$3.75

ELECTRIC RADIO

celebrating a bygone era

Number 183 August 2004

Dale Gagnon (KW1I) and Joe Carcia (NJ1Q)

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, Cortez, CO
USPS no. 004-611
ISSN 1048-3020

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

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

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

Editor's Comments

There Is No Such Thing as an Alexanderson "Arc" Transmitter

An error in my "Comments" column occurred in the July, 2004 issue. The famous Alexanderson 200 kW alternator transmitter was, of course, not an arc machine, but was a major breakthrough in wireless communications. Its introduction was directly responsible for the formation of RCA and the availability of dependable 24-hour, worldwide wireless communications. The Alexanderson machine was the first transmitter able to generate high power at RF. It featured a precise speed control system that prevented self-destruction of the high-speed rotating parts, could accept voice modulation, and had an advanced tuned antenna system with a lot of power gain. My apologies go out to the spirit of Dr. Alexanderson!

BPL Update

I know we are all probably tired of hearing about Broadband Power Line issues, but the topic is too important to the future (or the lack of a future) of licensed users in the HF spectrum. A recent press release from the Utilities Telecommunications Council (UTC) has announced some new research about BPL, citing what they are calling "the critical track on infrastructure communications" and "Opportunities in Broadband over Power Line." Quoting their press release of July 22, 2004 in part, "Utilities are increasingly intrigued by the potential of the Broadband over Power Line (BPL) market, which across the globe is expected to peak at 2.5 billion annually by 2010."

"Growing numbers of utilities are exploring opportunities to test the viability of BPL within their own service territories. Utilities are finding that existing assets are maximized by leveraging their T&D [Transmission and Distribution] network infrastructure for BPL.

The press release goes on, discussing marketing strategies for utilities wishing to test BPL systems, citing "The Importance of Price V.S. Speed in Customer Adoption of BPL,"

"A canvas of residents suggests a greater likelihood to purchase high-speed

[Continued on page 35...]

TABLE OF CONTENTS

Cover: Dale Gagnon (left) President of AM International is presenting AMI membership certificate number 1500 to Joe Carcia (NJ1Q) on June 18, 2004. Joe is the the W1AW Station Manager.

The Heathkit AT-1 That's a Real McCoy! Plus How To Fix A Fried Iron-Vane Meter

By Jim Hanlon, W8KGI
PO Box 581
Sandia Park, NM 87047
w8kgi@arrl.net

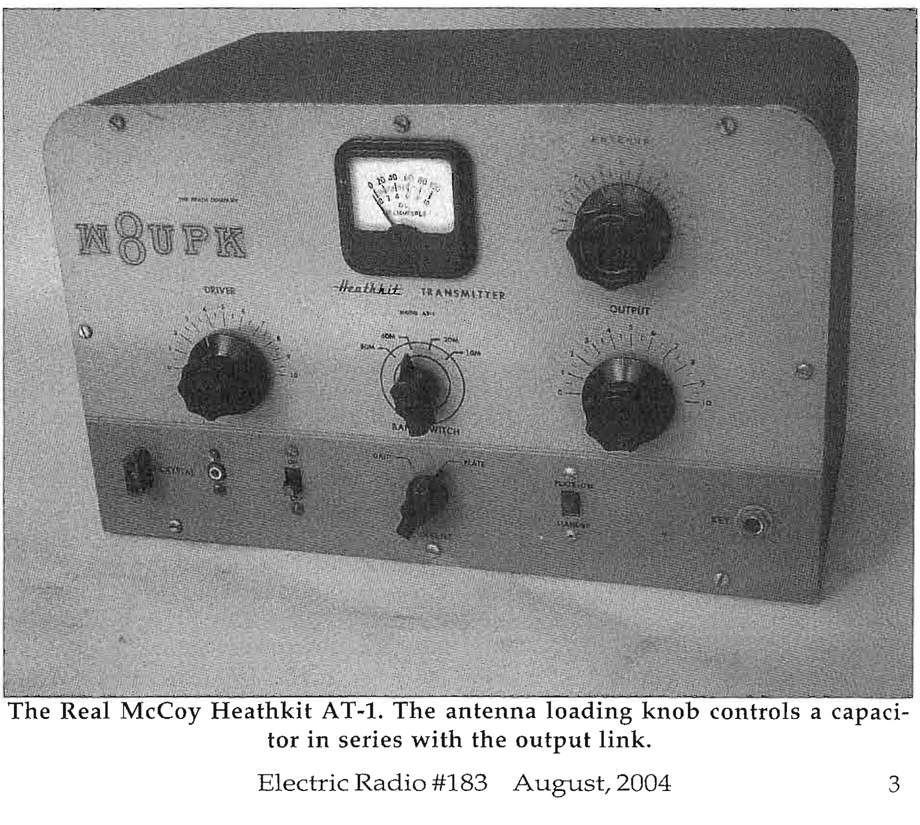
For a long time, and especially since my friend Mac, WQ8U, acquired a Heath AT-1 to replace the one his mom had presented to him in his misspent youth back in 1953, I have wanted a Heathkit AT-1. Anyone who is infected with the Boatanchor virus certainly knows that the AT-1 is Heath's first amateur transmitter, sold from 1952 through 1956, and the rig that launched many an early Novice into a great life in Ham radio. Its 6AG7/6L6 lineup was said in the Heath ads to run upwards of 35 watts input to the final, a respectable figure in those golden days. What was not mentioned, however, was its power output. As reported by Lew McCoy in "More Power with the AT-1," QST for October, 1955, his stock AT-1 when coupled to a 50 ohm load actually ran anywhere from 26 to 34 watts input across the five bands from 80 through 10 meters, but its output was 9 watts on 80, 40 and 20, 5 watts on 15, and 7 watts on 10. This relatively poor performance was due principally to the fact that the 6L6 doubled on all bands except for 80 meters where it did run straight through, and secondarily to its fixed, link-coupled output that was nominally set for 50 ohms (there's nothing new under the sun) and had no means for adjusting the loading. Doubling in the 6L6 was a very good idea for preventing parasitic oscillations, and the many AT-1's that went into the hands of inexperienced beginners earned a good reputation for being easy to adjust and for putting out clean signals. But that came at the cost of reduced power output, something that Heath was easily able to fix in its follow-on beginner's rigs like the DX-20 through DX-60 in at least some cases by neutralizing the final amplifier and running it straight through.

