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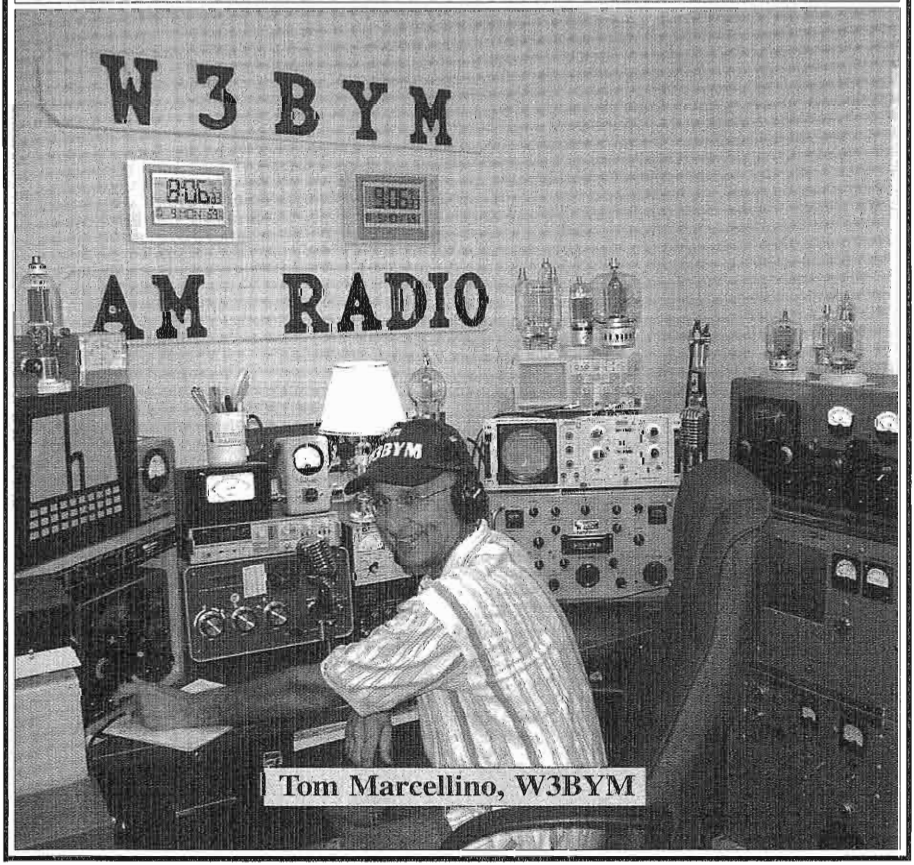
ELECTRIC RADIO

celebrating a bygone era

Number 215 April 2007



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ELECTRIC RADIO

Published monthly by Symbolic Publishing Company
PO Box 242, Bailey, Colorado 80421-0242
Periodicals postage paid at Cortez, CO
Printed by Southwest Printing Inc., Cortez, CO
USPS no. 004-611
ISSN 1048-3020

Postmaster send address changes to:
Electric Radio
PO Box 242
Bailey, CO 80421-0242

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Electric Radio is all about the restoration, maintenance, and continued use of vintage radio 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, email, or call.

Regular contributors include:
Chuck Teeters (W4MEW), Jim Hanlon (W8KGI), Tom Marcellino (W3BYM), Gary Halverson (K6GLH), David Kuraner (K2DK), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Larry Will (W3LW), Dave Gordon-Smith (G3UUR), Dale Gagnon (KW1I)

Editor's Comments

Electric Radio Vintage Field Day

The annual ER vintage field day is Saturday, June 2, 2007. We are scheduling it to start at 1200 UTC, and it runs until 2400 UTC the same day. I'll have more in next month's issue.

ARRL and Regulation by Bandwidth

Recently, the ARRL stirred up a lot of controversy when it sponsored a rulemaking proposal to the FCC that advocated segmenting the amateur radio bands by bandwidth rather than by mode, the traditional method. Briefly, very few operators thought that unattended digital noise generators with a 100 kHz-wide emissions bandwidth on the HF bands would benefit the majority of licensed operators. Due to the huge protest by hams, ARRL has amended its position, slightly, and now wants to have the changes effective on the 10-meter band and up (in frequency). If the FCC makes the rule changes ARRL wants, the 10, 6 and 2-meter amateur bands would be segmented into subbands allowing maximum emission bandwidths of 200 Hz, 500 Hz, 3.0 kHz, 16 kHz, or 100 kHz. AM operations would apparently be protected, the exception reading "*double-sideband, full-carrier AM phone.*" There are still problems with the revised proposal because not everyone is interested in having their weak-signal VHF work or FM repeater input trashed by unattended, wideband digital noise.

I highly recommend *closely* watching developments in this area, and be ready to file comments on a moment's notice with the FCC as needed, as soon as they ask for them.

Important BPL Developments

The IEEE, or the Institute of Electrical and Electronics Engineers, recently announced that a working group has developed requirements for a "baseline BPL standard" that is intended to help get around the problems BPL causes to licensed users of the radio spectrum. In a statement issued March 14th, 2007, the IEEE 1901

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Cover: Tom Marcellino (W3BYM) is a long-time author, not just in ER, but also with other amateur publications over the years. His newest article begins on page 2 of this issue. Tom completed a major shack rebuild project last summer, and is all ready to go in new surroundings!

The Mini-Max: A Practical Transmitter Using Unusual Concepts, Part 1

By Tom Marcellino, W3BYM
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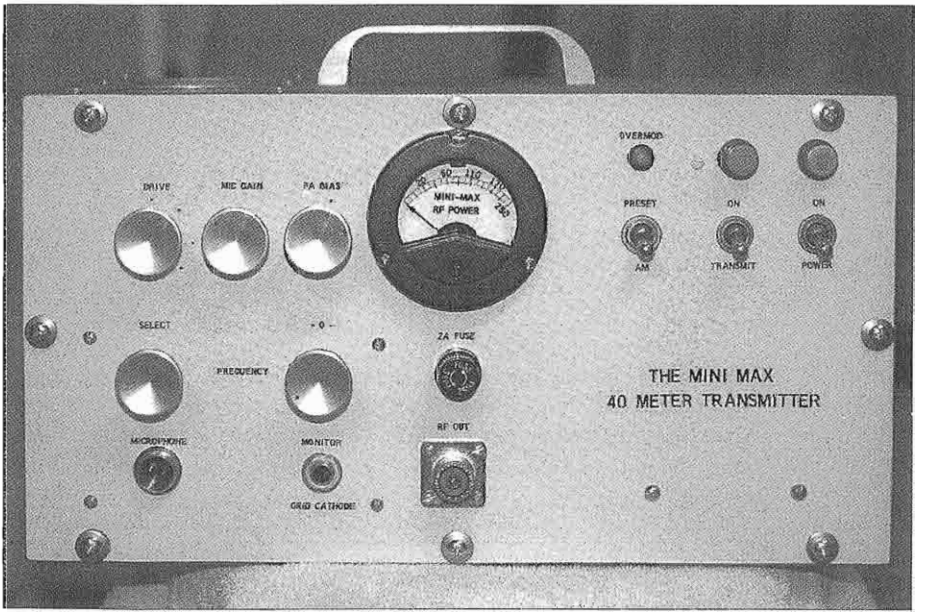
Could I design and build a practical AM transmitter for 40 meters using readily available parts with certain features? These features would include a maximum of four tubes, a Class-C power amplifier, 10-watt carrier, self contained with internal power supply, modulator, and the power amplifier, all packaged in a fully-enclosed cabinet about 5 x 10 x 12 inches. So far, the task sounded like a basic project with little difficulty.

Could I, in addition, incorporate fixed tuning with no front-panel tuning controls, no front-panel current meters and, lastly, be dedicated to one or two fixed but adjustable frequencies? Now, it got interesting and became more difficult.

Finally, could I use toroid coils and a metal ceramic tube where my experience in RF power circuits was very limited? This should be achievable with a little learning on my part.

In my tube collection, I had several 4CX250B metal ceramic tubes, sockets and chimneys (phenolic, not ceramic) all thanks to the generosity of Frank, WC3E. This tube immediately became the tube of choice for the PA section. This little tube is rated for 250 watts of plate dissipation and is specified from 500 to 2000 volts. The tube requires very low grid drive, -90 volts of bias, and 200 mA of plate current to make good power output in Class C. So, now I could start to mentally configure the power supply's



The Mini-Max has a white front panel with black lettering, a calibrated RF power meter, controls with matched knobs, and a nice symmetrical layout.

maximum requirements.

The conventional way would have been to use one tube for the oscillator and drive a second tube as a buffer-driver. But, I wanted to use a single tube as the oscillator and buffer-driver ahead of the PA. I scanned through the back of the RCA Tube Manual. That revealed a one tube oscillator circuit using a 5763. The 5763 would be the correct physical size match for my project and hopefully give adequate drive for the PA.

This 5763 oscillator-driver circuit is very appealing for several reasons. The crystal is connected from grid to ground with no grid tuning and the plate is shunt fed with an RF choke with no tuning. This would satisfy my fixed frequency need. The adjustable frequency addition would come later, using a small variable capacitor from grid to ground. Another term for this is "crystal warping." I now had a great start in achieving one of my goals, no tuning. Also tried were several dual-triode tubes for this circuit but they didn't produce the needed grid current for the PA.

I thought it best to make working prototypes of the oscillator-driver and PA, knowing there would be modifications. This added several weeks to the project, more than doubling the fabrication time, but in the end was worth all the effort. Even the power supply was prototyped because it to was new to me. The modulator was not prototyped, as you will read later.

By now, a few of the power requirements were identified. A filament supply of 6.3 volts (6.0 for the PA tube), a bias supply with a -90 volt range was included, and regulated high voltage of 300 volts, a PA high voltage of 800-1000 volts and upwards of 350 volts for the PA screen were built in. The hope was to use an old TV power transformer as the plate transformer. The current drain on the filament transformer is 3.35 amps for just the 5763 and 4CX250B. Not included yet was filament current for the modulator tubes which, at this point, "The Mini-Max: A Practical Transmitter Using Unusual Concepts" was unknown.

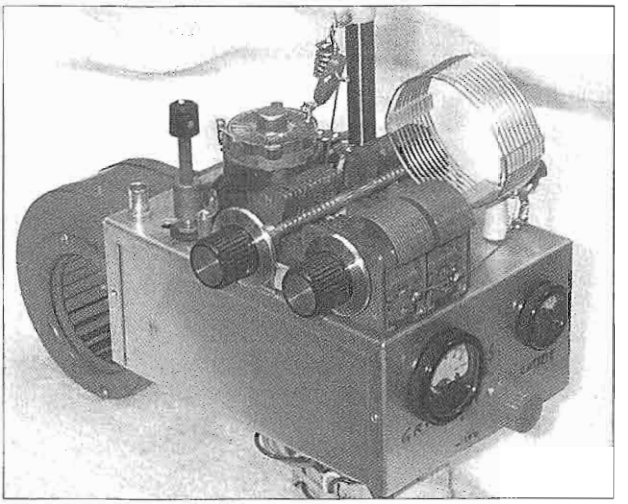
A review of my reference books showed a power supply circuit that I'd never used. Why I never thought to use it before remains a mystery to me. It is called the "economy power supply." After reviewing the circuit, it was clear why it was so named. The supply delivers two outputs; a high voltage output and another one that is one-half of the high voltage output, obtained from the transformer's center tap.

My under-the-bench TV iron stock consisted of a 300-0-300 and 400-0-400 transformer, both outputs rated for 200 mA. They both had 6.3 volt and 5.0 volt windings rated at 4 amperes. An easy calculation showed the second transformer with the 800 volt winding and a capacitor-input filter would yield 1120 volts and 560 volts unloaded. This transformer fit very close to my first guess of the PA plate voltage, but the 4-ampere filament winding would be on the light side after adding the modulator tubes.

It was decided at this time not to use the filament winding of this transformer and to add a separate filament transformer. In my iron stock was a nice 8-ampere unit that would fit next to the plate transformer. The current rating of 8 amperes is overkill but with this separate transformer the maximum voltage and current from the plate transformer would be available without the filament winding heating the unit. In the final design, the 5-volt winding supplied power for a pilot lamp.

Using two transformers offered another advantage. The plate, screen, and 300-volt regulated supplies would only be on during transmit. During receive, these heat-generating supplies would be off, thus maintaining a lower ambient temperature inside the cabinet.

Here is a word of caution concerning



The working RF deck prototype was made with large components.

my selection of the filament transformer. The general rule of thumb is to select and use a transformer that closely matches the current drawn. In my case, the voltage was a "tad" over 7 volts for a 6.3-volt transformer. To compensate for the luxury of using this transformer, I had to introduce some resistance in series with the four-tube load. I'm only talking about tenths of ohms in series.

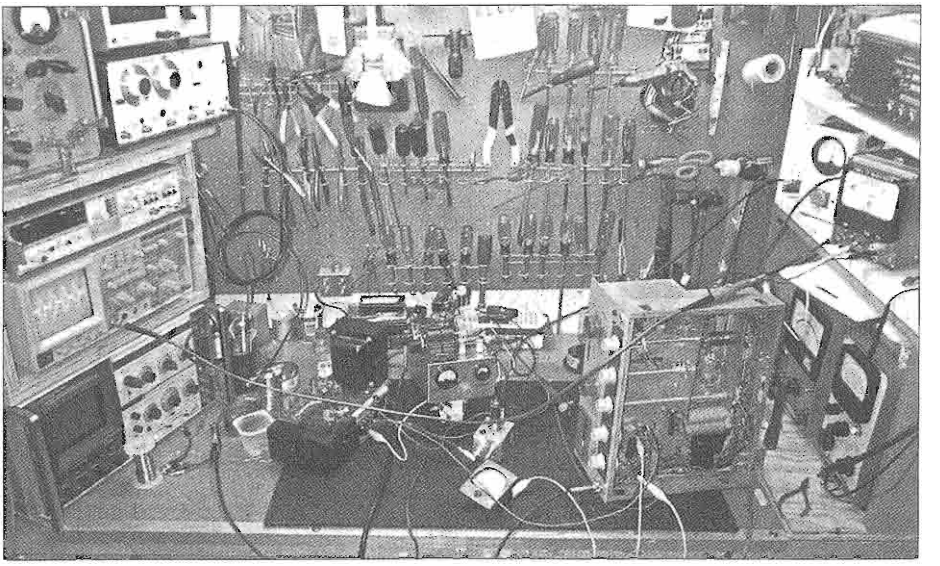
The 4CX250B had additional resistance inserted to meet its 6.0-volt filament requirement. If the filament voltage specification is ignored, the transmitter would still work and probably produce a little more power out but the tube's filament life would be greatly reduced.

Along about this time, the melting and fusing of the phenolic PA tube chimney to the tube's anode occurred. In the initial setup the filament transformer and blower were wired in parallel. The filament transformer was mounted under the minibox in the PA prototype and served as the front foot. Then, I started experimenting with different TV transformers with the hope of using their filament windings. I forgot to rewire the blower to this new filament source. Yes, this was a lesson learned, but to my surprise, after this extreme punishment, the 4CX250B still performed well.

Of the three chassis prototypes built, the PA was the most interesting. As you can see in the PA prototype photo, my approach was to get a working circuit up and running using standard components. Then, after that was accomplished, down-sizing the physical size of the parts to meet the small cabinet need would begin. Standard components meant air-core coil inductors, broadcast-band variable capacitors, and large RF chokes. At this stage in the project, the end value of bias for the PA tube was unknown so that supply was made variable from 0-130 volts. All PA tube currents were monitored with separate meters in the grid, screen and cathode.

Cooling for the metal ceramic tube initially started with a blower, as shown in the photo on this page. Temperature is a key characteristic for this tube, so an infrared laser thermometer was obtained for measuring the anode temperature. With this instrument, the effects of tube parameters versus the PA tube anode temperature could be monitored. A blower was not my end choice because of its large physical size. so the thermometer allowed me some experimentation with different fans.

My logic at this time was to end up with a CW carrier of 40 watts. Then, with the use of screen modulation having a controlled-carrier effect, the carrier would be much less, typically around 20 watts. With this low value of carrier and an average somewhat higher with speech, the anode temperature would be well



The full working prototype is in the center, above, with a DX-60 supplying the modulation.

below its specification, hence, I could get away with much less cooling. Therefore, based on this logic, maybe a fan blowing air into the plenum (Minibox) instead of the squirrel cage blower would work. My reasoning was correct. A muffin-type fan for cooling did work but the anode temperature, naturally, didn't stay at the same temperature as it did with the squirrel cage blower.

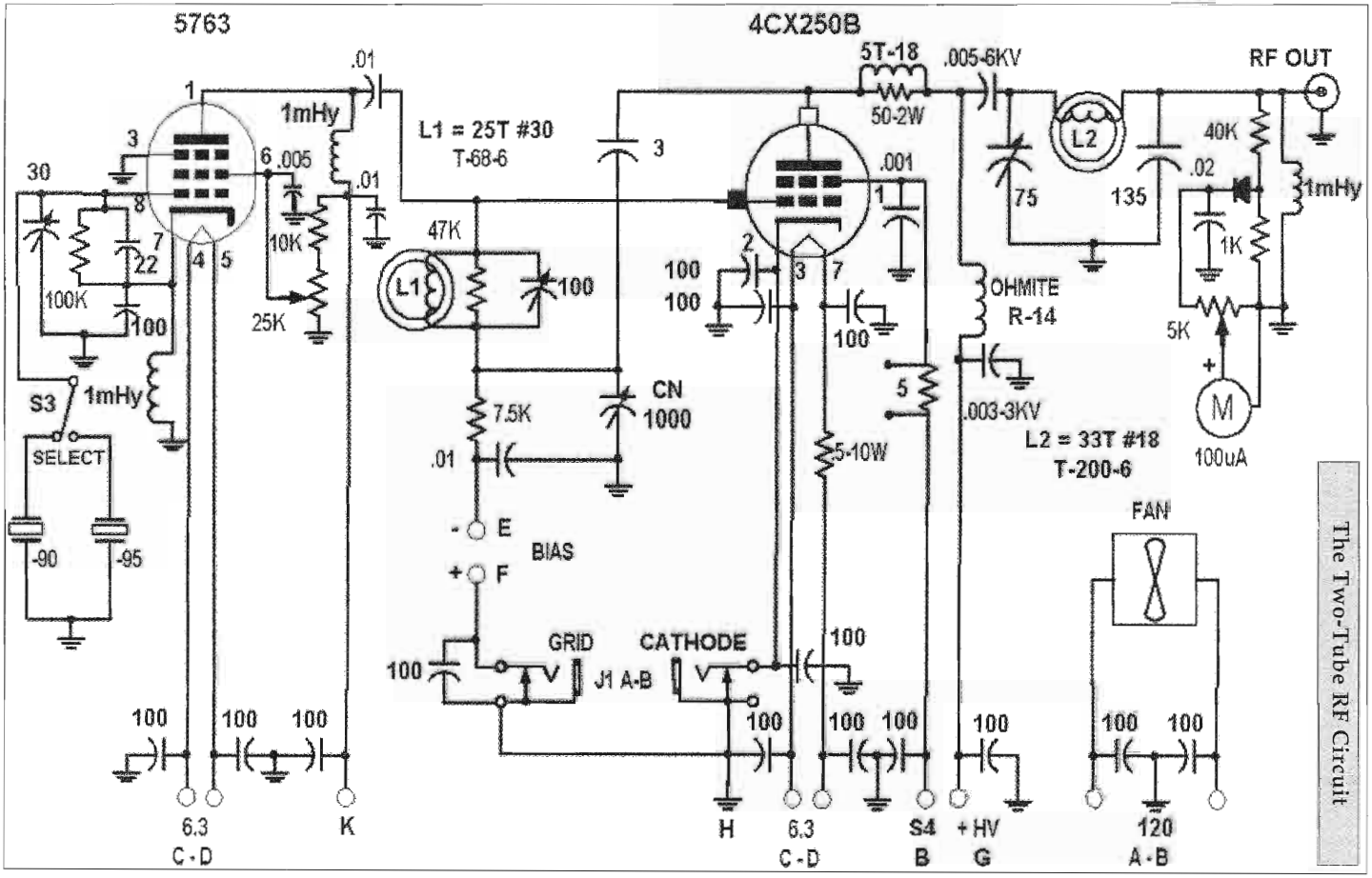
The oscillator-driver and PA prototypes were declared working at this time and a modulator design was needed. Since I had in mind to use screen modulation having a controlled-carrier effect, the first circuit to come to mind was my highly modified DX-60. All those modifications go to the credit of Bowie Bill, WC3K, (SK). Bill wrote several articles for ER on this subject as well as other Heathkit transmitter mods.

There was no earthly reason to hunt up all the parts and make a prototype when all I had to do was pull down the attic stairs and find the DX-60. This modulation circuit uses two tubes: a 12AX7 driving a 6DE7 in cathode-follower mode which drives the screen grid of the 6146.

