 pf between the cathode and ground. For 20-meter output with 40-meter crystals I wound up using no additional grid-to-cathode capacitance and 30 pf from cathode to ground. Note that in each case the 27 pf in the HT-6 circuit from cathode to ground is in parallel with my capacitor in the crystal adaptor, and thus adds to it. I also found that I had to increase the "gain" of the 6L6 by increasing its screen voltage. I wound up putting a 13-k resistor in parallel with the 150-k resistor in the three-resistor chain feeding current to the 6L6 screen grid. The 6L6 screen voltage under load is now around 135 volts. For 80-meter output, I continued to use the existing HT-6 crystal adaptor which runs the 6L6 as a straight beam-tetrode oscillator. With 135 volts on the screen, the 6L6 generates more than enough grid drive for the 807 on all three bands, and drive is adjusted to the 3.5 to 4 milliamps that the 807 prefers by tuning the 6L6 plate circuit. Keying is excellent on 80 and 40 meters. Keying is just a little soft but acceptable on 20 meters, at least with the crystal I was using for my tests. It's still a lot better for Doc to be able to use 40-meter crystals for 20-meter output than to have to scrounge around for 20-meter crystals which have pretty much become unobtainium these days.

I tuned the HT-6 up into a Heathkit Cantenna 50-ohm dummy load. With the 807 plate current dipped to about 80 mA, corresponding to about 34 watts input, I measured 20 watts output on 80, 18 watts output on 40, and 15 watts output on 20 with my Swan wattmeter. While that is not quite the 25 watts output advertised by Hallicrafters, it is certainly enough for Doc to make a lot of QSOs.

Since I'm writing this for Doc as well as for you ER readers, I want to include a few caveats of my own and one of Chuck Teeters' warnings. The HT-6 was a pretty decent rig in its day, but it sure wouldn't win any prizes for safety or convenience then or now. Changing frequencies within a band requires lifting the lid (after you've cleaned off everything you piled on top of the rig), reaching inside to the back row of plug-in adaptors, and swapping out crystals. If you move very far within a band you'll probably also want to touch up the oscillator plate

tuning. The knobs for doing that are dangerously close to two tubes, hot enough to burn you, and to both B+ and RF on the 807 plate cap and plate tuning capacitor. ***The exposed B+ and RF can shock and burn you.*** Be extremely careful when you are doing any of these things. Turn the "Transmit-Standby" switch to standby before you open the lid to change a crystal. Always look inside as you put your fingers on one of the tuning knobs – you'll need to do that anyway to make sure you have the right one. Make the initial adjustment of the oscillator plate tank with the front panel switch on the "Plate Off" position, and carefully tweak the tuning later after you have dipped and loaded the 807 plate with the switch in either the CW or Phone position. Keep one hand in your pocket when you are making adjustments inside with the B+ on. That way if you do happen to touch a hot spot you won't take a shock through your arms and chest.

I will paraphrase Chuck Teeters for the next warning. The CW/Plate-Off/Phone switch routes HV to the 807 through the modulation transformer for phone, bypasses the transformer for CW, and disconnects the 807 HV for oscillator tuning. The switch leaves the modulation transformer open in the CW and Plate-Off positions and it does not turn off the modulator B+. So, if the modulator AC switch on the audio gain control is turned on while tuning up or operating CW and you "woof" into the mike, the modulation transformer can arc. That is definitely poor design unless you are selling transformers.

So now the HT-6 is working pretty well, and it's all buttoned up in its cabinet and waiting for Doc to come pick it up and take it home. I've had fun playing with it and getting some insight on, and appreciation for, Bob Samuelson's design work. I really have to teach Doc how to "check out" his own gear one of these days, or I'll never be able to reach the rigs on my roll top or have room on bench to work on my own gear. Oh well, at least I can count on another article for ER when I see him coming, HI.

1: tinker, vi. 1. to work as a tinker, 2. to make clumsy, futile attempts to mend or repair something, 3. to fuss or putter aimlessly or uselessly (Webster's New World Dictionary)

2: BAMA = Boat Anchor Manual Archive, an Internet resource.

3: Mike O'Brien, NØNLQ, "The HT-6 and HT-9; Hallicrafters' Chevy and Buick," ER #38, June 1992.

4: Chuck Teeters, W4MEW, "The Hallicrafters HT-6 Transmitter," ER#130, February 2000.

5: Raymond S. Moore, "Transmitters, Exciters & Power Amplifiers, 1930 – 1980," RSM communications, 1996.

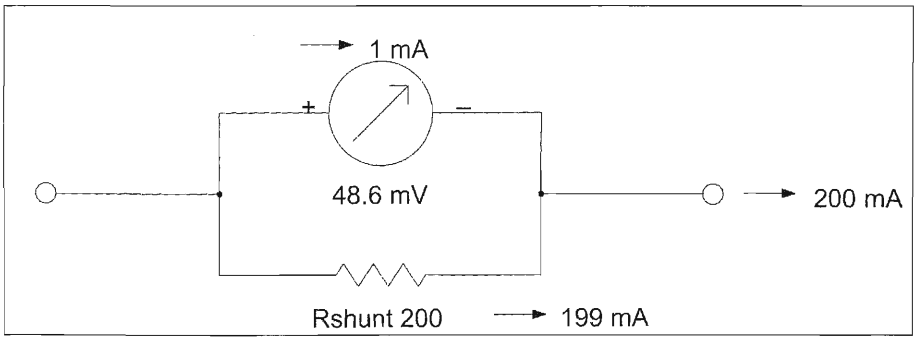

Figure 7: Current division and the resulting voltage drop with the meter and its 200-mA shunt.

Making Meter Shunts

To fix Doc's HT-6, I had to substitute a 1 mA meter from my junk box for a bad meter in the transmitter. Here's how I made the shunts for that meter so that it would work in the HT-6.

The first thing I needed to know was the resistance of the movement in my junk box meter, or more exactly, I needed to know the voltage across the meter when 1 mA was flowing through it. I connected the meter in series with a 10-k resistor and attached it to the output of my bench variable DC power supply. I adjusted the power supply until the meter indicated that 1 mA was flowing through it (at about 10 volts output from the supply), and then I measured the voltage across the meter with my best DVM, a Fluke 87. I measured 48.6 millivolts across the meter with 1 mA flowing though it.

Next, I calculated the resistance of the shunt that would allow 199 milliamps to flow through it with 48.6 millivolts across it. If I put this shunt across the meter, a total of 199 +1 milliamps or 200 milliamps will flow through both of them in parallel when there is 48.6 millivolts across them, and the meter with shunt will read "200 milliamps full scale." See **Figure 7**, page 10.

Shunt resistor required = "Rshunt"
Rshunt = (voltage drop across meter) / (current through new shunt)

Rshunt 200 = (48.6 x 10^{-3} volts) / (199 x 10^{-3} amps) = 0.244 ohms

Now, how do I make a 0.244 ohm shunt? I have a spool of #30 enamel insulated copper wire. According to the wire tables in my ARRL Handbook, the resistance of this wire at room temperature is 105.2 ohms per 1000 feet. I set up the following ratio to find the length of #30 wire, "X," I needed to make a 0.244-ohm shunt resistor:

1000/105.2 = X/0.244

Then solve for "X" as follows:
X = (0.244)(1000)/105.2
X = 2.319
Therefore, X = 2.319 feet of #30 wire
X = (2.319 feet)(12 inches), or 27.83 inches of #30 wire

I cut a piece of #30 wire that was long enough so that I could solder the ends to some larger wires that were, in turn, fixed into a piece of perf board and the wound 27.83 inches onto the board. That became my shunt resistor.

I checked myself by putting the shunt across the meter, putting the shunted meter in series with a smaller resistor (like 100 ohms), and also in series with my DVM which is now on a current scale. I ran the power supply up to about 20 volts which deflected the shunted meter full scale, and I read the current through the shunted meter on the DVM as 200 milliamps. I was happy.

Check yourself now by designing the shunt resistor to make the 1-mA meter read full scale when 20 mA is flowing through the shunted meter. Remember that 1 mA will flow through the meter and 19 mA through the shunt with 48.6 millivolts across them. Use #36 wire for the shunt, which has a resistance of 423.0 ohms per 1000 feet. You should find that you need a shunt of 2.56 ohms, and that you can make that shunt from 72.62 inches of #36 wire.

ER

The AM Broadcast Transmitter Log

Part 3, The Bauer 707

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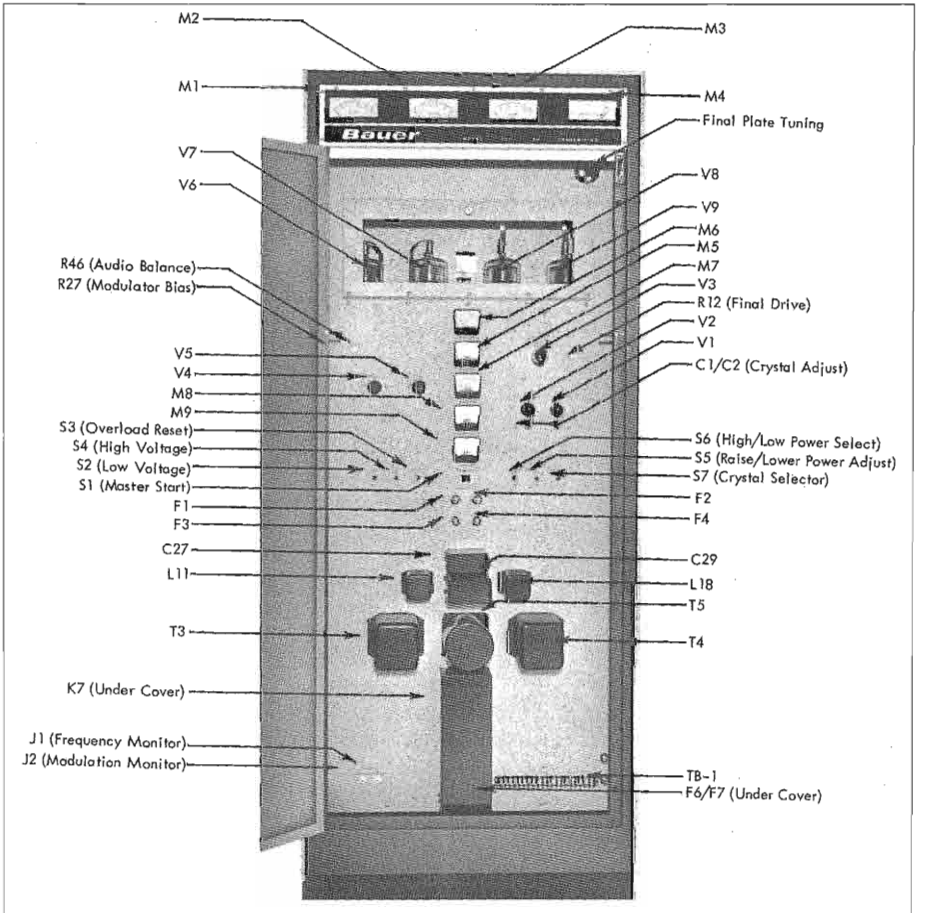
This month we will get into the specifics of the Bauer 707. The Bauer is not a particularly common transmitter as about only 400 were produced. It was the only one I am aware of that was sold as a kit. It really is well built and easy to work on. More modern than the Collins 20V series, it is a mid to late 1960's design and is much smaller than the Collins. The 20Vs weigh in at about 1150 lbs while the Bauer is about 800 lbs. The conversion presented here will be a bit more generic than the Collins 20V presented last month and be suitable for similarly designed transmitters.

Tuning the Bauer 707

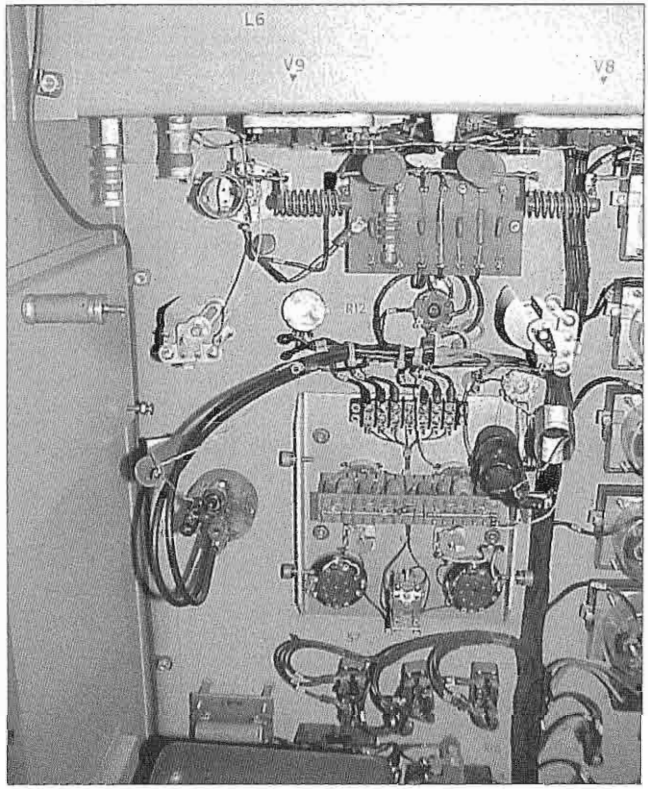
The lower-power RF chain consists of a 6AG7 oscillator and another one for the buffer. Driving the final is the 6CA7/

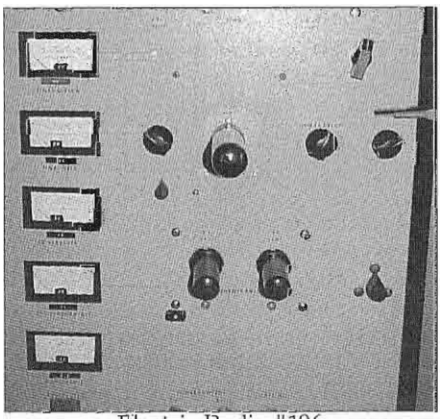


Front View of the Bauer Model 707 Broadcast Transmitter

EL34 audio power output tube. Using an audio tube in RF service would not be my first choice but it does work. Employing a tube with a plate cap, such as a 6146, would place the tube's plate voltage within easy reach for accidental contact.

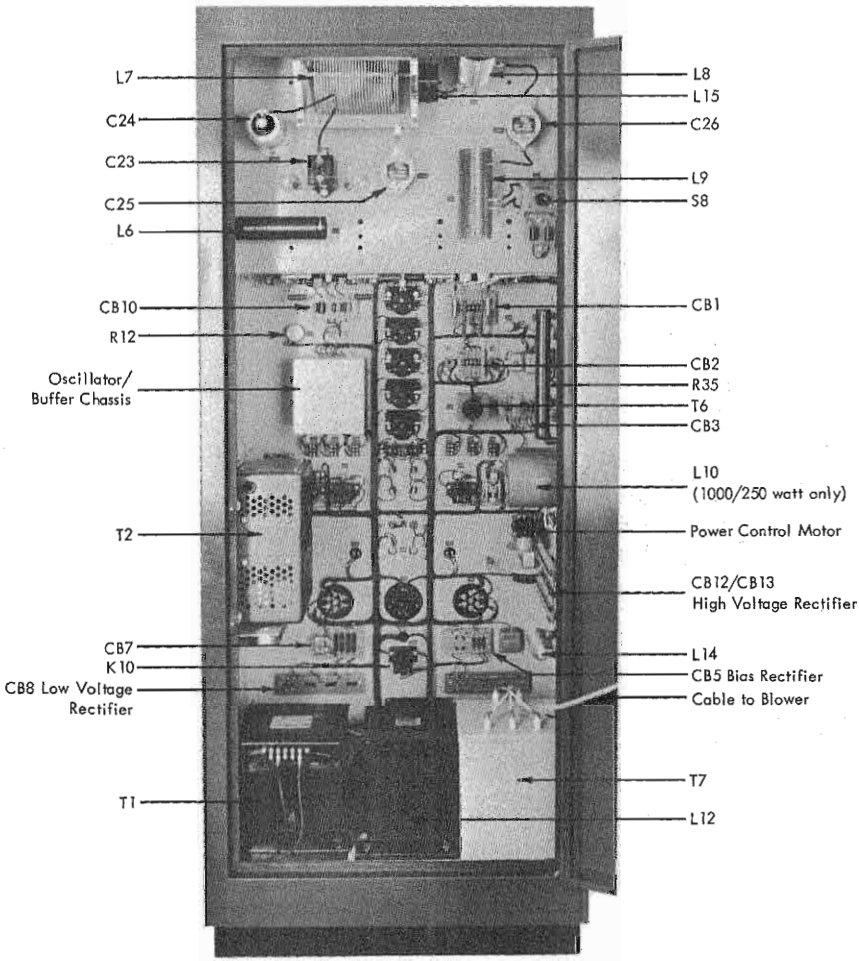
In the original configuration, only the driver and final are tuned. For the conversion to 160, this will do nicely. With the low voltage on enabling the low power stages, peak L4 for maximum final grid current. Remove about 10 turns at one time if necessary. Peaking must be done from the front. If you want multi-band operation, a band switch with a variable capacitor should be mounted on the front panel in close proximity to the driver tube and L4. I found that removing 40 turns was necessary on 160 when a tuning capacitor was in the circuit. The components I had in the junk box also tuned to 40 meters in the 80-meter position with the capacitor almost open. An air-wound inductor is now switched in instead of L4. Adjust the drive control as needed.





Above: A rear view showing, on the right, the buffer tuning cap and coils. To left are the driver tuning cap and coils. Below is internal/external select switch. Out of view on the right bottom is K4, the driver & buffer B+ relay. Left: On the right side of the front panel partial view are the added controls for the driver bandswitch and tuning. Just to the left are added controls for buffer band and tuning. The switch in line with the metal tubes on the right are for selection of internal/ external exciter.

The buffer stage needs to be tuned in order to achieve sufficient drive above 160. Bypass R10 (1k) and place the tuned circuit's coil between the grid of the driver and R9, the grid return resistor. The vari-



Rear View of the Bauer 707 Broadcast Transmitter

able cap goes between the grid and ground. Drive on 160 will be very high while 80 it will be adequate. I found 40 to be disappointing but not hopeless. A crystal socket was mounted on the front panel to facilitate frequency change.

The photos (page 13) show front and rear views of the buffer and driver tuned circuits. Some experimentation will be needed to achieve resonance with your choice of components. This is typical of what is needed in the low power stages of any transmitter converted for operation on bands other than 160 meters or multi-band operation.

Make use of the final tank components but change the circuit to the simple PI configuration. The vacuum tuning cap is perfect and all you need to do for 160 is use 2000 pf from any combination of the fixed loading capacitors. I found that I needed all but one turn of the tank coil (L3) for matching into my antenna system. (The schematic indicates the tank coil as L3. The rear photo labels it as L7.) Move the tap as needed for proper plate

current at resonance. For 80, only nine turns were needed on L3 and 1000pf on the loading cap. Consider mounting a variable in parallel or as the only loading component — especially if you plan to change bands or QSY often. With all transmitter models, check for evidence of RF plate choke heating on each band as it may be resonating near the operating frequency. I used the antenna analyzer method described in the first article of this series [ER #194]. It worked perfectly with only minor adjustments needed for proper loading into differing load impedances. Circuit designations would, of course, be different with other manufacturer's models, but the steps described will be similar. An up coming issue will be devoted to output network components.

This places the rig on the Ham bands, 1885 and 3885 kc. However, it may not be the most desirable approach. My transmitter appears to have been modified with an AM stereo generator feeding into the driver. It was perfect for feeding with about 15 watts from a small modern transceiver. You can use an antenna tuner or a 50-ohm dummy load with a .001-µF blocking capacitor and feed RF drive directly into the grid of the driver or better yet, the final. Plenty of grid drive will be available and no tuning of the low power stages would be necessary if feeding to the final grids. (Much less drive will be needed with an antenna tuner.)

I prefer to use an external exciter. Very often on 80 meters it is necessary to move slightly off frequency to zero beat or avoid interference. Also, it's nice to be able to see that digital readout and control the frequency from the operating position.

Although we are now delving into specific transmitters, you should realize that the methods described can be applied to other models.

Controlling the Bauer 707

This transmitter brings everything out to a terminal block on the bottom of the front panel. Unlike the Collins 20V series described last month, momentary switching is not used. A constant closure is required across the terminals involved. Remoted controls include: filament, plate, high/low power and crystal selection. The last is being used for the old Conelrad emergency system to place the transmitter on 1240 kHz.