In 1955, Lew McCoy fixed both "problems" by modifying his AT-1 to run straight through on all bands except for 10 meters where it still doubled in the final and by adding a capacitor in series with the final amplifier output link to adjust the loading. He changed the final tube from a 6L6 to a 6BQ6, a small, TV sweep tube, and he deftly added a neutralization circuit so that it would be just as stable as the original 6L6 doubler had been. His modification had the additional advantage of allowing the AT-1 to start with 40 meter crystals and to triple in the oscillator to get on 15 meters, rather than having to use crystals in the 5.25 to 5.3625 MHz range (15 meters divided by four) as in the original AT-1 version. I won't go into the details; they are available in step-by-step form in Lew's article in the unlikely event that someone is contemplating a change to his AT-1 at this point in time. But they involve changing the oscillator plate coil windings, adding a few extra parts including some nice mechanical brackets for the new neutralizing condenser and the output loading capacitor, and adding a resistor that stabilizes the oscillator screen voltage to improve its keying.

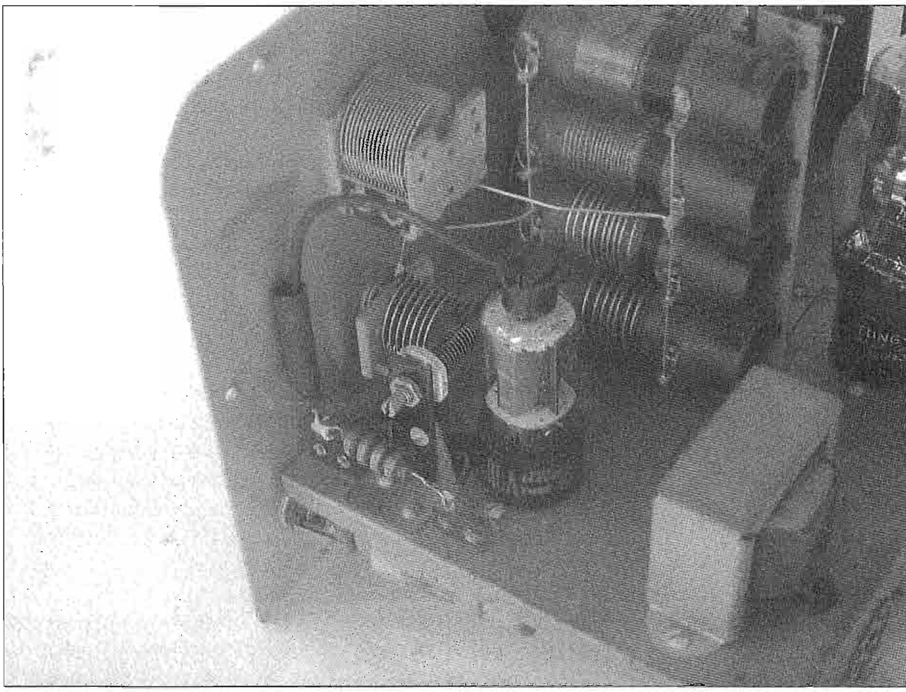
As you certainly have figured out by now, I did acquire that long-sought AT-

1 recently from the e-place. The rig arrived well-packed and it appeared to be in good condition. Of course one of the first things I did after releasing it from its wrappings was to have a peak inside. I had known there was an "antenna loading" control added to the front panel from its picture. But wouldn't you know, instead of the expected 6L6 in the final amplifier I found a 6BQ6 and a neatly mounted neutralizing condenser, just like the ones in McCoy's article that I somehow had copied one day and added to that file folder of AT-1 literature I had been building in long anticipation of finding one of the rigs. I didn't have just a garden-variety, stock AT-1 but rather a well- rendered "Real McCoy" version. I must admit that this really appeals to my crazy, boatanchor collector's spirit.

The only apparent problem that this new rig had was a broken meter switch, so I set off to make a repair. The original meter switch was a double pole, double throw rotary switch with a center off position. In my junque box I found a two pole switch wafer with six positions per pole and also a single wafer switch shaft and mount assembly. I found enough hardware to put them together, the necessary screws, washers, nuts and spacers; but when I assembled the switch I was not careful enough to make sure that rotor contacts on the wafer were completely isolated from the metallic switch frame. The result was that when I installed the new switch and, after bringing the rig up slowly on a variac and allowing time for the filter capacitors to re-form, when I powered up the rig, I caused a momentary short from the one side of the meter to the grounded switch frame while there was B+ on the other side of the meter. I didn't burn out the meter coil, but the momentary pulse of current was apparently enough to alter