The DX-60 was up-ended to test with the prototype RF deck. The power supply in the DX-60 powered the filaments and plate voltages for the 12AX7 speech amp and filament for the 6DE7. The plate and cathode output network from the 6DE7 were disconnected and clipped over to the PA prototype chassis. The plate voltage for the 6DE7 was via a dropping resistor from the prototype power supply.

Much to my amazement, the little two-tube modulator performed better than expected. The output waveform showed no distortion on positive peaks and the waveform in the negative direction could be easily flat lined (clamped) by cranking up on the mic gain pot. The modulator circuit was considered a done deal. The cathode follower components may need adjustment to alter the resting carrier. Likewise, the response of the audio chain may have to be changed from Hi-Fi to more communications-like, to help the low carrier punch through.

Part down-sizing began with the out-



The Two-Tube RF Circuit

put loading capacitor. This was an easy task. Using a Bird wattmeter and resistive dummy load, the value of loading capacitance was found that gave maximum power transfer into the load. In this case, the value was 135 pF. A 135-pF fixed mica transmitting-type capacitor worked well. Eliminating the variable loading capacitor forces the need for a resonant antenna system at the operating frequency. In my case, this wouldn't be an issue since I always present a resistance to the transmitter using my tuner.

The air-core inductor was replaced using a torroid-core inductor. An email to Palomar, asking for their advice, resulted in a quick answer from Jack Althouse (K6NY). From their catalog, the T-200-6 core was selected. This core has a μ=8.5 over a frequency range of 2-30 MHz. Jack agreed with my selection, saying it would work well in my intended application. The T-200-6 for the PA tank and the smaller T-68-6 for the PA input grid circuit were purchased, plus some spares.

The first toroid coil was wound and checked out. It was a pure "shot in the dark," paying little attention to the correct number of turns. This coil contained 23 turns of #18 wire. It was wound just to get a warm feeling that using a toroid core was the correct approach. As a result, it worked very well and the core heating was barely detectable. Another benefit that wasn't planned for was the extreme bandwidth this coil offered, but there was a price to pay. I could plug in a 7000 kHz or a 7300 kHz crystal and the full output remained without the need for retuning. The Mini-Max will need some bandwidth but not 300 kHz! A small sample of the RF was piped into a spectrum analyzer. It showed that harmonics were numerous and unacceptable. This verified the Q of this "shot in the dark" coil was extremely low.

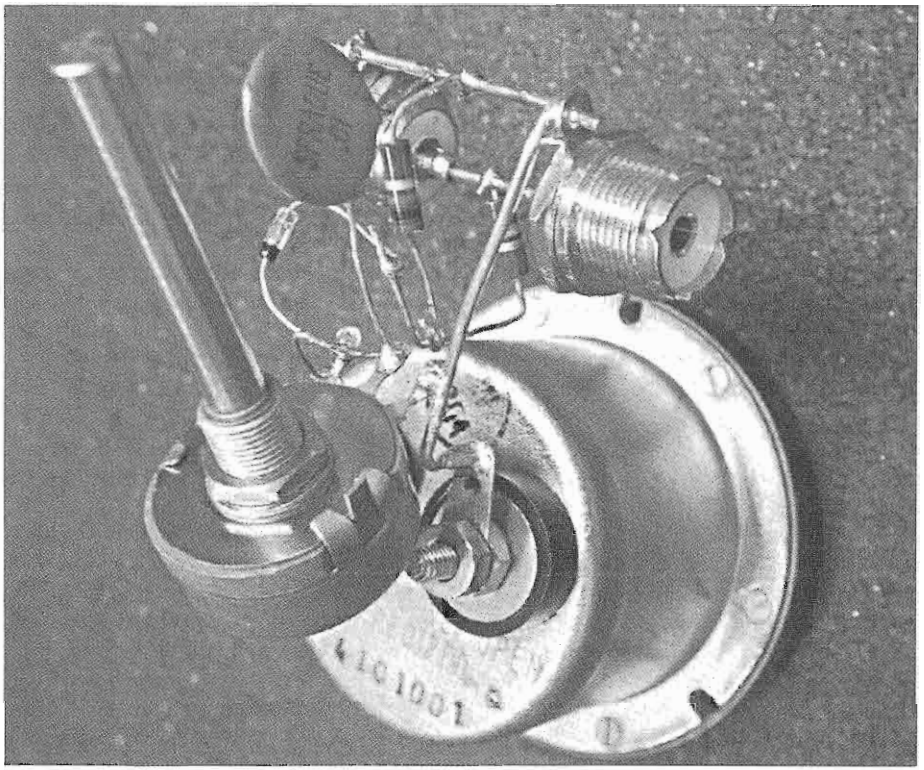
It was time to finalize the toroid coil, so it was best to hit the books and do it correctly, especially since the low-Q experience. Using a plate voltage of 950 volts and plate current of 200 mA, the load resistance was 4.75k. From the reference data using a Q=10, the Pi network components are C1=50 pF, C2=116 pF, and L=10.7 μH. These values are from a pre-calculated chart and are not concrete values, but they do serve as excellent starting values.

Knowing the required inductance, core type, and core mix makes for an easy calculation to determine the number of turns required to achieve the 10.7-μH inductance. The calculated number of 32.7 turns (33 actually wound) was then placed evenly around the T-200-6 core, leaving a 30-degree opening on the core between the coil ends.

The PA tank components including a down-sized, 75-pF variable were installed and the toroid coil was checked for resonance. There are several ways to check for resonance, and my favorite one uses a grid-dip meter. To be technically correct, my Heathkit is actually a tunnel dipper, since it uses a FET instead of a tube.

The resonance test was done with no power applied to the filaments or other elements of the PA tube. To do it properly, a 50-ohm, noninductive resistor is connected to the RF output terminal and the loading capacitor is turned to max capacity. Yes, I did take out the mica and reinstall the BC variable for this test. It doesn't matter if the tube is in or out of the socket. Another resistor, 4.7k, equal to the plate load resistance, can be connected from the anode to ground but it doesn't make much difference in the measurement. Using a short piece of wire, wind two turns more onto the new toroid coil. Wrap this wire around the correctly-ranged coil in the dipper with two turns, and then solder the ends together. Set the dipper to the operating frequency and rotate the Pi-tuning capacitor until resonance is obtained.

At this point in the project, the Mini-Max has completed its fabrication and



The RF Power Meter Calibration Setup

check-out. The only remaining task is to decal the front panel. Along the way, there have been several course corrections. The homebrew readers know what I mean. You can plan and plan and put it all on paper, but invariably there will be not one, but a couple of things that you simply forget.

I also attempted to layout the input and output of the PA paying attention to isolation with the hopes of avoiding the task of neutralization. In the end product, maximum grid and minimum plate current were almost achieved but neutralization still had to be done. As with everything else, there are many ways to deal with this issue. The 4CX250B makes it a bit more challenging with its extremely low grid-to-plate, interelectrode capacitance of 0.03 pF.

My only in-stock variable capacitor with the proper voltage rating suitable for this task had a capacitance of 15 pF. This was just too much capacitance, even at the minimum setting, for use in the grid-to-plate connection. Ideally, a 2-pF, 3-kV fixed capacitor would work, but I didn't want to wait for an order to arrive. The next best thing was to build my own. Isn't this what real hams do?

There are formulas and charts to aid in this design. I selected two 1.5-inch metal fender washers and a couple small diameter fiber washers so the dielectric would be close to air. The capacitor was held together with nylon hardware. Using a plate spacing of 0.15 inch, the homebrew capacitor had a capacitance of a little less than 3 pF.

Using a fixed capacitor in the top leg of

the neutralizing bridge forces the need for a variable capacitor in the bottom leg. Since this is a relatively low voltage point from the bottom of the grid coil to ground, a small mica compression trimmer having a max value of 1000 pF worked well. The passive neutralization method (no voltage on the screen or plate of the PA) was employed and the null was easily achieved using a dummy load and the oscillator-driver driving the PA grid. Many types of detectors can be used as the nulling device such as a receiver, RF voltmeter, diode-meter, or spectrum analyzer.

With no panel meters to read cathode or grid current, it was best to employ a power meter as an indication of how well the transmitter was working. One might say this power meter was built right "on" the coax line. The coax is connected from the Pi output to the SO-239 front-panel connector with an opening in the middle. This opening is a break in the braid, plus a small area where the center conductor insulation is removed. All power meter components are mounted to a small PC board that is mounted to the terminals of the meter. You may notice the scale of the meter [page 2]. It was redone as per one of my recent articles, "Modifying a Meter Face for Your Homebrew Project," ER #204, May 2006.

Now, before you send an email about the scale, I will answer your questions because I know some readers will look closely at the photos. The meter scale shows a maximum of 250 watts. That wasn't an accident or course correction, but was planned.

[Editor's note: Tom's article continues in next month's edition with the modulator and power supply schematics, the conclusion of the construction information, final adjustments to the Mini-Max transmitter, and operating hints.]

ER

(Comments, from page 1)

Working Group announced a set of 400 requirements for their new BPL standard. The ideas they are working on will include a set of rules (protocols) that help define how hardware and software can work together to avoid mutual interference. The IEEE "Standard for Broadband over Power Line Networks: Medium Access Control and Physical Layer Specifications" is intended to provide standards for sending high speed digital information over power lines with minimal interference to other spectrum users. It will also provide guidelines for the transmission of digital voice, data, and video over electrical lines within structures. They issued a deadline of June 4th, 2007, calling for technical system proposals that meet these 400 new conditions.

Sounds great, right?

House Rule HR-462

In the United States Congress, House Rule 462 has been introduced as the "Emergency Amateur Radio Interference Protection Act of 2007." If it passes, the bill would require a study, by the FCC, on interference *caused by* BPL data transmissions to other licensed users of radio spectrum. As of March 2007, this bill is currently before the House Energy and Commerce Committee in Washington.

Some are saying that the IEEE project, while sounding good on paper, will only give lousy BPL technology credibility it doesn't deserve, and that only real legislation will force BPL providers to use *non-interfering technology.*

I am writing to my congressional representatives to urge support of HR-462. Everyone interested in preserving useable radio spectrum for themselves and for future generations should consider doing the same thing right away before it is too late.

73, NØDMS, Keep Those Filaments Lit!

ER

Broadcast and Amateur Transmitter Audio Revisited, Part 1

By David Kuraner, K2DK
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In previous ER articles, we discussed broadcast audio, and audio modifications to vintage commercial ham transmitters. The Heathkit DX-100 was specifically illustrated with numerous suggestions that could be applied to most classic equipment. This was really a very limited discussion of the subject. This series will continue and expand on the subject in much more detail.

Here, we present many additional ideas to improve the frequency response and distortion of ham transmitters. In some cases, we show them as modifications that have been performed on several popular vintage ham rigs. However, this is not going to be a cookbook. Many things can cause poor response and distortion. Understanding the theory will help you to implement the circuits into other transmitters, including converted broadcast equipment. In the recent series of broadcast articles, we attempted to show similarities between broadcast and ham equipment. We now continue in this same vein.

One of the suggestions to reduce distortion is to bypass the DC path to the RF stage in the amateur transmitter with a Heising choke, replicating the BC modulation circuit. At least one ham on the east coast is on the air with a HB rig using this circuit. It does have the advantage of keeping the DC current off of the secondary of the modulation transformer. Less stress and distortion from possible saturation of the modulation transformer is the result. See ER #199, December 2005, for the basic circuit.

Since the BC rigs use a really big 50-Henry choke, use the highest value you have which is normally used in a high voltage power supply This may not be a very practical modification in a vintage commercial ham rig due to space issues, but it could be planned into a HB rig.

Spectrum Robbers and Dirty Audio Vandals

The Viking Ranger is known for excellent audio characteristics. The audio circuits include some insidious low-pass filters restricting the highs in the interstage coupling. John Barcroft (WA6ZJC) points this out in ER #9, January 1990. Some low value (200 to 470 pf) bypass caps appear to be used for RF feedback insurance. So, in any ham rig audio section, look for this restriction on the high audio frequency. In the Ranger, there is clearly some questionable small value bypass filters in the second triode stage at both the grid and plate. Removing them now in the Ranger, or other rigs, may not be the total answer as other sections of the modulator may not be capable of passing the higher frequencies and distortion could be induced. And be warned, some capacitors may have been intentionally installed to suppress high frequency instability.

Internal clipping circuits, such as found in the Apache and Valiant, are an absolute no-no. Clipping the wave form instantly generates distortion. Remember what a clipper circuit–called ANL in a vintage receiver–does to the fidelity of the received audio. I'd rather listen to static crashes than the perverted audio created. Get rid of them!

One of the spectrum robbers in the typical ham rig is the interstage transformer that is driving the modulator tubes. Here is a major source of frequency restriction and distortion. Many ham rigs are found to have bad interstage iron, and it could happen in a BC rig. The Multi-Elmac AF-67 and Viking IIs have been identified as often needing replace-

ments for one reason or another. Antique Electronic Supply, in the past, has offered the Thordarson transformer #20A14. If still available NOS, it would be perfect for the Vikings and others. It might be usable in the Elmac electrically, however, there is another solution here. Space in the AF-67 is a premium. I will have more on this later.

The Vikings are super bombproof transmitters, made with first-quality components. But, they were never designed for good low-distortion, full-spectrum audio. There have even been suggestions that 6146Bs could be used in the finals to run more power. The increase would be marginal at best and could really create a problem for the modulator unless further serious modifications are made. As described below, there are some problems with the modulator's design in stock form, and one of the solutions is to load it up to only about 200 mA. This reduces the necessity to push the modulators into distortion for 100 percent modulation. One of the Vikings I owned simply could not reach 100 percent. At best, I got 80 percent and wondered what was going on. Here is the apparent answer.

When the modulator stage has to be driven harder to get to 100 percent, it changes from Class AB1 to Class AB2. If the grid of a single (not push-pull) Class-A amplifier is always negative during the entire cycle, it is called a Class-A1 amplifier. This is referred to as a voltage amplifier and they usually drive another Class-A1 amplifier. No grid current flows and therefore no power is required from the preceding stage.

When a Class-A amplifier's grid is driven positive during part of the wave cycle, it now becomes more than a voltage amplifier. The grid draws current, and with the voltage present we now have a power amplifier. Again referring to a single tube, the device is operating Class A2. A Class-A2 stage must be driven by a Class-A2 stage because power is consumed in the grid circuits. If only voltage is present and suddenly power is consumed in the succeeding stage, severe distortion is the result.

When a Class-A amplifier is configured in push-pull, it becomes known as Class AB and the grid bias is normally a little more than that of the single tube in Class-A operation. A Class-AB circuit has the same low distortion as a single Class-A stage but provides more power output with better efficiency. Again, we have the situation of grid voltages and current resulting in power needed by the stage's grid circuit. With Class AB1, the grids never go positive, no power is needed, and the stage is normally driven with just a single Class-A voltage amplifier. When the grids are driven positive during any part of the wave cycle, we now have a Class-AB2 circuit which can provide more power than Class AB1, about 15 percent, or more. But, the preceding driver is supplying power and must be Class A2. If it's Class A1, you get severe distortion. Another consideration with two tubes is that the DC current of the total circuit never goes to zero, creating distortion, and even-order harmonics are cancelled.

Going back to the Viking's modulator, at 80 percent modulation with 250 mA of RF plate current, the push-pull modulators remain operating within the Class-AB1 parameters. When more audio power is needed to approach 100-percent modulation at that input, the stage jumps to Class-AB2 operation with the resulting distortion and, as I discovered, inability to fully modulate. So, if we reduce the DC input to the RF final by 10 to 20 percent, there is plenty of audio without distortion. (As per the operating manuals, the DX-100 loads to 250 mA. The Vikings load to 230 mA for phone.)

Why does this not happen with the DX-100? Simple! The 1625 push-pull modulators are already operating Class AB2. Thus, there is much more audio with the DX-100 modulator and much less distortion. The 12BY7 driver is very capable of delivering power without the

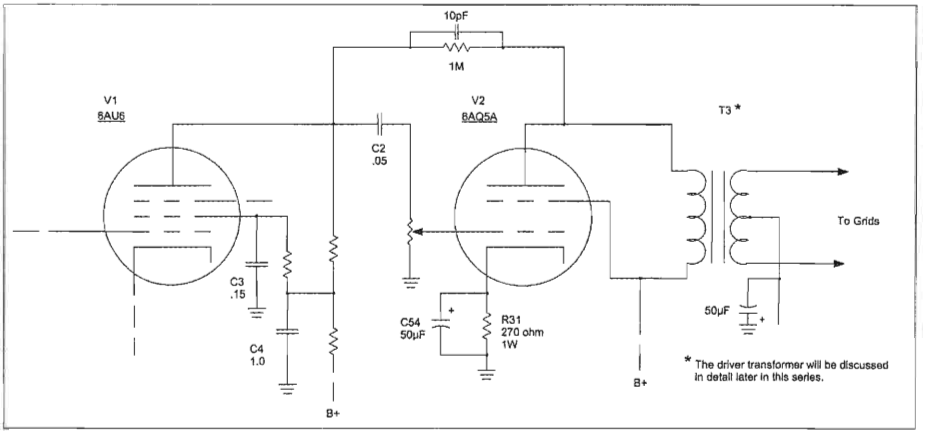

Figure 1: Sheldon Rubin's Viking II Driver Modification Originally Published in ER Issue 9.

distortion. Often, it is not obvious if the stage is a voltage or power amplifier. It does not help when the RCA tube manual only gives data on Class A1. The 6AU6 driver in the Viking is not a power driver. Broadcast transmitters obviously do not have this problem.

There have been attempts to resolve this by replacing the Viking's 6AU6 driver with a beam power output tube such as the 6AQ5 and changing the driver transformer. Re-biasing the modulators is not a good option. The solution here is to replace the driver transformer for (possible) better frequency response, regulate the screen grids, incorporate feedback and then reduce the power input, if needed. Or, you can modify the input of the modulators to be driven by a Class A2 or AB2-stage or use an external power Hi-Fi amplifier as some have done with vintage AM transmitters. The 6AQ5 driver modification described by Sheldon Rubin in ER #9, January 1990, is one attempt to drive the 807s, which are also beam-power tubes. See **Figure 1** above. Another was described by Thomas Bonomo (K6AD) in his three part series ER numbers 110 to 112, June, July, and August 1998. I will have more on the K6AD modifications later.

Bob Raide (W2ZM) drives the grids of the modulators in several of his broadcast transmitters from his Viking's modulator. Here is one alternative for defective lower-power audio stages in a broadcast rig. Bob, on at least one of his broadcast transmitters, feeds the modulator tubes directly but is running tetrodes as triodes. The screen and control grids are connected together. This effectively turns the tube into a high-µ triode. The modulator stage is greatly simplified as no bias or screen voltages are required.

Although these were either 4-400 or 4-1000 tubes, almost any of the smaller beam-power audio tubes can be used in this mode. A circuit using 807s is shown in **Figure 2** . The circuit is capable of 120 watts of audio in Class B. The triode configuration does not change the power capability. The screen grid is excited directly and the control grid is through a 20-k resistor. A step-up transformer is used with rather healthy drive from the previous push-pull stage. Tubes such as the 6AQ5, 6V6, 6L6, 807, 813 and the 4-400 can be triode connected. They become zero-bias devices.

Referring back to the modulator of the DX-100, you can see that with Class AB2 807s, there is tons of audio with little distortion.

And, before we leave the subject of triode-connected tetrodes, here is one more thing to consider. A triode con-

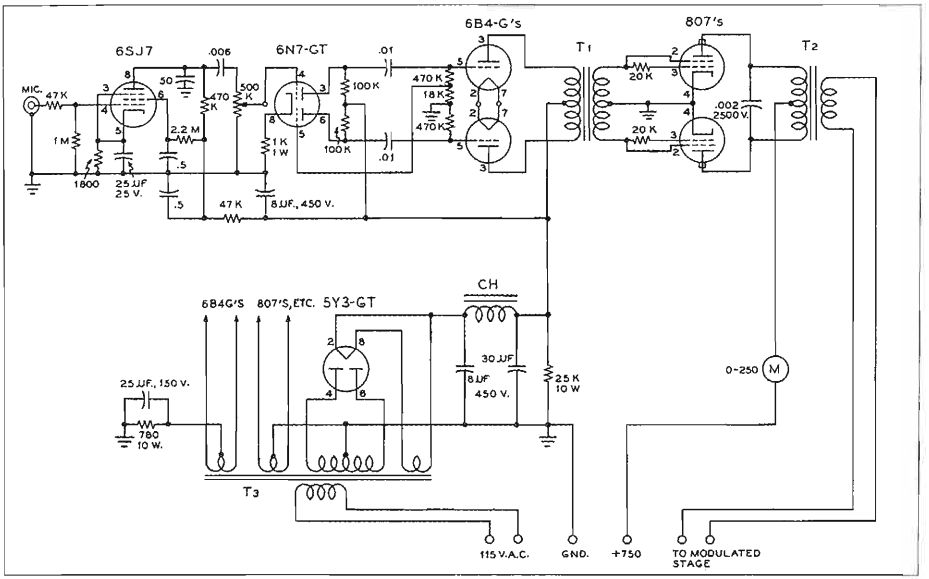

Figure 2: Schematic of an 807 Triode, 120-watt Class-B Modulator from the 14th Edition of the Radio Handbook, 1956.

nected 4-400 can be substituted for the 3-500 zero-bias triode. The tetrode is zero biased in that configuration. And, in linear RF service, the two different types, in a pinch, could be run together in parallel.