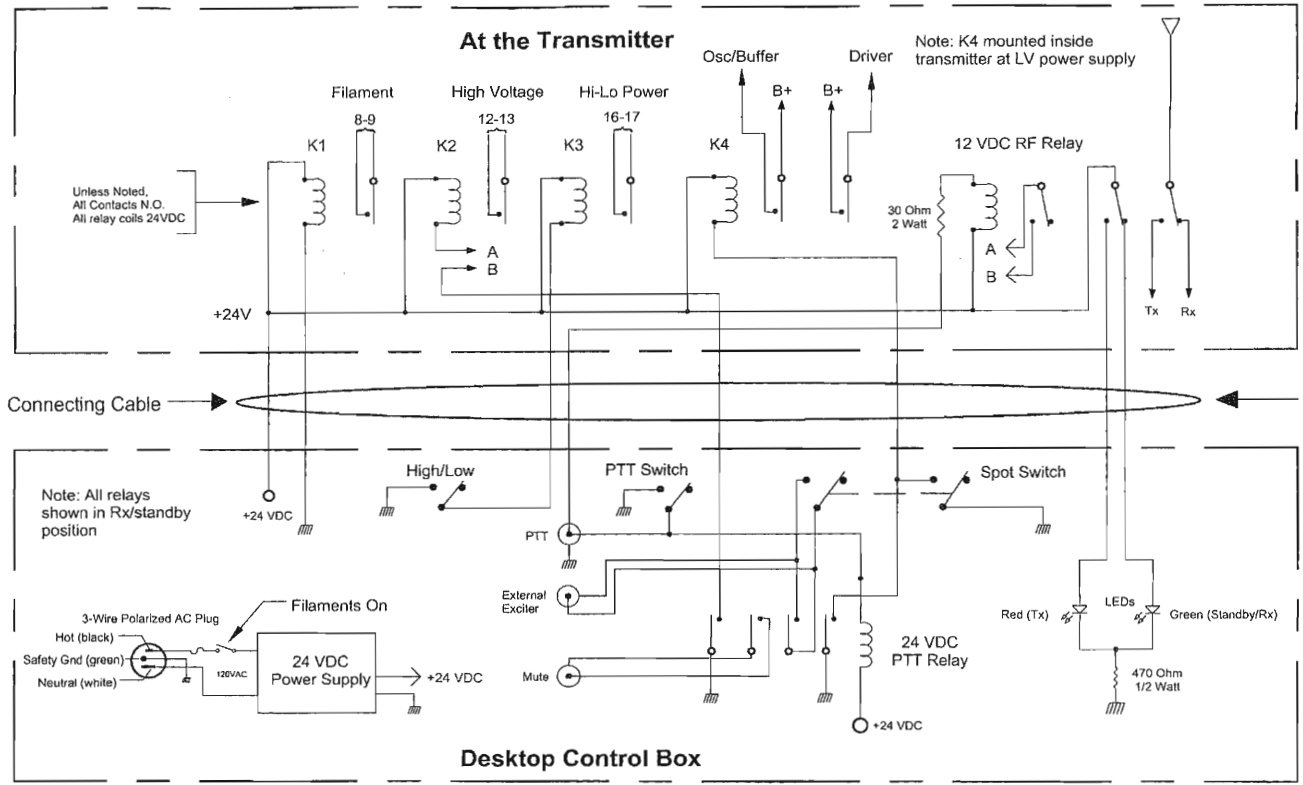
In this transmitter, the low power stages are left on as they are with many other BC transmitters. This will block your receiver if not disabled. The most expedient way to accomplish this is to switch to a vacant crystal position during standby/receive mode. A far better method, and the one I eventually chose, was to break the B+ going to the low-power stages. To spot the signal, just activate the relay which switches in the working crystal if leaving the low-power B+ on, or switch on the B+. This is one feature that is absent with the 20V and other BC transmitters if crystal controlled. If using an external exciter, it should be switched with both the HV and spot functions. The antenna changeover interlock scheme as described in last month's Collins 20V control system and status signals are used. Here are the connections: Filament, 8 & 9; Plate: 12 & 13, Hi/Lo, 16 &17; Crystal, 16 & 18.

A changeover delay is not necessary. Output is killed immediately when the exciter is disabled. The control system is similar to that of the 20V. It does add a relay for the power change and another for the crystal change/low power B+ switching. **Figure 1**, page 16, shows the control box circuitry. Expect to see additional control schemes in future issues as almost everyone has his own pet variation for a particular rig. Elements of each scheme may be just perfect for your conversion project.

Teething Pains

My transmitter did not like the intermittent on/off cycle of typical amateur operation and tended to protest by blowing fuses. The problem may have been

Figure 1



Bauer 707 Control Circuitry K2DK, September 2005

several factors which could occur with any BC rig conversion. The first one, and I originally thought the mostly likely, was that the antenna relay did not settle completely before the HV came on. This was an implementation issue, as the dropping resistor that changes 24 volts to the 12 volts needed for the antenna relay coil may have been underrated and was possibly heating up. The RF relay may close, but not close completely or fast enough, especially when starting in the high power position. A low power start up was tried, but didn't resolve the problem.

This situation now strongly suggested a more elaborate sequencing scheme. A controlled timing sequence would be to first switch the antenna, then switch the lower power stages, and finally raise the final HV. When un-keying the reverse sequence would be needed. I investigated solutions and found a super-simple, reasonable-cost solution, and commercially available. A company called JWM Engineering Group[1] sells a solid state sequencer for use in microwave applications. They only produce one model, the SEQ-1 Controller Sequencer. The cost is $39.95. Their web site is www.jwmeng.com and can be ordered over the Internet. So, if you are more comfortable with controlling the exact timing sequence, this is the most cost effective solution for any BC rig conversion control scheme. I have found, along with several others, that the small delay afforded by the daisy-chained sequential relays works well and no other delay circuitry is required.

The second issue was that the low power stages would heat up, detune and the final lost drive when just the crystal was switched out. You know the solution!

The third real possibility is that my antenna system was breaking down. This is much more RF than a DX-100 has. I recently rebuilt my aging antenna system as a planned upgrade. There was plenty of evidence that the ends of the 1/4-wave elements were arcing to trees supporting them.

Still occasionally, the rig would overload on key-up. Now, I just adore the sound of the KERCHUNK from the HV primary activator. It announces that this rig has POWER! But, it was getting into the audio chain and appearing as a big spike on the carrier just as the rig was coming to life. To confirm that this was an additional problem, I disabled the mike before key-up. No more problems with overloads. So, either subdue the KERCHUNK or kill the audio for a few moments until the carrier has been established. You could fashion a delay system to keep the audio killed for several microseconds or employ the SEQ-1. Here is another problem source which can develop with any BC transmitter conversion.

The Maintenance Log

Primary fuses for the Bauer 707and similar transmitters are the standard general purpose cartridge 30-amp fuses often used in central air conditioners. They are readily available at Home Depot, Lowes, etc. I suggest using the delayed timed fuses employed in motor circuits, and let the panel circuit breaker provide overload protection with these fuses acting as a fail safe. They are also readily available. (I went through a few of the other type — HI HI) AGC fuses are also available at these stores. The Bauer is still supported by the factory and parts should be available from their plant now located in El Paso, Texas[2]. Fortunately, there is nothing particularly unusual about this transmitter. It appears that electrical parts can readily be substituted and unique mechanical parts are minimal.

1) jwm Engineering Group
9 Westchester Court
Trabuco Canyon, CA 92679
949-713-6367

2) Bauer Transmitters, Inc.
10870 Pellicano Drive #252
El Paso, TX 79935
Phone: 915-595-1048

ER

Collins' Dream Transmitter: The 430 Series

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Question: What do you get when you cross a Collins KW-1 with a 20V-2 broadcast transmitter and a Wurlitzer jukebox?

Answer: The phenomenal Collins 430 series Transmitter.

The Collins 430 series represents the pinnacle of analog shortwave AM transmitter design and construction. One of the last commercial AM transmitters produced before its SSB capable successors arrived, its operating range covered the entire 2-30 MHz HF spectrum making it the ideal heavy-metal Ham-band AM transmitter. The two-tone grey paint scheme, fat chrome accent strips, and glass windows to view the big tubes make this beauty a feast for the eyes as well.

Originally built in 1954, the 430 series replaced the aging 200 Series which saw extensive duty in WWII and was one of Collins' oldest transmitter families.

Based on modular standard building blocks, the 430 series enabled 12 different "custom" transmitter configurations. Two power levels were offered: the 431 series with 1,000 watts output; and the 432 series with 2,500 watts output.

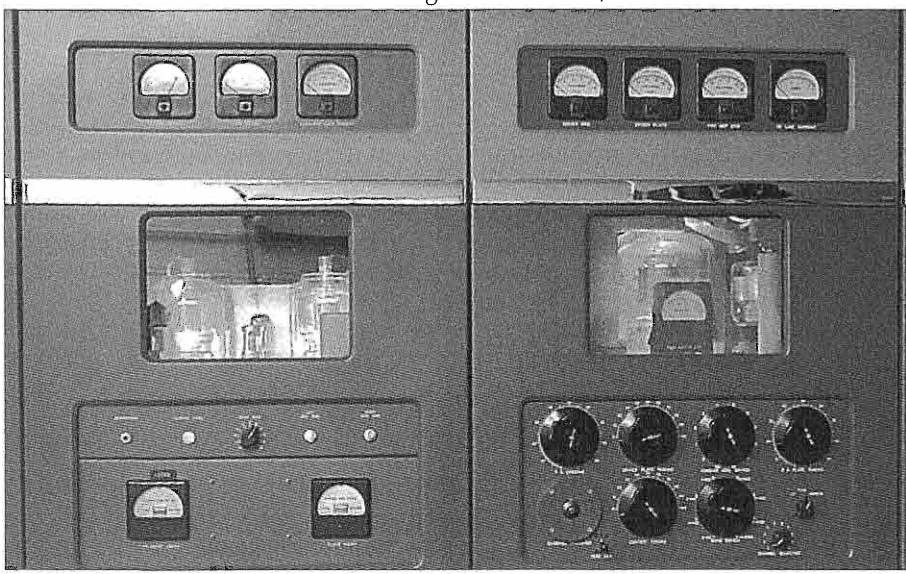
"Besides a choice of power, the buyer has these options in equipment: radio telegraph- teletype or radio telegraph-teletype-telephone; manual tuning or by Collins Autotune; local or remote control – from long or short distance – if the Collins Autotune is used."[1]

Customers included the FBI, Pan American Airways, the Union of South Africa, Portuguese East and West Africa, and Israel. But the biggest customer was the US Navy.

Of the 12 transmitter types, the Navy purchased several hundred of a military version, designated the AN/FRT-24. These transmitters had 10 channels of Collins Autotune, 9 crystal controlled and the tenth VFO controlled. Telegraph-teletype-telephone modes were provided along with remote control.

Overview of the AN/FRT-24

The AN/FRT-24 measures 83-inches



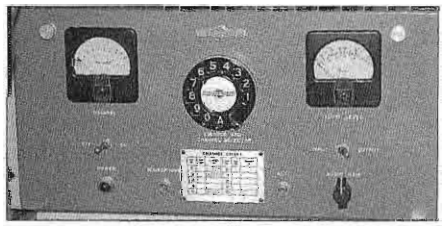
The author is shown with the AN/FRT-24 roll-out RF deck extended.

tall, 37- inches wide, and 32-inches deep. It weighs about 1500 pounds and operates from 230VAC single phase.

The tube lineup is basically 6CL6-type crystal oscillator/buffers driving a 4-65 driving a 4-1000A. A pair of 4-400As modulate the 4-1000A.

Construction is essentially two bays bolted together with rails supporting the various modules. Of particular interest is the "works-in-a- drawer" RF deck, which is mounted on chassis slides and can be extended out for service. The precision VFO rack (at the bottom of the left bay) is also on slides.

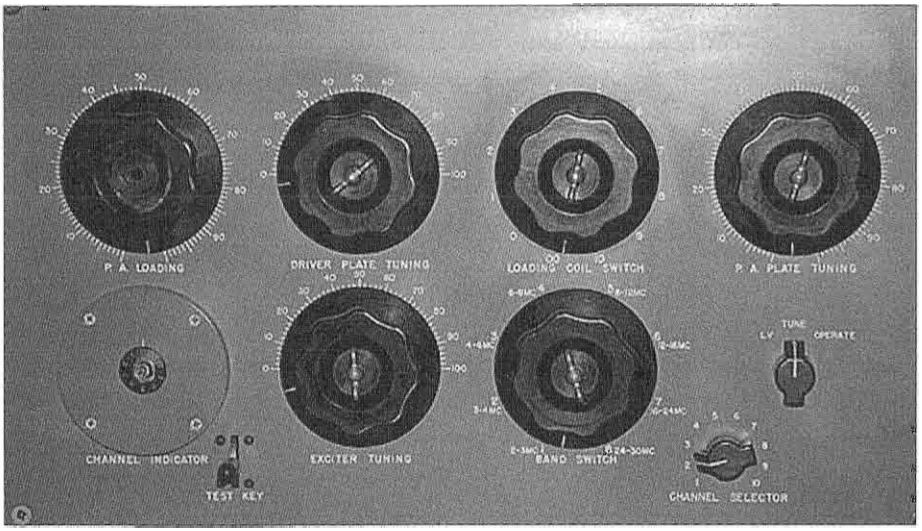
Remote control is accomplished using three circuits (dial, keying, and audio) over a 5-conductor line. A Dial Control Assembly in the transmitter contains relays which control the Autotune system, actuate the emission selector and turns the transmitter on or off according to pulse information entering the circuit from the remotely located CU-1362 Transmitter Control Unit.



The CU-1362/FRT-24 Transmitter Control Unit

The Collins Autotune is controlled by an eleven-position rotary telephone-type dial. Dial pulses to ground occur on the dial line, with the transmitter supplying the voltage to operate a telephone-type stepper relay. Transmitter power control, operating mode and channel frequency are all controlled over this circuit.

The Autotune system accomplishes band switching and tank tuning to any one of nine preset frequencies. The maximum time required for positioning any one channel setting of the transmitter is



AN/FRT-24 Autotune Panel

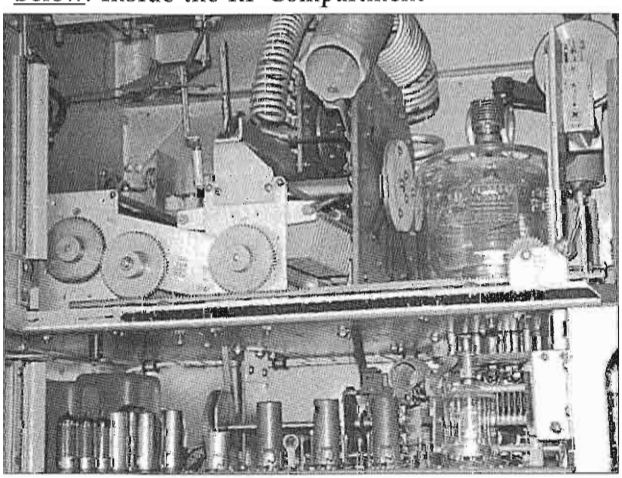
eight seconds — how sweet is that? Setting up a channel simply amounts to selecting the desired channel, unlocking each tuning control, tuning up each control on the desired frequency, then relocking the controls.

A standard 600-ohm balanced audio pair is also accommodated over the control lines. A proportional DC voltage is applied to the center tap on the input side of the audio input transformer in the transmitter. This voltage is used to indicate the currently selected Autotune channel on the CU-1362 Transmitter Control unit.

Keying is accomplished by providing 40 volts to the key line.

The CU-1362/FRT-24 Transmitter Control functions as a remote control for the transmitter. Normally, two of these units were supplied and connected in parallel. The only limitation on how far these units could be located from the transmitter was that the audio line attenuation could not be more than 25dB, and the key- line loop resistance not exceed 1000-ohms.

Below: Inside the RF Compartment



The CU-1362 Transmitter Control also contained audio preamp and compressor circuits. A carbon mic plug is provided on the front panel with approximately 4 volts of DC bias for the carbon element.

Optionally, a TA-267/U telephone set could be connected to the Transmitter Control unit. This was a modified hand tele-

phone using an eleven-position dial instead of the normal ten-position dial. A jack was provided on the front of the phone for the insertion of a telegraph-key plug for remote keying.

A Power Change Assembly is provided in the transmitter. This unit selects the power output of the transmitter, either one-quarter kilowatt, one-half kilowatt, or one kilowatt.

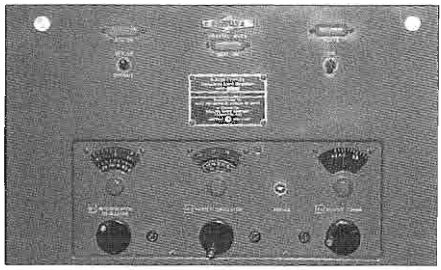
The RF output connector on the FRT-24 is designed for RG-17/U coax. To match the 52-ohm unbalanced output into a 600-ohm balanced antenna, a CU-390/FRT-24 Transmission Line Coupler was provided. This unit is housed in an aluminum weatherproof housing about the size of a small doghouse and normally located near the antenna feedpoint. Judging by the components used in its construction, the unit appears capable of handing well over 5kW.

The coupler first transforms the unbalanced 52-ohm input to a balanced, 52-ohm output, then steps up the impedance to approximately 600-ohms by means of artificial transmission lines and

"other circuit refinements."

Simba with the CU-390 Transmission Line Coupler

The AN/FRT-24 also contains a precision Master RF Oscillator assembly designated the O-243/FRT-24, a highly stabilized VFO deriving its stability from a 100kHz crystal standard oscillator and the use of a permeability tuned oscillator which provides an output in the range of 2 to 4.2MHz. It can be patched into the RF assembly through a patch panel connected to the number ten position of the autotune system. Frequency multiplication is used as required by the objective



final frequency.

The O-243/FRT-24 RF Oscillator

A unique feature of this VFO is the mechanically driven frequency correction circuit — think mechanical frequency-locked-loop, where a frequency error detection circuit drives a servo system involving a two-phase motor coupled to the AFC variable capacitor to correct the error/drift.

This complex assembly uses 25 tubes and is powered by an external power supply mounted below it in the pull-out relay frame.

The Men Behind The Design

It was Warren Bruene, W5OLY, who designed the 431D (Warren was also the designer of the 30K-1 amateur transmitter). However, it was Forest Cummings, W5LQU, who adapted the 431 for military use. Warren currently lives in Dallas, and Forest lives in Richardson, Texas.

Forest recalls "I joined Collins Radio as a young engineer fresh out of Purdue in June of 1953. One of my first assignments was to generate a set of MIL drawings from the commercial 431 transmitter design. I was also to build an engineering model of the Navy transmitter to

be designated the FRT-24. This was in 1954."

"That was my first introduction to real Collins equipment. The 4-1000A tube is a high gain tube with fairly long leads in the base of the tube, and I recall having many parasitic oscillation problems in building the model and getting it to work properly. That's when I first met Warren Bruene, W5OLY. He was the designer of the 430 series transmitters from which the FRT-24 was derived. Needless to say, it was a learning experience for me . . . a great one!"

"The FRT-24 was a very unique transmitter, especially with the SMO stabilized master oscillator and the 11-digit, dial-controlled autotune system. Those were top-of-the-line features in those days. Of course, that was Collins Radio Company."

Warren Bruene mentioned that he was awarded a patent on his unique design of the CU-390 Transmission Line Coupler and it's sibling, the 512B-1/2, which was used at SAC with 10kW transmitters.

Acquiring the FRT-24

It was at my first duty station in the Navy as an electronics technician during the early 70's that I first laid eyes on the FRT-24. Every morning when I entered the Ground Electronics building at NAS Glenview (near Chicago), I would walk past three of the gorgeous 2500-watt versions (based on the Collins 432 series) lined up side-by-side like great sphinxes. This virtual wall of transmitters left an indelible image permanently burned into my brain. Once every quarter we'd fire them up to be sure they were operational — a totally fun event for a young Ham. (The thought of putting them on the Ham bands never crossed my mind.)