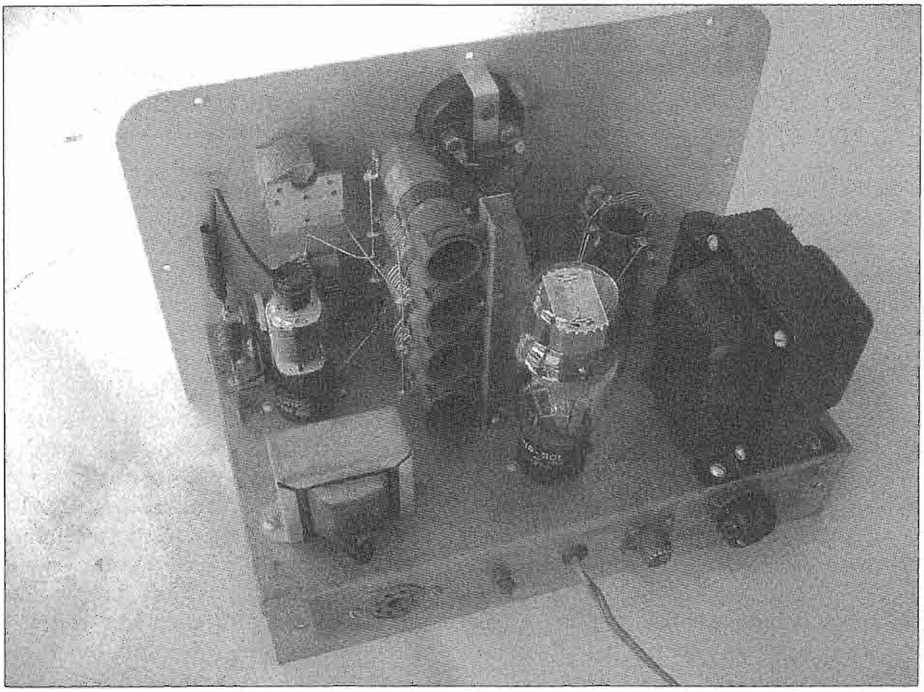
The Real McCoy Heathkit AT-1. The antenna loading knob controls a capacitor in series with the output link.



A view of the 6BQ6 final. The neutralizing capacitor is the one mounted on a bracket and has a screwdriver slot for adjustment.

the strength of the internal bias magnet in the iron vane meter on the AT-1. Now, instead of setting on zero with no current flowing, the meter pointer was very firmly pinned against the lower stop and it took quite a bit more than the 10 milliamps that was supposed to be the meter's full scale sensitivity to bring the pointer off its stop.

Talk about feeling stupid! Replacement AT-1 meters are extremely high on the list of Unobtanium these days. I didn't want to insult this otherwise nice-looking rig by cramming some obviously non-original, d'Arsonval movement meter into its panel. What to do? Finally I thought that since the problem seemed to be an altered magnetic field inside my meter I just might get lucky and be able to compensate by adding some additional field from the outside by using an external magnet. The meter case is a sturdy steel box, certainly intended to be a magnetic shield as well as a mechanical structure; but as I found when I took the meter apart for an inspection, just the stray field from an inadvertently magnetized screwdriver blade was enough to re-zero the pointer, so it shouldn't take much flux leaking through the case from an outside magnet to do the trick. Besides, I had nothing more to lose, so I decided to give it a try. A trip to the local hardware store produced a blister pack of half a dozen, ¾ inch round, "ceramic" magnets of the type you probably can find on your refrigerator door. With a little cut and try, I found that I could position one of these magnets on the side of the meter case near the bottom and with a little careful adjustment of both the magnet's position and its rotational orientation I could set the meter pointer right on zero again! Further, when I measured the



Inside the McCoy AT-1. The new final amplifier is a 6BQ6. You can see two, round external bias magnets glued with epoxy to the lower left and upper right of the meter.

meter's sensitivity, 10 ma of current through the meter from an external power supply pushed the pointer up to the 10 ma, full-scale marking on the meter! Wow, did I get lucky! I reassembled the meter into the AT-1 and fastened the magnet into position, using slow-drying epoxy to hold it in exactly the right spot. I found out, by the way, that the position of the magnetic solder lugs that connect to the back of the meter also influenced the zero position of the pointer. I had positioned my first magnet without those lugs attached, so I wound up gluing a second magnet to the meter case as well to compensate for the effect of the lugs. Needless to say I also cleaned up my mistakes on the switch that had caused all of this grief in the first place. Now I was back in business with a refurbished meter that did everything it had done in the first place before I pulled my stupid trick.

From there on, tuning up the Real McCoy AT-1 was easy. 80 meter crystals can be used for transmitter output on 80, 40 and 20 meters, while 40 meter crystals will work for output on 40, 20, 15 and 10. Lew recommended tuning the oscillator for about 3 ma grid drive to the final, and that was easily obtained on all bands. The 6BQ6 should be loaded to about 90 milliamps cathode current as indicated by the AT-1 meter on the "Plate" position. That results in about 35 watts input. My output on 40 meters is about 18 watts as measured on a Swan WM-1500 wattmeter into a 50 ohm load. That's considerably less than the 25 watts Lew reported with his rig, so perhaps I should go shopping for a new 6BQ6 one of these days. 18 watts is still enough to do a very respectable job barefoot, and it drives my SB-200 amplifier to a bit more than 100 watts output, so I'm pretty satisfied.

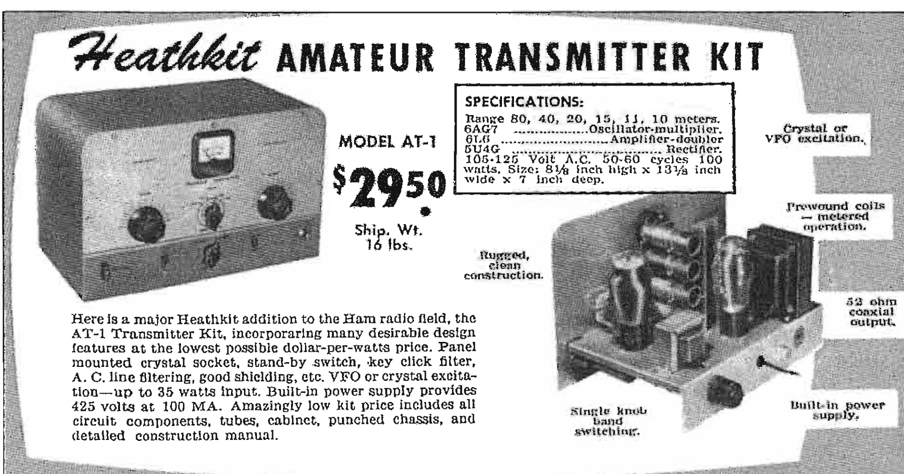
Lew's recommendation for adjusting the neutralization was to start on 80 meters, tune the rig up into a 40 Watt light bulb, pull the crystal, and then adjust the neutralizing capacitor for no indicated grid drive and for the bulb to go out. He then had you repeat the process on 15 meters in case a little more careful trimming was needed. That's kind of a rough-and-ready approach to neutralization, but it does get the essential job done. As it came, my rig was sufficiently well neutralized already, so I didn't attempt any further tweaking on my own.