One More Source of Distortion

A broadcast transmitter is expecting high level audio input (line level is 0 dBm or greater). A typical vintage ham transmitter is expecting microphone levels from a crystal or amplified dynamic mike. When using professional audio equipment with much higher output levels, the tendency is to simply feed it into the mike jack and turn the gain down.

The only problem here is that the audio gain control is usually in the second stage and the first stage can be severely overloaded by this high level audio. The obvious solution is to bypass the first stage and go right into the top of the gain control. Typically this is found at the grid of the second audio stage. A really simple way to do this is shown in **Figure 3**. A closed-circuit jack is used to connect the output of the first stage when using the normal crystal mike element. When higher level is applied, it goes through the jack. This effectively disconnects the first stage and now feeds the high-level audio into the gain control directly. So now, the front panel audio gain control is the first thing the external high level

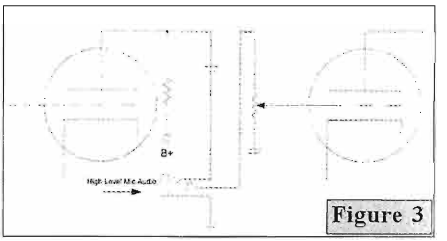

Figure 3

audio sees, and it can be adjusted correctly without the possibility of overloading the first stage and causing distortion. The 600-ohm impedance of the high level device is bridged across the audio gain control.

In part 2, we discuss audio phase inverters and driver impedance matching circuits.

ER

A Work of Art:
A Collins 30K-1 Time Capsule Found, Part 1

By Bruce J. Howes, W1UJR
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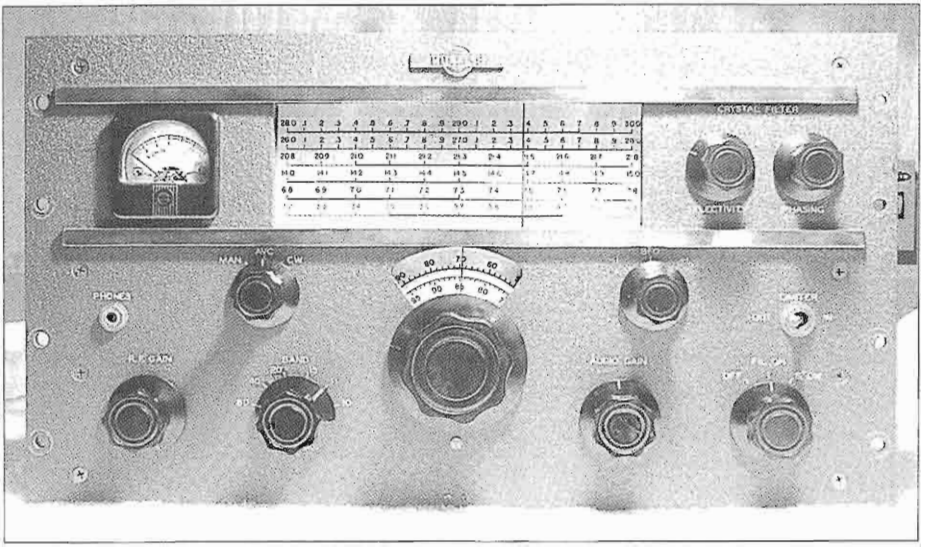
October 2, 2006, just after 9:30 PM EST, on a small peninsula on the Maine coast, a Collins 30K-1 amateur transmitter, serial number 32, returned to life after a 48-year hiatus.

This was no simple resurrection, but the culmination of a long journey that started well over half a century ago. The journey began in 1947 when a 30K-1 transmitter, serial number 32, left the Collins factory at Cedar Rapids, Iowa, and traveled to the station of Walter Jahries, W7MGA, in Salt Lake City, Utah. It saw service at W7MGA until sometime in the late 1950s. After the passing of W7MGA the unit was put into storage. In 1991, it traveled westward to Los Gatos, California, and the home of Peter, K6DGH.

Peter, busy with other projects and his Hallicrafters HT-4 station, never quite got around to unpacking the transmitter and getting it on the air. So there it sat, in heated storage for 15 years, until September 2006, when it headed for the east coast and to my home at Woolwich, Maine, some 59 years after it first rolled off the factory floor.

But, it was not just the transmitter that survived the half century of storage and

The Collins 30K-1 time capsule station of W7MGA is now in service at W1UJR.



The Collins 75A-1 was a high performance 14-tube receiver, built in moderate quantities between 1947 and 1950.

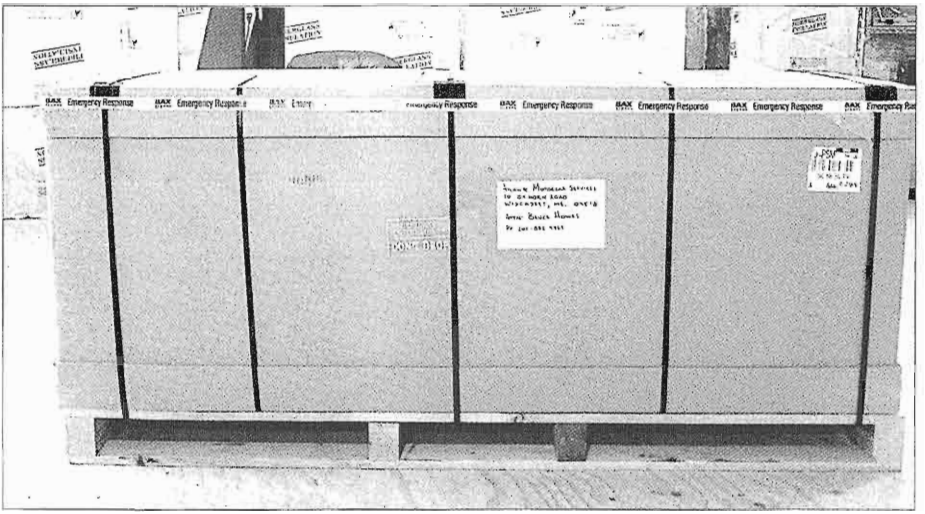
travel, amazingly the complete station, sans antenna, survived intact! Included in the package was the matching Collins 75A-1 receiver, a Collins 270G-1 speaker, a Collins 310A exciter to drive the big 30K-1, W7MGA's manuals, extensive spare parts, a homebrew coil holder and a Shure microphone. In other words, the complete 1940s-era station of W7MGA had been transported through time and space to arrive here, the coastal station of W1UJR.

A Little History

First, here are a few words about the 30K series. I have been a Collins fan since I was first licensed in the 1990s, but really fell in love with the 30K when I visited the home, perhaps more appropriately, the radio museum of Todd (KA1KAQ). Todd had the commercial version of the 30K-1, known as a 30K-5, and I was privileged to work on it for him last December. Very similar in design, the 30K-4 and 30K-5 are commercial models offering two discreet tank circuits for rapid frequency changes but lack the band-switching arrangement of the 30K-1.

The 30K series was designed by Collins engineer Warren Bruene in 1945 and was first offered for sale the following year. It was, in some way, a "Hail Mary Pass" for Collins as the war contacts were drying up, and yet amateur radio operation was still banned during wartime. Collins forecast a pent up demand from the return of GIs from the war, and, with the elimination of the wartime ban on amateur operation, hoped the 30K would fill the gap. Sales were somewhat limited as the 1946 cost of the 30K-1 transmitter and 310A exciter was $1450, the equivalent to approximately $15,000 in today's dollars. According to Jay Miller's (KK5IM) excellent publication, "The Pocket Guide to Collins Amateur Radio Equipment 1946-1980", less than 100 of the 30K-1 are known to have been built, and few survive today, making serial number 32 a rare bird indeed.

Visually, the 30K transmitter series are most impressive to behold, housed in a cabinet 5-½ feet tall, finished in black wrinkle paint, and weighing over 350 pounds, this is a big transmitter! The design of the unit is pure art deco; verti-

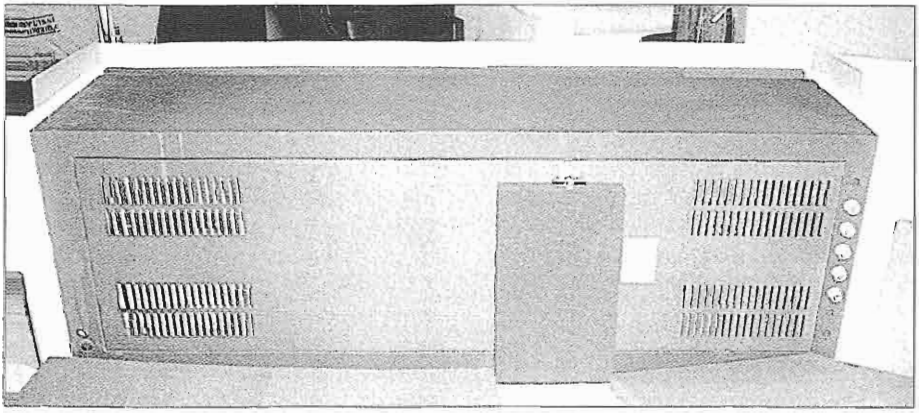


The 30K-1 was received from the shipper without any damage, thanks to a proper, careful packing job that included metal banding and a wooden pallet.

cal and horizontal chrome accent strips, a large window for viewing the 4-125 final tube, and a most impressive meter panel at the top of the cabinet, also housed behind glass. Looking every inch a serious transmitter, the 30K-1 is of robust construction along the lines of commercial broadcast gear. Emission modes are CW and phone (AM), with the plate input power given as 500 watts on CW, and 375 watts on AM. The 30K-1 offered coverage from 80 to 10 meters using two plug-in output coils. With a tube compliment of 11 tubes in the transmitter, and 10 tubes in the 310A exciter, the 30K station as much a delight to operate as it is to look at.

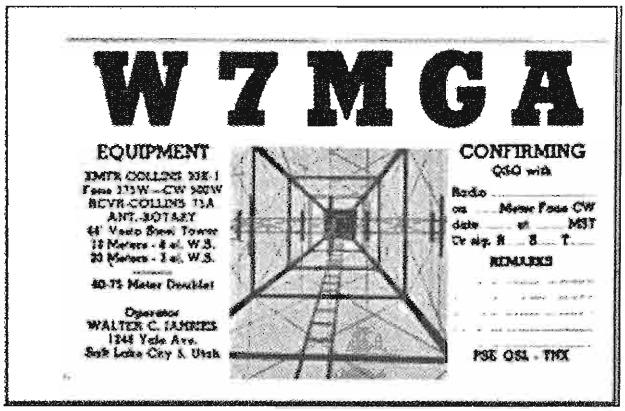
Always Practice Safe Shipping

As the safe movement of even a small receiver from coast to coast is often a daunting task, I wanted to take extra care to make certain that this station, entrusted to me, made the trip intact. I won't enter the debate of who is better/worse, UPS or FedEx; suffice to say that I have developed two simple rules for



The entire transmitter was enclosed in an inner foam liner before crating.

safe shipping. First, pack the unit as a box within a box; peanuts are near useless, use bubble wrap and foam. Second rule, the less time in transit, the less change for damage, Overnight or at the very least, 2nd-day air shipping for everything fragile.



Fortunately Peter had considerable experience packing and shipping vintage electronic gear, so the process was quite straightforward. Careful packing, with a minimum time in transit, is the key to the shipping of fragile electronics. Brian, at JDM Packing in Sunnyvale, California, did an outstanding job of packing up the 75A-1 receiver and the 310A exciter. The method was surprisingly simple, a large box, then a layer of dense foam, then another box, and again dense foam, followed by the object to be shipped, which was bubble wrapped. I utilized my commercial UPS account to have all the critical items sent overnight to minimize exposure time. All items thankfully arrived without damage, and I saved the packing for future use.

With the easy items out of the way, now came the real challenge, how to ship the 5-½ foot tall, 400 pound transmitter across the country without any damage. Wisely, Peter had already removed the heavy plate transformer and shipped that separately. So with the nearly 75 pound transformer out of the way, Peter once again called on Brian for assistance. Brian built a large enclosure, again with the dense foam packing, placed the transmitter on its side and then banded the entire unit, all 5-½ feet of it, to a wooden pallet. Cost estimates were obtained for surface (truck) transport and 2nd day airfreight. Surprisingly the cost differential was minimal, and BAX handled the airfreight duties, delivering the package safely to the door of my office just two days after it left California. My employees, used to seeing various small radio items trickle in, were astonished at the size of this large coffin sized package. I informed them that it contained the remains of a deceased family member, and required special handling! Once it was safely unloaded at my workshop, I let fly that it was in fact "yet another radio," which brought forth a profound sigh of relief.

Provenance

Whenever I purchase vintage amateur gear, I like to know the identity of the previous owner, or builder, and document the construction, use and ownership of the item. The museum people call this "provenance" and use it to establish the authenticity of an item. For my purposes I find this information gives me a greater appreciation of, and respect for, the handiwork of the previous owner. It can also be helpful for restoration purposes, knowing what period of components to use in a rebuild, or even in designing a vintage station configuration.

Fortunately, Peter remembered the name and call sign of the previous owner, so with the Internet close at hand, it was a simple matter to quickly track down his next of kin. I sent a tentative email off to W7MGA's son, Conrad, who was most helpful in filling in the details and history of the station. Conrad shared the

history of the station, saying, "That is interesting about your having the old 30K station. Yes, it belonged to my Father, W7MGA (born in Chicago in 1895). I think he probably bought it from Henry Radio in Kansas City, probably in 1947 as he returned from Hawaii in 1946. He was the district manager for S.H. Kress Company in Hawaii and the store manager for the Honolulu store. He retired over there I think in 1946 and moved back to Salt Lake, where he lived before being transferred to Honolulu in 1936.

"The way he got into ham radio is when we lived in Honolulu, my brother was going to university here in Salt Lake, and he ran into a fellow by the name of Malc Majors. Malc was a ham there (WØOJI) and set up schedules between Hawaii and Salt Lake to talk with my brother. When we returned to Salt Lake he got his ticket probably about 1947, and purchased the Collins equipment.

"I was in school then and remember his having people up to the house all times of the day and night to have schedules with servicemen in the South Pacific. He was using 4-element beam for 10 meters and 3-element beam for 20 meters. It was home made and sat on top of a 44 ft. Vesto tower. The skip was open then and I think he made most of his contacts on 10 meters. I think 10 meters was open then and the skip was good in the early evenings and people were over to the house almost every day. He did a lot of hamming on 10 and 20, spending most of his time in the shack He sort of lost interest in hamming in the late '50s and the Collins sat in his shack for quite a while. When he passed away, I got it and it sat in my basement for several years not being used. I was interested in RTTY when I had Collins here, and used Kenwood Twins when I was on the air, so I never used the Collins or Henry at all.

"You should get Dad's QSL card. That is a shot of a 45-foot Vesto (windmill) tower that Malc was selling back in Kansas City. It was taken from the center inside of the base looking straight up. He built the beam himself."

The Process Begins

As noted, this time capsule has been unused since the late 1950s, so the task of careful removal of half a century's worth of accumulated dust and dirt is no simple matter. It calls for both a through and methodical approach, while preserving the integrity of the unit to be restored. This 1940s vintage Collins 30K-1 has not traveled through time and space only to be damaged at my hands. So, I proceeded with the utmost care. Each part, nut, bolt, screw that I removed was placed in labeled sandwich bags for later cleaning and evaluation. I carefully photographed and noted the location of each wire disconnected so it could be put back into its proper place (digital cameras are excellent for this purpose).

There are two basic schools of thought on restorations. The first school takes the approach to make every nut and bolt shine, to polish IF cans and other sheet metal to a mirror finish. To in short, make the unit more of a piece of art, eye candy if you will, than the purpose it was designed for. An apt analogy for this school of thought might be a heavily chromed and tricked out 1957 Chevy at an auto show vs. the daily driver. Over the years my approach to restoration has moderated, as you will note below. My current theory behind most of my restorations, and this unit is no exception, is to return the item to be restored to the condition in which it left the factory. This means the use of the same style hardware, like kind and type of wiring, and same finish, if refinishing is needed.

I've moderated on the depth of restoration efforts over the years, accepting the "in-service" look as opposed to the overly done, polished chassis approach. This is no way means that I compromise on my efforts, it simply means that I restore the transmitter to the level which a ham of that era would see the unit. It

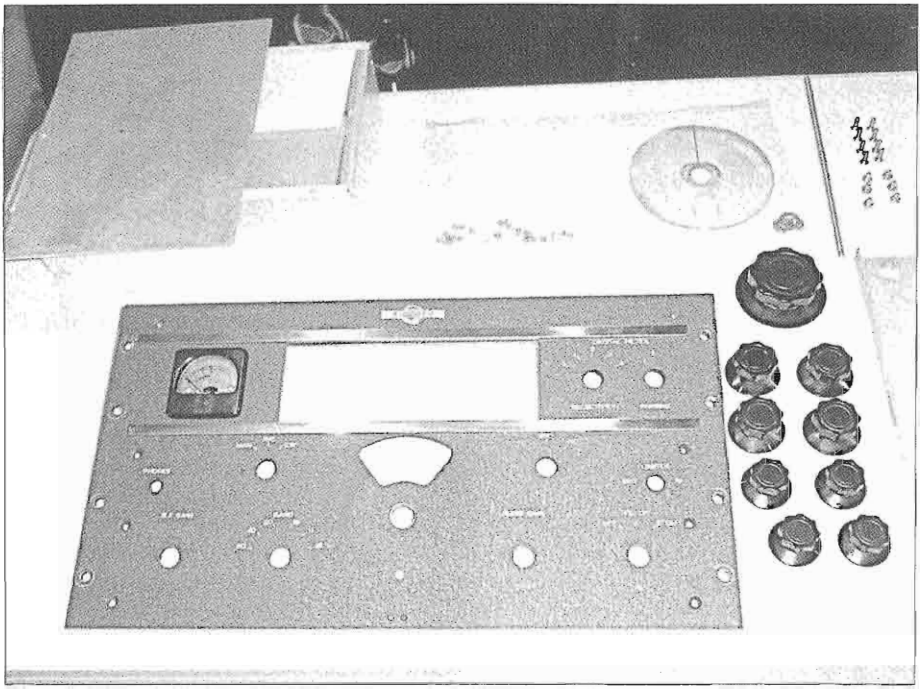
should look, for all intents and purposes, like it was *not* restored but is simply an in-service unit. In most cases this means keeping intact the original finish, labels, sheet metal finish, etc. Dependent upon the restoration, I do endeavor to remove modifications added over the years, the goal being to return the unit to the standard operating condition.

Nor do I ever really "finish" a restoration. Often I will pull a unit out of service after perhaps six months or years worth of use, and go through it yet again. With older gear, parts will invariably be damaged or missing and often not readily available during the first restoration. So I will employ "field expedient measures", temporary fixes if you will, to allow the unit to operate, while scouring hamfests and the Internet for the needed part. It is during this second trip to the bench, I find myself carrying out additional cleaning, realignments, and checking component values again. Despite a through "burn-in" effort during its initial visit to my test bench, often certain components don't fail until they have some additional time and use. So, in general, my time is spent correcting any overlooked, unsatisfactory items from the first work. I find it often takes 2-3 trips to the bench before I am satisfied that I have the unit ready for another 50 years of service.