The outputs of the transmitters were routed to a patch panel across the room. Here, various antennas could be selected for the different operating frequencies. A bay of SP-600 receivers completed the installation.

Then in 1972, they were decommissioned, obsoleted by sophisticated microwave and satellite links. The grand old gals were removed from the building and literally "put out to pasture" in an open field (along with the antennas) to be rained and snowed on while the Navy bean-counters administered the scrap bidding process. It was a pathetic sight to see.

I never thought I'd see another FRT-24 until I got a phone call in late 1995 from a used audio equipment jockey in Los Angeles whom I had met through a microphone deal. It seems he had just acquired an FRT-24 from an old timer who had it stored in a warehouse for many years and was eager to turn it for a quick profit.

The audio jock said the old timer told him it had been in service at a West Coast Navy base and then spent its golden years running MARS traffic for servicemen in Southeast Asia, which evidently spared it from becoming landfil. Apparently the Old Girl's good looks and "soul" had some kind of irresistible appeal to the old man who gave her a home for the next 20 years.

The big rig arrived in an extended van provided by my good friend and master guitar builder, Charlie Hall, who offered the move logistics. All the main units were disconnected and removed from the two bays which were then disassembled and loaded into the van. This made it very easy to get the Old Girl cleaned up for her next life. Everything went together without problem and she fired up just like the day she was first put into service.

Operating the FRT-24

The FRT-24 is now the centerpiece of the garage. Unfortunately, her one-sixth-horsepower blower is noisy enough to force locating the AM operating position as far away as possible. The blower contains a squirrel-cage that draws air in through a filter at the bottom of the front door and forces air up through a duct

that feeds the RF deck and modulator. Warm air exits at the top of the transmitter, so sound reduction is not practical in the transmitter itself.

The convenience of remote control and the Collins Autotune is simply great. Being able to QSY to any band within 8 seconds by dialing a number never ceases to amaze me. You can hear the stepper relay click with every dial pulse, then the whir of the Autotune motor. On the first half of the Autotune cycle, all controls are brought to the home position (full CCW). The second half of the cycle brings the controls to their preset position. A loud metallic buzz announces completion of the cycle. I never get tired of hearing those sounds which reminds me of an old jukebox.

I currently have three channels set up on the the autotune for which I have crystals: 1925kHz, 3870kHz, and 3885kHz (although the FRT-24 frequency coverage is rated from 2-30MHz, it will just "reach" down to 1925kHz). To select a desired channel, one simply dials the number corresponding to that channel. If the transmitter was powered off, it energizes, the autotune engages, and the desired channel is brought up. Dialing AØ powers the whole rig down. (The eleventh dial position is labelled A).

On frequencies for which I do not have a crystal, an HP-8640B signal generator is used as a VFO instead of the Collins Master Oscillator—it's just quicker and easier.

The current operating position is about 15 feet from the transmitter, so while I can still hear the blower, it's tolerable at that distance. An external Dow-Key coax relay is used to switch the antenna between the receiver and transmitter. This relay also mutes the receiver during transmit. Remote monitoring is facilitated through a simple RF sampler and AM diode detector circuit obtained from the NU9N website[2].

Because this is a military transmitter, the audio bandwidth was spec'd from

The FRT-24 with HP-8640B as VFO

350 Hz to 2700 Hz. According to Warren Bruene, the audio was rolled off at 6dB/octave starting at 800 Hz on the low end and to 3000 Hz on the high end. This restriction occurs in three places: the CU-1362 Transmitter Control unit, the line-level input amplifier in the modulator, and a pi-type splatter filter on the output side of the modulation transformer. Compared to many of the fine AM signals on the bands today, the FRT-24's audio sounded thin with no low end or highs — in other words, like what you would expect from a carbon microphone on a military transmitter.

The first modification was to bypass the bandpass filter in the modulator. Bypassing it was a straightforward operation and the result was that the audio filled out considerably. The modulators (push-pull 4-400A's) are operated Class AB, so the grids are driven directly by a 12AU7 yet it's capable of producing 750 watts of audio.

But the audio still wasn't what I'd call broadcast quality. While there was now low end and more highs, the highs lacked "presence." So back to work I went to "de-mil" the audio.

The next fix was to bypass the audio preamp in the CU-1362 Transmitter Control unit. This involved replacing it with a new interface panel that duplicated the dial and keying circuits, but provided a simple 600-ohm input from my solid-state audio chain. This panel was also provisioned with additional 600-ohm inputs for convenient connection of a test audio oscillator or a tape deck for playback that bypassed the normal equalization, compression, and limiting[2]. A 1:1 600-ohm line transformer blocked the DC voltage on the transmitter side of the audio line (used for remote channel indication) from reaching the solid-state gear.

The solid-state audio chain consists of an ElectroVoice RE-20 dynamic microphone feeding a Rolls mic preamp with compression and graphic equalization. Connected to the output of the mic processor is a splitter that feeds the equalized mic audio into each of a DBX 166 compressor/limiters' two channels. One channel feeds the sideband rig, while the other feeds the AM rig. A "No Money Mike"[3] audio meter monitors the level to the transmitter.

The result of these modifications/fixes is now a broadcast-audio bandwidth that rarely fails to elicit complements. Great audio from a great transmitter. I have to occasionally pinch myself to be sure I'm not dreaming.

References:

1) From the June 1954 Collins Column Employee magazine.

2) For additional information about tape playback, see the AM Processing section of NU9N's website, www.nu9n.com.

3) KO6NM, Mike Dorrough of Dorrough Electronics.

ER

Gary at the garage FRT-24 Operation Position

The SX-101A

Hallicrafters' Heavyweight Champion, Part 1

By Ray Osterwald, NØDMS
PO Box 242
Bailey, CO 80421

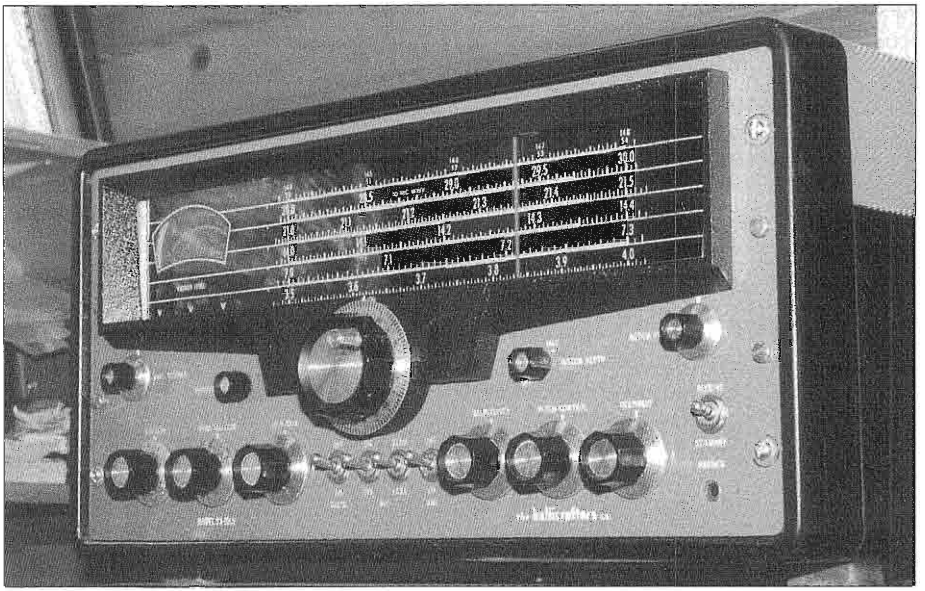
Bill Halligan kept an advertiser's tradition going when he displaced the long-running National Radio Company serialed product discussions with his own in the February 1955 edition of QST. The next month he discussed the merits of Hallicrafters' "selectable sideband receivers," which were based upon a QST article of June 1941[1]. Bill's discussion followed the earlier introduction of the first two Hallicrafters receivers that used selectable-sideband IF conversion schemes, the SX-88 and the SX-96. This was the method Hallicrafters used to provide sideband selection in association with variable selectivity for many years to come, including the fateful period after 1966 when Hallicrafters had been sold to the Northrop Corporation.

Production of these receivers began with the high end, general coverage SX-88 and its more afforable cousin, the SX-96. The SX-88 was introduced with a 6-page colorized ad in the front of QST in December 1953. The SX-96 followed a year later in December 1954. The SX-88, in spite of extensive publicity, was only produced during 1954 and is now quite rare and collectible. The SX-96 design was used as the basis for the SX-100, introduced in 1955, and was dressed up again to become the SX-122 in 1964. Reportedly, production of these receivers ended with the last SX-122A in 1970.

After the SX-88 was discontinued, a less elaborate Ham-band only receiver was introduced, the now-famous SX-101. This was in the fall of 1956. There were at least 5 versions of the SX-101 produced. An equally popular reduced-cost model, the SX-111, was introduced in 1960. 1960 also witnessed the introduction of the high performance SX-115, which has the same basic IF circuit design as the other receivers but included enhanced performance features. The SX-117 of 1962 can be thought of as a cost-reduced SX-115. It also used the same basic IF circuitry but was missing some of the more useful features.

Here is a timeline introduction of various selectable-sideband models, as compiled from advertisements in QST:

- December 1953, SX-88
- December 1954, SX-96
- September 1955, SX-100
- October 1956, SX-101
- June 1958, SX-101 MK 3
- January 1959, SX-101 MK 3A
- August 1959, SX-101A
- April 1960, SX-111
- May 1960, SX-115
- October 1962, SX-117
- April 1964, SX-122



Front-panel view of the SX-101A. The main tuning knob was provided by Mike Langston (KL7CD), and the new dial skirt around the tuning knob was purchased from Charlie Talbott (K3ICH).

The SX-101 Design Evolution: SX-101 Mark I

The original SX-101 was released as a 15-tube, 7-band, double-conversion superhet and was Hallicrafters' first Ham-band only receiver. It was pictured in the catalog section of the 1957 ARRL handbook having a digital-mechanical readout for the band indication, just to the upper left of the tuning dial. This is the same space that is occupied in some production models with the circular Hallicrafters "h" trademark symbol. In that same handbook, the Walter Ashe ad on page 106 has a photo of the SX-101 with a completely different dial bezel, main tuning knob, and different control knob inserts (see photos, page 29).

The original '101 offered full 160-meter coverage on the first band, with the conventional 80 through 15-meter allocations provided on the next four bands. Its upper band covered 11 and 10 meters (27 to 29.7 Mc) because 11 meters was still one of our bands in 1956. An additional bandswitch position allowed 10-Mc WWV reception for calibration purposes on the upper band. So, the upper band scale covered bands 6 and 7, but the 10-Mc portion was not directly calibrated.

A sharp-cutoff 6CB6 pentode in the front-end RF amplifier fed the first mixer, a 6BY6 heptode. The RF amplifier was an AGC-controlled design with rigid, well-built coils. An antenna trimmer in the secondary of the grid coils maximized the overall signal-to-noise ratio.

The 6BY6 was originally designed as a gated amplifier for use in TV sets, and as such was commonly found in the sync separator circuit. In a communications receiver it does a good job as a signal mixer because it is relatively quiet and has about all the signal isolation you are going to get with this style mixer. While not as resistant to cross modulation as the 6BA7, it is not as noisy and was used in the entire SX-101 series. It provides a significant amount of conversion gain because of the low first IF frequency.

The first local oscillator in the SX-101 (the VFO) was originally half of a 12AU7 dual triode. The other half was configured as a cathode follower that was used to feed the 6BY6 mixer grid #1. The follower gave good isolation of the VFO so that the VFO frequency wouldn't drift with gain and tuning changes in other circuits, and it provided a low-impedance, low-noise feed for the mixer. Also included was a VFO output circuit that could be used to drive an external transmit exciter by merely building a 1650 kc local oscillator and mixing it with the VFO output to arrive at a transmit output frequency equal to the receiver's dial frequency indication. This worked because the VFO in the SX-101 always ran 1650 kc higher than the incoming RF signal frequency.

The first IF was at 1650 kc, using one 6BA6 IF amplifier with two conventional double-tuned transformers. 1650 kc was outside of the broadcast band in 1956, but the recent expansions of broadcast assignments are now causing problems with IF rejection in Hallicrafters receivers.

The 6BA6 1st-IF amplifier was AGC controlled and was the best tube that could have been selected for this job. This stage was designed for a bandpass response, 13 kc wide at 6 dB down. This was much less than the bandwidth of the RF amplifier and helped to develop the image rejection the receiver was advertised to have.

The 2nd-mixer stage was isolated from other receiver circuitry on a separate chassis that was mounted in the center and on top of the main chassis. This subchassis contained a 6BA6 2nd mixer and a 12AT7 2nd-local oscillator. Because it was doing duty in mixer service, the 6BA6 was biased so that it was running in a relatively nonlinear portion of its plate current curve. The 12AT7 triode sections were the 1600 and 1700-kc crystal oscillators that provided the 6BA6 with low-noise mixer injection at its cathode. The oscillator crystals were factory selected to be within .05% or less. The proper crystal oscillator was selected by grounding the appropriate cathode via the front panel "Response" control. The oscillator outputs were coupled to the cathode of the 6BA6 mixer via a special transformer (T9) that provided the required low output impedance to match the cathode input, and kept the oscillator voltages in the same relative phase.

The SX-101 instruction manuals have good graphic illustrations of how the selectable-sideband system works. Briefly, the upper or lower positions of the "Response" switch change the injection frequency going to the 2nd mixer. By doing so, either the upper or lower portion of the 1650 1st-IF frequency band is selected for conversion to 50.5 kc. Good sideband selection is probably a requirement for SSB reception, and is handy for CW work because in the 1/2-kc position only one side of zero beat is audible. In the AM position, having either "AM Upper" or "AM Lower" can help to dodge interference because the crud can sometimes be placed outside of the received passband. An IF passband of 5 kc for AM seems to be adequate for full-voice fidelity during average noisy band conditions.

The 2nd IF frequency is 50.5 kc. The first two 50.5 kc IF transformers (T3 and T4) are on the 2nd-mixer subchassis, but they are magnetically shielded from one another. The IF signal leaves this subchassis via a length of RG-174 coax and is fed to the first 50.5 kc IF amplifier grid (a 6C4 triode), a passive notch filter in the 6C4 plate circuit, and to the second 50.5 IF amplifier, another 6BA6 pentode. The last two 50.5 IF transformers, T5 and T6, are in the output circuit of the 2nd 50.5 IF amplifier, located on the main chassis.

Figure 1 (page 28) is a greatly simplified schematic of the basic system used to provide variable selectivity in all of the selectable-sideband receivers. The four

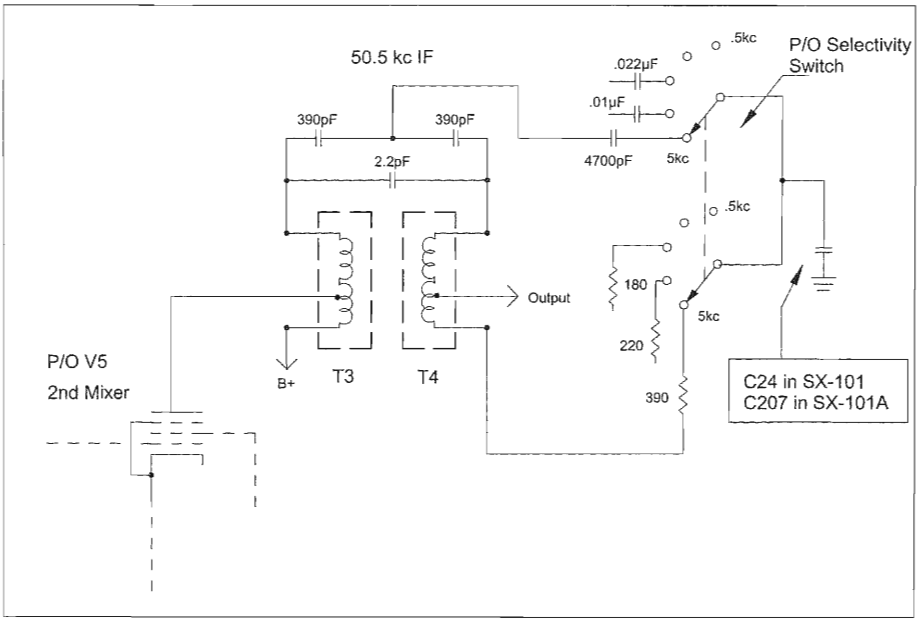


Figure 1: A greatly simplified schematic of the 1st section of the 50.5 kc IF system. T5 and T6 are not shown, but are identical except for the common ground on the selectivity switch, which returns directly to the chassis rather than through the AC ground shown here. C24/C207 also shares the 2nd mixer screen-bypass job.

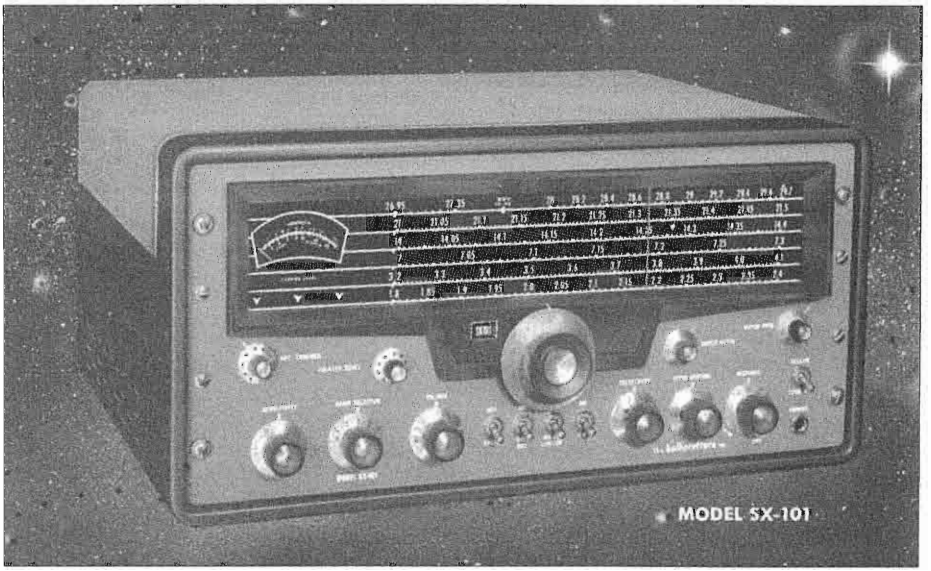
special 50.5 kc IF transformers, and the means of coupling them, is how Hallicrafters provided a selection of IF bandwidths that kept the cost of production reasonable while still providing a versatile design with good performance.

This design was adapted from early FM broadcast receivers and from television sound-IF channels. It is known as "top capacitive coupling." In the SX-101 and the other receivers, a selection of capacitors and resistors are gang-switched by the front-panel "Selectivity" control. The capacitors that are selectively grounded by this switch determine the coupling coefficient. By design, they need to be relatively high in capacity. This is convenient because stray capacitance will have little effect on the developed bandwidth.

As the bandwidth is narrowed from the widest 5-kc position, the capacitance that controls the amount of coupling between the primary and secondary sections goes down, reducing the bandwidth because the amount of coupling (the coefficient) goes down. At the same time, the amount of resistance shunting the secondary transformer coil goes down. This sharpens the response curve because circuit Q goes up. All four of the 50.5 kc IF transformers are controlled this way, using four sections of the "Selectivity" switch and capacitors and resistors matched in production to within 10%. When similar amplifier stages are arranged in a cascade configuration, the combined selectivity is the product of the individual selectivities. Selectivity is also proportional to circuit Q times the coupling coefficient.

The fifth bandswitch section was used for gain equalization in the 2nd-IF stage. In the 1-kc position, a series resistor was added to the cathode bias of the 2nd 50.5 IF amplifier, V6, to bring its gain down somewhat.

An additional position on the "Selec-



Above is a partial reproduction of Hallicrafters' ad in the catalog setion of the 1957 ARRL Handbook. Notice the mechanical-digital band readout to the upper left of the main tuning knob.

The Walter Ashe ad in the 1957 ARRL Handbook shows an SX-101 with a much different dial bezel. Also notice the sharply pointed inserts on the control knobs.

tivity" control was the "Phono" switch. This was an obligatory inclusion on a lot of 1950s equipment, although its usefulness on the SX-101 could be questioned.