My first QSO with the Real McCoy AT-1 was of course with Mac, WQ8U. We keep a regular sked on Sunday evenings, and Mac put his AT-1 on the air for the occasion, driving a trio of parallel 6146's in a linear amplifier for a little extra signal strength. (Mac's "linear" is his Viking Valiant running in SSB mode with external input from his AT-1.) I started our QSO with my SB-200 in line, but the AT-1 by itself was getting into Dayton that evening with a 569 report, so I just ran it barefoot after making the initial contact. We carried on for an hour that evening, appropriate for two guys who acquired our RCC certificates when we were WN4VIV and KN4AWW respectively.

Before I end this article, I have to tip my hat to W8UPK for the nice job he did on this little rig. You can see his call in nice, gold, transfer letters on the front panel. The QRZ data base shows that call as unassigned now, but the guys on the Boatanchor reflector found him listed as David C. Hutchcroft of Cleveland, Ohio in Callbooks as early as Winter, 1955 (when he was WN8UPK). By Summer, 1963, he had moved to Thompson, Ohio. Thanks, Dave, and please know that your AT-1 is back on the air and appreciated.

So if you run across an AT-1 with an added antenna loading control on the panel just to the right of the meter, don't be automatically afraid to give it a home. Look inside to see if it's got a 6BQ6 (with a plate cap) in the final and a neutralizing capacitor mounted on a bracket between the output tube and the front panel. If it has, you've probably found a "Real McCoy AT-1." I would definitely recommend that you add it to your collection and that you put it on the air and work the WQ8U original and the W8KGI Real McCoy AT-1's with it on the next Classic Exchange.

ER



From QST for October, 1954

Cheaper and Simpler Upgrades for the R-390A HF Receiver

By Chuck Felton, KDØZS
Felton Electronic Design
PO Box 187
Wheatland, WY 82201

In a few hours it is possible to make some simple and inexpensive upgrades to the R-390A receiver which greatly enhance its basic performance. These changes involve 18 components which are added or replaced, all of which are easy to find. This article will discuss my upgrades in the text and captions to the various schematics on the pages that follow.

A Better Front End Tube.

Most of tube manuals list the 6DC6 as a remote-cutoff RF pentode. Actually, this is not the case, and the 6DC6 is really a sharp-cutoff type that cuts off or limits at a little over -5 V on the signal grid. Many receiver designers used the 6DC6 as the RF amplifier, aparently without ever testing it! By changing it to a 6BZ6, you will gain a stage that has a much lower noise floor, and which will accept up to -35 volts on its grid. There are no circuit changes to make. Just remove the 6DC6 and plug in a 6BZ6. The pin-outs are the same and the electrode voltages are correct for both tubes. Some of the later R-390A's were changed to include a voltage divider on the RF amplifier as a partial solution. If your receiver has this mod, remove the 1.5 M

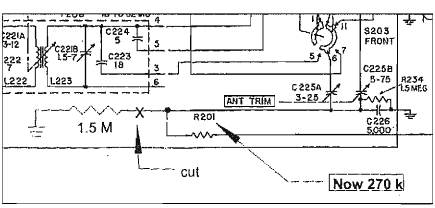


Figure 1: Schematic location of R201 in the RF deck.

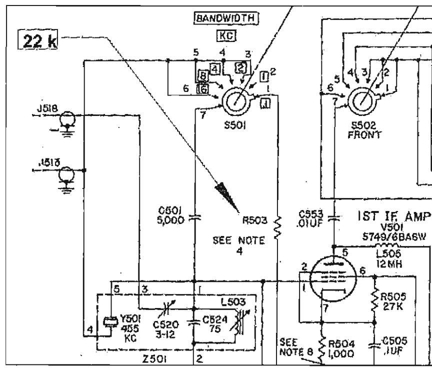


Figure 2: A real value for R503.

resistor to ground to allow full AGC action as shown in **Figure 1.**

In **Figure 2**, replace R503 with a 22 k, ½ Watt resistor. Whatever the value was, replace it with 22 k. The original 100 cycle filter position is too narrow and too lossy. The new value will give you about 350 cycles of bandwidth at -6 dB.

Looking at **Figure 3**, more easy changes are shown. If the shunt across the carrier meter adjustment, R537, is replaced with 6.8 ohms, ½ Watt, the adjustment range of the meter will be more reasonable.

If the BFO plate load resistor, R550, is replaced with a 3.6 mH shielded choke in a 1-Watt case size, a slight detuning of the 4th IF transformer (T503) will produce 40 volts of BFO injection. Then adjust C525 for minimum BFO signal at J116. This change makes SSB demodulation much easier. Due to some pulling, it will also produce exalted-carrier AM detection, which is known to counter the effects of selective fading.

Wouldn't it be nice to have a limiter

that acts like a real limiter instead of a "distortion injector?" In **Figure 3**, If you add a 10 k resistor in series with the wire going to the #7 top limiter switch contact, the limiter will soft limit at turn-on, and will progress to hard limiting when the control is fully clockwise.

Figure 4 has some simple AGC changes. Changing the pull-up resistor, R544, to 10 Megohm, metal film, ½ Watt will produce some AGC "hang" action, plus an obvious increase in AGC gain. The maximum detector signal is now about 8 volts. The 100k resistor added in series with C551 increases the AGC time constant in all positions of the AGC switch.