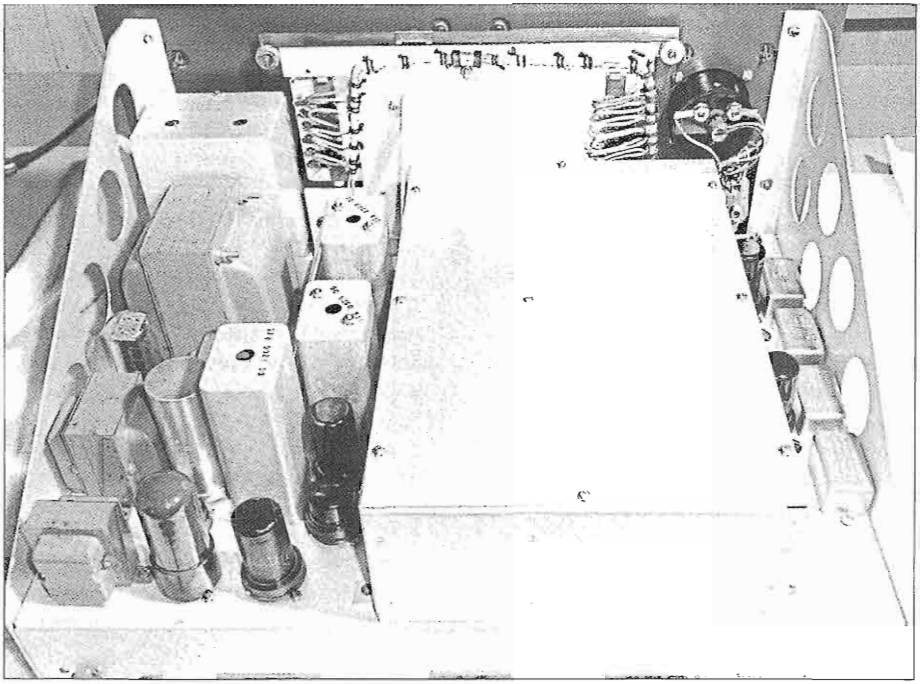
So, let's start with the first part of any amateur radio station, the receiver. The receiver, exciter and plate transformer had arrived first while Peter made preparations to ship the large and more cumbersome transmitter. Restoration work on the W7MGA's 75A-1 receiver began on Sunday, September 10, 2006.

Restoring the 75A-1

For a receiver which appears to been unused for nearly half a century, this A-1 was in surprisingly good condition. Before I even attempted to fire it up, I did



The 75A-1 was disassembled for restoration and cleaning and all individual parts were stored separately to avoid loss and to make reassembly easier.



Rear View of the Restored Collins 75A-1

the standard W1UJR clean and restoration. When cleaning an old radio, the first order is to remove the dust, then concentrate on cleaning the chassis and other components. I've found it far easier to vacuum or blow said dust off than it is to get it wet and try to wipe it down. So out came the trusty Shop-Vac with the small brush attachment. Always use a brush if possible, it really helps to loosen up the caked dust, much more efficient than using just a nozzle itself.

When restoring gear that has been out of service for some time, one must be very careful of the presence of rodent droppings. It's not so much the droppings that are the problem as it is the potential for transmission of the Hantavirus. If you see any droppings at all, always take the safe course and do not create aerosols by blowing with compressed air, or aspirating with a vacuum. The safest method is to don a pair of rubber gloves and a respirator, wet down the droppings with bleach. The remains should then be placed into a trash bag and carefully sealed. Take additional time to thoroughly clean and wet down the chassis to remove any residual remains before going further.

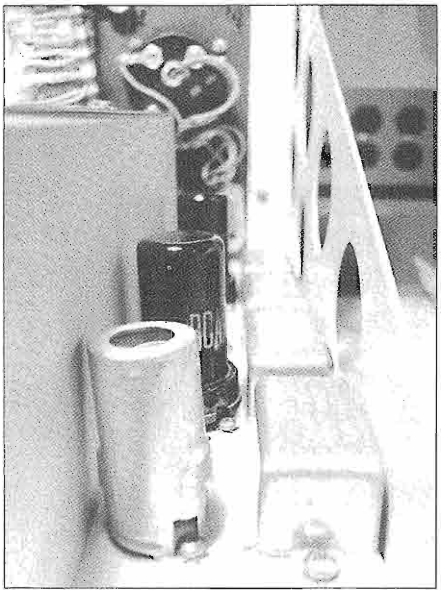
When I start a restoration, I make a quick inventory of items to be replaced, serviced or checked. Once the cleaning is complete I then attend to the electrical items. I realize that some folks feel the electrical should come before the cosmetic work. I find it much simpler, and enjoyable, to service a clean radio as opposed to a dirty one.

Over the years I have tried many cleaning products, with varying success. What I have now settled on, and seems to do a good job, while preserving silk-screened chassis markings, is the commercial version of Windex® and a number of cloth rags. Cloth is much more durable than

my earlier choice, paper towers. Cloth allows you to scrub firmly, and can be even used for a polishing effect on tarnished parts. For really stubborn, or nicotine coated units I resort to the Simple Green® product.

A word on black winkle, sometimes called "black crackle" paint. On most black wrinkle paint items I prefer to keep the original finish intact, as today's paint compounds can not properly duplicate the subtle wrinkling effect of the early lead paints. Originally chosen for its durability, as well as its ability to hide minor sheet metal imperfections, this finish is amazingly forgiving, and most grime can be removed by gentle scrubbing with a nylon tipped bush and Go-Jo® hand cleaner (without pumice).

As a rule, I always remove all of the front knobs, inner sheet-metal covers, and trim bezels when doing a restoration. Be very careful with the Bakelite knobs, Windex® seems to have a dulling effect on the Bakelite. I clean and then treat Bakelite items with Wurth Cockpit Cleaner®. The Wurth product allows the dull shine to return to the knobs while not looking overly glossy.



Attention to detail will produce results that should last many years.

I also remove all the tubes, clean and test them before reinstalling. As part of the cleaning process I coat the pins with Caig DeOxit® compound. Metal tube shields receive a quick buff with Windex and the cleaning cloth.

Any and all wax paper caps, no matter how new they look, should be replaced. For this purpose, I often use the Sprague Orange Drop line of capacitors. While the Orange Drops are perhaps overkill, I know that they will not fail, and the unit, once fully serviced, is good for another 50 years.

Special attention should be paid to the electrolytic capacitors in the power supply. Once the unit is fired up, one can check the audio output for hum, indicating a defective filter cap. Also check the outside can of the electrolytics after the unit has been on for 10 to 15 minutes (be careful, some units, like the Heathkit DX-100, have the metal housing of the capacitor above ground potential). It should be at room temperature, not overly warm. If the can feels warm then the cap is not doing its job and its time to replace it before it damages the power transformer. Yes, I know the process of "reforming" such caps, but my feeling is that if the cap is bad, it is not to be trusted, and should be replaced. Power transformers are certainly more costly and difficult to locate than an electrolytic cap. Suppliers like Antique Electronics Supply are an excellent source of replacement caps. They even carry the electrolytic series.

Surprisingly, W7MGA's 75A-1 powered right up and played like a charm. Just a simple touch up of the alignment was all that was needed to make the unit both look and play like it was fresh from the factory shipping crate!

[Editor's note: Next month in part 2, Bruce covers restoration of the 30K-1 transmitter.]

ER

Collins 75S-1 Copy Cats

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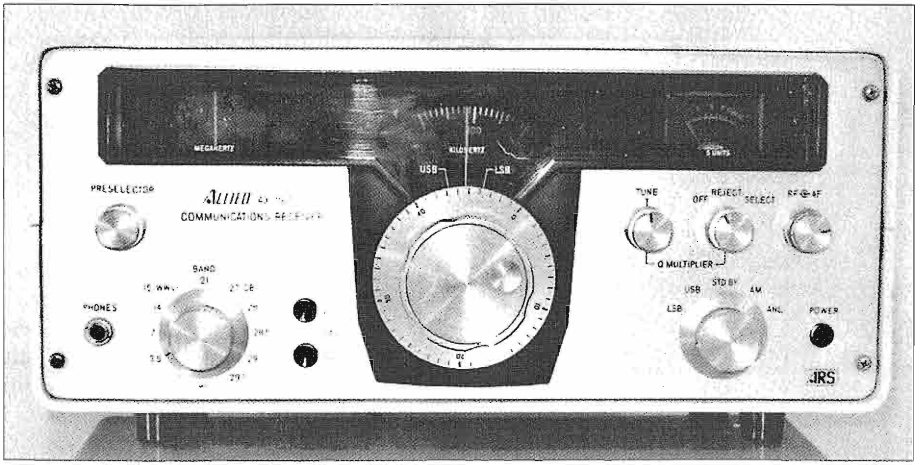
I recently helped a new ham in town get some equipment problems straightened out, and he offered me a nonworking Allied receiver for my efforts. He had used it to copy WIAW code practice 25 years ago. He said it probably had a bad tube. I had never seen the model before, so I took it home. A few days later I took the cabinet off the Allied Radio AX-190, and found no tubes, but instead a bunch of Japanese 1970-vintage XXXP printed circuit boards and transistor electronics. The bank of crystals, preselector tuning, and the main tuning connected to a VFO and IF strip said it was a solid-state copy of the Collins 75S-1 or 75S-3 receiver. I had previously restored an Allied Radio A-2516 Japanese tube copy of the 75S-1, and had a Lafayette HA-350 Japanese tube copy of the 75S-1 for a short time. This made the Allied AX-190 copy worth fixing, in order to compare it to the previous Japanese tube import copies, and the real Collins 75S-1.

Collins had set the standard for ham-band receivers in 1947 with the 75A. The image rejection, frequency stability, and a linear dial that read out to better than one kilocycle set the 75A 10 years ahead of all other ham receivers. The 75A's crystal-controlled front end, variable high-frequency IF, and linear tuning second oscillator were not duplicated for over ten years. Of course, Collins also improved the 75A over the 10-year span with the 75A-2, 75A-3, and 75A-4 models which made copying them even more difficult for other manufacturers. Collins added 160 meters with the 75A-2 and the mechanical filter with the 75A-3 models. They topped it off with the mechanical passband tuning, hang AGC, and a sideband detector in the 75A-4 model.

Collins had also priced itself out of the mainstream ham receiver market as the 75A-4 cost over $650, twice the price of most top line ham receivers. Collins solved the price problem when the 75S-

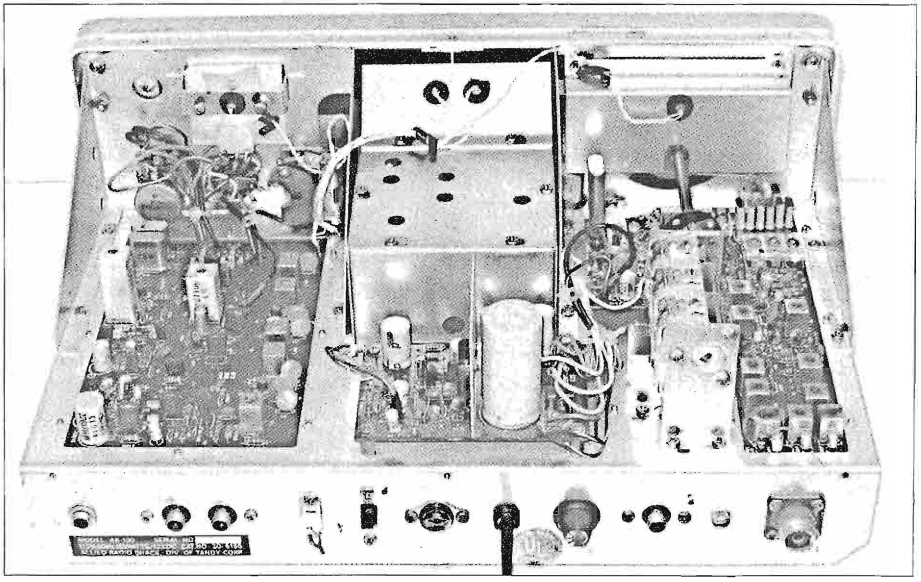


The Allied AX-190 was an early import, sold by Allied from 1971 to 1972. They may also be found with a Radio Shack "Realistic" label, same model number.

1 was introduced in 1957. The 75S-1 could have been the result of a 75A-4 cost-reduction program. Collins had been involved in Signal Corps cost-reduction programs with the R-390A and the AN/ARC-73A. The new S-1 was 35% cheaper than the 75A-4. It was also smaller and lighter, probably reflecting what Collins was expecting in the amateur market, based upon their experience with their recently introduced KWM-1. The 75S-1 incorporated significant cost-reduction features such as 200-kHz bands in place of 1000-kHz bands, thus simplifying VFO linearity and allowing an open PTO without internal mechanical tracking. The separate preselector tuning eliminated gang tuning, gears, and RF band switching. The sideband switching with two crystals and a switch was much cheaper than the belt-driven, rotating PTO of the 75A-4. The 75S-1 also reflected Collins experience with the Signal Corps 28-volt plate supply voltage in the R-392, which proved how lower voltages equal less heat and longer times between failures. The 75S-1 used an unusually low 150-volt plate supply.

While Collins was preparing to test the market with the new smaller, lighter, cheaper, 75S-1, R.L. Drake entered the receiver market with an almost identical circuit configuration for about half of the 75S-1 price. The Drake 1-A used a band-pass first IF in place of the variable-IF tuning of Collins and a 50-kHz, second IF in place of the Collins 455-kHz mechanical filter. The most unusual thing about the Drake 1-A was its physical configuration, 7" wide, 11" high, and 15" deep. The receiver had an internal speaker on the 7" by 11" back end and had the dial and controls on the 7" by 11" front end. Drake had a good working receiver with performance almost as good as the 75S-1 but the odd look was hard to take for many amateurs. Drake changed to a conventional looking cabinet with the model 2-A the following year but the Drake still had a somewhat cheaper look.

As the Collins and Drake started selling well, Eldico of New York City underbid Collins to build S-line equipment for the US Air Force. Eldico then built exact



The AX-190 as it looks without the main cabinet. There are lots of radio electronics inside, but the only glowing parts are the dial lamps.

copies of the Collins equipment. When the contract ended, Eldico started selling their S-line copies, including the R-104, which was an exact copy the 75S-1 on the open market. Only a few were sold in 1960 before Collins threatened legal action, which put an end to the R-104, and all the other Eldico S-line copies. Until the Air Force declared the Eldico S-line sets surplus in the eighties, they were very scarce.

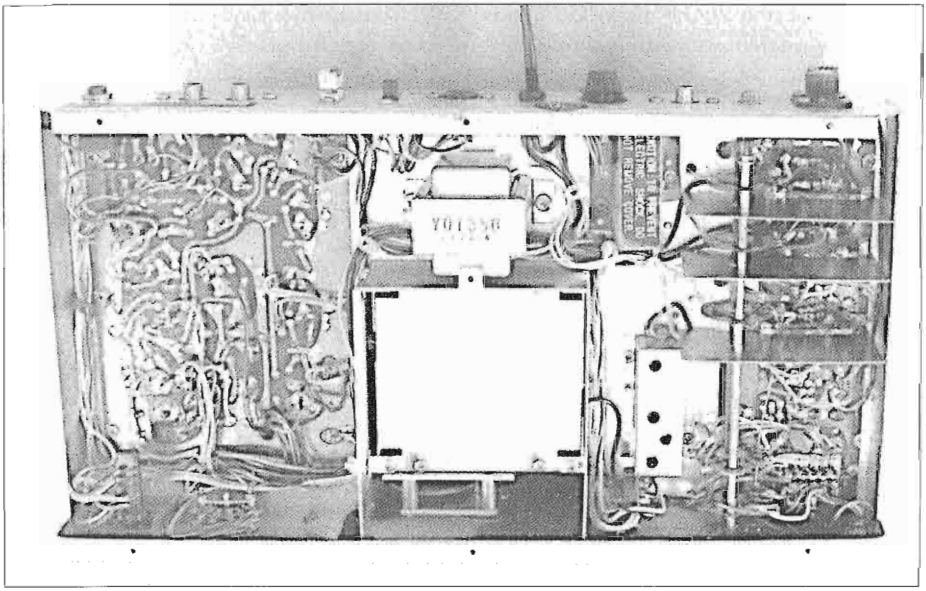
Heath was next in 1963 with a copy of the 75S-1, the Heathkit SB-300. Since they were only selling a bunch of parts and an instruction book, Collins could not take any action against Heath. The SB-300 used a crystal lattice filter and a preassembled linear master oscillator (LMO), which were very close in performance to the Collins 75S-1 mechanical filter and PTO. The SB-300 was a very nice looking and operating receiver at about 70% cost of the Collins and they sold well.

The following year, Lafayette Radio, a New York wholesale outlet, brought the Japanese into the 75S-1 look-alike market. Lafayette had been selling ham radios, CB radios, and "Hi-Fi" equipment that were made in Tokyo for them by Kuranishi Keisokuki. They shipped a 75S-1 to Japan and said "See what you can do." The result was the Lafayette model HA-350. The Lafayette was a close electrical copy of the Collins, right down to a Japanese-built PTO and mechanical filter. The physical appearance was similar to the 75S-1. The performance was equal to the 75S-1, except it was a bit flimsy mechanically. Even so, it was just as stable as the Collins. The Lafayette sold for 40% of the 75S-1 price and 80% of the Heath 8B-300 price, but it was fully assembled and ready to go right out of the box.

I got an HA-350 loner from Joe Trad, who had a Lafayette store in Asbury Park, NJ. He was interested in my comments, as I had both a 75S-1 and 75A-4. My comments, at the time, were that I could see no difference between the two S-type receivers; however I liked the 75A-4 a bit better–I guess size and weight were important to me back then. I kept the Lafayette receiver for a few months teamed up with my KWS-1. When I was using the Lafayette in a QSO most of the comments were "What happened to your Collins?" Perhaps the Lafayette name was the drawback, as it represented a product of poor quality to many hams. Sales of the HA-350 were not spectacular, even though it performed right up there with the Collins. The HA-350 was on the market for only 3 years, and as a result it is now scarce.

Next in line to build a 75S-1 copy was the Allied Radio Company of Chicago. They were an old-time supplier of radios and electronics. They carried most of the major lines of ham equipment, plus their own private "Allied" and "Knight-Kit" lines. Allied, like Lafayette, went to Japan for a copy of the 75S-1. Kasuga Musen Denki Shokai took the challenge and built the Allied 2516, a copy of the 75S-1. It sold for $170, about the same as the Lafayette HA-350, but was somewhat sturdier than the HA-350. It used ceramic filters and the circuit was almost identical to the HA-350 and 75S-1 except that it had a solid-state PTO with a buffer but lacked a sideband switching capability. However, it was more stable right from the turn on. It also had provisions for a crystal calibrator, like the Lafayette.

As the Japanese company started production of the Allied 2516, they changed their name to Trio Limited and test marketed the A-2516 in the United States as the Trio JR-500SE. Allied Radio had an established distribution and advertising system in place and the Allied 2516 outsold the JR-500SE. The Trio also cost $35 more than the Allied 2516. Trio stopped their sales of the 500SE and concentrated on the Allied A-2516. In 1972, Allied



A look under the AX-190 shows construction typical of all imported electronics during this period.

Radio found itself in trouble with Federal and local governments. They were forced to diversify their work force to be in line with the Chicago-area population. The rampant theft and dishonesty of the new workers led Allied into a downward spiral towards bankruptcy, and in late 1972 Allied Radio was purchased by the Tandy Corporation and combined with the Tandy Radio Shack chain. The Department of Justice stepped in with antitrust concerns, and 2 years later Tandy sold Allied to Schaack Electronics. Today, Allied is one of the largest and most comprehensive electronics mail order supply houses in the world. Trio Limited went on to establish Trio-Kenwood in the United States to market their amateur radio equipment under the Kenwood name.

I ran into an Allied A-2516 in a Nokomis, Florida radio shop on Route 41. It was on consignment and I got it for $25. It didn't work very well, but was in good condition and was unmodified. A bit of cleaning and deoxidizing, few new tubes and it was as good as new. It was a good receiver, perhaps a bit better than the 75S-1 because of a bit less drift, and you could beat on the cabinet and nothing changed. Again like the Drake it had an unusual look, with a small horizontal S meter. A description of the A-2516, by K8BYQ, was in the January 2007, ER issue #212.

In the seventies, when Allied was bought out by Radio Shack, the infusion of money allowed them to update some products. The Allied AX-190, also sometimes labeled the Realistic AX-190, was put on the market for $250. It was a significant step up over the A-2516, both electrically and mechanically and with a very up-to-date styling. It was a close copy of the 75S-3. The Allied AX-190 that I got last year started this article. It was not working, but was in excellent physical condition. I got the instruction book with the receiver, complete with a schematic, so repair was fairly easy. The upper frequency bands in the front end had been converted from the ham bands

to cover a very wide 11-meter CB band. There was also a very strange mod in the audio. I have no idea what it was supposed to accomplish, but it reduced the audio output and caused much distortion and feedback. Both of these mods were undone and the receiver worked like gang busters. I now had my newest and only solid-state copy of the 75S-1 or 75S-3.

I cannot find any reference to the builder of the set, other than "Made in Japan" on the chassis, and as both Tandy and Allied had Japanese connections, it could have been anybody who made it. It is built on 5 printed circuit boards. The RF is on one board with the first crystal oscillator. The VFO and tunable first IF are located on the second and are completely enclosed in a shielded enclosure. The second IF, filters, detectors, notch filter (copied from the 75S-3), and crystal BFO are on the third board, and the audio and power supply are on the fourth board. The 25 and 100 -kHz calibrators are on the fifth board. The 3-gang preselector tuning cap for the RF section and the power transformer are the only components, other than controls, which are mounted on the chassis. All interconnections are in a wiring harness which terminates with wire wrap connections at the various PC boards and controls. The variable IF is 2.4 to 2.9 MHz and the second IF is 455 kHz.