The last IF transformer is coupled to a 6BJ7 triple-triode. The three sections of this tube provide AM detection, AVC rectification, and an ANL function. The

ANL diode is of the series-coupled style, and its output feeds into an octal-based 6SC7 dual triode. The first triode section is the first audio amplifier, and the second section is the BFO. The BFO voltage is coupled back into the detector's cathode by a 330-pF mica capacitor. Finally, the audio PA is another octal tube, a 6K6GT. No inverse feedback was used in the audio stages.

The other tubes in the lineup were an 0A2 that provided regulated 150 volts to the first mixer screen circuit, the VFO, the S-meter screen circuit, and to the BFO plate circuit.

A separate S-meter tube was provided, another 6BA6 pentode. The tube's grid was connected to the AGC bus, and increasingly negative AGC voltage, caused by increasing signal strength, reduced the tube's plate current. The S-meter is a backwards-reading milliammeter in series with the tube's plate resistance. Higher plate current, caused by lower RF signal strength, caused the meter pointer to stay to the left side of the scale.

A 5Y3GT was used in a typical power supply rectifier circuit.

SX-101 Mark 1A

I am not sure when the changes to the original SX-101 resulted in the "Mark 1A" model. My manual for the Mark 1A is not dated, but it must have been early in the production history. Here is a summary of the electrical changes made with the Mark 1A:

- They must have had stability problems with the early units, and in order to improve the situation an 8-watt power resistor was added to the metal shield around the VFO components. This was called the "Dampp Chaser." It was wired so that it was always across the AC line if the set was plugged in. Owners were given the admonition to not unpack the new receiver until it was ready to be used because the set had been shipped in a vapor barrier.
- The S-meter circuit had parts added and deleted to improve what looks like the meter's log response to changes in the AGC voltage.
- Screen circuit voltage dividers were added to the RF amplifier and the 1st-IF amplifier. This is curious because a single series-dropping resistor in screen circuits has long been known to reduce amplitude distortion in RF amplifiers[2].
- Other components were changed to "improve AVC action."

SX-101 Mark 2

- As far as can be determined, there were only minor changes to the AGC decoupling circuit in the Mark 2 model. Possibly the "Mark 2" designation was designed as a sales tool.

SX-101 Mark 3

- In the Mark 3 model, major changes were made to the VFO to improve stability and reduce hum. The tube was changed to a 12BY7 pentode, and the output cathode follower was removed. A separate filament transformer and safety fuse was added so that the VFO filament is always on when the set is plugged into the AC line. The secondary of the transformer was center-tapped and fed a small amount of DC bias to reduce hum modulation of the VFO signal. This was borrowed from hi-fi practice.

SX-101A Mark 3A

As of this writing, I have not been able to find circuit data on this model.

The SX-101A

The SX-101A is an excellent receiver, and don't let anyone tell you differently. The SX-101A restoration will be discussed in Part 2 of this article, coming up in next month's issue.

References:

1) J.L.A. McLaughlin, "The Selectable Single Side-Band Receiving System," QST, June 1941. Described a system that used a 455 kc output from an SX-28 to feed a selectable-sideband mixer, then into sharp bandpass amplifiers.
2) "Screen Dropping Resistors--Restrictions with Super-Control Valves," Radiotronics No. 96, March 1936.

ER

Amplifiers, Speakers, and Microphones

By Chuck Teeters, W4MEW
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Martinez, GA 30907
Photography by Reggie Frazier, KG4HAD

My earliest attempt at radio communications was standing outside our house and shouting at the top of my lungs, while my neighborhood pal was inside tuning our living room radio trying to pick up my voice. My mother told me to stop all the noise. When she told my father that evening about the shouting, he said he would fix it so I could talk through the radio. Several days later my father came home with a small package marked "DeLuxe Studio Style Radio Mike." It had cost 75 cents, which was a bit of money in 1930. I guess he figured it was worth the expense to preserve the quiet in our neighborhood.

We had a game room in the basement with a Philco radio and dad connected the mike to it with the "special lugs" as per the instructions. They guaranteed easy connections without injuring the radio. Push the button on the mike and the radio program stoppped and your voice came out of the radio. All worked as described. I think my dad got more fun out of it than I did. A lot of our family entertaining was done in the basement game room, so he put the mike upstairs and ran the wire through the floor to the basement radio. The public reaction to Orson Wells' "War of the Worlds" broadcast was nothing compared to some of the other reactions dad would get from our party guests when he would sneak upstairs and announce "We interrupt this broadcast to..."

Several years later, a new console replaced the basement Philco, and I took possession of the old radio and "Deluxe Studio Style Radio Mike". Ensconced in my attic workshop I proceeded to get

The Stancor "Hi-Fi 11"

hands on experience in chassis and cabinet separation, short circuits, open circuits, and high voltage testing by feel. With the speaker mounted in the attic window, I could proceed with a much amplified version of my original neighborhood shouting. The reaction, as before, was a resounding "shut up." In the interest of preserving my backsides, I reversed the mike and speaker locations, and got into aural aircraft detection, and listening to neighborhood gossip.

The neighbors identified me as a noise source and I was sought after on various occasions for disturbing the neighborhood peace, and more important to me, to provide public address services at birthday parties, and such. I decided I needed a decent PA system and proceeded to build an amplifier copied from Radio-Craft using a 58, a 56, and a pair of 2A5s using Jefferson transformers. My father had a nice workbench with power tools and bought me a 100-watt Jackson soldering iron to replace my stove heated iron. My grandmother, probably because of word from my mother, sent me $14 to buy a Readrite volt ohmmeter kit. Readrite was the meter of choice back then as they were cheap. The VOM eliminated lots of shocks.

With my new amplifier and some homemade speaker cabinets I was in the sound system rental business, and managed to pick up a dollar or two around the neighborhood. It appeared, however, that the big money was in mobile sound systems. Several of the local radio shops had sound trucks, which they rented out for advertising, political speeches, and street corner announcements. They drove around town making their announcements as not every one had radios, so you could reach a lot more people. A telephone call confirmed that the going rate for a sound truck was 45 cents per hour. My dad had just bought a 1935 Ford Roadster, complete with a radio and cigarette lighter, for my mother, so a car and driver would be available for a mobile P A service, with the proper approach of course.

I had a 6-volt motor generator that had an output of 200 volts DC or so that came from a car radio. It would be ideal for a mobile amplifier shown in the Thordarson catalog. The mobile amplifier used tubes with 6 volt heaters and my pair of2A5s had 2.5 volt heaters. The mobile amplifier used a 79, a twin triode power amplifier, rated at 8 watts out, which cost $1.50. A tour of several local radio shops and I found a used one, but testing good, for 50 cents. My Jefferson transformers worked just fine with the 6-volt tubes and motor generator. Mobile amplifier testing was conducted in the garage, due to the need for a 6-volt supply. On several occasions my parents found the Ford battery was dead, but they didn't associate the problem with me. With 8 watts, I added two more speakers. I made brackets to mount one in front of the grill, hang one on each side door, and had the fourth facing the rear on the back of the rumble seat.

One of my benefactors down the street worked for the telephone company and supplied me with excess wire, relays, fuses, lamps, and so forth. He was trying to get into politics as the local ward boss. I asked him if he would like to try some mobile politicking. He thought it would be a great idea. Most important, he could drive legally. We approached my mother about using her car on Saturday, and he graciously offered her the use of his Packard. She said OK and I was in the mobile sound business.

With campaign posters stuck all over my mother's car, we spent the day driving around our ward and other parts of town. My function was to adjust the gain as high as possible with out getting feedback. For those interludes when he was not talking, I held the mike in front of the car's radio speaker. The loud music would attract attention to the car and the posters. On several occasions this proved fatal, as the music would stop and they

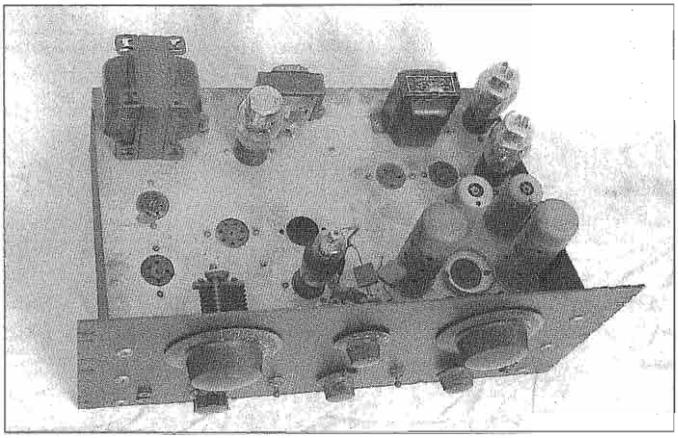
would start broadcasting a rival politician's advertisement. For the second weekend I mounted a wind-up Victrola motor and a magnetic pick up on a box and added a second input to my mobile amplifier. Now I could play records for a music break, providing the road was paved. I got my first lesson in political advertising when I was told not to play "The Old Rugged Cross" and "What A Sinner I Am." I got my second lesson in political advertising the next weekend when he brought along a sweet young thing to sit on the folded down top and wave at the crowd. I also found out that 20+ year old girls don't pay attention to 15-year-old sound technicians, even if you have a few dollars in your pocket. On Election Day, we started early and went all day. My benefactor got elected, I got five dollars, and I was in the mobile sound business.

I was introduced into the cost of doing business when my Mother asked for $1 to replace the five gallons of gas we used. A month or so later I also got introduced into the legal aspects of business when a summons was presented to my Mother for operating a sound truck with out a city license. One of the losers, or possibly a sound truck competitor, had apparently checked the license plate on our car and reported us to the city license inspector. Since we now had an excellent relationship with our new Ward leader, my Father got the charge dropped and strongly suggested that I get out of the mobile sound advertising business.

I decided that running a business was not for me. However, after I got my driver's license the following year, still having the mobile PA system made a tempting combination. I mounted two speakers in the grill of my Mother's car, and connected up the system. Several of my friends and I would drive through downtown, behind a local delivery truck. My friend, Eddie Stevenson, an aspiring sports announcer, would make sales announcements for whatever the truck was delivering. The truck driver, trying to find out where the sound was coming from, usually did some erratic driving and sometimes the driving and the sound attracted the attention of the police. Eddie's favorite was giving a phony play by play of a local high school football game, particularly in the middle of a February snowstorm. Driving slowly through downtown, people would flag us down to ask the score or who's playing. In those days, if it came out of a loud speaker it had to be the truth.

All of these memories were brought into focus last year when I was making a tour of eBay looking for Stancor kits. I saw a listing for a 1940 Stancor Hi-Fi-11 audio amplifier. What caught my attention was the anodized aluminum dial plate. It was obviously a Crowe Company dial plate that was very popular before the war and a few years after. They looked like chrome and added class to any project. About 70 years ago, for 50 cents, they gave my amplifiers a professional touch. So for nostalgia and $14, I bought a dial plate with amplifier attached. When it arrived it was a Crowe dial plate in excellent condition. The amplifier wasn't in bad condition either, missing a 6SJ7, but had a 6C5, a pair of 25L6s and a pair of 25Z5s. I installed a 6SJ7, a new filter cap, line cord, replaced several paper caps and it was working. An extra hole in the front was plugged, and the chassis cleaned up, and it looked like the Stancor advertisement for the Hi-Fi-11, complete with the anodized dial plate.

The Hi-Fi-11 was the lowest powered of 6 audio amplifier kits, from 4 watts to 50 watts, which Stancor sold in 1940, but was the only one listed as Hi-Fi. With 4 watts out at 4, 8, 15, or 500 ohms, one high gain mike input, and one low gain phono input, it cost $10.77 less tubes. The frequency response was listed as 60 to 10,000 Hz within 6 db. The double 25Z5 rectifiers were to provide an extra 100 mA of B+ for dynamic speaker field



Above: The Hamfest chassis that I restored as an audio amplifier.

coils so common in those days, if needed. While the frequency response doesn't seem like much today, the 1938 Radio Manufactures Association, RMA, specifications for a Hi-Fi amplifier were 60 to 10k within 10 db. FCC broadcast transmitter requirements in 1938 were 60 to 7000 Hz within 2 db. So, Stancor was exceeding all the standards at that time. For the acid test, I connected a Shure 55 mike and a 12" Hallicrafters speaker. There was a 20' cord on the mike so the speaker and mike could be put in separate rooms. In the middle of testing (read fun), my number 2 Son stopped in for a visit with his 4 and 7 year olds. They took over and have been having fun with it ever since. It sure makes me remember the good times I had with amplifiers, speakers and microphones.

Early this year, at the Marietta hamfest, Mike (K4HBI) had a collection of old stuff he was selling for Bill (W4NX). Sitting there was an old 17" by 12" steel chassis with a 19" panel, and old parts. It was never finished as it was 3/4 unwired, had empty holes and missing tubes. What caught my eye was a large Thordarson audio output transformer, and three chrome UTC audio transformers. In the mid thirties, UTC used chrome cases on their top-line stuff. Two of the five tubes were 53s, great audio tubes from the early thirties. Some friendly dickering and I was taking it home.

I installed a new line cord and an 80 rectifier, rebuilt the insides of an Aervox, "The Compact Condenser in the Cardboard Box," to quote the advertising, and got the power supply up and running. The 53 is a twin triode that can run class B with zero bias, and that's the way Bill had wired this up. The second 53 was connected in parallel as the driver. Two 57s were voltage amplifiers mixers preceding the 53s. So, this section of the chassis was a 10-watt audio amplifier. A 58 in the front middle was wired up as a 100-kHz VFO. There were two unconnected 262 kc IF transformers, two 140 mfd variables and that was it, everything else is empty sockets or empty holes.

A speaker and mike connected to Bill's audio amplifier sounded great, with more output than the Stancor. Just for the heck of it, I ran a frequency response test. It measured 50 to 7500 Hz within a few db, not bad for something 70 years old. Obviously, Bill built up a fine amplifier. I wondered what the rest of it was going to be. No telling what he had in mind, but what was obvious was that back in the thirties he was building, and, I hope he was having as much fun with amplifiers, speakers and microphones as I did.

ER

Alignment Procedures for the Chinese Type 102E Radio Set

By Doran S. "Jeep" Platt, K3HVG
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Transmitter adjustments and alignments are provided to optimize operation within the 160M, 80M, and 40M amateur bands. As such, a 40-80% increase in power output may be realized. Receiver alignment is conventional.

Equipment required includes a 50-watt dummy load, RF power indicating meter, frequency counter (optional and in lieu of the receiver for making transmitter adjustments), and a signal generator. To unlock the collars on adjustment capacitors, use an appropriate size hex nut driver. CAUTION! Do not use pliers or other un-symmetrical force tools to unlock these collars!

Receiver

1. Remove the accessory battery case from the rear of the receiver by releasing the 4 retaining clips, and un-plugging the receiver power pigtail cable.

2. Loosen the receiver panel locking dogs and rotate the dot 90 degrees CCW.

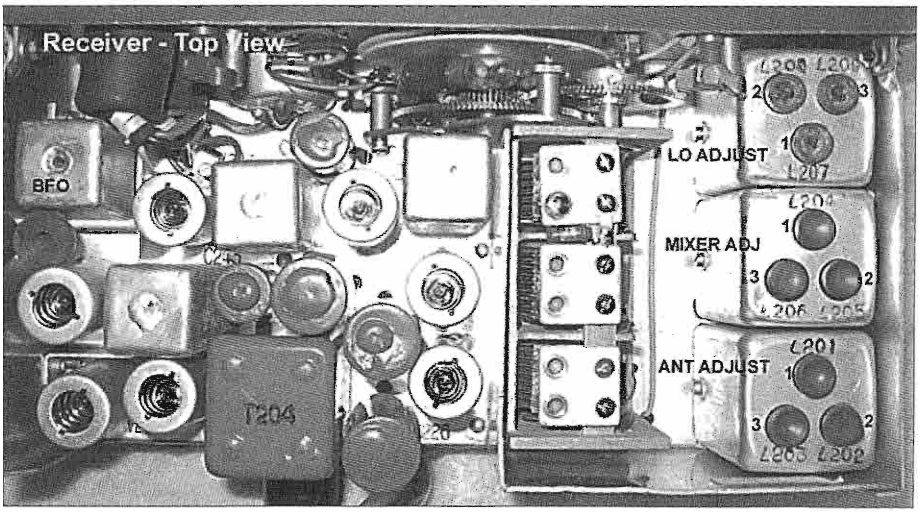
3. Carefully slide out the receiver chassis. Exercise caution as tube shields may have come loose during transit and will jam the chassis.

4. Re-connect the receiver power pigtail to the accessory battery case and power supply, and connect an antenna or signal generator.

BFO Adjustment

To facilitate "netting" of the 102E transmitter and to properly receive SSB signals, BFO zero should be calibrated. Check BFO zero by tuning the receiver to WWV, CHU, or other strong signal and center it in the bandpass. Turn the receiver to the CW mode and rotate the BFO control for zero-beat. If zero–beat coincides with mark, no adjustment will be required. If not, remove power and perform the following steps:

1. Using a soldering gun of at least 100 watts, carefully heat and wick the solder from the top of L-211 so as to reveal an



A top view of the 102E Chinese radio set showing the locations of the adjustments discussed in the text.

indentation and small metal disk covering the alignment access hole. Unsolder and slide away the metal disk using a pick, etc.

2. With power re-applied, and the receiver set up as above, using a small flat blade screwdriver, adjust L-211 for zero beat with the BFO control set at the zero point.

Note: L-211 need not be re-sealed unless operation in a tactical environment is anticipated.

Receiver RF/Mixer/LO Alignment

In preparation for these adjustment, it will be necessary to remove the wax plugs from the three inductor cans on the top side of the receiver. Using a small flat blade screwdriver (1/8"), carefully remove the wax from inside each ring and explore for the top of the inductor adjustment. Continue removing the wax until the top of the iron core is exposed. Some residual wax will not hinder adjustments. Note: If receiver sensitivity is deemed satisfactory, it is recommended that an "expedient field alignment" of the receiver, LO only, be done.. This alignment, shown last, will calibrate the receiver dial for the 160, 80 and 40 meter bands and will require that only one wax-sealed can be opened. Note also that it may be necessary to repeat steps for each band owing to adjustment interaction. Before beginning adjustments, loosen the locking collars of the capacitors indicated. Proceed in accordance with the table below, and adjust the signal generator and receiver dial for the band and frequency indicated.

Band 1 covers the top of 160M and the lower CW portion of 80M. Either align the dial for whichever band will be used the most or perform the complete, balanced alignment if both band segments are regularly used.