In **Figure 5**, find V601B, the 5814 cathode follower stage. If you add some forward bias to avoid overloading, less distortion from the detector will take place. Simply add a 10 megohm, ½ Watt resistor from pin 1, V601A, to pin 7.

If you remove C609 from the cathode of the first audio amplifier, V601A, the stage will have much improved linearity. It is usually a defective part anyway, and won't be missed.

To get rid of the 5 kc hetrodyne caused by the channel spacing in the SWL bands, add a series-resonant notch filter. It is made from an inductor, a capacitor, and a switch. If a 1 Henry inductor and an 890 pF capacitor is added at the audio response switch top connection (#9) to ground, you will do just that. The 890 pF capacitor may be adjustable or selected. This change also reduces ringing of the 8 kc mechanical filter.

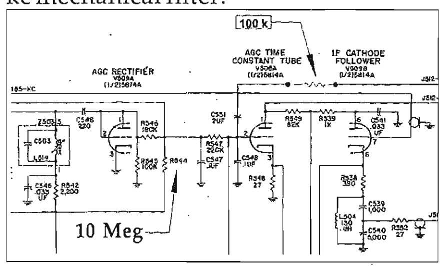


Figure 4: The AGC Changes.

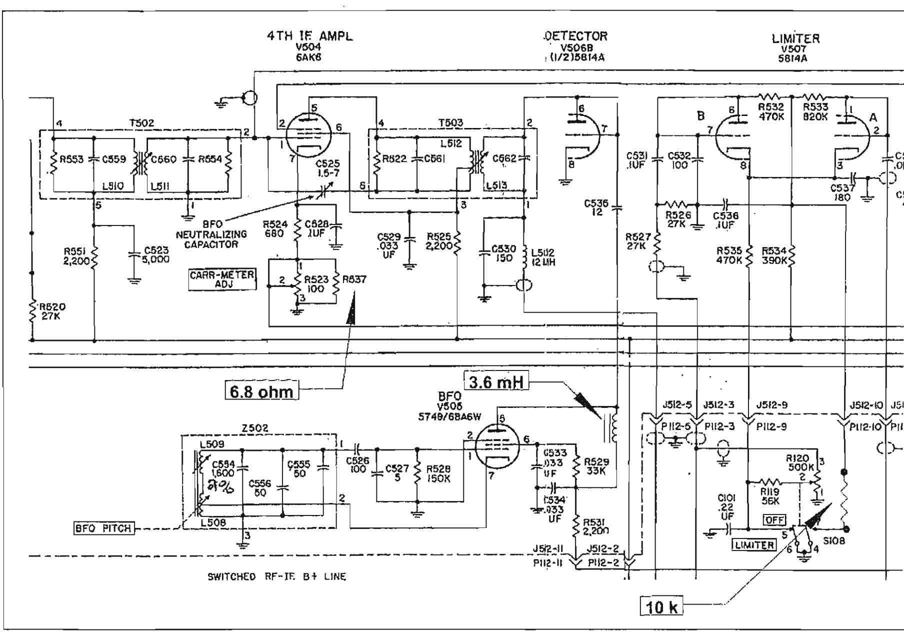


Figure 3: Schematic locations for the changes to the carrier meter adjustment, BFO, and noise limiter.