Performance wise, the AX-190 behaves exactly like the Collins 75S-3, except for bandwidth. The two ceramic filters measure 3.9 kHz at 6-dB down, and 11 kHz at 60-db down. Stability, sensitivity, and dial read out are equal to or better than Collins, with spurs and images down over 58 dB, almost as good as Collins. The all gear-driven tuning assembly feels great with no backlash or slop. The dial is calibrated by a friction drive knob system like the Drakes or Kenwoods. The receiver is set up with an external input for receiver muting, and a buffered HFO and VFO output for transmitter frequency control or a digital frequency read out. A rear-panel switch allows operation from a 12-volt DC source in place of the internal 120-volt AC supply. The power requirements, either AC or DC, are 10 watts. The antenna impedance is 50 ohms and is made through an SO-239, not an RCA jack.

A very simple modification allows the addition of the WARC bands, 30, 17 and 12 meters. A spare unused band switch position, number 1, is used to receive 30 meters by installing a 12.920 kHz crystal in position number 1. This will then provide 10 to 10.5 MHz coverage on Band 1 for WWV and the 30-meter ham band. The band 5 crystal for 15 MHz WWV reception is removed and replaced by a 20.920 MHz crystal which makes band 5 cover 17 meters, 18-18.5 MHz. The CB band crystal, number 7, is removed and replaced by a 27.420 MHz crystal, which provides 12-meter coverage of 24.5 to 25 MHz. The new 20 and 27-MHz crystals should be 3rd-overtone types. So, for about $38 and less than one hour's work, you will have complete 80 thorough 10-meter ham-band coverage including the WARC bands and WWV.

It's too bad the original Allied didn't survive to push the AX-190, as I find it to be one of the best ham-band receivers of the seventies, and as they seem to be selling for under $100, it has to be a "best buy." While most of the other 75S-1 copies are good receivers, they all lack a little something, either electrically or mechanically. Of course, none says "Collins," so if you are a purist, pass them up. If you want very good ham-band coverage in a receiver with performance up with the best of the analog ones, find an AX-190. At 15 pounds, it is not a boat anchor, but for us older guys that's the biggest advantage of the AX-190.

ER

Chinese Type 139 Receiver, a GRC-9 Copy

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Many authorized copies of the famous GRC-9 were produced under license from Crosley, **Figure 1**, but this Chinese copy was not. The French (GRC-9F) and the Germans made licensed production for NATO and their own use. The Chinese, in copying the design, made their own GRC-9 version using materials from within their country to forge their X-D6 system. The receiver portion was identified as Model 139, **Figure 2**, and the transmitter was model 102E. The 102E is not reviewed here.

The circuits are, for the most part, identical; however, the placement of the control positions were a slight variant from the US version. Several modifications in the power requirements and controls were made to accommodate their use by inexperienced Chinese operators. The U.S. GRC-9 had a protective grill covering the front panel. The 139 did not copy this feature. A battery pack or a hand-crank generator is required to operate the receiver, but the AC-powered provisions of the U.S. GRC-9 were not available to the Chinese.

In order for the receiver to function, the mode switch turned must be turned on and the headphones must be inserted. These interlocks prevent the battery from draining when not in use.

The standard LS-166 speaker works very well with this receiver. Tubes are Chinese copies of the standard 1R5, 1L4, and other types, and the electrolytic capacitor cans appear to be from some packaged fish or food tin, see **Figure 3**. Every component was skillfully but crudely copied, and no western components were used.

A small, crude tool kit, seen in **Figure 4**, is provided for field repairs, but no

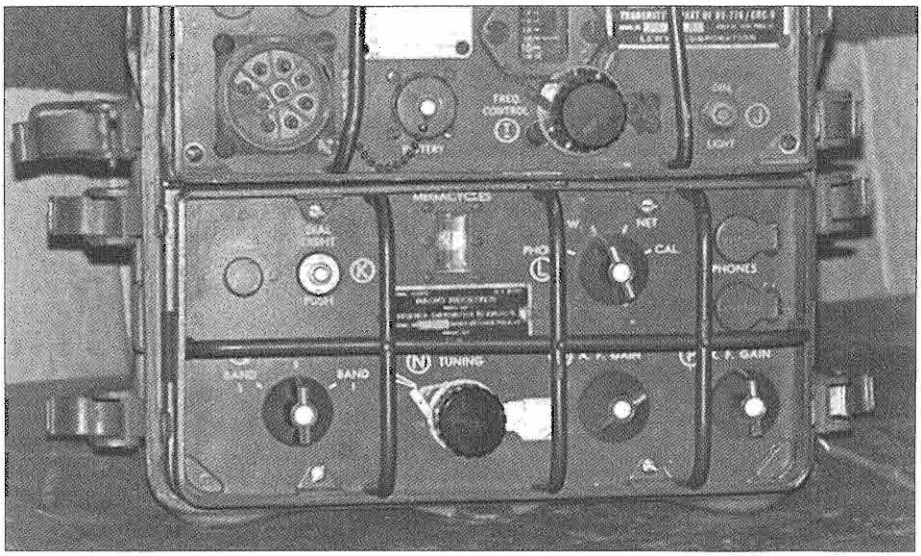
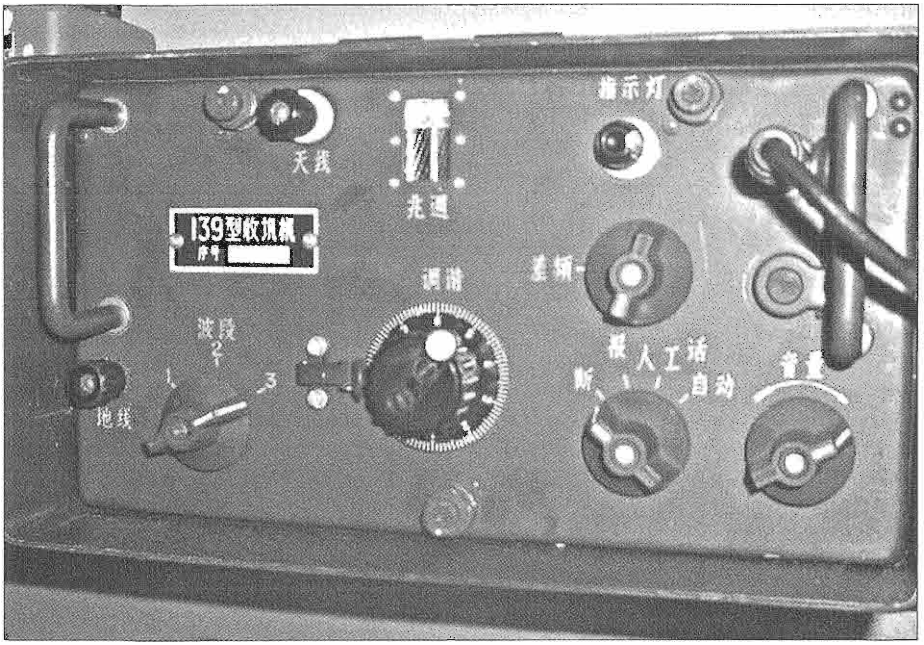
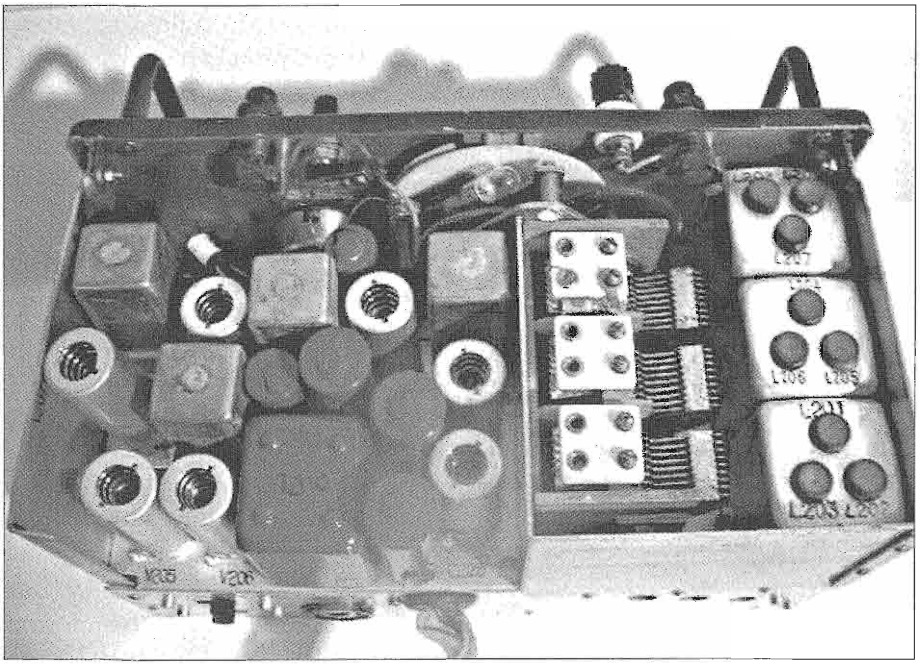


Figure 1: An authorized, licensed, US-made GRC-9 is above. The receiver section is shown on the bottom (photo courtesy of George Rancourt, K1ANX).



Above: Figure 2, Model 139 Receiver Portion of the Chinese GRC-9 Copy

Below: Figure 3, Inside Chassis View of the Model 139 Receiver, Showing Copied Components



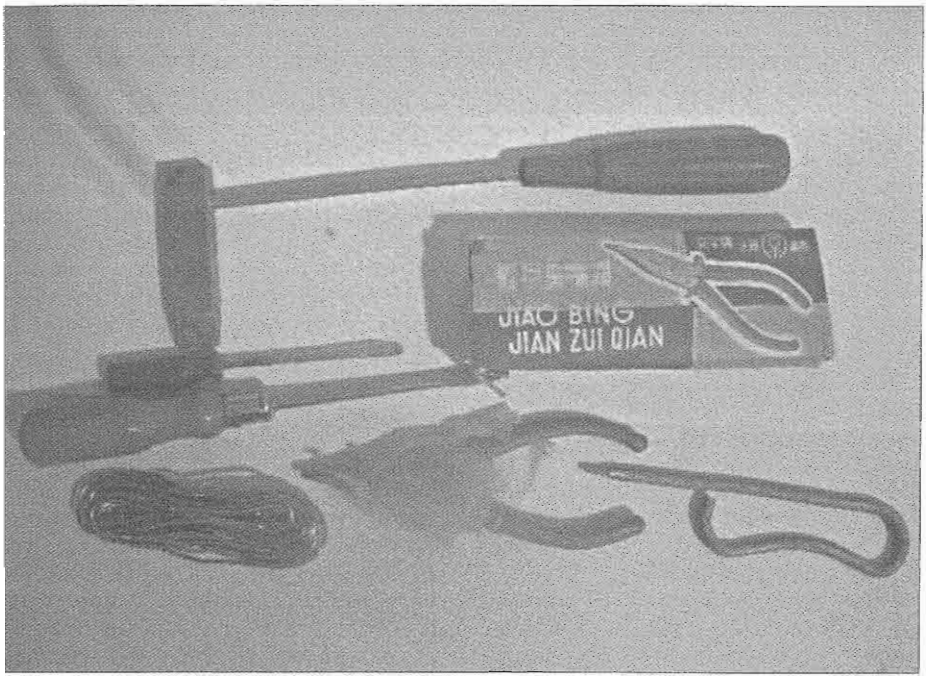


Figure 4: The Chinese Tool Kit Furnished with the GRC-9 Copy

spare parts are included. Note the crude fire-heated soldering iron included in the tool kit.

Operation is not too bad for a 7-tube, single-conversion receiver, and both sensitivity and selectivity appear to be adequate. Signals from the top of 160 meters were clear and strong, as was WWV at 10 MHz. It tunes from 1.89 MHz to 12.22 MHz in three bands. In the CW mode, using the pitch control for SSB reception produced clear and stable signals. The mode switch selects CW, MCW, and AM operation.

I had no access to an original Chinese battery pack, so a simple homemade pack was installed in the battery compartment, in place of the original, **Figure 5**. A single "D" cell was used for the filaments, and ten 9-volt batteries were connected in series for the 90-volt B+. There is no bias battery like the American GRC-9 requires. I guess the Chinese updated the design. A manual was obtained, translated by some US government agency, that completely explains all functions and operations of the Chinese system.

In conclusion, it seems like everything today is made in China, and in 1968 they may have started the program with the GRC-9!

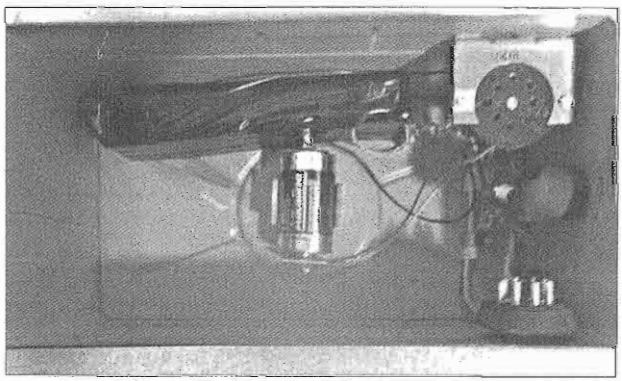


Figure 5: Homemade Battery Box

ER

Another Fowler 1984 R-390A Has Survived
Part 2, Frequently Asked Questions

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After the publication in ER #202, March 2006, of my paper about the five R-390As built by Fowler Industries, I received emails and letters from readers who were asking for further details on these radios and on my own unit. This clearly shows that there is still wide interest in any subject related to R-390As. I replied to each question directly, but now I think that a short survey of their content could be interesting to ER readers.

This article appears in the form of "questions and answers" for convenience.

Q: - You wrote that this unit shows very good performance, probably "well beyond the original specs." OK on the electrical side, but, is it true on the mechanics too?

A: Yes, this is true also from a mechanical point of view. As I pointed out in the article, the entire gear train was disassembled, fully cleaned and checked, reassembled, rechecked and lubricated prior to the mechanical alignment. Also the slug racks, the cams and the cam-followers were subject to the same treatment, so that the mechanical tracking is now almost perfect. The restoration led also to a remarkable smoothness of operation of the tuning knobs: when turning the "Kilocycle Change" control you can't believe that you are operating an R-390A, and also the "Megacycle Change" control shows easy and secure detent operation.

Q: - I read that the five units by Fowler were made with the same parts as the former R-390As (by EAC or other manufacturers). Are you really sure that no refurbished parts or subchassis were employed?

A: The five units by Fowler were built just like all the other R-390As of former production (latest version EAC/Dittmore-Freimuth units, see Ref.1), without any further improvement or modification applied. Hence a number of refurbished parts/subchassis could really have been employed by Fowler Industries during the manufacturing process. But also, assuming that some refurbished parts were employed, only mechanical parts were involved (not electrical parts or components). On this subject, Rick Mish (who restored three of the four Fowler units that until now have survived), points out that "these sets were really made up with *all* new components, except I don't believe they cut new gears." I agree with Rick in full. If you look at the underside of every subchassis, you can realize that there are no refurbished components and that all items (resistors, capacitors, etc.) were produced in the 1980s. This doesn't exclude that new parts and components could have been assembled into refurbished metal parts. At Fowler, old subchassis could have been employed after they had emptied, cleaned and polished them to like new condition. Who knows? So, it's also likely that refurbished gear trains/slug rack assemblies were employed indeed, as the tooling required to cut all new gears for only five units might have cost a fortune to Fowler Industries!

Q: - You told that in your own Fowler unit every subchassis has the Fowler signature and its part number stamped. Is it really true ? Could you please let me know further details?

A: It certainly is true. In this unit, every subchassis (but the "mainframe" and the PTO) shows a Fowler signature. Also the gear train assembly has one. However the rear panel shows that "SYWC" misprint (that seems to be common to one of the other Fowler units at least), and about the PTO it seems that also the three other known radios have a similar Cos-

mos device, at least in my knowledge. About the numbers, this is the complete list of what is readable on the visible parts:

Gear Train, front: GEAR TRAIN ASSY., SM-D-343600, FOWLER, 12996

RF Subchassis, side: RF ASSY., SM-D-344601, FOWLER, 12996

T201 can, RF Subchassis: FOWLER, 12996, SM-D-249086

Z201-1 can, RF Subchassis: FOWLER, 12996 SM-D-249082,

Z201-2 can, RF Subchassis: FOWLER, 12996, SM-D-249092

Xtal Oscillator Subchassis, side: OSCILLATOR ASSY., XTAL, SM-D-249007, FOWLER 12996

IF Subchassis, side: AMPLIFIER IF, SM-C-343621, FOWLER, 12996

T501 and T502 cans, IF Subchassis: FOWLER, 12996, SM-D-249086

T503 can, IF Subchassis: SM-D-249238, F&W, INC, 12910

Z503 can, IF Subchassis: FOWLER, 12996, SM-D-249238

AF Subchassis: AUDIO ASSY, SM-D-248801, FOWLER, 12996

Power Supply Subchassis: SM-D-248984, FOWLER, 12996

PTO Subchassis: COSMOS INDUSTRIES, INC., Type: 136\283 Serial: 28998, on the can: 70H12, SE2-0248-004, P/O R390A

Antenna relay assembly: AMPHENOL (name and logo)

Please notice that all the codes in the form "SM-X-NNNNNN" are specific part numbers and they directly refer to the corresponding drawings of the original R-390A design plans developed by the Ft. Monmouth teams (in which there had been involved both Signal Corps technicians and "external" engineers, at first only from Collins Radio Company and in the subsequent years also from Stewart-Warner, EAC and other contractors), see Ref. 2. I don't know yet what exactly means that number "129XX" instead: as I already wrote, it looks like neither an EIA Date Code nor a Serial Number.

Q: - I noticed that this Fowler R-390A still shows some signs of corrosion (rear panel, Xtal cover in the Xtal Osc. subchassis). How did it get that corroded up in so few years of use?

A: In my opinion, the corrosion in the rear panel and in the quoted crystal cover are not due to the few (6-7?) years of use by the US Navy, but rather to the "open-air treatment" that was so kindly applied to the St. Juliens Creek piles.

Q: - As your Fowler unit had been provided with that AN/Cannon subpanel (with PS and Audio multipole connectors), is its rear panel missing of the usual TB102 and TB103 terminals?

A: No, the TB102 and TB103 terminal strips are still in place under that "subpanel". You can figure it as an added cover held in place by some existing screws (no need for new holes); the leads from and to the "AN" connectors are provided with spade lugs to be screwed to the proper rear terminals of the radio (no soldering required). Please also note that the addition of that sub-panel to the rear of R-390As is an official Navy field modification, listed and described in many Navy Manuals and documents (NAVSHIPS 93053, NAVSHIPS 0967-063-2010, etc.) as "Field Change No. 3 (EIB702) - Conversion to AN Type Connectors for shipboard use only."

Q: - I noticed from Figure 10 [ER #202] that the Cosmos PTO in this R-390A has no Fowler markings and it has also a "70H12" signature stamped on the can. In my knowledge, "70H12" is just the Collins designation for the R-390A PTO. Are you sure it is not a Collins PTO refurbished by Cosmos?

A: Really, I don't know the reason why that code "70H12" was stamped on a Cosmos PTO can. Definitely, "70H12" is just the Collins model designation for the R-390A PTOs (as it can be seen also on some old catalogs from Collins Radio Company), but in my opinion this particular PTO has nothing to do with Collins, as it is not a refurbished old-production component.

Apart from its "Cosmos Industries, Inc." label and the very late Serial Number (#28998) printed on it, this PTO is

provided with the "external" adjustment device for linearity (every 25 kHz), so it makes use of the US Patent #3,098,989 that was released to Cosmos Industries in 1963. See "Calibration of the Cosmos PTO", ER #107. Hence, no firm other than Cosmos (or a licensee) could have built such a PTO. Anyway, I cannot exclude it is really a "refurbished" item, but only in the sense it could have been taken from a late-production EAC or Dittmore-Freimuth R-390A (I don't know exactly if Cosmos Industries of Brooklyn, N.Y. was still active in the 1980s) or, most likely, from a depot of brand new R-390A spare parts. On the "70H12" stamp, I can only suppose that this code had become a generic identifier for R-390A PTOs (not necessarily related to Collins Radio Company) and it was used that way. Incidentally, the R-390A PTO is the subject of two of the Ft. Monmouth drawings, the SM-D-248785 (Revision: March 4, 1958) and the SM-D-343626 (Revision: March 24, 1965). The two drawings are almost similar one another, in the first of them the PTO is named "70H12 Oscillator", whilst in the second one its designation is "Oscillator, Variable Frequency, 2.455 Mc to 3.455 Mc" instead. Hence, the above supposition could also be true.