Transmitter

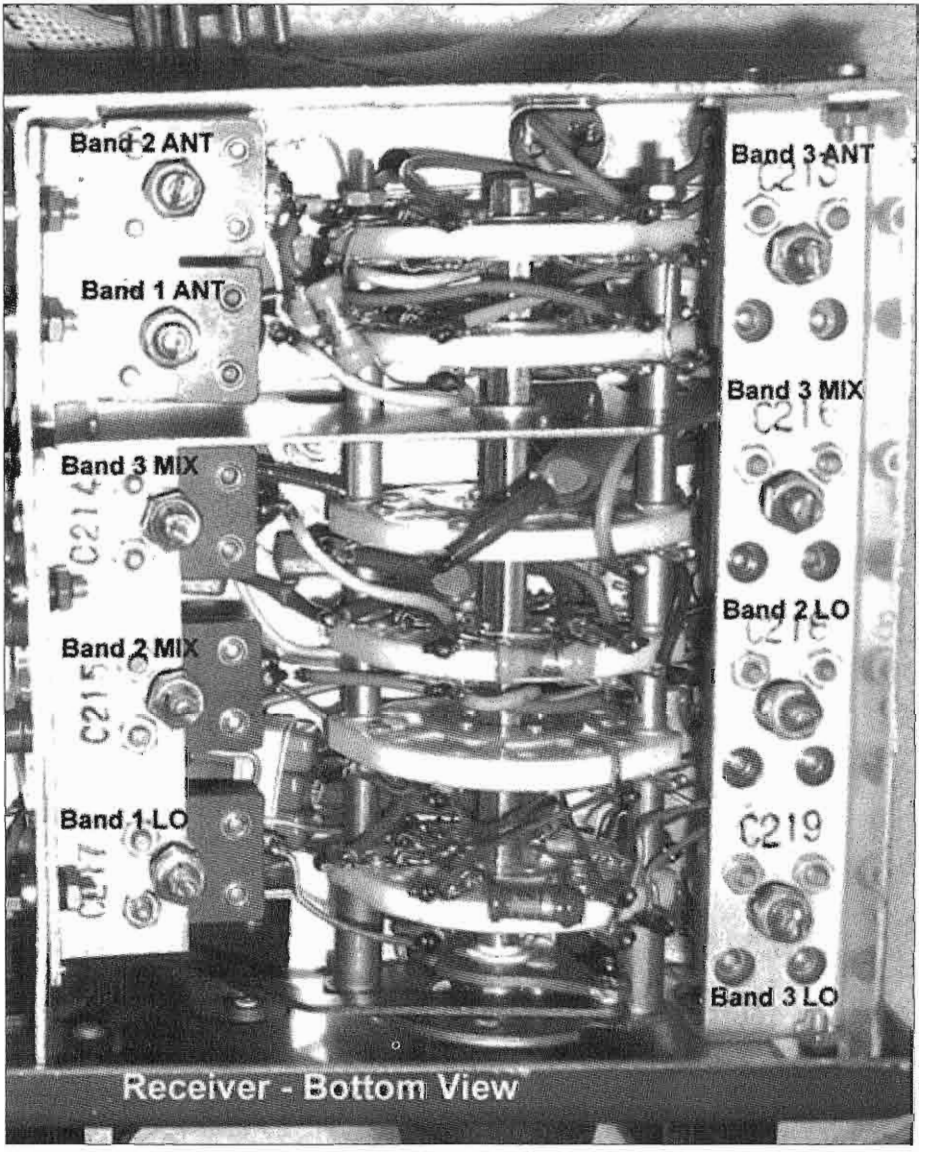
1. Remove the transmitter cubby panel door by loosening the front panel locks

Band	Gen. Freq. (kHz) - Receiver Dial	L.O. Align:
1	2000	L207
1	3800	C217
2	3800	L208
2	7000	C218
3	7000	L209
3	12000	C219

Band	Gen. Freq. (kHz) - Receiver Dial	RF/Mixer Align
1	2000	L201 - L204
1	3800	C211 - C214
2	3800	L202 - L205
2	7000	C212 - C215
3	7000	L203 - L206
3	12000	C213 - C216

Expedient Field Alignment (160, 80, and 40 meter dial calibration)

Band	Gen. Freq. (KHz) - Receiver Dial	LO Align
1	2000* (3500)*	L207 (160M) C217 (80M CW)
2	3800	L208
3	7200	L209



Here is a bottom view of the 102E that shows the various trimmer locations.

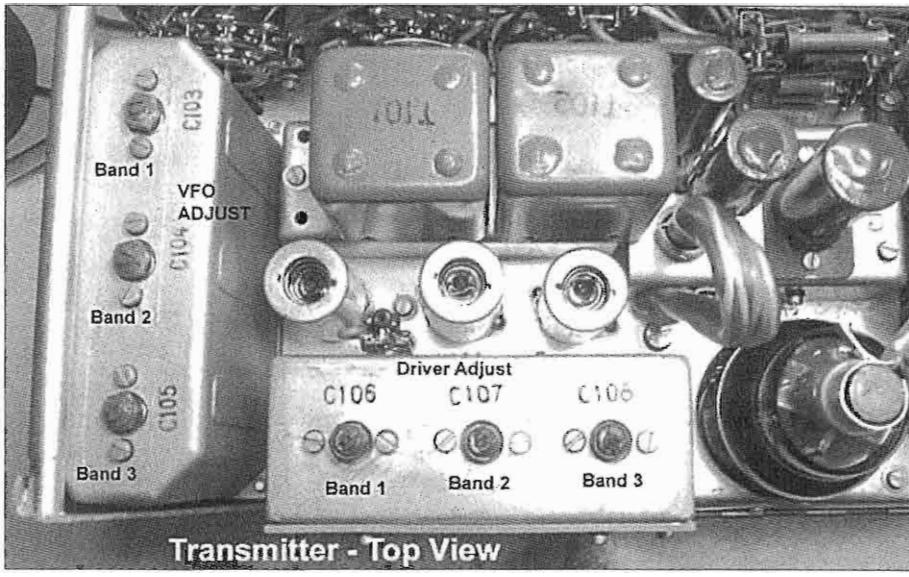
and dogs.

2. Remove the transmitter from its case by loosening the remaining dogs and then sliding it out.

3. Connect the transmitter to an appropriate power supply, dummy-load, and power meter and connect the receiver antenna jumper.

4. Loosen the control lock nuts on capacitors C-103, 104, 105, 106, 107, and 108. Observe the caution, above!

If frequency counter is to be used, omit references to the receiver in the following steps.



This top view of the transmitter section shows the locations of the adjustments that are necessary for proper alignment.

5. Set receiver for SPOT (if modification has been performed) or set internal switch for "Single Use".

6. Turn on transmitter and receiver power supply(ies) and allow both to warm up for several minutes.

7. Set receiver to CW mode and BFO to zero position

8. Set transmitter and receiver to Band 1 and 2000 kHz.

9. Set transmitter to CW mode (Note: In CW mode, transmitter low-level stages are now keyed). Key the transmitter if frequency counter is used.

10. Adjust C-103 for zero beat in the receiver (or proper frequency on the optional counter).

11. Repeat steps 7 thru 10 for:
Band 2, 3900 kHz, adjust C-104
Band 3, 7250 kHz, adjust C-105.

11. Set transmitter to AM mode.

12. Set receiver SPOT switch to normal or internal switch back to "Combined Use"

12. Set transmitter to 2000 kHz.

13. Key transmitter and tune for best power out. Then adjust C-106 for max power out as indicated by plate meter resonance and measured power out.

Note: If Band 1, low-end, 80M CW is preferred to 160M, set VFO to 3500 kHz. If both bands are required, it will be necessary to balance the output power between 160M and 80M.

14. Repeat steps 11 thru 13 for:
Band 2 at 3900 kHz adjust C-107
Band 3 at 7250 kHz adjust C-108.

15. Return transmitter to its case and secure the panel locking dogs.

If the transmitter is to be operated via an AC power supply, and the mic-bias bypass capacitor modification[1] has not been accomplished, this may be an opportune time to do so as the unit is conveniently out of its case.

1: Refer to my article on the basic 102E radio set in ER #195, August 2005.

ER

Tale of a 3-Tube, Swap Meet, Homebrew Radio Part 2

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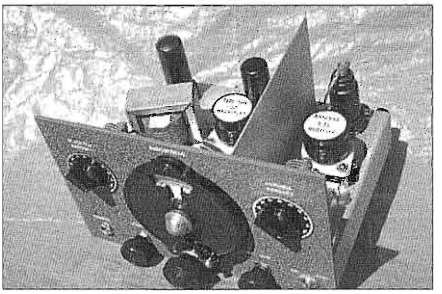
To save as-is, restore, part-out, or rebuild - that is the question. The 3-tube regenerative receiver that was the subject of Part 1 of this epistle is an example of a homebrew radio that required a decision on how to deal with it after purchase. As described in Part 1, I chose to tear it down to its component parts and rebuild it. This article describes my reasons for taking this approach rather than using the set as-is or restoring it to working condition in its original physical form. In this article, I will also briefly introduce a second homebrew receiver that I chose to save as-is and my reasons for doing so.

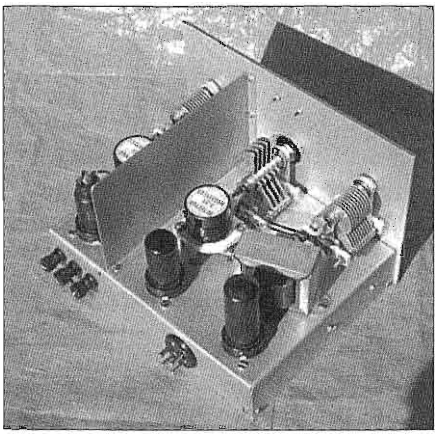
Over the past three decades I have purchased many homebrew radios at various swap meets and flea markets. Of all of them, I've saved only three, restored three and rebuilt two while preferring to part-out the rest as sources of good or restorable vintage parts as collectibles in their own right, or as parts for building my own homebrews. I have pondered my reasons for not saving more of these homebrews in as-found condition or restoring them to good working condition, and have finally reached some conclusions. One reason is that they have no particular historical significance, but the main reason is the mediocre workmanship exhibited by so many of these radios. None of them ever seem to have the quality of craftsmanship shown on the pages of QST or the ARRL handbooks. Nevertheless, they must have provided some measure of pleasure to their previous owners. Consequently, I've decided that in judging homebrew radios whether for a contest or for deciding what to do with them after purchase, there should be two major categories in which they are judged. In Category 1, the main criterion for judging is - Does it work? In this category, workmanship doesn't necessarily count for much. In Category 2, the "Does it work" criterion remains, but otherwise, workmanship counts heavily. Further explanation of these categories follows.

Category 1

This category celebrates the fine tradition of amateur construction wherein the use of ordinary, non-electronic materials that are found around the home, improvised non-traditional solutions to construction problems and the use of non-contemporaneous components are O.K. It also encompasses the work of those who have not yet mastered the details of fine craftsmanship such as beginners and those who really don't care about craftsmanship, don't have the patience for it or don't have the proper tools. Remember, the main thing is - Does it work? Making do with what you have, be it materials, tools or your own skills, is by and large a good thing. One harkens back to the days when hams made nearly everything in their rigs including "condensers" made out of sheets of glass, or even wax paper, and sheets of tin foil. An interesting example is shown in Figures 2 through 4. It is a one-tube regenerative set given to me by Larry Tinkler (K6LXT), and no, Larry didn't build it. Here we see the classic features that classify this receiver as a Category 1 set:

• Use of non-electronic, found materials: The chassis and panel are cut out of some kind of plastic that appears to be sections of stair tread material. This integrates all the parts into a working set, but it does not provide shielding so the set does suffer from hand capacity effects. The right side of the chassis is screwed to the wooden end-block with round-head





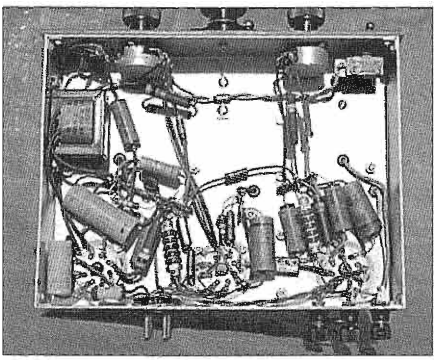


Figure 1: The three photos above show the rebuilt 3-tube regen receiver I described in Part 1 of this article.

wood screws (good choice). But on the left side, flush-head screws are used without countersinking (poor choice of fasteners or poor workmanship). Goodness knows where the strange sheet metal bracket holding the central bandspread capacitor came from. But don't knock it, it works. I almost forgot to mention the paraffin wax meltings holding the turns on the tube-base plug-in coil. Actually this is one of the neater aspects of this set and it works well.

• Beginner's wiring practices: Believe it or not, one end of the 2.5 mH RFC is soldered to the frame of the audio choke as a convenient soldering point for the junction between these two components and the coupling capacitor to the audio amplifier. This junction is at the 250-volt B+ potential. I would have grounded the frame, and put as much of the 250-volt stuff as possible under the chassis where it couldn't be accidentally touched when changing plug-in coils.

• Use Of Non-Contemporaneous Components: I suppose the use of latter day Japanese electrolytics and volume control is forgivable as old-time components of this type in good condition are very hard to find these days, but what about that IC lurking on the perfboard in this 1930s vintage regenerative circuit? Here we have an LM386N integrated circuit used as an audio amplifier on the same chassis with a type 76 triode used as the detector. These are definitely non-contemporaneous components. Actually, the IC does a great job of transforming this set from earphone level to loudspeaker volume. However, I would have hidden the IC inside an old bathtub capacitor housing or some other such trickery.

Well, I could go on and on about this set, but you get the point. In the spirit of experimentation, the builder put this set together out of stuff he had on hand, and it works! Although this set does not exhibit the greatest workmanship, it has no serious safety issues and is in good working condition. Therefore I decided to save it as-is. No doubt many of you have also encountered innovative and unusual solutions to homebrew construction problems that work.

Category 2

This category requires that the radio

not only work, but be designed and constructed similar to a brass-board, as we used to call it in the industry. That is something between an experimental breadboard and a production model. It should have the form, fit and function of a production model but not require the use of industrial processes that cannot be done in the average home workshop. For example, bent sheet metal parts may be used where they would be replaced by castings in a production model. Similarly, rub-on lettering may be used on front panels where engraving or silk screening would be used on a production model, and machine screws, washers and nuts can be used instead of rivets. This category does not exclude radios where there is hardly any difference between industrial methods and homebrew methods such as 1920s radios with wooden baseboards and bakelite front panels, or beginner's radios with pressed board panels and chassis decks. The point is that the radio should reflect trueness to its purpose and period, and exhibit the best craftsman available in that period. For some examples of truly magnificent Category 2 homebrew radios that are well laid out with efficient use of chassis real estate and flawless workmanship check the HBR web site (www.qsl.net/K5BCQ/HBR/hbr.html).

Decision Time, An Example

Here are my specific reasons for choosing to tear down the 3-tube regenerative receiver (described in Part 1, ER #195) to its component parts and rebuild it.

Defective components

One electrolytic capacitor had some strange fuzz growing out of one end.

A filter choke with laminations meant to be held together with home-made metal clips had one clip fallen off and was starting to delaminate.

The On/Standby switch, which carried B+ voltage, had intermittent resistance to its grounded housing and intermittent high resistance in both its On and Off positions.

The insulation of the zip cord used for the AC line input and also for the heater and B+ power outputs of the power supply was hardened and cracking off exposing the bare wires.

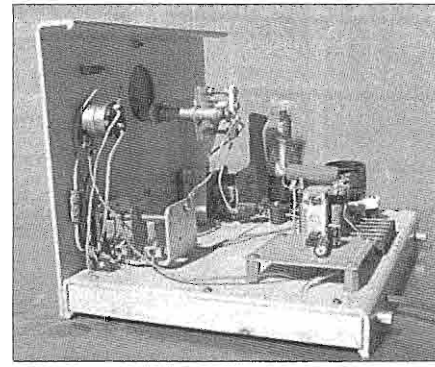


Figure 2. Right side view showing cross section of stair tread material used for chassis and panel. The bandspread capacitor in the center was once a nice National, 2-gang, 50-pF variable capacitor that has been cut down to 2 stator plates and one rotor plate. The All-American Five superhet capacitor at the left is the regeneration throttling control.

Workmanship Safety Issues

Some B+ (high voltage) wires were strung through un-deburred holes with no grommets or other protection.

Wire splices were loosely insulated with plastic electrical tape which was starting to fall off.

The heavy power transformer and filter chokes were not secured inside the power supply case by any means.

Leads with stripped ends from unused transformer windings were hanging loose inside the chassis.

Reversed power connectors. The radio had a female connector while the mating connector on the cable from the power supply was male, thus exposing high voltage on its pins. One cannot fault the builder for this situation as it was common practice during the time frame of this set (late 1930s).

The power supply had no fuse or grounding wire.

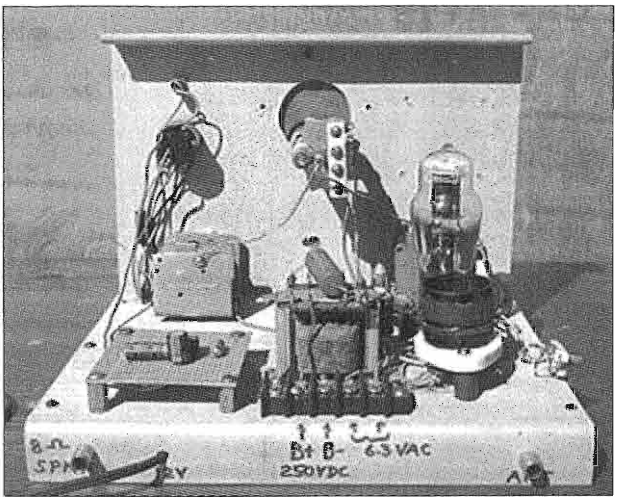


Figure 3. Rear view showing audio choke used as soldering point for components carrying high voltage. Perfboard with LM386N audio amplifier at the left, tube-base plug-in coil at the right.

The B+ bleeder resistor, which consisted of two 10k wire-wound resistors soldered together in series, was mounted externally by connecting its two ends respectively to the B- and B+ output terminals of the power supply, thus exposing its high-voltage center tap to being touched or shorted against the power supply's metal case.

Ordinary poor workmanship

Drilled holes on the chassis and panel were not deburred.

There were several cold solder joints.

Many components did not have their pigtails put through holes in solder terminals but were just laid on terminals and soldered in place. One cathode bias resistor had already pulled off of its tube socket terminal.

There were no lock washers under any nuts.

Each ceramic socket for the plug-in coils was fastened to the chassis with a long screw and spacer on only one end, with the unfastened end overhanging the edge of the too-small chassis. I could see myself cracking and breaking the sockets when inserting or extracting the plug-in coils.

There were no soft washers (fiber, rubber or lead) between ceramic parts and their mounting screws and metal spacers resulting in another opportunity for cracking these parts.

There was no binding post or any other form of permanent attachment for an antenna, just a 5-inch piece of stranded, insulated wire soldered to one lug of the antenna coil socket with the other end stripped bare.

There was no attachment point of any kind for a ground connection.

Two pieces of zip-cord were used to carry power from the power supply to the radio instead of proper 4-wire cable.

The hack sawed edges of the panel and shield plate were not filed smooth.

The detector plug-in coil had a loose winding that was falling off the bottom end of its form. The use of old tube bases as plug-in coil forms is a time honored tradition, but the windings should not be so loose.

A speaker field coil, as separated from its speaker, without an iron core of any kind was used as one filter choke of the power supply.

The bottom of the power supply case had a layer of a strange waxy substance with an accretion of assorted crud stuck to it and embedded in it, apparently acquired during its previous life as a B-battery eliminator case. This had been allowed to remain during its new use as a power supply case.

Parts Inappropriate to the Late 1930s Time Frame of this Set

The knobs were of 1970s vintage and were hardly compatible with the nice National Type-B tuning dial that came with the set.

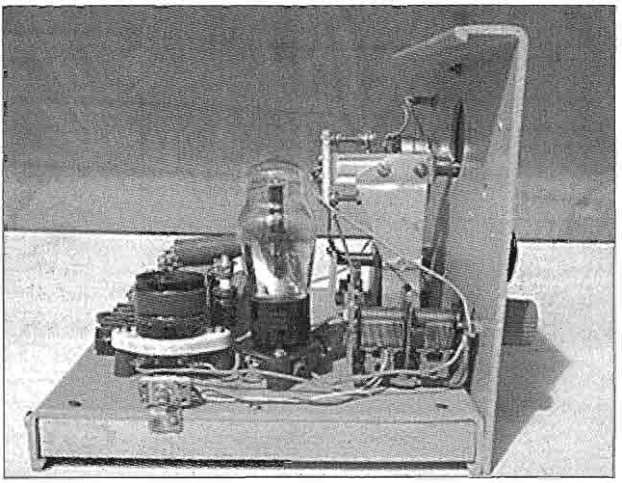


Figure 4. Left side view. The All-American Five superhet capacitor at the right is the bandset tuning control. Behind it and holding the bandspread capacitor is a sheet metal bracket that was obviously cut from something else with tin shears.

There were some Mylar polyester film and ceramic disk capacitors mixed in with the vintage paper and mica capacitors.

The pilot light assembly mounted in a side of the power supply case was a modern unit with a permanently embedded neon bulb.

There were non-electronic hardware items such as tiny square nuts instead of the hex nuts that have been traditionally used in electronic equipment from the 1920s onward. The square nuts and their matching screws were most likely obtained from some kid's Erector Set.

Poor Design (It's in the eye of the beholder)

A piece of 1/8" x 7" x 12" aluminum was used for the front panel. It was too large and out of proportion for this set. The builder apparently used a piece of metal he had on hand without cutting it to fit this job. As shown in Part 1 of this article, a 5-¾" x 9" panel cut out of the original panel worked just fine.