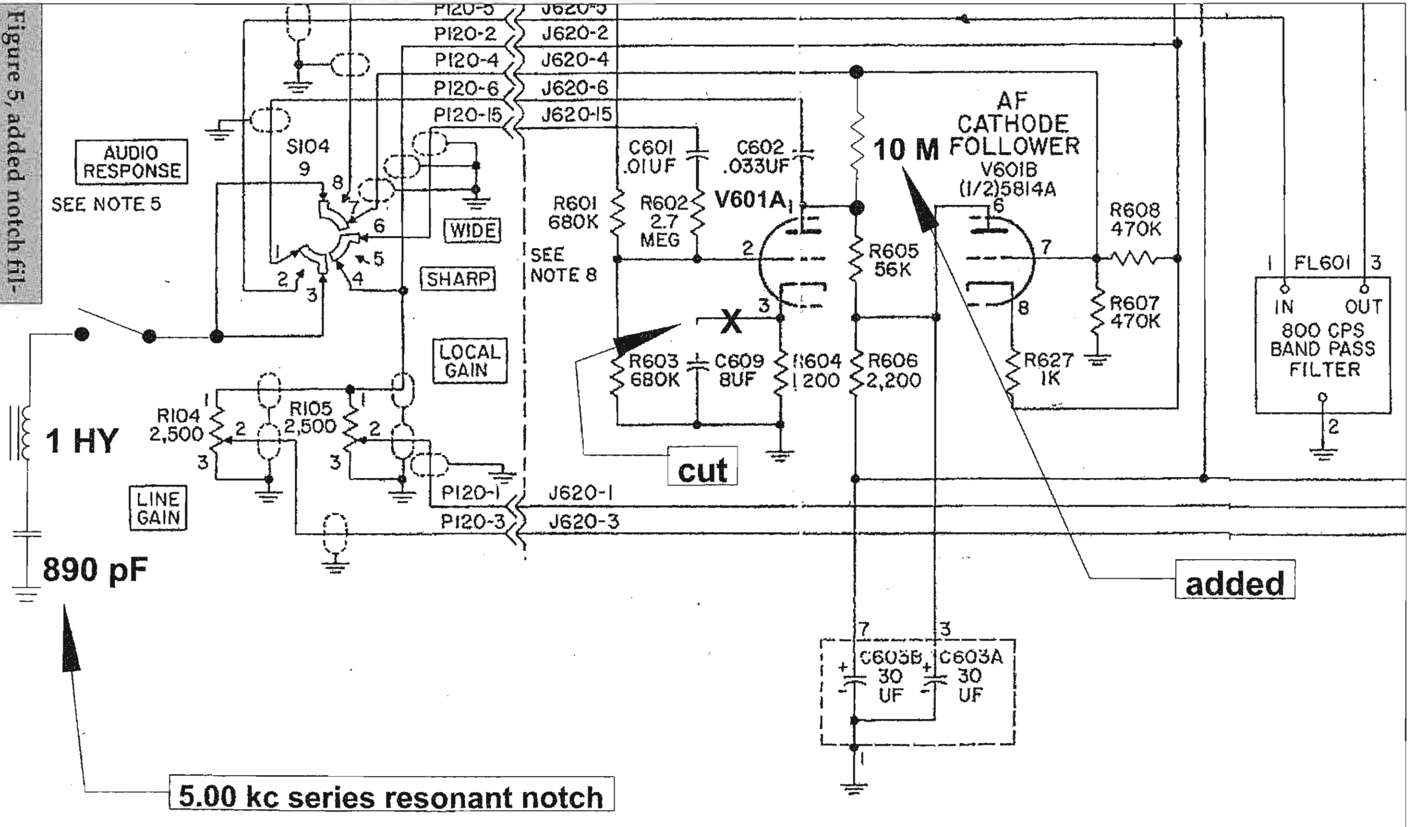


Figure 5, added notch filter and audio changes.

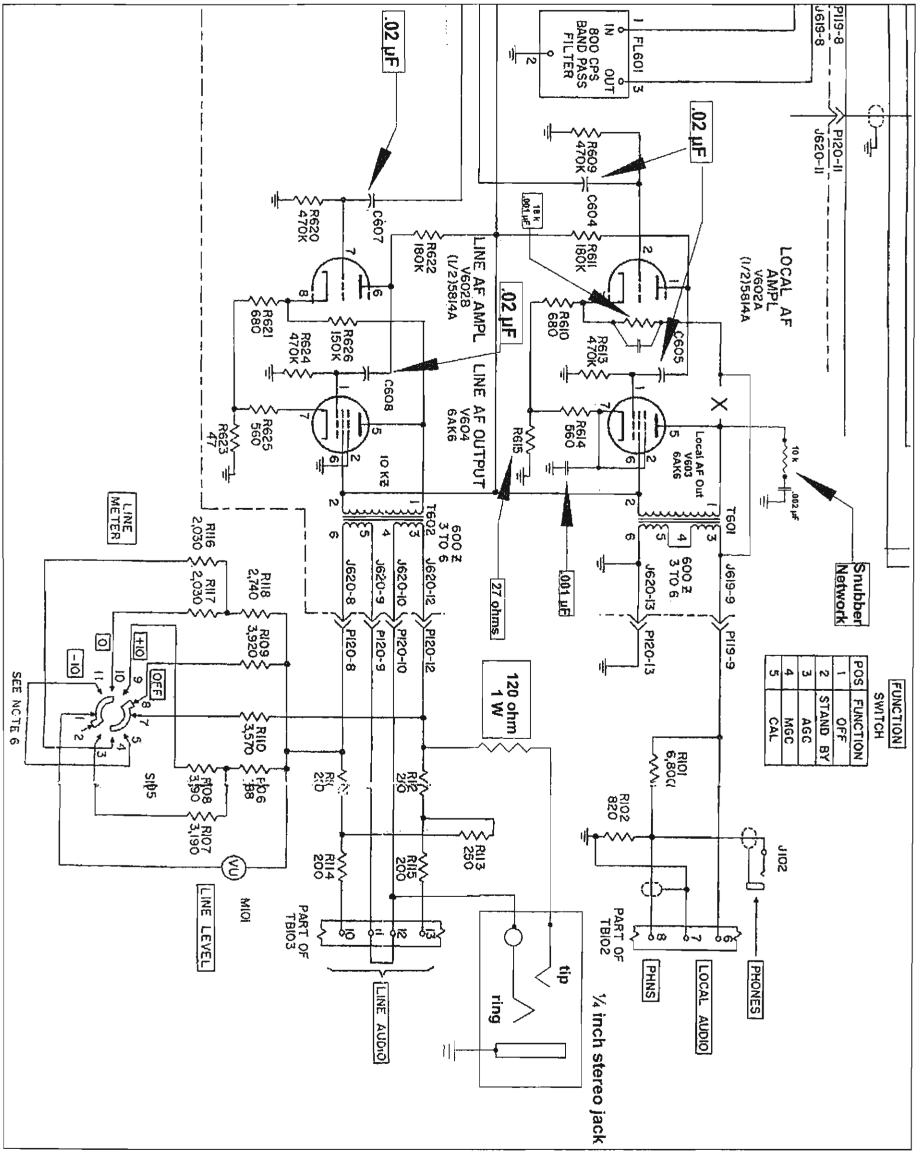


Figure 6: For improved low frequecy response, replace audio coupling caps C604, C605, C607, C608, with .02 µF, 400 volt mylars. A snubber network is added to the V603 plate consisting of 10k, ½W and .002 µF 1 kV ceramic disc. To include the original output transformer in the negative feedback loop, disconnect the wire at pin 5 going to R612 and remove from the wiring harness. Replace R612 (in V602A cathode ckt.) with 18k ½ Watt. Connect the disconnected wire to T601 pin 3. Replace R615 with 27 ohm, ½ Watt. Parallel the new R612 with .001 µF disk ceramic. Add .001 µF ceramic from V603 pin 7 to ground. The 1 Watt of audio power now available requires a correct matching transformer and an efficient speaker for undistorted audio. ER

The Philco-Pro: The Communications Receiver Philco Never Made

By Frank W. Fisher, WA6RBQ
600 Trollview Road
Grants Pass, Oregon 97527
wa6rbq@arrl.net