Recently, Sergio Musante (I1SRG) pointed out to me that the signature "SE2-0248-004" that appears on the PTO can just under the "70H12" code could also represent a Collins Part Number for the 70H12 PTO. In a recent letter, Sergio Musante also wrote me explaining that he had given a very close look at three Cosmos PTOs he had on hand in the past, and he found one of them missing of the external 25 kHz calibration device. That PTO belonged to the very first Cosmos production and it was very similar to the usual Collins PTOs. According to this assumption, it appears that the Cosmos PTOs of early production are substantially different - and much less sophisticated - from those of the later production runs. However, I cannot believe that Cosmos Industries ever applied their label on a Collins-built PTO! If it is true –but really, I don't know–why did they use a Collins Part Number instead of one of the "official" R-390A PTO Part Numbers (SM-D-248785 or, most properly, SM-D-343626)? A further mystery of this Fowler unit?

Please also note that, as far as I know, the Cosmos PTO of the Fowler R-390A that had been formerly identified as the "No.1" (due to the S/N appearing on all its decks and modules) shows the following "regular" writing stamped on its can: "Fowler Ind., Port Jervis, N.Y., Oscillator, Variable Frequency, SM-D-343626, Serial No. 1."

So, it could be very interesting and useful to give a closer look at the Cosmos PTOs of all the remaining Fowler-manufactured R-390As!

Q: - About the "A&M" meters: I saw in the past some other receivers (R-392s, etc.) that were provided with meters of the same shape. They are not exclusive for the Fowlers!

A: True! The production of those meters by "A & M Instruments" had started well before the Fowler contract, and a number of them had also been used for replacement of the old radioactive products in R-390As and other sets. So, you can happen to stumble upon radios (even R-392s or R-390s) that show meters of such a particular shape. But in my opinion they are only replacements, the latest 1968 R-390As manufactured by EAC and Dittmore Freimuth were still factory-provided with the conventional type meters. Incidentally, the Ft. Monmouth Part Numbers (drawings) for the R-390A meters are: Carrier Level Meter (dB): SM-C-283216 (Revision: June 6, 1967); Line Level Meter (VU): SM-C-283217 (Revision: March 23, 1965). From time to time some brand-new and unused meters by A&M still appear for sale on the surplus market (often in their original package).

Q: - Did you fix the "bad wire spot" concerning the "Break-In" circuit of which you made mention in your paper? Where was it located precisely?

A: Sorry, not yet. That fix is easy enough, and it is much less important than having developed that "bad spot" in a Fowler R-390A. While it means that the "Break-In" circuit was never used with this unit (it couldn't work properly), might this characteristic be common to any other of the Fowler units (just like the "SYWC" typo on the rear panel)?

Q: - At last, have you succeeded in finding a valid answer to your "hamletic question"? Also, why you think that the front tag in your unit is only a repro? Couldn't it be original instead?

A: Unfortunately, not yet. But I know this task is not easy, further investigation should be also done through a direct comparison among the other three units that have survived (for sure this is very difficult or almost impossible for me!) and with the cooperation of their owners. Maybe one day I (or someone else) will succeed in it! I'm now almost convinced that Rick is right when he says: "You do have the true Fowler No.1." Anyway, further important and valuable contributions could come sooner or later from the major experts in R-390A history. On the front tag of this Fowler unit, I guess it is only a repro because of the following reasons: (a) I'm almost sure that all the tags but the one of the "No. 2" were removed at St. Julien's Creek, (b) If you compare the two tags (of the "No. 2", see ER #72, April 1995, page 8, with ER #202/March 2006, page 36), you can easily notice that (a) The characters employed and the empty spaces are a bit different, (b) In the original nomenclature tag of the "No. 2" there is a "V" after the "115" voltage specification, missing in this one's, (c) The original nomenclature tag seems to be engraved, most likely this one is only silk screened (by a xerographic process).

Also, I cannot believe in the existence of different original tags: you would never order one label at a time, from different manufacturers!

References:

1: I think it is useful to remind readers that around 1967, when EAC obtained its second order for R-390As, the company learned that the receiver assembly time could have been improved by redesigning some details of its wiring and modules. So, they worked together with the Signal Corps at Ft. Monmouth and some improvements were developed and approved; among them, the two-piece chassis for the IF deck (designed to be wired while still open) and some wire splices (both in the IF deck and directly behind the R-390A front panel). Tom Marcotte (N5OFF), "The Million Dollar Radio, or a Capsule History of the Electronic Assistance Corporation", ER #117, January 1999, pp. 8-11. Of course the above quoted "official" improvements that had been adopted for the latest EAC production were also reflected to the production of the five Fowler units.

2: Most of the original R-390A project drawings, after their declassification and release by the U.S. Government, had been inserted into a CD-ROM. In mid 1998 that CD was available from a man who took care of the recording process (Pentti Haka of Mikrolog Ltd., Paivankakkrantie 10 or PO Box 45, FIN-02271 Espoo, Finland, Pentti.Haka@mikrolog.fi). A CD containing those drawings was available from Jeffrey L. Adams, 210 Kent Ave., Fredericksburg VA 22405, jadams@mcqassociates.com or: eengineer@erols.com. Probably, that CD is still available from Robert Downs, WA5CAB, 2027 Mapleton Drive, Houston, TX 77043, wa5cab@cs.com.

Furthermore, thanks to Al Tirewold WAØHQQ from Kennesaw, GA., email: root@r-390a.net (the author of "The 21st Century R-390A/URR Technical Reference" manual already quoted in the first part of this paper), the complete lists (by name and by number) of the Ft. Monmouth R-390A drawings are currently retrievable in the Adobe Acrobat ".PDF" format from the website: http://www.r-390a.net at "The R-390A Frequently Asked Questions Page".

ER

Power Supply Replacement/Upgrade for the Heathkit SB-400 and SB-401

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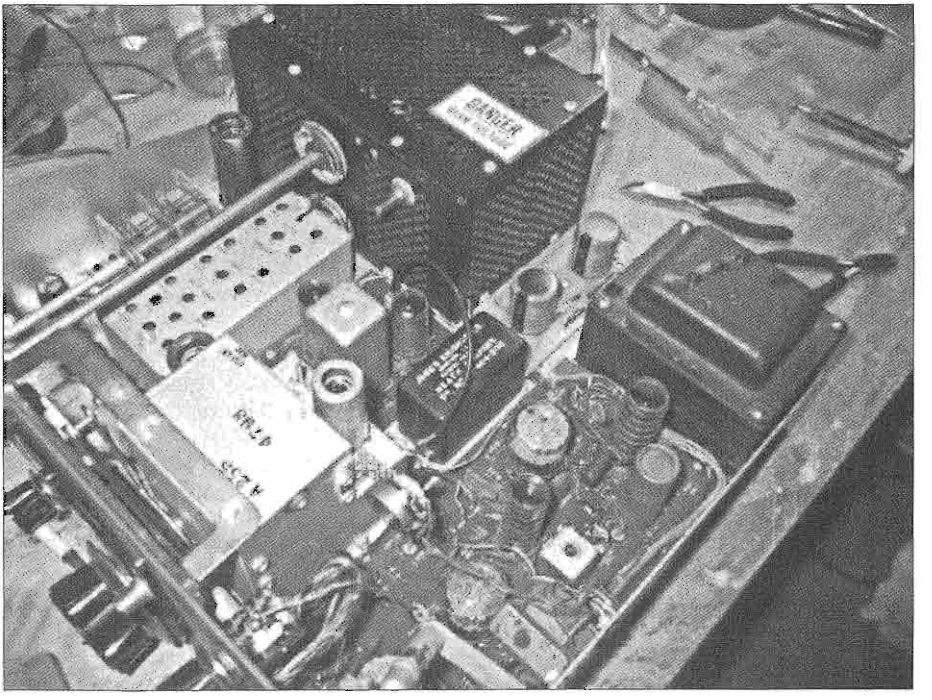
The Heathkit SB-400 single sideband and CW transmitter was Heathkit's answer to the Collins 32S-1 transmitter. The SB-400 operated both upper or lower sideband (USB or LSB) plus CW with a single sideband input power of 180 watts PEP and a CW input power of 170 watts DC using a pair of 6146 or 6146As operating in class AB1. In November 2006, Electric Radio issue #210, page 23, David Kuraner (K2DK) wrote an excellent article describing the SB line. Therefore, I will refrain from duplicating his article here.

As David Kuraner's article points out, the Heathkit SB-400 and SB-401 series of transmitters had a long and successful life throughout the mid 1960s and into the early '70s. Unfortunately, age takes it toll on these fine old Heathkit transmitters, as it does with much other Heathkit equipment. Knowing this, I decided to replace every electrolytic capacitor in my SB-400. Searching the Internet for new capacitors was successfull, except for the black cardboard covered capacitors and the metal, dual-capacitor, canned capacitors. These simply were not available. There were NOS (New Old Stock) parts available, but I wanted



The new high-voltage board is to the rear of the SB-400 chassis, between the PA cage and the power transformer.

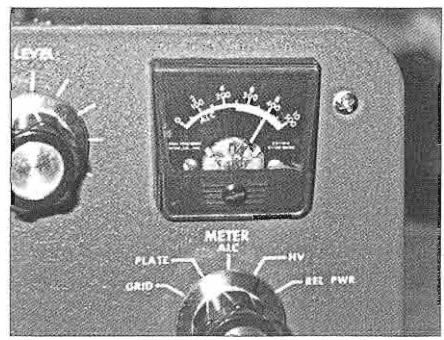
new, modern capacitors. With that in mind, I knew I would have to find a means to mount the new, modern, low-profile capacitors I found on the SB-400 chassis. I'm sure there are those who would prefer to keep the equipment original. However, I felt functionality was more important than originality, at least in the case of the power supplies.

After spending a lot of time searching ways to mount the new modern capacitors, I came up with the idea of a printed circuit board. The printed circuit board would mount in the same location as the original capacitors. Each printed circuit board would have new, low-profile capacitors, resistors and diodes. I wanted the installation to be simple and it would reuse existing wiring and mounting holes. With this in mind, and the design firmly planted in my mind, I researched the Internet for a company that could and would produce such a printed circuit board. During my research, I came across many companies that could do the job. However, one company caught my eye, ExpressPCB.[1] Like the others, they provided free design software. I had downloaded ExpressPCB software, like the others, and compared them all. ExpressPCB appeared to be the easiest to learn so I decided to use them as my printed circuit board source.

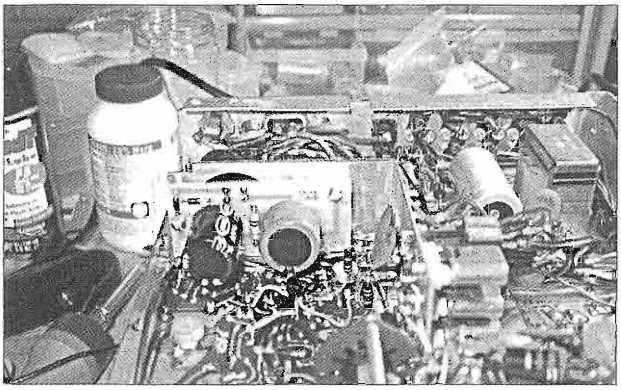
My initial attempts at designing the board were rather good except for one small detail. The software component library did not have a snap-in capacitor component. Using the software's ability to create library components, I decided to create one. After several attempts I was successful, and a new snap-in library component that matched the capacitors perfectly was made. It was very important that the mounting holes were correct. Previously, I had experiences with printed circuit board upgrades similar to what I was doing, where the mounting holes simply did not line up properly. The printed circuit board I had designed used 3/8-inch tall aluminum hex female threaded standoffs to mount it to the chassis. Therefore, it was important that each hex standoff got lined up properly with the original holes. Completing the board, I used the software's ordering option and ordered 2 boards.

During the short time I waited for the boards to arrive, I removed all the old components. When the boards arrived, I populated one board with all new low-profile electrolytic capacitors, new equalizing resistors and new metering resistors. Since I had already removed the old outdated components, installation was rather quick and easy. After completing the installation, I checked the wiring for shorts, solder bridges on the circuit board, broken wires, etc. It was time to "smoke test" the board.

Clearing a place on the workbench, I placed the SB-400 right side up with the front panel facing me. The front panel meter switch was placed in HV position, a dummy load was attached to the rear SO-239 and the FUNCTION switch was placed in the OFF position. I plugged the SB-400 into the power source and switched the FUNCTION switch to the STBY position. The meter instantly showed 800 volts, exactly what I expected. Previously, I had prepared a separate receiver with the antenna disconnected in order to listen to the SB-400 carrier. The SB-400 loaded up nicely with 100 watts of carrier into the dummy load. Turning the separate receiver to the SB-



The SB-400 Meter Indicating HV



In the photo above, the new low-voltage board is standing upright, near the center.

400 carrier frequency, there was no hum and it was stable. I switched the meter to the IP position and the meter displayed 250 mA. Switching back to HV position, the meter displayed just what Heath's manual stated it should be. Having achieved the expected results, I let the SB-400 sit idle for a couple of hours. Everything worked rather well.

Everything was working great. Having successfully completed this portion of the capacitor replacement, I knew the canned capacitor in the low-voltage supply also needed replacing. Like the high voltage capacitor replacement, I designed a similar board using new low-profile capacitors, new resistors, new diodes and using the same mounting configuration. All went perfectly and the design was sent to ExpressPCB and within 3 days I had the low voltage boards in hand. I populated the board with new capacitors, resistors and diodes just as I had done with the high voltage board. Removing the old components as had been done with the high voltage board made the installation go quickly. Connecting the low-voltage board, using existing wiring, went as well as the high voltage board did. Testing the low-voltage board proved successful. The SB-400's signal was clean, hum free and 100 watts output into the dummy load. To complete the power supply capacitor upgrade, I installed the 3 remaining axial-lead capacitors. Having reviewed both manuals and schematics, I knew the Heathkit SB-401's power supply is exactly the same as the SB-400's power supply. Therefore, I knew both boards would install into either transmitter.

Having been successful in designing, building and installing the SB-400 high and low-voltage capacitor printed circuit boards, I felt a similar design would work in the Heathkit Apache TX-1 and the Heathkit Marauder HX-10. Therefore, I am presently designing similar boards for these fine old boat anchors and hope to have them completed and tested shortly.

I have found, through many on-the-air contacts, that there appears to be a lot of Heathkit SB-400/401 transmitters as well as other fine old transmitters and transceivers still operating today. Bringing these fine old classic rigs back on the air is a time-consuming job but well worth it. With a lot of patience, some ingenuity, and hard work, these fine old classics can continue to stand up and be counted. There's nothing that compares to the warmth and the glow of a tube's filament, the hum of the transformer and the click of the old relays in an classic transmitter/transceiver. As a person once said, "Real radios glow in the dark" and these old classics do it so eloquently.

1. The contact information for ExpressPCB is:
www.ExpressPCB.com
Email is: support@expressPCB.com

ER

Tuning the Heathkit SB-200 Linear Amplifier Input Circuit Coils

By Victor L. Gregowski, WD8DWR
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wd8dwr@arrl.net

After purchasing a used Heathkit SB-200 linear amplifier I began to surf the Internet for information that pertained to the RF input circuits. Several threads on this subject are available. The whole idea of the tuned input circuit is to provide the exciter with reasonable load impedance while driving the SB200. Since I wanted the linear to be compatible with my wife's Kenwood TS-440S transceiver, I needed to get the standing wave ratio (SWR) of the input circuits as low as possible so the transceiver would drive the linear. Before I could work on lowering the SWR, I needed to address a concern I had about the high keying voltage (130 volts) of the SB200 amplifier being applied to the relay in the TS440S transceiver. Newer transceivers cannot handle high voltage being applied to their linear control relays. To correct this I installed a Harbach Electronics[1] model SK-201 soft keying kit.

Now all I needed to do was to get the input circuits down to a respectable SWR level. I began to read various documents published on the Internet and became overwhelmed by some of the extreme recommended modifications suggested in order to obtain a good input SWR. For a moment I began to wish I hadn't purchased the SB200. However, remembering that in the past, Heathkit engineers usually created some very good equipment. I kept that thought in mind as I began to tackle the SB200.

I decided to make a test setup that would mimic the same situation as when the amplifier is in normal service. I found that it was necessary to have the amplifier energized during the testing and final adjustment of each input coil. This is because the SWR changes drastically from when the amplifier is in a resting state with the relay manually pushed up, to when it is energized and keyed up. For example at 3.6 MHz, in my amplifier's present state of repair, the SWR is 13 to 1 when in a resting state. When the amplifier is energized and keyed up the SWR is 1.3 to 1.

The Heathkit SB-200 amplifier that is the subject of this article (Photo by Bob Richmond, W8MNQ).

CAUTION: When the amplifier is energized lethal voltages are present. Use extreme caution when working on energized equipment!

In trying to keep the job simple and easy to repeat I used the following

six pieces of equipment:

1. I used a MFJ HF/VHF SWR analyzer, model MFJ-259B. (If you don't have one, a good SWR bridge with a low level exciter would work as a substitute.)

2. A Sencore capacitor/ inductor analyzer. (A digital voltmeter that has capacitor measurement capabilities would be a good substitute.)

3. A dummy load. (I wanted the output tied to 50 ohms although this is not necessary.)

4. A trimmer capacitor with a range of 12pf to at least 100pf.

5. A tuning tool that will fit the trimmer capacitor of choice.

6. A tuning tool that will fit the input coil slugs.

While doing the test I had the MFJ-259B plugged into the RF input jack, a dummy load plugged into the RF output jack and the linear was energized and keyed up. The trimmer capacitor was tack soldered to the ground lug located just above the 10 and 15 meter input coils on the back of the linear. I did this to help physically stabilize the trimmer capacitor while trying to adjust it. To attach the other side of the trimmer, I used a clip test lead. The test lead caused no significant problems when trying to determine the value of the trimmer during each test.

I began my testing on 80 meters. With the linear energized and keyed up, I tried to get the best SWR by adjusting the slug in coil L5 and using the factory capacitor. (Refer to pictorials 10 and 11 and the schematic in the Heathkit assembly manual for physical locations of coils and capacitors in the RF input circuits.) Before any changes were made, the best obtainable SWR was 2.5 to1. Not being satisfied with this reading, I decided to connect the trimmer in parallel with C30, a 470pf capacitor. I adjusted the trimmer while watching the MFJ-259B analyzer and was pleased to discover the SWR went below 1.5 to 1. I then de-energized the SB200 and measured the trimmer capacitor with the Sencore. The Sencore indicated that the trimmer capacitor had been adjusted to a value of 85pf. I had an 82pf mica capacitor rated at 500vdc. I soldered it in parallel with C30. Due to the slight difference in the capacitor value, I made a small adjustment to the slug in coil L5. I was able to obtain a SWR of 1.4 to 1 or better across the 80 meter band. (The highest SWR of 1.4 to 1 is at the low end of 80 meters.)

Bands 20 and 40 meters needed no modifications. I adjusted each corresponding slug in the input coil to get the best SWR of less than 1.5 to 1 across each band.

The capacitance on bands 10 and 15 meters needed to be lowered. When testing each band I needed to disconnect the capacitors C36 for 15 meters and C38 for 10 meters because the factory capacitance values were too large. I was able to use the trimmer capacitor alone to obtain a good SWR. I had to change C36 to a 33pf instead of a 75pf and C38 to a 22pf instead of a 68pf. Then I was able to get a good SWR by adjusting the slug of the input coil under test. When all the changes were complete, I was able to obtain a SWR of 1.5 to 1 or less with no problems.

Just remember that by adding or subtracting capacitance, don't assume that your SWR is now at minimum. You may need to touch up the adjustment of the slug for each coil affected for the best SWR.

Heathkit made a good amplifier when they made the SB200. The input circuits just need a little TLC to get the best possible SWR.

1. Harbach Electronics:
468 County Road 620
Polk, OH 44866
Telephone & Fax 419-945-2359
www.harbachelectronics.com

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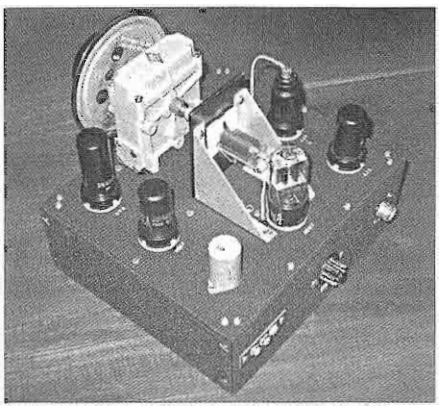
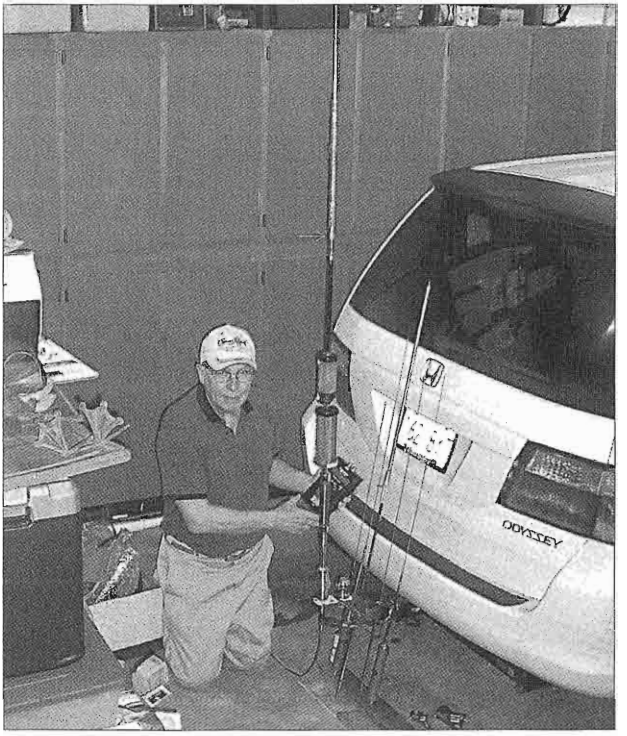
PHOTOS

Editor's Note: "Thank You" to everyone who has recently sent in photos, and please keep them coming so I can run the Photo Column on a regular basis!