A piece of 3/32" x 4-5/8" x 6" aluminum was used to shield the RF stage from the rest of the set. Like the front panel, it was badly proportioned and was overhanging the back of the chassis – another case of using a piece of material on hand without cutting it to fit. Also, the 3/32" material is very difficult to bend into a sharp 90-degree angle as needed for its mounting flange. As a result, the shield plate was deeply cracked all along this bend. A piece of aluminum 0.050" x 3-3/4" x 6-1/2" (plus flanges) worked much better.

The used, pre-punched, 1-1/2" x 4-7/8" x 9-3/8" steel chassis with a speaker cutout had an inappropriate form factor and socket-hole layout for this regen set which has no speaker and only three tubes. As shown in Part 1 of this article, a 1-5/8" x 6-5/8" x 8-3/4" chassis resulted in a much neater and more efficient layout.

The panel was attached to the chassis in an asymmetrical manner with the overhang at one side of the chassis larger than on the other side.

The knobs on the front panel were placed in a haphazard manner, probably to take advantage of some holes that were already drilled in the panel.

The four knobs on the front panel were all of different styles and, except for the National dial tuning knob, were not related by size and shape to their respective functions.

There were no labels for control functions on the front panel.

The Hammarlund band spread capacitor shaft was connected to the National vernier dial by means of a wooden dowel and an insulated universal shaft coupling. The wooden dowel had shrunk resulting in looseness between the dial and the band spread capacitor. Further-

more, there was no need for the wooden dowel or the insulated coupling as the 1/4" diameter capacitor shaft can fit directly into the 1/4" diameter opening in the dial, and in this circuit, the capacitor shaft is grounded to the chassis.

Picky, picky, picky: OK, so I'm picky, but I couldn't place this set in either Category 1 or 2. It had a lot of features of Category 1, but the classic nature of its circuit plus the many nice '30s vintage components mitigated in favor of it not being left in that category. Instead, I decided on a rebuild in Category 2 with the safety issues corrected and, hopefully, better quality workmanship. As indicated above, it would be necessary to fabricate a new metal chassis. Building radios from scratch often involves metal working, and this becomes the big discouraging stumbling block for many would-be radio builders. So, here are my thoughts on that subject.

Hand Tools vs. Professional Tools

Having the proper metal working tools for chassis and panel construction is a tremendous force multiplier that makes fun out of what can otherwise be tedious drudgery. With the proper tools on hand, one is less inclined to get by with metal parts not cut to the proper sizes and make-do parts, as in the subject regen set, and more inclined to do a first rate construction job that is up to the standards depicted in the ARRL handbooks. However, when I first became interested in this subject in the late '40s and early '50s, the Construction Practices section of the Handbooks and other books and articles dealing with radio construction never mentioned the use of tools such as box-and-pan bending brakes, press-brakes, shears and punch-and-die sets. Instead, they detailed the use of hand tools such as hack saws and processes such as breaking sheet metal by bending it after scoring it or bending it by holding it between two pieces of hardwood held in the jaws of a vise. Well, parts that have been cut with a hack saw look like they have been cut with a hack saw and so on. Even as a kid, I couldn't reconcile the difference in appearance between the projects pictured in the Handbook and the results obtained with ordinary hand tools. Clarification of this matter was provided by Lew McCoy (W1ICP-SK) on page 2 of ER #130, February 2000, where he explained that the ARRL lab "had metal working equipment" including "a [sheet metal] shear, a bending brake, a large stock of socket punches and drill presses". He says, "It usually took a few hours to prepare a chassis for wiring." He also indicates that the starting point for chassis fabrication was "sheets of aluminum, 3 by 8 feet". No doubt, the reason for all the focus on hand tools rather than metal working equipment was because such equipment was beyond the means of the average amateur.

Affordable Tools

In recent years, reasonably priced metal working equipment has been made available by various imported tool outlets (check the web). Tools that have both shear and press-brake functions in one as well as individual tools for these functions are available in 12-inch and 24-inch sizes and are priced from around $150 to $300. This is comparable to the prices of many computer accessories and "rice boxes", and certainly beats the over $1000 price range of professional equipment It is extremely gratifying to be able to place a piece of aluminum in a sheet metal shear, and with one stroke of the handle have a perfectly edged cut. Compare that with the time and effort spent in cutting with a hack saw and then filing to get a smooth edge. Ditto for making nice sharp bends in chassis flanges, shield plates and various brackets for holding potentiometers, variable capacitors and such. The results obtained with a bending brake or a press-brake are so much better looking and so much easier to do than bending over something clamped in a vise with a ball peen hammer. However, keep in mind that better looking does not necessarily translate to being more effective, circuit-wise. That is why

Category 1 remains a viable alternative in homebrew radio construction. If you are considering buying one of these combination tools or a straight bending brake, I should warn you to avoid small, cheap bending brakes or even larger ones intended for use in home-built aircraft construction that do not have different sized fingers to fit between the already bent flanges of the piece on which you are working. If the brake has no fingers, you can only make a U-shaped chassis with front and back sides, but no left or right sides. Finally, one should keep in mind that near professional quality work can be accomplished with hand-tool methods as has been demonstrated by numerous homebrew jobs over the years. It's just more work and takes more time. Also, even if you use metal working machinery, there will still be certain tedious hand work to be done. In Part 1, I explained how some hand work was needed to make the square cutouts in each corner of the chassis blank before bending up its sides. Besides this, the National octal tube sockets required 1-1/16 inch diameter chassis holes, but I don't have a chassis punch of that diameter. Therefore, I punched 1-inch diameter holes with a punch that I do have and filed the holes out to scribed lines of the correct diameter.

Suggested Guidelines For Restored, Rebuilt, and Scratch-Built Homebrews

First of all decide whether the radio is, or is going to be, a Category 1 or a Category 2 type of set. If it's an existing Category 1 type, don't mess with it except to clean it, replace or fix defective components and clear up any possible safety issues. Category 1 sets have a charm all their own. If it's going to be a new project of the Category 1 type, as the Nike ads say, just do it. It's only a hobby, so enjoy yourself. But remember, when you're done with it, it's supposed to work. If it's a Category 2 type, remember that workmanship is paramount. The procedures for dealing with an existing Category 2 radio are the same as mentioned above for an existing Category 1 radio. If you are planning a new project or a rebuild of the Category 2 type, use the above list of workmanship faults I found with my recent homebrew purchase as guidelines on how not to do it, and by implication, how to do it right. For goodness sake, deburr those holes with a pen knife or a small deburring tool. Use grommets where appropriate and machine screws, nuts, lock washers, spacers, etc. that are the correct sizes and types for their intended use. And, use components that are appropriate to the time frame of the radio. The ARRL Handbooks and various radio magazines and catalogs are good guides in this regard. Watch out for cold solder joints. One of the reasons that these occur when using new-old-stock (NOS) parts is the corrosion that accumulates on these parts such as on the leads of resistors and the solder lugs of tube sockets. This is a case were parts that have been recently liberated from an old radio, such as the tube and coil sockets and other small components from my 3-tube regen, have an advantage over NOS parts. After desoldering, the liberated parts have nice clean solder tabs, whereas NOS parts will typically have a fine patina of corrosion that must be scraped, sanded, or scrubbed off to achieve a properly wetted solder joint.

Conclusion

As mentioned in Part 1, there should be no need for inventing while building. See "Planning for the rebuild" in Part 1 for detailed instructions on how to discover all your potential mistakes with pencil and paper, and mostly eraser, before starting the actual construction. I hope this article will be helpful in rebuilding and scratch building homebrew radios.

ER

A Striking Experience

By Bob Lackey, W4QBE
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This story begins on October 2, 2004, about 4:00 A.M. When you become 72 years old, it is not unusual to awake in the middle of the night, and be as wide awake as a child on Christmas morning with no hope of a visit from the sandman. So you get up and write an article for your favorite magazine, Electric Radio. This article is too long for QST and too technical for another magazine (to go unnamed) to which I subscribe, so Electric Radio seems to be my best sounding board.

I have been employed in electronics/electrical work for over 54 years and have held a variety of jobs in this field. I have always been fascinated by lightning and grounding systems. I suppose my interest was prodded by one of my first electronic jobs back in 1950, when I was in high school. I was fortunate enough to work with a gentleman, Mr. Ed Cowan. Mr. Ed had retired from Georgia Power Company and had opened a hardware store with Mr. C. E. Steele in Conyers, Georgia. Mr. Ed had a radio and TV shop in the hardware store and hired me to work in the afternoons and Saturdays repairing radios while he did the TV repair. At that period of time, Conyers and Rockdale County were mostly rural and the folks from the country would come to town on Saturday morning to do their shopping. Every Saturday morning, Mr. Ed or Mr. Steele would sell several TV sets and that afternoon Mr. Ed and I would travel out into the rural area and install the sets and their antennas.

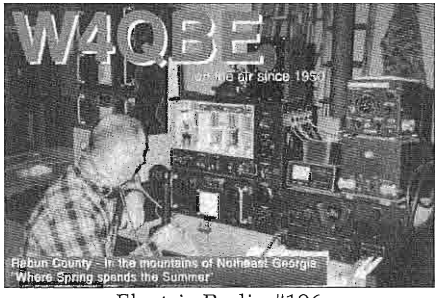
Mr. Ed always constructed the TV antenna masts from galvanized water pipe (no thin wall for him). One of my jobs was to dig the hole for the pipe, put a rock in the bottom of it and ground the mast to a cold water pipe with a #6 AWG copper conductor. Mr. Ed always did the "high work" on the house and I did all the "low work" under the house. He was no dummy. He said he did the high work because he was afraid I might fall and left the safer low work for me. In later life, I realized why he was so generous. Back in 1950, lots of folks kept chickens and the houses were not underpinned, so crawling under the house to connect the grounding conductor for the TV mast could be a rather 'nasty' job — and that's how I became interested in grounding and lightning protection.

Now that all the background work has been laid, I'll tell the "rest of the story." I have since retired but still do some electrical and lightning protection work. A Ham friend of mine (to go unnamed for obvious reasons) called and requested my assistance with an electrical problem he was having. During hurricane Ivan, we were without power for several days and he was powering his house for the first time from his emergency generator. He was doing this by opening his main circuit breaker and back feeding his entire house from a 30-amp, 120/240-volt air compressor circuit feeding his garage. While this is a common thing to do and works very well, it is dangerous and frowned upon by the power company for obvious safety reasons. My friend informed me he had blown some of his lamps, his TV, microwave and several other appliances and was rather beside himself.

When I arrived at his home some time later (I had my own problems to work on), I found he had enlisted the help of another friend, who informed me that one side of his AC line was about 200 volts and the other side about 40 volts. To an experienced electrician, this is a classic case of an open neutral. Upon checking, I found a normal output of

120/240 volts at his generator but the 'odd' voltages at his circuit breaker panel. I checked the line from his generator to the circuit breaker panel (his air compressor line) and found the neutral to be open. He had previously used his air compressor, but it is 240 volts and does not use the neutral. An electrical fault normally happens at a junction box or at a plug connection. After checking, I found no fault at any of these points which put the culprit in the Romax cable (A 10-2 Romax with safety ground). He was using the safety ground for a neutral which is a No-No. While this works, it is not according to the NEC. To get my friend some power, I ran a cable from his generator to the circuit breaker panel and got him back in service and was soon back to my own problems.

Several days later, I returned to his house to correctly fix his problem and it was a "doozy." Several years ago, he had a severe lightning hit and what it did was to hit his buried phone cable outside his house. It blew a hole in the ground and slung mud over the side of his garage. This goes to prove that lightning does not always hit the highest point. His house is down hill from his 50-foot antenna tower and I had previously installed a ground field of four (4) eight-foot ground rods, properly spaced and connected in the meter base at the service entrance. The lightning hit the buried cable about 15 feet from the meter base instead of hitting the underground power. I should have done a better job of grounding. I had also installed a 2000 Joule-per-pole lightning arrester in his



circuit breaker panel. His initial service wiring was not ideal; his meter base was on one end of the house and the circuit breaker panel was on the other end of the house; connected by a 4/0 service entrance cable which ran the entire length of his attic. If I had wired the house, I would have placed the circuit breaker panel near the meter base for cost reduction and better lightning protection.

After removing plywood from his storage space in the attic, I found a ceiling joist had been notched out for his 10-2 Romax air compressor line to allow for the plywood flooring. To hold the Romax in the notch while installing the plywood, a nail had been bent over the Romax. This should have been no problem as it is no different from the many steel staples used to install Romax. I noticed the Romax was burned under the nail. An arc had occurred between the safety ground being used as a neutral, through the Romax sheath, to the nail, and then back through the Romax sheath, through the hot conductor insulation to the hot conductor. This arc did not open the hot conductor but it did burn open the safety ground, which in this case, was used as the neutral. This 10-2 Romax runs parallel to, and about four feet from his 4/0 service entrance cable, both running almost the entire length of the house.

Lightning generates a broad band of frequencies up to 100 MHz and can cause standing waves to be generated on any conductors in its influence. In this case, voltage maxima happened to be right under the nail and the voltage was high enough to cause an arc between the conductors. It is amazing the tricks lightning can play on you. After 54 years, I have seen some strange problems caused by lightning. The best protection you can have is a well-engineered installation with lighting protection built in from the beginning of the installation to the completion, and if you are lucky nothing will fall through the cracks, not even lightning.

ER

W8GLW Time Capsule

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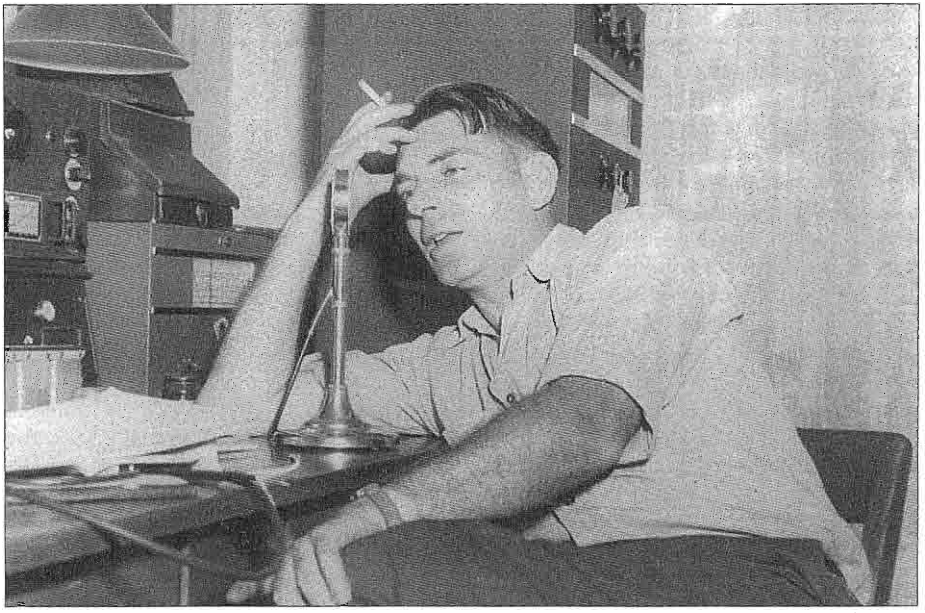
Shelby Township, MI
48317

On April 22, 2005 my close friend Larry (W8ER) posted a link on the AmFone.net bulletin board. Larry was letting the rest of us know about an interesting Collins transmitter that had been listed on "The World's Largest Online Marketplace." I followed the link and found this heading:
Collins 30K-1 with Collins 310A-1 Ham Radio Dream Machines! 30K Serial #14 & 310A Serial #35.

I scrolled down to the picture and price. No bids yet, and interestingly enough the seller was in Michigan, my home state. If I bid and if I won I could drive the 350 miles and pick it up. Next, the item description came up. Early in the seller's information section was this sentence: "Grandpa died in 1962, after he died Grandmother locked the door to the radio room and it was never touched again until recently."

The sellers ID was "grandpasradios" and the seller had no feedback. Further down the page were pictures that seemed to reinforce the notion that this story might be true. At the end of the photo gallery was a fairly good digital picture taken by the seller of the operating position showing the 30K-1 and 310-A, surrounded by other vintage equipment as well as knick knacks from the 1960s and earlier. The seller stated the other radio equipment shown was being listed separately. I looked at the other listings that

When this photo of Paul Snyder's station was taken in April 2005 it had been closed, silent, and undisturbed for 43 years. The wall calendar still shows 1962.



In brighter days, the filaments are lit and Paul Snyder (W8GLW) is on the air with his 30K-1 and a National HRO sometime after WWII from Boyne Falls, Michigan.

day and came away with the impression that this might be a rare time capsule. We have all seen listings at this auction site that appear to be less than honest or misrepresented. Everything I saw here held my attention.

I poured over the pictures and descriptions for hours looking for any hint of dishonesty, not finding a single word that led me in that direction. The seller's photographs in the co-listed advertisements showed the same operating position, but featured a different piece of equipment. All of the pictures and all of the seller's descriptions had a ring of sincerity to them. I was hooked.

I wrote an email to the seller. I conveyed my interest in the equipment and tested them on the facts presented in the ads. I asked if the photographs where actually the way the equipment was left in 1962. Had this equipment been arranged for dramatic effect or was the equipment actually in "as left" condition? I closed with a historic preservationist's tone. I was quickly answered by the seller. The reply stated clearly that the equipment was in his home and that the home had been passed down to him and his wife through the family of the original Ham operator, and the radio room was intact. Not only was the radio room intact, but a collection of other equipment filled another section of the home and a large area of "the mill" as well. The seller stated all items, including the contents of the mill, had not been touched in many years nor had it been arranged for photos.

On April 21st I asked my new acquaintance in an email reply if he would allow me access to the collection for photographs. I felt this collection should be photographed and the history recorded as soon as possible since the final sale date was only a few days away. Again his response was fast and direct. More information surfaced regarding the station log books, QSL cards and many other documents. All of which still existed in the radio room. My new pen pal, Bill Carson, supported my photo and oral

history gathering idea fully. Bill offered access not only to his grandfather's radio room, but told me of a family event scheduled for that weekend. I asked if it was possible that other family members with memories of the radio station might make themselves available. We made plans for a visit on Monday, April 25th.

Nothing travels faster than news like this. After our weekly Sunday morning AM net a few of us sat in to chew the rag. I mentioned the Internet listing and some of the emails. I also mentioned my plans to visit Boyne Falls, Michigan, to photograph the station and interview the owners. Suddenly, we had 6 or more stations in a round table asking questions and making comments like "I saw that too" and "I thought the same thing." All of the comments made it clear many others had the same curiosity and passion to preserve this bit of history. Gary, KG8LB, is a neighbor. Gary offered his help with photographs. Having a professional photographer and fellow boat anchor enthusiast along would be great.

Gary and I hit the road Monday morning April 25th. We had a four and one half hour drive in front of us. The time went fast and we made out a list of questions for the interview. We arrived at the Boyne Falls QTH at three PM just as Bill arrived home from work. At that time we met Bill senior and Sally, Bill junior's wife. The family home is on the second floor above an old general store. The general store had later become a hardware store and today is an office. On the property is an old grain mill and post office.

We learned the general store and granary had been built and owned by Paul Edward Snyder. Bill senior was Paul's son-in-law. Now we had a name. Paul E. Snyder was the amateur radio operator who had owned the station. Next came the time to visit to the shack.

Walking into Bill and Sally's home was like visiting family. Bill and Sally welcomed us like old friends. We went directly into Grandpa's radio room, just off the kitchen. Standing in the shack and seeing all four walls for the first time we were convinced this was truly a radio shack used from the 1930s until the 1960s and had indeed not been touched since 1962 when Paul Snyder passed away. Each wall had interesting features. Awards and membership certificates hung on one wall, and there were calendars complete with girlie pictures of the era. We saw antenna wire feeders, an old ship's clock and barometer as well as a really cool green glass hanging lamp with a cloth-covered cord. Most interesting was the Amateur Radio License issued to Paul E. Snyder, W8GLW, tacked to the wall just above and to the right of the operating position. A Meyers triode dated 1922 was also on display.

Gary and I headed down to the truck and packed our cameras, lights, cords, etc. on up the stairs and into the radio room. We spent the next hour taking pictures of the shack and chatting with the family as Sally fixed dinner. Finishing up in the shack, we where invited to the back room and mill. Here we found the rest of Paul's collection. Older retired transmitters and receivers plus tubes, parts and tools lay exactly as they were left in 1962. We even found the original packing crates for the TMC GPR-90 receiver and CE 200-V transmitter. I believe, if we had the time, we might even find the original crate for the Collins 30K-1.