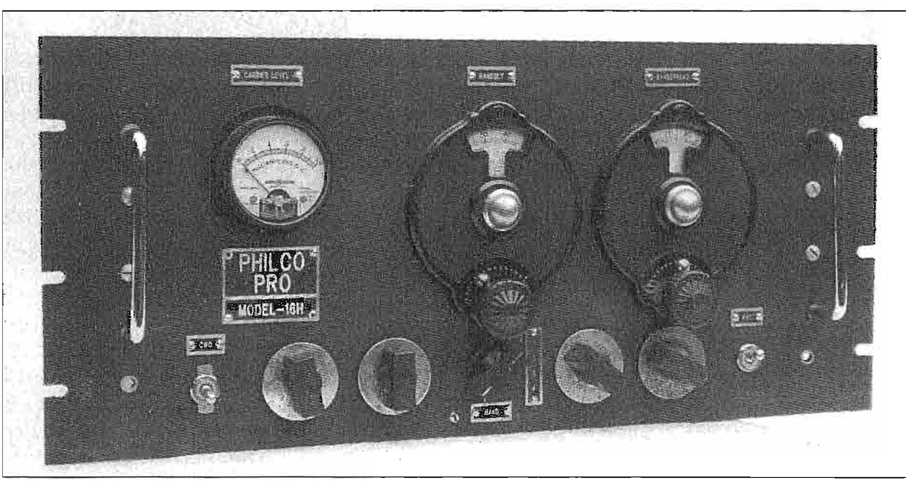
One time or other most of us have looked over some 30's vintage short wave set and thought that it ought to be useable as a Ham receiver with a little help here and there. The trouble with that is, these sets are worthwhile in their own right and probably should just be restored to original condition.

Well, maybe not always!

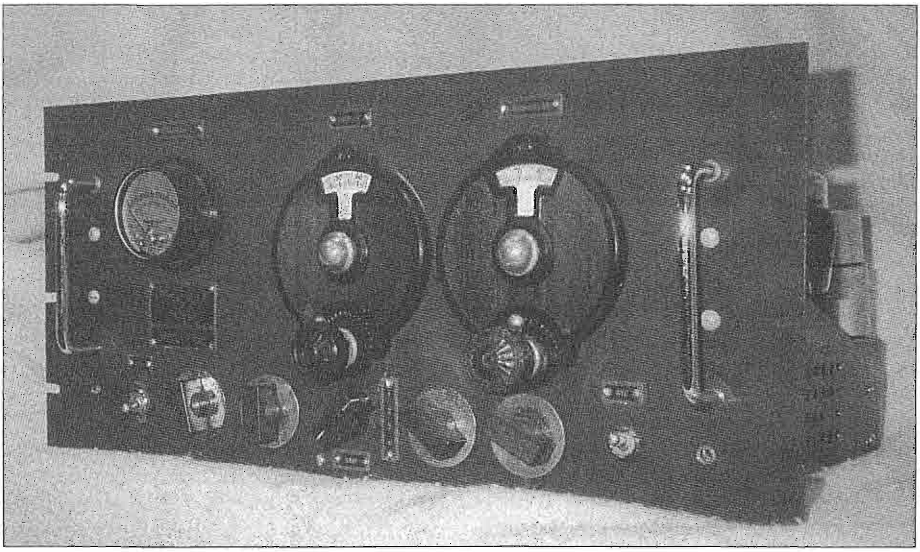
I had this old Philco Model 16 chassis, lotsa rust, no cabinet and the dial was in pieces. Probably it would make a good "parts" unit. It had sat on a shelf for a few years. Recently, I pulled it down and was looking it over. It was pretty sad all right. But, still... There were some good design features there; the set had a tuned R.F. stage, two I.F. stages and push pull audio. It tuned to 24 Megacycles. I recalled that back in the early 1960's I had used a Philco chassis for my Ham receiver and that it was not a bad way to go at that time. "That time" meaning: I was young, I had no money, and I wanted to get on the air in the worst way. The old Philco chassis (a 1938 console) was just an old radio that cost me all of 5 dollars at a second hand store (sigh!). I built up a ten meter converter and was soon having a great time on ten meter phone.

That receiver has long since bit the dust, in fact, was probably thrown in the trash when I moved. Sure proof that hindsight is at least 20-20! It occurred to me that I could duplicate and much improve that old SWBC set "Ham" receiver using this Model 16 as the foundation.

I would have to add some features that the average SWL of old would not have cared about and were not included in the receiver. I would need a BFO, an R.F. gain control and an AVC on-off switch, but that seemed like all it would take. Actually that was only a good starting point. Later on, an S meter and a good bandspread were called for. I also wanted to retain the '30's vintage look. To provide room for the new controls and the



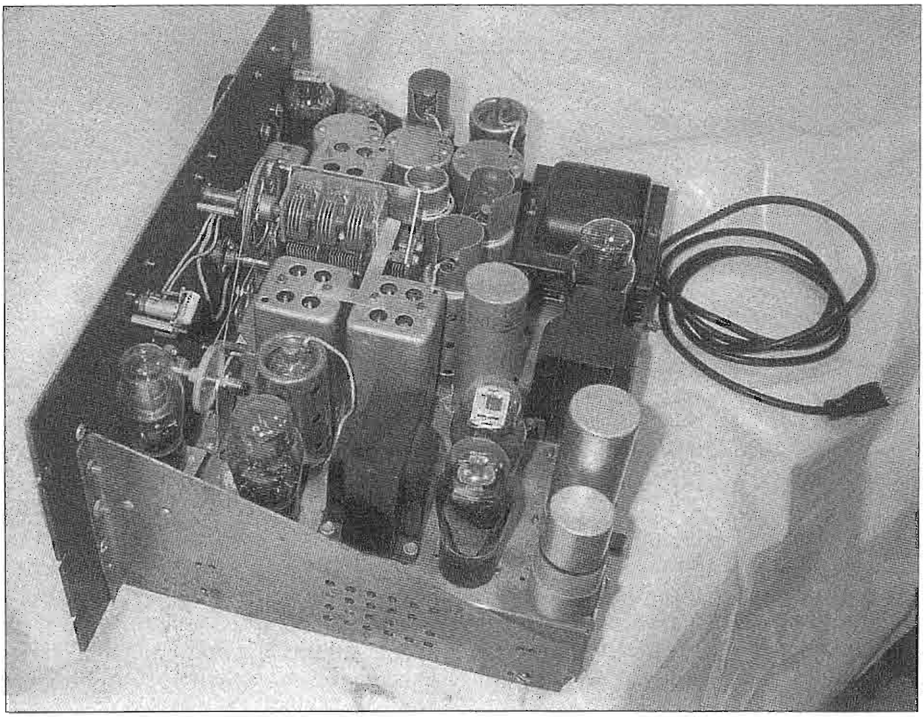
A front-panel view of my Philco-Pro communications receiver.