Above, John Burke operates WØENE with some nice equipment from his home QTH in Yulee, Florida. Above John's right shoulder, sitting on the National HRO receiver, is a home-brew receiver that is being called the "Regenerodyne." This is a 5-tube set that's equipped with a National type PW dial. There will be an article about this receiver in an upcoming issue of Electric Radio. To the left is a view of the Regenerodyne with the cabinet removed.



Bill Hooper is adjusting his mobile antennas in preparation for a long road trip.

Bill Hooper (KF6AR) with Advice on Antennas:

During a long trip late last year, several of the stations we worked from our mobile station had a problem believing we were "mobile" because our signal seemed to be stronger than they were expecting from a mobile–especially when we were running 25 watts AM. The reason may be the antenna(s) that I use while mobile, so I thought I would send some pictures to you of what we are doing "on the road."

We have operated mobile since 1948, starting with a modified Motorola T-69 police transmitter (modified for ten meters) and we were then using a Gonset 10-11 converter ahead of the car radio–it was magic!

I worked up through Harvey Wells TBS-50s and the Gonset Twins and the Elmac AF-67 (which we maintained as our RV rig in a camper from 1972 until 1989) and the PMR-7 receiver. Always worked all bands 160 through 10 (and 2M FM). In 1979, I started using Swan equipment and went though about six 350s and a 400 - using a Linear Systems DC/DC power supply. The Swan 350 was running enough power to really dim the headlights with a whistle! It ran almost 700 watts PEP input and would warm most mobile antennas up pretty fast.

Finally, I graduated to the Yaesu FT-101 series and about six or seven of them were collected. They were used mobile, with their own built-in DC power supply and had wonderful success on SSB, CW, and AM. However, even they get heavy after carrying one for a while up the stairs to a motel room–so last year we sold all the '101s (yes, even the ZD) but one ('101E with two 6146 finals) and used the $$ to buy (sigh) a sand-state Yaesu FT-857D. Oh the shame of it all! But, it's a lot lighter to carry around and the signal it puts out–DC to daylight–is really hard to believe. I have almost always used homebrew mobile antennas, especially on 160M, and I have had very good luck. My hesitation in purchasing the sand-state rig was that it would "fold back" on my home brew antennas and therefore not be usable unless I was very, very careful. Surprise! The '857 could care less! It just pumps power into my strange and ugly antennas like there is no tomorrow.

So, I guess maybe I should let you see the antennas I use. It is very hard to take a picture of a whip antenna and have it show up very well–so the XYL and I experimented in our garage.

I use a combination of coils, fittings (mostly homebrew), quick disconnects, extensions and a WWII military telescoping antenna (I think they were used on tanks). It is about 18 inches long and telescopes to 12 feet. With a coil or several coils (or no coil at all), and this whip, I can resonate the antenna at any frequency between about 1.5 MHz and 60 MHz. I use preset Websters and Master Mobile coils with preset tips for my favorite frequencies on 20, 40 and 80 meters and use most everything for 160M. I can operate mobile-in-motion on all bands 80M thorough 6M (I use a magmount whip on 2M), but I park in a nice electrically-quiet location for 160M, as the antenna will be between 16 and 17 feet in height and I, in fact, did put a whip into the HV transmission lines in Benson, Arizona!

Besides, when you operate on 160M in any "urban" location the noise floor is so high it is usually impossible to hear anyone–they, of course, hear you just fine and wonder what is wrong with your receiver. Verticals and 160M and downtown or in a subdivision just don't mix.

Using the little MFJ antenna analyzer–shown in the picture–and the other antenna hardware, it is a few minutes work to set up on any frequency or on any band. And, as I say, I have preset stuff for favorite frequencies of 3880, 7290, etc.

Just in case, I have about 100 pounds of other coils, clip leads, RF ammeters, light bulbs, adapters, cable, wire, insulators, etc. for any given situation in any location. When you have done this for a while (including operating out of 100s of hotel rooms with windows that sometimes open and sometimes don't) you find that limited space for antennas just isn't a reason to not get on the air.

One time I was visiting a friend in Arizona and he was at that time living in a "gated community" with every restriction known to man and had a lot smaller than the house we ramble around in now - and he said "I just don't have any way to put up an antenna." To me, that was a red flag, and within two hours we had put up a loaded dipole inside his garage and we were talking to all the guys in California and Oregon on 40M! He was somewhat surprised, saying "conditions must be really good." But a week later the results were the same (at noon no less).

Get the RF current into the antenna - if vertical, as high up the rod as you can– if horizontal–keep the lengths short outboard of the loading coils. Keep tweaking and trimming until all the power is either heating up the antenna (not the best) or radiating into space. Sure, a resonant dipole or inverted V at 50 feet is nice, but a wire 7 feet above the ground inside the garage works too–if you get the power into the wire and out of the rig!

Sorry about the solid state rice box, but it's still fun! And, you know I will always be on 14.260, 7290, 3880 and 1945 with Elmacs, Eicos, BC-191s, Boat Radios, TCSs, and other delightful old rigs.

73, Bill, KF6AR *ER*

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!

Don Buska's on-line, searchable index to the entire history of Electric Radio Magazine may be found under the "links" tab at www.ermag.com.

Western Region CW Net Frequencies:
MSN (Mountain States Net) Slow Speed Beginners Net 3.570 0300Z (8pm MST)
TWN - Twelfth Region Net 3.570 0330Z (6:30pm MST)

The Restoration Corner

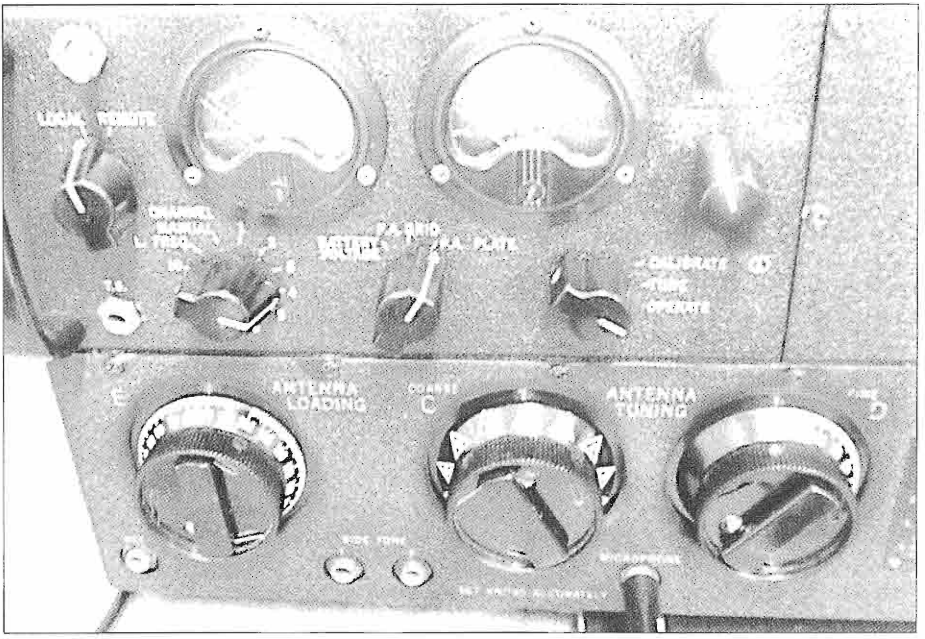
Please send in your short restoration topics so this column can run regularly!

Barry Wilber's Fully Restored Collins ART-13 HF Transmitter

Restoring ART-13 Bakelite Knobs

By Barry Wilber
122 Bison Meadow
Waxahachie, TX 75165
WB5MLT@sbcglobal.net

Restoring these old Bakelite knobs, as you well know, requires a delicate touch. Start by putting on plastic gloves as you will not want to leave anything behind off of your hands until the knob is sealed. Begin cleaning by gently scrubbing the knob with a stiff bristle toothbrush using dish detergent and warm water. This should remove most of the dirt and old paint. Now, take a hypodermic needle and carefully clean the rest of the paint from the engraving. Once all the old paint is removed the knob needs to be scrubbed and rinsed once more. Set the knob out in the sun until it is completely dry. Next, use correction fluid, to paint over all the engraving so that the groves are full of fluid and allow the "White-Out" to dry for at least an hour. Now comes the best part of all. Take the knob back to the sink and begin to lightly polish over the lettering with 400 wet-or-dry paper. You will discover that, once dry, the correction fluid is water proof. As you buff away the excess white under running water, the lettering, numbers, and so on, will reappear looking as good as new. Dry the knob once more and give it a light coat of spray clear coat to seal the job. The results will be a knob that looks like it just came NOS out of the box. I used BIC White-Out Cover-It®



Closeup View of the Restored Bakelite Knobs

multipurpose correction fluid and Krylon Crystal Clear® acrylic #1301 on this project with very satisfactory results.

I hope this will be of value to you as you work to bring your favorite project back to life. Remember, only real radios glow in the dark!

73, Barry, WB5MLT

Little "Old" Coax!

By Jim Riff, K7SC
9411 E. Happy Valley Rd.
Scottsdale, AZ 85255
k7sc@arrl.net

We have all gone through the drill of replacing the coax running to our antennas from time to time, usually because of age–the coax, not us. Well have you ever thought of those 50 year old short runs of coax inside your old boatanchors? They suffer the same aging effects as the longer antenna runs, even worse they sit in 150 degree heat all of their life. Sure they are just short pieces, how could they hurt anything? Recently while restoring an older 2M-transceiver boatanchor, I did notice the coax connecting the TR relay to the tank circuit was stiff, but gave it no further thought. While tuning up into a 50 ohm dummy load I noticed the antenna loading capacitor was fully open (minimum capacity). Thinking that could be normal I continued to hunt for other reasons for the slightly lower power output. Finding none, my thoughts turned to the old 6-inch run of original RG58 coax buried inside the chassis. Knowing that at 144 MHz, a small capacitance increase could render the loading capacitor useless, I changed the old coax for a new one. That did it; the old coax had aged to the point where the capacitance increase was greater than the tank circuit requirements, thus no tuning range left on the loading capacitor. These little changes often go overlooked because the radio still works, and the SWR meter is usually outside of the rig after the old internal coax runs. Save the leftovers from the new antenna runs and put them inside your boatanchors when it is restoration time. 73, Jim Riff, K7SC

ER

VINTAGE NETS

AM Carrier Net: Sunday mornings, 8:30AM local Eastern time, 3835 kc. QSX W2DAP. Friendly format.

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

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

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

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

Colorado Morning Net: Informal AMers on 3875 kc daily @ 6:00 to 6:15 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: Sunday, 14.263 Mc @ 2000Z. Informal ragchew net Tue. evening, 3805 kc @ 2100 ET, Thu. 3875 kc. West Coast 75M net, 3895 kc 2000 PT. 10M AM net 1800Z, 29.05 Mc Sunday, QSX 1700Z. CCA First Wednesday AM Night each month, 3880 kc starting @ 2000 CST, or 0200 UTC.

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

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

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

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

Eastcoast Military Net: Sat. mornings starting 0500, 3885 kc +/- QRM. QSX Ted, W3PWW. It isn't necessary to check in with military gear, but that is what this net is all about. Late checkins are welcome.

Florida AM Group: A large group meeting every Sunday, 7:30AM ET, 3875 kc and pre-net checkin 7:00AM ET, 3675 kc. QSX Maury, N4GUI. Also, Florida vintage SSB net "AFLAC" meets Wed., 3910 kc, 9PM ET. QSX Warren, W1GUD.

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

Gulf Coast Mullet Society: Thu. @ 6PM CT, 3885 kc, QSX control op W4GCN in Pensacola.

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

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 20 Meter Net: Flagship AM net 14.286 Mc daily for 25+ years. Check 5:00 PM Pacific Time.

Lake Erie Boatanchor CW Net: Saturday morning, 1 PM ET, 7094 kc QSX op Steve (WA3JJT) or Ron (W8KYD).

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

Mighty Elmac Net: Wed. nights @8PM ET (not the first Wed., reserved for CCA AM Net), 3880 +5 kc. Closes for a few summer months. QSX op 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 Charlie (W1EIZ) 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 Net Sunday 2200z winter 14.250Mc ±QRM. QSX op rotates Jim (WA5BDR), Jay (WB6MWL), Norm (W7RXG), Bill (W4WHW). Tech Nets: Wednesday 2300z 14.251Mhz / Saturday 1900z 7235 kc QSX op 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), or Vic (KF6RIP)

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

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

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

SERVICE FOR SALE: JOHNSON "TURBO" RANGER, Valiant, Viking 500, Viking II, includes panel and cabinet refinish. Hammarlund 180(A), National 300, 303, R390(A). http://w4pnt.8k.com Patty & Dee's Marina: 534 W. Main St. Waynesboro, VA. 22980 w4pnt@highspeedlink.net 540-249-3161 Cell: 540-480-7179

FOR SALE: Hickok 810 sig tracer, Precision 10-54 tube tester, E200C, RCA SR Voltohmyst, B&K 375 VTVM. Carter, 434 979 7383, celliott14@earthlink.net

FOR SALE: Collins: 75S-1 w/136A-1 noise blanker, 32S-1 w/516F-2 supply, 312B-4 speaker console. Excellent appearance, working, documentation. Complete: $1,600. Don Benecchi, K1DC, W. Bridgewater, MA, 508.587.7045 Email: don.k1dc@comcast.net

FOR SALE: Hallicrafters SX117. Heathkit SB104A. Hallicrafters microphone. MC Jones 0 to 500 watt 50 ohm metered load. Set of attenuators. Bill Coolahan, 1450 Miami Dr NE, Cedar Rapids, IA 52402, 1-319-393-8075

FOR SALE: Hallicrafters: SX-101 $175. SX-71 $165. S-20R $150. Hammarlund: HQ-170AC/sp $350. HQ-140X $175 + shipping. All in good working and cosmetic condx. Tom Koch (Atlanta) w4uoc@aol.com 404-314-6109

FOR SALE: SRD-12/TRC-7 system. TCS chassis. WANTED: APR-1 rec and plugins. APR-4 rec and plugins. Dean, 612-869-9264

FOR SALE: Boatanchors and accessories: Purchase now or at Dayton! Drake, Gonset, Johnson, Knight, Lafayette. SASE or email for list and flea market space number. John Curtis, WØCAR, 3146 S. Franklin St., Englewood, CO 80113, 303-273-3887 jbcurtis@mines.edu

FOR SALE: Collins 32S-1, 312B-3, 75S-3, 32S-3, 312B-4, 75S3-B, 32V-1, 75A-1, 75A-2, 75A-4, 51S-1, 30L-1, 30S-1. National: HRO-60, NC-57, NC-183. Drake L4. Kenwood R-820, TS870. Yaesu FRG-7. Bob, W6CYX, w6cyx@arrl.net or 408-251-3843

FOR SALE: Tube tester charts for Eico 667, Simpson 555, and Hickok 535/600A/605, $15 each. Ross Wollrab, 229 N. Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385.

FOR SALE: Citi-Fone ten tube 23ch CB transceiver 110VAC or 12VDC $15. plus shpg. 989-354-5978 jeohlrich@hotmail.com

FOR SALE: SAM's tube substitution handbooks: Vol. 1; Vol.7; Vol.11; Vol.13; Vol.18; Vol.19; $10 each plus $4 each postage. John Snow 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: RCA tube manuals; RCA-13 $20; RCA-14 $15; RCA-15 $12; RCA-16 & 17 $12 each; RCA-23; 24; 26; 27 each $10 plus shipping. John Snow 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: Military Model T-67/ARC-3 transmitter, new, never any mods $35 plus shipping. John Snow 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: DRAKE low pass filter 1000 watts max below 30 Mc. $20 plus shipping. John Snow, 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: Ballast tubes 29 total most new in box, JFD; Amperite, Clarostat and others. Best offer for all. John Snow 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: Leader Model LBO-501 scope as new with original manual $75 plus shipping. John Snow 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: EICO 465 professional oscilloscope with manual and probe in exc cond $75 plus shipping. John Snow 1910 Remington Ct. Andover, KS 67002 316-733-1856

FOR SALE: Sencore probes for test equipment Model 39G41 Demodulator Probe new $10; Model 39G144 test lead adapter $5; Model SCR224 for SCR and TRIAC test accessory to be used on Sencore LC53 or CS55 $15. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: New Jan 6SG7gt tubes. Tubes & boxes look like new. $7.00 for 5 plus $4.05 shipping. Email for large quantities or write. Wayne Letourneau, PO Box 62, Wannaska, MN 56761 letourneau@wiktel.com

FOR SALE: Drake equipment: TR-3 w/ MS-4 speaker and Heath HP-23 supply, package only $350 you ship. Ken Sands, K8TFD, 734-453-7658 home, 734-564-0316 cell

FOR SALE: Meissner EX Signal Shifter. This is a working unit with output on 160-thru-10. The overall condition is good-there are some smudges on the front panel and the cabinet has been repainted. Tuning is silky-smooth. Price: $145 including shipping anywhere in the lower 48. It's heavy. I will email photos on request. k4jej@bellsouth.net 864-716-0965

FOR SALE: Ham radio friendly QTH in West Broward County (Tamarac) Florida. 3/2 home, Florida room, breakfast room and screened-in patio facing lake with magnificent sunsets. "55 and over" community pool, tennis, clubhouse. **"Release of Restrictions" permits tower and antenna.** Contact Dave, K2DP, for information and photo CD at 314-862-5698(h) or K2DP@charter.net

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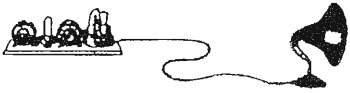

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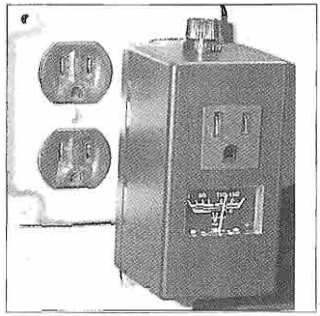
ZIM ELECTRONICS INRUSH CURRENT LIMITERS

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
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 $5.45

(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. AB-1 and AB-1M are 150W. All models come with a full money-back guarantee.



Model AB1-M

Electric Radio Store
720-924-0171

FOR SALE: Johnson Ranger $450. HQ-170 $150. Deluxe Mac Key $375 (1938). Mac Key Standard, 1936, $375 Denver CO pick up preferred but will ship. ke0mt@aol.com

FOR SALE: Collins KWM2A, Hallicrafters SX117, Heathkit SB104A. Jones RF Wattmeter. Bill Coolahan, 1450 Miami Dr NE, Cedar Rapids, IA 52402, 1-319-393-8075

FOR SALE: Hammarlund HQ-129X. Richard, 319-377-9126 dottielee526@juno.com

FOR SALE/TRADE: Manuals: EICO, Knight-Kit, Lafayette, Multi-Elmac, Collins, Morrow, Gonset, Harvey-Wells, Ameco, Millen. Al, NI4Q, POB 690098, Orlando, FL 32869 407-351-5536 ni4q@juno.com

FOR SALE: Lab tested tubes; T250 globe for best offer, 6L6G $30ea; 6L6 $15; 6L6GB $15; 6L6GC $30; 6L6GA $10. All tubes guaranteed or money refunded. John Snow W9MHS 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: 12SG7 tubes NOS in the original military packing, $1.25 ea. or 10 for $10. Tom, 303-979-6135

FOR SALE: KWM-2 CDs. All original material, not a copy of the manual. High resolution color pictures which will really help locate parts, plus much more. For more information visit my web page at http://www.heavymetalradios.com/ or E-Mail me at boatanchors@comcast.net, DW Holtman, WB7SSN

This is possibly a long shot, but I would like to obtain an unrestorable SX-88 for parts. A chassis with missing unobtainable parts or a complete receiver in very rough condition is preferred to prevent breaking up an otherwise restorable unit. I am willing to pay above-market for the right chassis or parts unit and I will make it available to others whom might also have a project SX-88 on hold due to needing parts.