We learned that Paul was born in 1906 here in Boyne Falls, Michigan. Paul had lived his life here except for his days in college where he attended an electronics training school near Chicago. Paul married Regina (Cherry) in 1932. Paul worked for the telephone company his entire working life while his wife ran the general store. Paul and Regina raised 2 children, Patty and Paul Jr., in that flat above the store.

Paul's early experience in radio had included operating an old spark gap transmitter of which we found parts. In August of 1932 he was using a MOPA

transmitter and a two-tube receiver consisting of a 224 detector and a 227 audio amplifier, both home brew. This information was found on an unsent QSL card. I think we found that receiver in the back room but the tubes had been updated slightly to an SX200A and CX301A. The MOPA is probably in the barn as well but we haven't found it yet. DX on CW and phone helped while away the hours during the extremes of Northern Michigan's winters. An average of ninety-six inches of snow falls here each year. Several drawers full of QSL cards from around the world tell an interesting story within a story as do the log books and other artifacts.

Looking at the photographs on the auction site, I noted an RTTY tuning scope above the GPR-90 receiver. Paul's son-in-law, Bill senior, recalls clearly the clatter of the teletype in the 1950's. No teletype machines are left. We did find many saved teletype messages in the stacks of logs. We also found an unopened Quarter Century Wireless Association register of members from 1962 and Paul's membership certificate hanging on the wall.

Paul worked for the FCC Radio Intelligence Division during World War II at a listening post in Allegan, Michigan. Little is known about this activity. Paul was picked up by an FCC employee at odd hours and would return a week or so later. A postcard from his young daughter, Patty, dated September 1944 and addressed to Paul at the FCC post in Allegan, reported all was well with Mom and Brother Paul Jr. and told Daddy not to cry. Apparently, Paul's skill as a radio operator was in demand during the war. A certificate from the Federal Communications Commission, Radio Intelligence Division, dated May, 1956 noting Paul's service during World War II hangs with others in the shack. The certificates on this wall include an Army Signal Corps plaque designating Paul as an official Army Amateur Radio Operator dated June, 1938. A Second Class Radio Telegraph Operator's License issued to Paul E. Snyder dated May, 1948 hangs silently nearby.

None of the antennas remain, however, Sally and Bill tell me it is almost impossible to dig in the garden or lawn without pulling up strips of copper. Sally showed me her latest find in a new flower bed behind the house. Bill senior remembers Paul's antenna building activities. We found a hand written letter on stationary from a commercial broadcast station in a nearby town. The engineer was asking Paul's help selecting an antenna design for his Ham station. The collection of QSL cards from many foreign countries dating back to the late 1920's tend to prove Paul's ability and skills in designing and building antennas.

Paul's wife Regina locked the radio room in 1962 after Paul's passing and nothing was touched for the remainder of her life. Regina passed away in 1981. The property including the radio room and collection now was passed on to Paul's daughter, Patty. The residence above the store housed Paul's granddaughter Carol (Patty's daughter) and her husband Charlie from 1982 until 1987. The residence was empty for a total of 6 years when, in 1992, Bill and Sally took over. The general store below turned into a family run hardware store in 1982 and went out of business in 2000. During the winter of 2004/2005 Patty passed away and the remaining family had to decide what to do with tons of equipment they knew nothing about. Sally and Bill wished to do some remodeling and cleaning. The couple talked it over with Bill senior who gave permission to try to find buyers for the radios. The family thought they might have to find somebody interested in hauling the remainder away.

Sally went to work. Using the Internet, she started searching for information that matched the manufacturer's names and model numbers. Sally wrote many emails to people she found in an effort to estab-

lish the value (if any) of the equipment and how much to ask for it. Sally did her homework and it showed in her auction descriptions. I heard from other Hams that this set of auctions sounded suspicious because the seller seemed to know so much about the equipment but didn't know how to plug it in and test it. I too wondered how this was possible until we met. Sally and Bill are careful and have all of the tools needed to find out about anything they don't understand. Most of all they were not in any hurry. It had been 43 years since the station went dark so a few months more wouldn't matter.

Bill and Sally had a few things in mind for the proceeds of this auction. Having electricity installed in their summer cabin was one plan. Having an extra room in their house was another. They knew nothing about amateur radio and the equipment had only one connection to them. It belonged to their grandfather. Both Bill and Sally felt sorry that the collection would be broken up. They only knew it was special to them. They had no idea it would be interesting and important to others. Feeling a bit of guilt made them approach this project carefully.

I made up my mind on April 23rd (before my first visit) I would not attempt to purchase anything I found in the collection during my visits nor would I attempt to sway the seller's decisions in any way. I would collect photographs and information only and leave no footprints. Gary (KG8LB) agreed with me during the drive to Boyne Falls. While we toured the granary, Gary spotted some new (old stock) green glass lamp shades identical to the one in Paul's shack. They might have been left over from the general store or hardware inventory. Gary and I both showed our interest in them but we held to our agreement and bit our tongues.

During our visit to the back room and the granary we pulled out treasure after treasure. Not treasure worth thousands of dollars, rather, history and a well preserved chronology of an amateur radio operator at the peak of technology at that point in time. Some valuable items where seen and pointed out, but in general these folks, for all of the research they had done so far, had no idea what they had. Mention was made of the Hammond museum in Guelph, Ontario Canada and the Indiana Historic Radio Museum in Ligonier, Indiana, as possible homes for some of the remaining artifacts after the auctions finished.

The sun was getting low as we sat in the dining room. I made a compact disk copy of the digital pictures I had taken for the family and scanned some old photos. We went over our list of questions for the family and recorded the discussion on a small audio recorder. It was during this evening meeting Bill announced he and Sally had decided to pull the auctions. Gary and I where stunned when Bill expressed his growing feeling that not enough thought had been put into this sale and after talking to us they had separately but simultaneously chosen to keep the collection in one piece for now and look for a collector or museum interested in putting this collection on display and open to the public.

Both Gary and I worried we might have influenced the family. This went against our best intentions. Bill assured us he and Sally came to this decision by themselves. By helping them understand what was in the storage areas beyond the shack and telling them how those items fit in Paul's station at one time a bigger picture unfolded to them. Bill and Sally had made up their minds and the auctions would be pulled shortly.

We said our goodbyes as we loaded our gear and got ready for the return trip to Detroit. A few last pictures where taken of our new friends and we turned for the truck. Bill said "hold it a second" and went in the door. He returned a moment later with two green glass lamp shades, one for each of us. I was speechless. It was a touching moment. We thanked them again and packed our treasure well for the ride home.

It is now mid-July 2005 and I have traded many emails with Bill and Sally since our first meeting. Gary and I volunteered 2 days last weekend to help Bill and Sally sell a large quantity of parts at an antique radio swap in Lansing, Michigan. Sally has become interested in old radios and amateur radio during all of this. At the swap Sally pulled a new (old stock) cat whisker and the best looking NOS galena crystal from the table and has plans of building her own set. Maybe in a few years we will see a new Ham on the bands.

At the Lansing swap, Bill announced he and Sally had decided to go ahead with the auctions in the near future, possibly fall 2005. Selling the station and artifacts within as a lot was the goal. Requesting the buyer to keep the station intact and on display is a problematic proposal. It has been suggested that the real goal is to keep Paul Snyder's memory alive and preserve this bit of history. A web site will be established and the history of W8GLW will be on display with photographs and equipment serial numbers plus artifact descriptions and history. A signed certificate will be issued with each piece sold along with a W8GLW QSL card. At this writing a local newspaper is looking into this story as a possible feature.

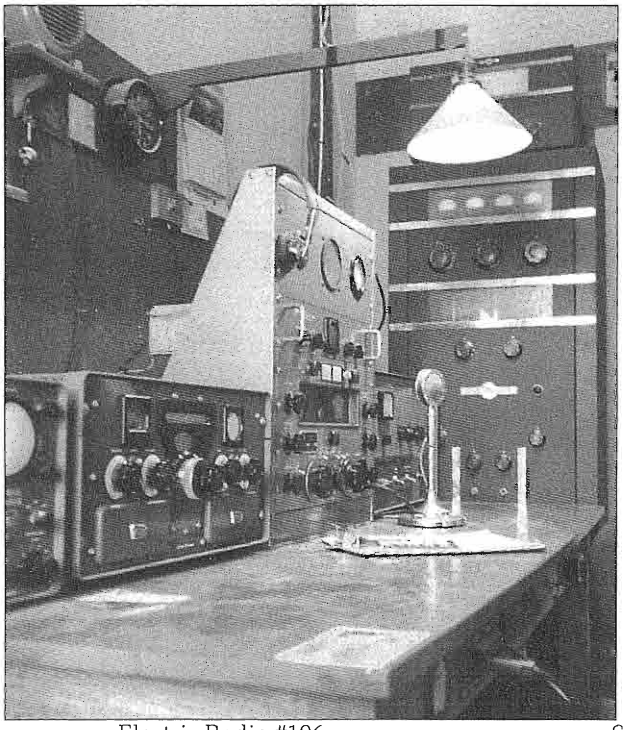
Whatever the outcome, we wish the Carson's the best. In too many cases historic collections such as this have been ravaged due to the seller's haste or lack of knowledge. I often wonder who owned my Hallicrafters SX-17 back in 1938 or who loaded up my Collins 32V-2 for the first time. Thanks Bill and Sally for being so careful.

Postscript

I am Sally Carson of Boyne Falls, Michigan. Mike Monnier has been writing a story for us about my husband's Grandfather, W8GLW. Mike and Gary Cheek (a friend of Mike's) have been so kind to come and help us with all of the radio equipment, sorting, taking some things to the Lansing Extravaganza Swap Meet at the beginning of July. They were nice enough to come to the Swap Meet and stay with us from sun up till sun down helping us sell some radio related items. I think they both deserve recognition for helping us do this huge task! Mike doesn't think he deserves the recognition. But, He Does!

Thank you ever so much,
Sally and Bill Carson
Boyne Falls, Michigan

[Editor's note: Electric Radio would be interesed in hearing from anyone who remembers W8GLW. I will be running more pictures of Paul's equipment in future issues.]



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.

BFO CW Net: Thursday eves. @7PM local Eastern time 3693 kc. QSX WY3D.

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 Sun. 14.263 Mc @ 2000Z. Informal ragchew nets Tue. eve. 3805 kc @ 2100 Eastern time, Thu. on 3875 kc. West Coast 75M net 3895 kc 2000 Pacific time. 10M AM net starts 1800Z on 29.05 Mc Sundays, QSX op 1700Z. CCA Monthly AM Night: First Wed. each month, 3880 kc starting @ 2000 CST, or 0200 UTC. All AMers are welcome, Collins equipment not necessary.

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: 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 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: 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 established nets,160M AM Tue. evening 1945 kc @8:00 PM EST and 8:30 EDT.

Hallicrafters 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 over 30 years. Check 5:00 PM Pacific Time, runs for about 2 hours. QSX W8VYZ.

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 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)

Texoma Trader's Net: Sat. morning 8:00AM CT 3890 kc, AM & vintage equip. swap net.

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). A classic West-coast AM net.

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 Dave (VA3ORP).

CLASSIFIEDS

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Deadline for the October 2005 issue: Thursday, Sept. 29

SERVICE FOR SALE: Repair and restoration on all vintage equipment; over 50 years of experience. Barney Wooters, W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. 303-770-5314

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: Hallicrafters SX-88. Excellent. Recapped, new shutter belt. $4000 plus shipping. John Gibson, Berkeley CA. 510-849-1051 gibsonj@mindspring.com

FOR SALE: Very nice Vibroplex "Champion" bug, S/N 153349 NY, $85. 80M ARC-5 Transmitter, average condition, $40. Buyer pays shipping. James Owen, NWØO, 1363 Tipperary St., Boulder, CO 80303 303-673-9019 evenings.

FOR SALE: HP606B sig gen, HP870A sync, $75 ea. Tandburg TR2075 $100. Buddy Herring 1310 Andover Rd, Charlotte NC 29211 704-366-6600

FOR SALE: Hallicrafters service manuals: Ham, SWL, CB, Consumer, Military. Need your model number. Write or email. Arco Electronics, PO Box 24, Palos Park IL, 60464, WA9GOB@aol.com 708-361-9012 www.Arcoelectronics.com

FOR SALE: Harvey-Wells T90 & matching P.S. $350. National 100ASD $350. Plus shipping. Richard Cohen 813-962-2460

FOR SALE: Collins 32V-3 works and looks good. Approx. 200' 7/8 Prodelin coax w/connectors. 180' Andrew Helix. Kato-Lite 500W 110V 60 cy 1800 RPM generator perfect for field day. HP608F rack mount VHF sig gen. Rudy, W2ZIA, 3411 Home Rd., Alden NY, 14004 716-937-9279.

FOR SALE: Grebe CR-18 Special w/4 coils, pristine and working. Luftwaffe EL 10 longwave receiver, very nice & working. Will trade for Norden Hauck Navy 10; other supers; WW I: CN 112/239; WWII: nav and radio compass gear. See our wanted ad this issue. For more cool radios, check out our website at: http://www.radioattic.com/kremer. Ph: 423-625-1994. E-mail: witzend99@bellsouth.net

FOR SALE: National NCX-5 Mk II w/ NCX-A and NCL-2000. Pix/desc avail. $1000 OBO. N4GL,

pendragon@netsignia.net

FOR SALE: Lafayette HE80 with speaker $150 OBO with manual + shpg. Alinco DM-340 MV power supply like new still in box $100 OBO + shpg. One box tubes (approx 110) starting 6AH4GT to 25 volt filament $40.50 + shpg. One box tubes (approx 80) starting 8BO5 to 50 volt filament $40.50 + shpg. One box tubes (approx 100) 3 volt to 7 volt filament $45 + shpg. One-Six band hybrid quad antenna (MQ-2) still on 25 foot tower with 75 feet coax. $175 w/manual. Robert McManaway, K8VVG, 195 Ruth Ave, Logan OH 43138 740-385-2860 mac195@adelphia.net.

FOR SALE: Original preliminary instruction book, Navy TCE-2 xmtr. Westinghouse logo binder (crumbly, tears, text fine) Restricted, S/N 2788, 1942 contract. Approx. 200 pgs. $15 ppd. Robert Wheaton, W5XW, 16015 White Fawn Dr. San Antonio TX 78225, 210-695-8430.

FOR SALE: CBS Labs AUDIMAX audio processors models 444 and 710. John, W6MIT, 530-672-0903 (leave msg), svoboda@directcon.net

FOR SALE: BC-610l, Apache, Mohawk, Warrior, Marauder, Thunderbolt, Valiant, AR-88D, Globe King 500C, Globe Champion 300, and lots more. N9ZSV, 479-675-4376 n9zsv@cei.net

FOR SALE: Globe King 400A, $400/swap. **WANTED:** 7.5V and 10V filament transformers. Gary, WA9MZU, 209-286-0931 (CA) or ghal@ix.netcom.com.

FOR SALE: Collins 12-Z four channel remote amplifier/mixer. Fair condx. Make offer. Gary, KØCX, kzerocx@rapidcity.net 605-343-6739 evenings

FOR SALE: Dentron 500W transmatch 160-10 AT internal balun, single or balanced output $49 + Shpg. Henry Mohr, W3NCX, 1005 W. Wyoming St., Allentown PA 18103-3131

FOR SALE: DRAKE TR-7/TR-7A/R-7/R-7A Service kit. Includes 13 Extender Boards and Digital Jumper Card. $63.85 includes postage. See http://pweb.amerion.com/~w7avk, Bob, W7AVK, 807 Westshore J28, Moses Lake, WA 98837, w7avk@arrl.net, 509-766-7277.

FOR SALE: Heath HW-101 with PS-23 (AC) and HP-13A (DC) power supplies, $145. Hallicrafters S-76 receiver $125. Have manuals, shipping to lower 48 not included. Doug Carter, W5AAO, 830-990-7548

FOR SALE: 75A-1 factory front panel, good condx, no holes, $100 + shpg. **WANTED:** R-388 depot mtce book, not basic alignment instructions. Dennis, K6RCL, k6rcl@cox.net, 805-683-2876

FOR SALE: 3 Air Force Training Manuals (circa mid 50's). Receivers, transmitters and antenna systems. Over 500 pages in all. VGC, $23 shipped, for all. k4deejim@aol.com 864-855-9570

FOR SALE: National NC-155 Works Good $75. Hallicrafters S-38 Not Working $25. All Items Priced To Sell. Bob, W1RMB 508-222-5553

FOR SALE: 4 open frame Variacs: Input 120V. Output: 0-140V @5 amps $15 ea. 4 open frame Variacs: Input 120V. Output 0-132V @2.25 amps. $10 ea. All plus shipping. Jesus Moreno, 634 15th St., Douglas, AZ 85607 520-364-3127

FOR SALE: Hammarlund XP-55 plug in coils. Four 6-prong. Four 4-prong. $35 for all. Free shipping in contiguous USA. John, W2PRR, 585-671-4228 or jandjm130@peoplepc.com

FOR SALE: Galena crystal radios and or parts. Also Radio tubes. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150 radiolen@att.net

FOR SALE: Knight tube tester $40. Project radios: Philco cathedral $40, Grunow SW tombstone $40. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777 989-595-6483

FOR SALE: National dials NOS: ACN $45; SCN $45; N, $32; used "PW" (HRO), several configurations. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973-728-2454. rprester@warwick.net

FOR SALE: Millen Variarm E.C.O. 90700 for 40 & 80 meters. Very nice condition, $ 195. Don Galarneau, W7KCK, 503-289-2326 dgkck@qwest.net

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

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

FOR SALE/TRADE: Manuals: Buy, Sell, Swap Drake, National, Heathkit, Collins, Hallicrafters, Gonset, WRL, Morrow, others. NI4Q, POB 690098, Orlando FL 32869, 407-351-5536, ni4q@juno.com

FOR SALE: Cleaning house after 70 years a Ham. Many old and antique items. LSASE for long list. John Snow, W9MHS, 1910 Remington Ct., Andover, KS 67002 316-733-1856

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

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

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

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

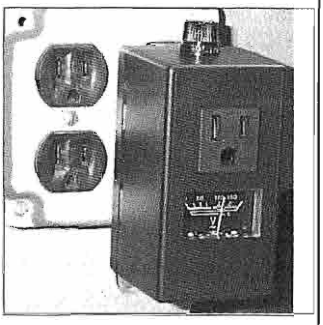
mlangston@hcpriceco.com

ZIM ELECTRONICS INRUSH CURRENT LIMITERS

Inrush Current Limiters are now available from the Electric Radio Store or on-line! These inrush limiters were reviewed in the September 2004 issue of Electric Radio and are available in three versions:

Model AB-1M (With Voltmeter) $34.95
***NEW! Model AB-300M* 300 watts (2.5 amps x 120 VAC) with meter $39.95**
Model AB-1 (With Pilot Light) $29.95
Shipping, each limiter $4.95
(4 or more limiters are shipped free for US orders. Overseas customers please ask for shipping quotes.)

The Inrush Limiter provides a gentle, slow startup for your valuable vintage radio equipment. They also reduce the line voltage closer to original design values due to the voltage drop across the limiter element. Both models come with a full money-back guarantee.



Model AB1-M

Electric Radio Store
720-924-0171

JOHNSON PARTS: EFJ replacement parts: Valiant tie bolts-4 for $18.50. Ranger tie bolts-3 for $17. 80-2CM mic connector (also for Heath/Collins/others) 10 All ppd. Contact Cal Eustaquio, N6KYR/8, 823 W. Shiawasee St, Lansing, MI 48915, catman351@yahoo.com

FOR SALE/TRADE: Transmitting/ Receiving tubes, new and used. LSASE or email 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, Email: 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: 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

SERVICE FOR SALE: Repair, upgrade, performance modification of tube comm. & test equip. Accepting most military, all Collins & Drake, & better efforts from others. Laboratory performance documentation on request. Work guaranteed. Chuck Felton, KDØZS, Felton Electronic Design, 1115 S. Greeley Hwy, Cheyenne, WY 82007. 307-634-5858 feltondesign@yahoo.com

SERVICE FOR SALE: Repair, Restore, Sales of antique, vintage tube radios. John Hartman, NM1H, www.radioattic.com/nm1h

TUBES FOR SALE: Tested good globe 201A and 226 $14, 227 $10 and others. Slightly weak 226, 227, 245, 280 guaranteed to work in early radios ½ regular price. Write or e-mail: tubes@qwest.net for a new price list or see www.fathauer.com. George H. Fathauer & Assoc., 123 N. Centennial Way, Ste. 105, Mesa, AZ 85201. 480-968-7686 or 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

SERVICE FOR SALE: Authorized repairs and sales of all types of amateur radio, communications, and test equipment. Please call Land Air Communications, 718-847-3090, visit our web site: www.landaircom.com. We have over 3,000 items in inventory and carry all types of communications parts.