Greg Gore, WA1KBQ
10291 Kendan Knoll Dr.
Charlotte, NC 28262
704-503-5952
WA1KBQ@AOL.COM

RADIOS FOR SALE: Kenwood TS930S SN 8 mil+, CW filter, VGC, $450. TS930S, IRL filters (4) $400. Kenwood TS820S, digital, perfect, book, $400. Yaesu FT9020M $400. ACCESSORIES FOR SALE: Collins SM2, nice, $300. SM3, older style, $200. 312B4, RE, $250. Kenwood VFO 820 $100, SP820 $50. MC50 $50. Yaesu SP901, perfect, $50. YO101, cables, $200. YO301 $200. Shure 444T, D104.G stand, $50 each. ElectroVoice hand mics $25 ea. All wired for Collins/Drake. All items guaranteed. Prices FOB Houston. Don, K5AAD, 713-942-9747

FOR SALE: Ham, CB, and test equipment, all older tube-type gear. Send for list. Ed, WA7DAX, 1649 E. Stratford Ave., Salt Lake City, UT 84106. 801-484-5853

FOR SALE: Hammarlund clock reproductions, 12 hour (easier to read) or 24 hour, specify, $35 each, shipped. Rob Hummel, WA9ZTY, 202 Midvale Dr, Marshall WI, 53559-9616

FOR SALE: QRZ Mobile Operators: 100A alternator, 14.5 VDC in, 12V out, with 120V 10A pwr sply. Also 3 phase 2200V 1 kw transformer. $100 for all + shpg. 350uF 330V capacitors .50 ea. Rudy, W2ZIA, 716-937-9279.

FOR SALE: Heath semiconductors: Over 200 unique, new, OEM Heath part numbers. Card or email for list, or just tell me what you need. JeRB, K8WPI, 9549 N. 17Th St, Kalamazoo, Mi. 49009, 269-226-8873 Oldbugger@earthlink.net

FOR SALE Sprague Orange Drop capacitors New/NOS. Many values/ voltages. 50% off retail. Mix or match values. eMail for complete list. gg136@aol.com

FOR SALE: Technical Books & CDs. Harold Kinley (WA4GIB), 204 Tanglewylde Dr., Spartanburg, SC 29301 www.radiotechnologies.net

FOR SALE: New, universal power supply for Elmac, Gonset, Harvey Wells, others. SASE for brochure. Harold Smith, W4PQW, 1435 Bush St., Pensacola, Fl. 32534 850-476 8107 w4pqw@cox.net

FOR SALE: Chinese Army type 65 hand crank generators for 102E radio sets. Ken, KD6B, kd6b@bendbroadband.com 541-923-1013, POB 310, Redmond, OR 97756

FOR SALE: "Unique Radio Parts", LLC. www.wa9tgt.com (Replacement parts for "Drake" radio equipment)

FOR SALE: Atwater-Kent dual speed tuner repair kit. Complete details at www.adamsradio.com Adams Manufacturing Co., POB 1005, Lincoln Park, MI 48146

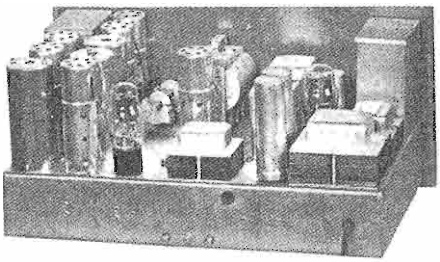
FOR SALE: Galena crystals and/or parts to make your own crystal radio. Also have radio tubes. Len Gardner, 458 Two Mile Creek Rd, Tonawanda, NY 14150, radiolen@att.net

FOR SALE: Telephone Filters, suppress >1MHz interference, plug in, 1/$7, 2/$11, 3/$14, 4/$16.75, shipped U.S. Brian Harris WA5UEK 3521 Teakwood Lane, Plano TX 75075 brian.k.harris@philips.com 214-763-5977

FOR SALE: Military whip antennas $40. AN/TRC-77 FM transceiver $295. Bruce Beckeney, 5472 Timberway, Presque Isle, MI 49777, 989-595-6483

REWARD – WANTED!

THE NEW "RME-9" SUPER



Will pay $2000 for complete RME-9 receiver in any condition. Not tested, working order unknown or needs restoration is OK. The RME-9 has a single airplane style tuning dial and was the forerunner to the later RME-9D and RME-69. Greg Gore, WA1KBQ; 10291 Kendan Knoll Dr.; Charlotte, NC 28262 (704) 503-5952; wa1kbq@aol.com

SERVICE FOR SALE: Repair of tube and solid state 1930 to 1975 radio equipment, auto, shortwave and older amateur gear. Please contact Ken Hubbard, KA9WRN, at 608-362-1896 or write Vintage Radio Service, POB 792, Beloit, WI 53512-0792.

DRAKE PARTS FOR SALE: New spun inlays for the B Line or TR4 main knob. $6. Also sell new pointer knobs. Alan, KC9YS, 630-879-1132 after 7pm.

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

QSLs FOR SALE: Your old QSL card? Search by call free, buy find at $3.50 ppd. Chuck, NZ5M, nz5m@arrl.net

SERVICE FOR SALE: Let's get that old radio of yours working again! Antique Radio Repair - All Makes- Also Transistor Radio Repair. Tom Senne, N5KCL, 937-865-5213 http://tomsradiorepair.bizland.com

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.

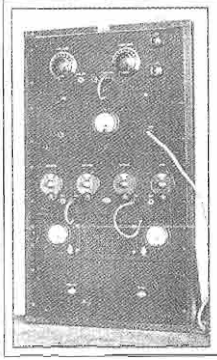
FOR SALE/TRADE: Transmitting/Receiving tubes, new and used. LSASE or email for list. WANTED: Taylor 204A, 211, TR40M and Eimac 500T. John H. Walker Jr., 13406 W. 128th Terr., Overland Park, KS. 66213. PH: 913-782-6455, Email: jwalker83@kc.rr.com

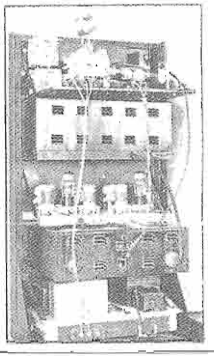
DRAKE OWNERS: New Sylvania 6JB6, same date code, tubes for sale. Price: $23 ea. Call Dick at 207-490-5870

FOR SALE: FT243 Crystals: 1000, 1700, 1750, 1822, 1880, 1942.5, 3530, 3535, 3540, 3545, 3550, 3625, 3675, 3735, 3870, 4325, 4335, 4340, 7040, 7050, 7123, 7140, 7143, 8400, 10106, 28238, 28258, 28571 kHz more. 100kHz, 455kHz HC51U wire leads. Some FT171B, HC6U Crystals. Contact af4k@hotmail.com or send SASE to Brian Carling, AF4K, 117 Sterling Pine Street, Sanford, FL 32773 or call 407-323-4178 http://www.af4k.com/crystals.htm

HALLICRAFTERS SERVICE MANUALS: Ham, SWL, CB, Consumer, Military. Need your model number. Write or email. Ardco Electronics, PO Box 24, Palos Park IL, 60464, wa9gob@aol.com 708-361-9012 www.Ardcoelectronics.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





REWARD – WANTED!

Will pay $1000 for a 1930s National type LRR 36" relay rack pictured to left. It is identified by its ¾" wide top and bottom crossmembers with a red "National Co.; Malden, Mass" decal on the top crossmember. Greg Gore, WA1KBQ; 10291 Kendan Knoll Dr.; Charlotte, NC 28262

704-503-5952
wa1kbq@aol.com

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

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

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

FOR SALE: Radio parts and hardware. Some are 60 years young! Free flyer, USA only. Bigelow Electronics, POB 125, Bluffton, OH 45817-0125

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

FOR SALE: Tubes tested good globe 200A $8.50, 201A $14, 226 $8, 227 $9. Write or e-mail: tubes@qwest.net for price lists or see www.fathauer.com. Slightly weak tubes guaranteed to work in early radios 1/2 regular price. 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: 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.

WANTED: Johnson Ranger II, avg condx will be fine. Charlie 941-747-2082, k4zks@tampabay.rr.com

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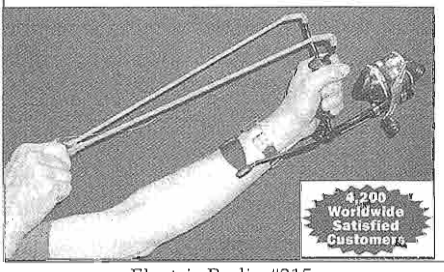

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BOOKS FOR SALE: Radio books, magazines, catalogs, manuals (copies), radios, hi-fi, parts. Send 2 stamp, LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857. ka1edp@juno.com

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

FOR SALE: FT243 CRYSTALS: 1885, 1915, 1925, 1945, 1985, 3870, 3875, 3880, 3885, 3890, 7143, 7280, 7285, 7290, 7293 kHz, more. Contact af4k@hotmail.com or send SASE to Brian Carling, AF4K, 117 Sterling Pine Street, Sanford, FL 32773 or call 407-323-4178 http://www.af4k.com/crystals.htm

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

FOR SALE: Vintage electronics at Alameda Antique Mall, 9837 Alameda Genoa in Houston. Visit www.RadioWorld-OnLine.com Carl Blomstran, POB 890473, Houston, TX 77289

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 w1etc@adelphia.net

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 mobeng@hickorytech.net

NOTICE: Visit Radioing.com, dedicated to traditional ham radio & vintage radio resources. Let's Radio! Charlie, W5AM. www.radioing.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, fixer7526@wmconnect.com

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

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

WANTED: BC348 parts set. NEED complete panel of an early model designation (i.e. K, L, or R) with antenna alignment. Will trade a dynamotor DM28 or buy. Ed Allison, 5525 20th Ave, Sacramento CA, 95820, 1-916-454-1788

WANTED: Filter choke, 6K working volts at 1 amp or greater, 7.5V, 42 amp filament transformer, 42 amp filament choke. Ed Hatcher, KV5I, 2618 Heatherwood Dr. Dallas, TX 75228 214-320-5835 eh54@sbcglobal.net

WANTED: Meter for the Heathkit DX-40. Ron, W6TUR, 619-303-1307, w6tur@cox.net.

WANTED: Radio Shack working DSP-40D signal processor. Richard, WAØKKC, 7139 Hardy, Overland Park, KS 66204, 913-432-5136

WANTED: Manual/schematic for test set TS-IG/APN and need the power supply. Walt, KB6BKN, kb6bkn@juno.com

WANTED: National AN/FRR-24 receiver components and info. See http://www.virhistory.com/ham/frr24.htm Nick, KD4CPL, nick@3rdtech.com 919-929-4342 (NC)

SIGNAL ONE CX11 WANTED: Looking for Signal One CX11 / CX11A transceiver. Will consider radios needing work and parts-only radios. Bob KD7FT; kd7ft@earthlink.net 206-375-3234

WANTED: Hallicrafters SX-28. Vern, W9STB, 8679 Pinkhurst Dr, Minocqua, WI 54548 Email: telegrapher@hotmail.com

WANTED: BW-2008, 3011, 3012, 3018 Miniductors, Hammarlund MCD-140M dual 140pf variable, Pete Hamersma, WB2JWU, PO Box 467, Holderness, NH 03245. pehamers@worldpath.net

WANTED: Federal Tel. & Tel. RF transformer type 30 or 35 for 1924 Model 102 Special receiver. Shown on page 27 of Larry Babcock's 1993 Federal book. Kenneth Hodge, 5330 N. Nashua Circle, Parker, CO 80134, 303-284-5581 kb4cm@yahoo.com

HAMMARLUND WANTED: Super Pro 100 model. Coils for Comet Pro. Thanks, dennis.gilliam@kjzz.org 602-710-0803.

WANTED: Intact circular bandspread tuning dial for Hammarlund HQ-180 or HQ-180 dead with such. Bob, KD9GI@msn.com, 815-332-9520

WANTED: Swan Mark 6B (50 MC) 2 kW PEP linear working power supply. Richard, WAØKKC, 913-432-5136

WANTED: National 1-10 or 1-10A RF section, or complete parts unit. Ivan, WA6SWA, 703-237-9511, ihxxv@cox.net

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WANTED: 1953 Callbook, partial one OK, as long as it has 5th district calls Sam, W5WAX, k5sw@arrl.net

WANTED: Someone with a collection of Short Wave Craft, Radio Craft from the 1930s to collaborate on a series of articles on a substantial collection of original items form that time period. Please call Chuck, WØIUH, 320-277-3242

WANTED: BC-457A, BC-458A parts. Robert Caponi, 30 Revolution Dr. Leominster, MA 01453 recaponi@hotmail.com

WANTED: James Millen plug in oscillator coils for Millen 90881 linear amplifier, Millen parts #s 43011, 43015, 43021, 43041 and 43081. Gary K2PVC; gschonwald @earthlink.net 917-359-8826

WANTED: Technical Materiel Corp (TMC) power supplies PS4 (low voltage and bias) and PS5 (high voltage) for the TMC PAL 1K kilowatt linear amplifier, also known as the RFD or RFA. Gary K2PVC; gschonwald@earthlink.net 917-359-8826

WANTED: Squires-Sanders SS-1R and SS-1V. Bob, WØYVA. 703-450-7049, robert@isquare.com

WANTED: One of my "KN8GCC" QSLs from the mid-1950s. Tom Root, 1508 Henry Court, Flushing, MI 48433, 810-659-5404, wb8uuj@arrl.net

WANTED: Hallicrafters HT33 with salvageable power supply. The RF section is not required to be useable, need a power supply to contribute to one that is. Gary Schonwald K2PVC. gschonwald@earthlink.net phone: 917-359-8826

WANTED: Technical Materiel Corp rack mounted antenna tuner and RF /SWR meters to be used with the 350-watt or 1000-watt TMC linear amplifiers. Will consider other TMC transmitting equipment and accessories for collection and on-air use. Gary Schonwald K2PVC. gschonwald@earthlink.net phone: 917-359-8826

WANTED: Need two Westinghouse RT35 0-1 RF amps, 3-1/2" round Steve Bartkowski, 1-708-430-5080

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

WANTED: Vacuum Tubes: 279A, 212E, 249B, 258B, 271A, 242A, C120, C100A, 804, RK20, CK70, GL805, C201, ZB-120, 802. Components for rebuilding Collins 30J RF output deck, including Cardwell or equivalent dual section variable 440 pF and 240 pF capacitors. Components for Collins 12H /12N speech input console, including preamplifiers and program amplifiers. Rod, W5CZ, 303-324-2725, rodperala@aol.com

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

WANTED: Pearce-Simpson manual/ schematics for VHF marine radio, model "Catalina", JR Linden, K7PUR, PO Box 4927, Cave Creek, AZ 85327, jrlinden@usa.net

WANTED: Clean National Select-O-Ject, NC-183DTS and Heath VX-1. Contact Ric at c6ani@arrl.net.

WANTED: ITT-Mackay Marine 3010-C Receiver, late S/N, complete and in good or VG conditions, with original box and manual. The item has to be shipped to a friend in Ohio (not outside U.S.). Send your offer to Paolo Viappiani, Via Valle 7, 19124 La Spezia, Italy, or pviappiani@tin.it

WANTED: Early QSL cards from my Grandfather, Hal Smith (SK). His calls were KH6KA, K6YJR, K6OQE. Gladly reimburse postage plus modest finder's fee! Phil Wilson, 1355 Big Otter Dr, Blue Ridge, VA 24064 k6cra@arrl.net

WANTED: National NTE-30 Transmitter. Any condition, any price! I love National. Sylvia Thompson, n1vj@hotmail.com 33 Lawton Foster Rd., Hopkinton, RI 02833. 401-377-4912.

WANTED: One of my "KN8GCC" QSLs from the mid-1950s. Tom Root, 1508 Henry Court, Flushing, MI 48433, wb8uuj@arrl.net 810-659-5404.

WANTED: Any TMC equipment or manuals, what have you? Will buy or trade. Brent Bailey,109 Belcourt Dr., Greenwood, SC.29649, 864-227-6292, brentw2@earthlink.net

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

PRESS WIRELESS, NY: Photos, information wanted on Hicksville, Baldwin, Little Neck, Centereach, Northville facilities. George Flanagan, 42 Cygnet Dr., Smithtown, NY 11787 w2krm@optonline.net 631-360-9011

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

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: 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: 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 30th, Oklahoma City, OK 73112. 405-525-3376, bglcc@aol.com

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: 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: TCS & TBY Navy radios. Ken Kolthoff, K8AXH, PO Box 215, Craig, MO 64437. 913-634-3863.

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 900 N. San Marcos Dr. Lot 77, Apache Junction, AZ 85220

WANTED: Harvey-Wells Odds-'N-Ends: Speakers, phones, mikes, manuals, supplies, prototypes, military, aircraft. Kelley, W8GFG, 219-365-4730, 9010 Marquette St., St. John, IN 46373

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: 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: 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

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

WANTED: Scott Special Communications rcvr. EA4JL, please call Kurt Keller, CT, 203-431-6850

WANTED: SCR-602 components, BC-1083, BC-1084 displays, and APS-4 components. Carl Bloom, 714-639-1679

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

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

DONATIONS WANTED: Southern Appalachian Radio Museum, Asheville, NC, where others can view your radio treasures. For general information or donations call Clinton Gorman, Curator, 828-299-1276

WANTED: WW-2 IFF Equip FM-80 rack BC-126F RA-105A 1-221, BC-1293. Will pay top dollar. Steve Bartkowski, 1-708-430-5080, 7702 Austin Ave, Burkank, IL 60459

WANTED: NOS 11" x 7" aluminum natural finish bottom plate for chassis. Louis L. D'Antuono, WA2CBZ, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

WANTED: R 390, R 390A and R 392 receivers dead or alive or parts/assemblies. Any condition considered. Will pickup if you have enough items. Glenn, WA4AOS, 864-684-2956

WANTED: Mint, complete or parts sets. Hammarlund SP-600 JX-28 version, has nomenclature tag R-620, doesn't have name engraved on panel like others, 1937 RCA ACR-111, RCA CR-88B version, RCA AR-8516, TMC CV-1758 SSB converter, and DEI Defense Electronics TR-711 telemetry receivers and modules. Will send custom shipping carton for easy transaction/shipment. Dan Gutowski AB8VM P.O. Box 142 Dexter, MI 48130 734-718-7450. dg16ms26@msn.com

WANTED: Electric Radio Tuning Meter as shown in many back issues of ER. Also need a 10-Amp Variac, anyone have one for sale? Joel, W7EPA 928 231 3674 or W7EPA@ARRL.net

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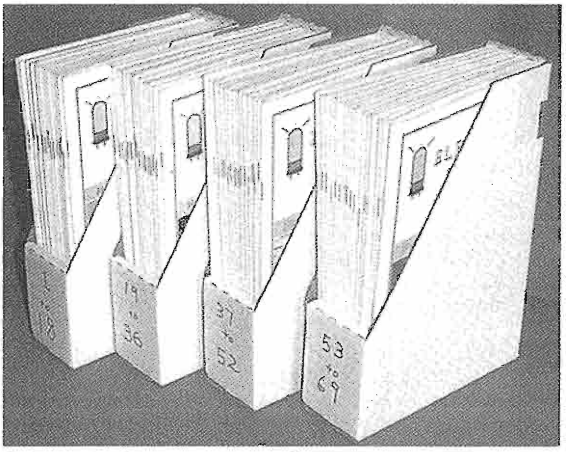

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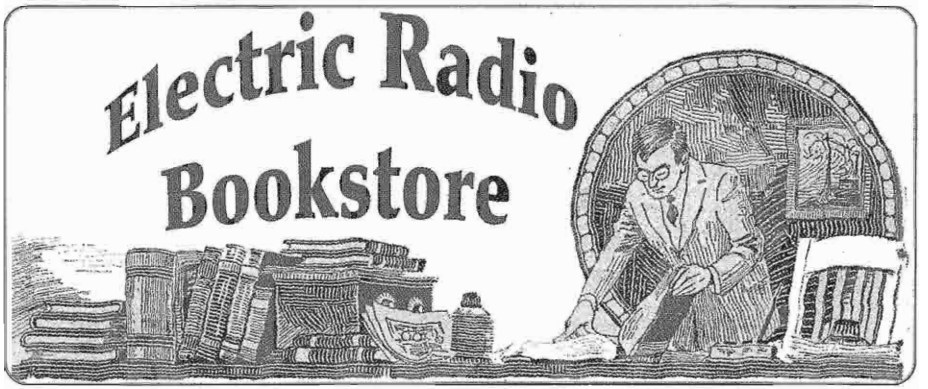

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