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

JOHNSON PARTS: New Ranger 1, Valiant 1, & Navigator plastic dials, freq numbers in green, with all the holes just like orig.-$17.50 ppd. Bruce Kryder, W4LWW, 277 Mallory Station Dr., Ste. 109, Franklin, TN 37067. b.kpvt@provisiontools.com

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

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

Mil-Spec Communications
R-390, R-390A, R-388 & Other Military Receivers
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Please call us at: 941-474-6818
FAX: 941-474-7874
milspec39Ø@aol.com
"Since 1985"

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

TREASURES FROM THE CLOSET! Go to www.cjpworld.com/micromart to find some unique items many hams would lust for! Gus, WA, 360-699-0038 gus@wa-net.com

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

PLEASE VISIT: RadioWorld-Online. Come to see our Ham gear, parts, and more. Carl Blomstran, PO Box 890473, Houston TX. 281-660-4571.

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

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

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

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.

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 bigspndr@yk.mv.com

PARTS FOR SALE: Aluminum heat dissipating plate and grid connectors for all 3, 4 and T series Eimac tubes including 3-500Z, 4-1000, 304T's and others. Alan Price, 1545 S CR 1150 W, Parker City, IN 47368

SERVICE FOR SALE: I build hot-rod receivers: R-390A, SP-600, R-388/51J. NC-183D and transmitters: Valiant, DX-100, T-4X-A-B, HT-32, AF-67. 51J-4 filter replacements, R390A Hi-fi AM $245.00 ea. Chuck Felton, KDØZS, Wyoming, 307-634-5858, feltondesign@yahoo.com

SERVICE FOR SALE: COMPLETE SERVICE JOHNSON "TURBO" RANGER, Valiant, Viking 500, Viking II, include panel / cab refinish. Also Hammarlund 180(A), National 300, 303, R390(A), others. http://w4pnt.8k.com Patty & Dee's Marina: 534 W. Main St. Waynesboro, Va. 22980. 540-249-3161 Cell: 540-480-7179

w4pnt@highspeedlink.net

WANTED: National NTE CW xmtr in working Condx. I love National. Sylvia Thompson, 33 Lawton Foster Rd., Hopkinton, RI 02833. 401-377-4912. n1vj@arrl.net

WANTED: Scott Special Communications receiver, EA4JL. Please call Kurt Keller, CT, 203-431-9740, k2112@earthlink.net

WANTED: Navy WW2 shipboard receivers and transmitters. Need equipment, manuals and general operating information. Receivers of the type RAK, RAL, RBA, RBB, RBC, RLS etc, Transmitters of the type TBA, TBK & TBM (with modulators), TDE TBS etc. Equipment is for the restoration of Radio facilities aboard the USS Alabama (BB-60), now part of the Battleship Memorial Park, Mobile, Alabama. I was a Radio Technician aboard the Alabama in WW2 and would like to hear from other WW2 RTs and Radio Operators concerning radio operating and maintenance procedures aboard other Navy WW2 ships. Please call Stan Bryn, AC5TW, at 1-800-984-9814 week days between 0800-1100 MST. Or email intor@zianet.com.

WANTED: Unmodified Heathkit AT-1, mint Hallicrafters S-38D, Tom Root, 1508 Henry Court, Flushing, MI 48433, 810-659-5404, wb8uuj@arrl.net.

WANTED: Ribbons for older teletype machines. Bob, KL7HDY, 907-346-1044. 9501 Brien St, Anchorage AK 99503

WANTED: EM34 tuning-eye tube with good fluorescence; Frank, W6LPU, prozach7@aol.com 5112 E. Glen Arran Lane, Orange, CA 92869 714-771-0538

WANTED: In good condition, bandspread dial for a Hammarlund HQ-120, HQ-129, or HQ-140. Richard Beckett WØBVT, 113 Norma Lane, Ashland, Mo. 65010, 573-657-2108 ferbish@intergate.com

WANTED: Meter movement for Western Electric tube tester KS-15750. Walter Hughes, WB4FPD, 6 Academy Ct., Berryville, VA 22611 540-955-2635

WANTED: Working tube type FM signal generator for 455 IF alignment. Bob Hazuka, 810-765-9391

WANTED: Tektronix Type 570 curve tracer, any condition. Ron, AA2QQ, 718-824-6922

WANTED: Manual/schematic for Pearce-Simpson Marine Radio "Catalina". JR Linden, K7PUR, PO Box 4927, Cave Creek, AZ, 85327, 480.502.6396, jrlinden@usa.net

WANTED: CONAR Tuned Signal Tracer, mfg for National Radio Institute students. Also radio correspondence courses by National Radio Institute of Washington, DC. George Reese, 380 9th St., Tracy, MN 56175, 507-629-6091

WANTED: Hallicrafters SM-40 external S-meter in working condition. dorybillATcomcast.net 617-924-4140.

WANTED: Top lid, manual for Hickok 580, manual for Hickok 121. **FOR SALE:** AK 20 $25, AK-44 $45. Carter, 434-979-7383 celliott14@earthlink.net

WANTED: Meter escutcheon (3 by 5 1/2") for Hallicrafters SX-146 or HT-46. Andy, K8LE, Ohio, 614- 864-2922 aelliott7@sbcglobal.net

WANTED: Manual schematics etc. Submarine VLF loop antenna tuner Borg Warner CU-352A/BRR. Weber, 4845 W. 107th St., Oak Lawn, IL 60453

WANTED: Heath SB104, SB102, SB301, SB303, HG108. Hallicrafters SR series transceiver 150-2000. BC348, T195, R392 and others. Jimmy Weaver, KB5WLB, 870-238-8328

WANTED: Knight Kit T-150A transmitter, no rust, original knobs a must. Gary Mayfield, WAØEAF, 102 South Jackson, Marquette, KS 67464. 785-546-2369 or email wa0eaf@kans.com

WANTED: INTECH COM 6000 Service Manuals: COM3648, COM1000, COM1005 HF SSB Marine radio. Wes, K5APL, 870-773-7424 k5apl@cableone.net.

WANTED: Meter movement for a Knight KG-600B tube tester or the complete tester for parts. Johnny Umphress, 1415 Moore Terrace, Arlington TX 76010, 817-915-4706

WANTED: Harvey Radio Labs Tri-Tet Exciter or FT-30 Transmitter. $1000 reward! Robert Enemark, W1EC, PO Box 1607, Duxbury, MA 02331, 781-585-6233

WANTED: Any TMC Equipment or Manuals, what have you? Will buy or trade. Brent Bailey, 109 Belcourt Dr.,Greenwood, S.C. 29649, 864- 227-6292 brentw@emeraldis.com

WANTED: Top prices paid for globe shape radio tubes, new or used. Send for buy list or send your list for offers. Write or e-mail: tubes@qwest.net See www.fathauer.com or send for catalog of tubes for sale. George H. Fathauer & Assoc., 123 N. Centennial Way, Ste 105, Mesa AZ 85201. 480-968-7686, Call toll free 877-307-1414

WANTED: Seeking unbuilt Heathkits, Knight kits. Gene Peroni, POB 7164, St. Davids, PA 19087. 215-806-2005

WANTED: Manuals, manuals, and manuals for radio-related equipment to buy or swap. Catalog available. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. 732-238-8964

WANTED: Postcards of old wireless stations; QSL cards showing pre-WWII Ham shacks/equip. George, W2KRM, NY, 631-360-9011, w2krm@optonline.net

WANTED: Searching for RME CT-100 or 3R9 xmtrs and info about them. David Edsall, W1TDD, 156 Sunset Ave., Amherst, MA 01002. 413-549-0349, dedsall@crocker.com

WANTED: WW II German, Japanese, Italian, French equipment, tubes, manuals and parts. Bob Graham, 2105 NW 3Oth, Oklahoma City, OK 73112. 405-525-3376, bglcc@aol.com

WANTED: Incarcerated Ham seeks correspondence. w/others on mil (R-390's &backpacks) & tube radios. Also copies of postwar-90's surplus catalogs, backpack specs & photos. W.K. Smith, 44684-083, FCI Cumberland Unit A-1, POB 1000, Cumberland, MD 21501.

WANTED: Looking for a National NTX or NTE transmitter/exciter for use in my vintage hamshack. Any condition, even basket cases or parts, considered. Will pick up in New England, or arrange shipping if outside of area. Paying any reasonable price, and most unreasonable ones! Please email with details or photos, all considered and most likely bought! Thanks! Bruce, W1UJR, 207-882-9969 or w1ujr@arrl.net

WANTED: Schematic and related info on Halowatt TR5 broadcast rcvr made mid-1920s in Portland, OR. Fern Rivard, VE7GZ , PO Box 457, Cranbrook, BC V1C4H9 Canada crc@cyberlink.bc.ca

WANTED: Collins 312A1 speaker, National SW5, Eldico R104 and T102, QSL cards from 1920's, 9CXX or W9CXX. Scott Freeberg, WA9WFA, 327 Wildwood Avenue, Saint Paul MN 55110. 651-653-2054 wa9wfa@qsl.net

WANTED: Parts for HT-33 amp. Need T1 & amplifier compartment. John, W8JKS, 740-998-4518

WANTED: Will buy SP-600 and some other Hammarlund equipment, working, not, or incomplete. Al, W8UT, anchor@ec.rr.com 252-636-0837

WANTED: Commercial or kit-built 1930s and 40s transmitters. Doc, K7SO, 505-920-5528 or doc@cybermesa.com

WANTED: Hallicrafters SX115, SX88, Collins 75A-1, AM broadcast transmitter in New England area, Heath DX100B. Will pay good price for good equipment. w1txjohn@aol.com, 802-775-7632 Eves.

WANTED: DAVID GRIMES: radio model 3XP, and advertising, ephemera, literature, references, parts; please contact: Mike Grimes, K5MLG; 5306 Creekside Ct.; Plano, Texas, 75094, 972-384-1133. Email: grimesm@flash.net

WANTED: TCS & TBY Navy radios. Ken Kolthoff, K8AXH, PO Box 215, Craig, MO 64437. Work #913-577-8422.

WANTED: Sonar CB transceiver model J23 mobile set. 23-channel, tube-type CB radios, also 23-channel mobile sets. Ed, WA7DAX, 1649 E. Stratford Ave., Salt Lake City, UT 84106. 801-484-5853

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 900 N. San Marcos Dr. Lot 15, Apache Junction, AZ 85220

The Hats Are Back!

By popular request, we are offering another run of the popular Electric Radio baseball caps. These new hats are a nice 5-panel all-cotton style with an adjustable rear headband and a 3-inch front brim. The background color is light tan, and the ER logo is embroidered in 3 colors, not printed. These hats will hold up for a long time.

$19.95, shipped postpaid in the US.

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Or on-line: www.ermag.com

WANTED: ANY Harvey-Wells speaker, aircraft unit, or military surplus component. Will answer all. Kelley, W8GFG, 9010 Marquette St., St. John IN, 46373, 219-365-4730

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

WANTED: Top dollar paid for WWII radios, PRC-1, PRC-5, AR-11, SSTR-1, SSTR-5, British B2, need pts for PRS-1 mine detector. Steve Bartkowski, 708-863-3090

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. 501-318-1844, Fax 623-8783

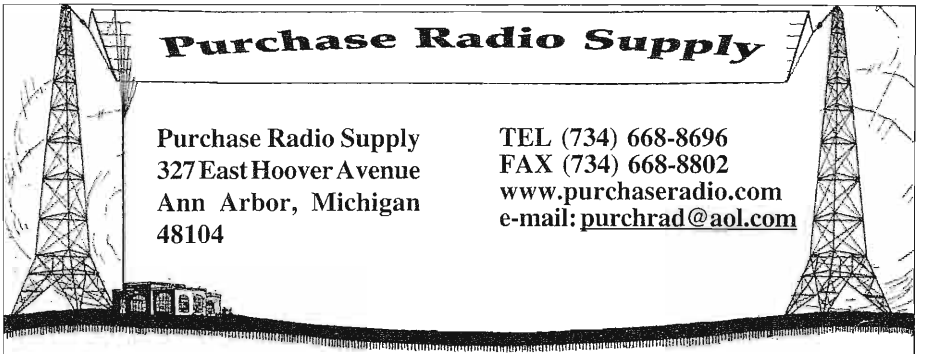
www.boatanchor.com

WANTED: Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. 661-259-2011. FAX: 661-259-3830

jstitz@pacbell.net

WANTED: Westinghouse SSB Transmitters MW-3 (Exciter, Amplifier, Power Supply). Also, MW-2 (AM). Will pickup anywhere. Gary, WA4ODY, Seabrook, TX 77586, 281-291-7701, 'myctpab@earthlink.net.

WANTED: Receivers. Telefunken E1800, Rohde Schwarz, EK-56/4, NC-400, Racal 3712, Hallicrafters SX 88, Collins HF8054A, Collins 851S-1. Manual for Racal R2174B(P)URR 310-812-0188(w) alan.royce@ngc.com



WANTED: WW I era and 20's hi-end sets; detectors; amps; IP 500, 501, CN 112/239, RCA 106, SE 1071; Norden Hauck Navy 10; Golden Leutz; other supers. WW I; WW II RDF and radio compass gear; DZ 2 MN 26; RAK-7; others. We're always buying vintage broadcast mics; tube pre's & compressors by Altec, RCA, Sony, WE. Check out for sale ad this issue and our website at: http://www.radioatttic.com/kremer for cool stuff for sale/trade! Ph: 423-625-1994. E-mail: witzend99@bellsouth.net

WANTED: Manuals for Heathkit IM-105 VOM, Turner +2 microphone. **FOR SALE:** Loudspeaker tube C.P.O., $20 ppd. Louis L. D'Antuono, WA2CBZ, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

WANTED: Manuals/data on the following: Johnson Matchbox, the 300 watt variety, Johnson VFO, model 122, RCI 2950 26-32 MC transceiver. MacDonald CE 100 UHF/VHF scanner, Adzen PCS 3000 two meter FM transceiver. Also need mic/controller for same. Manual/data DZ 2 radio/RDF receiver, 19" case 10 1/2" high, 13" deep. Ward Kremer KI4 JHA, 1179 Petunia Rd., Newport, TN 37821. Ph/fax: 423-6254-1994, Email: witzend99@bellsouth.net.

WANTED: Hammarlund ED-4 transmitter. Any condition or information. Bob Mattson, W2AMI 16 Carly Drive Highland NY 12528. 895-691-6247 WANTED: Circuit for the "Mitey-Mite" transmitter-receiver. Harold Schaffner, W2GMX, 519 Perine St., Elmira, NY 14904.

The Collins Video Library

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The Collins 30S-1 video or DVD (1 hour, $39.95)
The Collins KWS-1 Video or DVD (2 hours, $39.95
The Collins 75A-4 Video or DVD (4 hours, $89.95)
R-390A Video or DVD (7 hours, $109.95)
R390A Addendum Video or DVD ($49.95)
SP-600JX Video or DVD (4 hours, $89.95)

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Produced by Floyd Soo, W8RO

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720-924-0171

WANTED: Scott Special Communications rcvr. EA4JL, please call Kurt Keller, CT, 203-431-9740, k2112@earthlink.net

WANTED: QSL card from W9QLY, Frank (Mac) Maruna, from 1956 or before. WILL PAY TOP DOLLAR. Don Barsema, KC8WBM, 1458 Byron SE, Grand Rapids, MI 49506, 616-451-9874

WANTED: Western Electric horns, speakers, amps, and mics. Barry Nadel, POB 29303, San Francisco, CA 94129 museumofsound@earthlink.net

WANTED: Lafayette HE73 Precon, Collins 75S meter, knobs for Valiant II and Gonset G-28/50 Bill, 701-772-6531,or ke7kk@earthlink.net

WANTED: Information and schematic for Navy Control Receiver C-5028A/FRA-501 built by TMC. Jeff Holmquest, K2EWM, 68 Covered Bridge Dr., Hawley, PA 570-226-4499

WANTED INFO: Radiomarine T-408/URT-12/USCG/1955. Sam, KF4TXQ, PO Box 161. Dadeville, AL 36853-0161 stimber@lakemartin.net 256-825-7305

WANTED: Clean and working Hallicrafters SX-140. jdok1@juno.com or WAØRHY, 310 East 16th, Fremont, NE. 58025.

FOR SALE: 13V @ 10 amp regulated supply, $20 + shipping. 5 element 10 meter beam. 56 ft. self supporting tower. 5 ft rack. Pick up only. 2.1 kc Collins filter $90. K9GTB, 22756 White Park Ln, Litchfield, IL 62056. 618-362-6269.

FOR SALE: Viking Invader 2000, Good Condition, $1,500, OBO. Parts unit $350 OBO, You ship. Ken Sands, K8TFD, 734-453-7658, ken.sands@juno.com

NOTICE: Expert HRO-500 alignment done with modern test equipment (HP, TEK, etc.) www.nortrex.net or nortrex@bigplanet.com 650-529-9180

AM Calling Frequencies

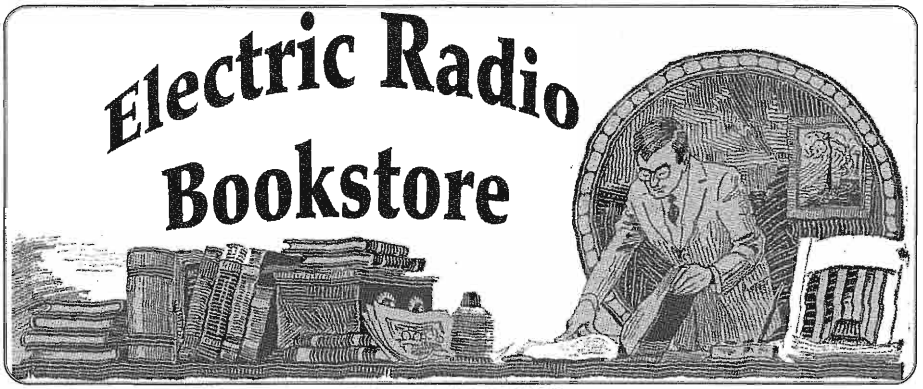
160 meter band: 1885, 1945 kc. In the Midwest, listen on 1980 and 1985 kc.
80 meter band: 3870, 3880, 3885 kc. In the Midwest also try 3891.
40 meter band: 7200, 7290 kc national calling frequencies. Also 7295 in the Midwest.
20 meter band: 14.286 Mc
15 meter band: 21.400 to 21.450 Mc. Try CQ on 21.4, move up for QSO
10 meter band: 29.0 to 29.1 Mc
Try CQ on 29.0, move up for QSO
6 meter band: 50.4 Mc
2 meter band: 144.450 Mc

Vintage CW Calling Frequencies

80 meter band: 3546 kc
40 meter band: 7050 (+/- "Fists" club)
30 meter band: 10120 kc
20 meter band: 14050 kc

For a lifetime AM International membership, send $2.00 to AM International, PO Box 1500, Merrimack, NH 03054. AMI is our AM organization and it deserves your support!

An on-line, searchable index to the entire 15-year history of Electric Radio Magazine may be found under the "links" tab at www.ermag.com or at Don Buska's web site: http://home.wi.rr.com/n9oo/ersearch.html



BACK ISSUES

All are either original copies or reprints from the original negatives. All Electric Radio back issues are available at **$38.00 per year** (or any 12 issues), or **$3.75 for single** copies. Buy the entire run of Electric Radio from #1 for **$375,** a 55% discount over single issues. **Special deal on any four years (or any 48 issues): $100.00.** These prices *include* delivery by media mail in the USA. For a postpaid 29-page **printed back issue index**, please send $2. Foreign orders please inquire for shipping rates.

COMPENDIUMS

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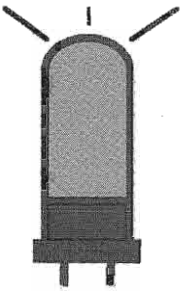

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