Another front view of the Philco-Pro receiver, made from a Philco Model 16.

meter, I went with a rack panel type of construction. I extended it out several inches in front of the original chassis and used side supports. I still did not have room for the flush mounted S meter and after much trial and error figured out a way to make it mount on front of the panel by pulling the meter out of the case and turning it around so the flange was on the rear. That way it looked like it was made to be mounted on a flat panel. The glass was removed and placed over the new "front" of the meter. It is easier than it sounds. See the photo. The band spread was added by using a three section variable from the junk box of about 15 pf per section, it is connected in parallel with the main tuning capacitor and "geared" by a pulley and dial cord arrangement from other junk box parts. Just a note here, old VCR's are a good source for gears, pulleys and belts etc. and they are mostly free for the taking. I used National Type B dials for the main tuning and bandspread and some National knobs with labeled skirts for controls.

But I am getting ahead of myself. The first thing I had to do was make the original chassis work. That was no easy task as it had been laying outside in the elements for several years in a sort of junk yard where I found it. I removed a considerable amount of rust and had to remove the tube shield bottoms and sockets in order to clean and paint them and the chassis area around them. I removed, opened, dried out and painted the transformers and chokes. I replaced all paper capacitors and electrolytics. I opened all the I.F. and coil R.F coil cans and replaced capacitors inside them and removed much dirt and spider products. Surprisingly enough, the thing did not turn out to look too bad. That brought on a twinge of doubt; maybe I should restore this to original and find a dial and cabinet somewhere. After checking with friends and searching the Internet, I found that this was not likely to work out anytime soon. I decided to continue with the original project but to keep in mind that no major modifications that were not reversible would be done, just in case, someday, I would like to bring it back to its original state. By this, I mean that I would not modify the chassis in a way that it could not be returned to as-built appearance. That, as it turned out was not difficult as there was really not much room to do otherwise as far as top of the chassis was concerned. I fired it up, it worked! I went through an alignment



A top view shows how the Philco chassis has been made to fit the new rack panel.

and all looked good, in fact it performed quite well.

The rack panel is actually made from a sheet of PC circuit board, also found at that junk yard years ago. It was easy to work and nice and thick. I finished it off with some light sanding and flat black paint.

Looking at the front panel you can see screw-mounted lettered labels. These were made on a circuit board engraving machine where I worked at the time. There are several other ways to make such labels, and that is one more thing that computers are good for, by the way. See the reference list at the end for more info on making tags, labels and dials etc. The added tubes, BFO and VR are mounted on "L" shaped brackets attached to the rack panel so as to not interfere with the original chassis layout.

The photos tell the story for the most part. Circuits for adding S meters and AVC switching and BFOs abound in handbooks and previous ER articles and should be no problem for anyone of moderate technical ability (and a good junk box). The end result is a real beauty (at least to my eye) and it performs quite well, even on SSB. I plan on pairing it up with a 30's style transmitter to be built at a later date. Many thanks go to Wayne (KE7EHD) and Roy (KA7NGT) for their help and input on this project.

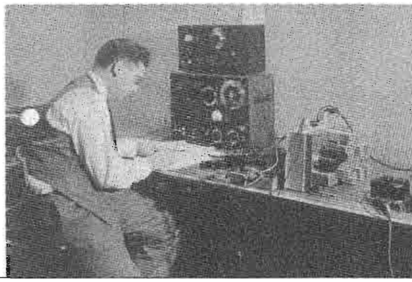
I wonder why the folks at Philco, and other makers of quality SWBC sets did not make communications receiver versions of some of their entertainment sets. I suppose that they just did not see the need, considering the size of that market, and that was too bad.

References:

Creating Meter and Dial Faces
ER Magazine #160, September, 2002
By Rich Bartoski, W3HWJ
Replacement I.D. Tags for Military Equipment, ER Magazine #141, February, 2001
By Doran Platt, K3HVG

ER

The Restoration Corner



The Restoration Corner can run only if your restoration topics are sent in for everyone to read!

Pinch Dial Drive Slippage

By Clark Hatch, WØBT

The pinch dial drive on my SP-400-X was slipping at the 100 mark on the Band Spread dial. After cleaning, and adjusting, it still has some slippage. After spraying a cotton swab with a small amount of Gunk belt dressing and applying a small amount of it to the pinch drive disks and the outer edge of the plastic dial, the drive has a very good grip and does not slip. It also provides some lubrication and makes the dial turn smoother. It seems as though this would work on National and other pinch dial drives as well.

Be sure to use a small amount so it does not get on the dial markings.

Neutralization for Class C Final Power Amplifiers.

By Bob Stout, WB9ECK

There are many ways to check and perform neutralization and all will get you in the ball park which most of the time is good enough. The following information will aid you in getting it exact. This is the optimum method for checking if your PA is truly neutralized.

Load your final amplifier stage into a dummy load (purely rfsistive) and do not use an antenna or reactive load of any kind. This includes so-called antenna tuning units in the transmission line between your final stage and its purely resistive load.

The dummy load on your final stage must be purely resistive at all radio frequencies simultaneously. A tuner network of any kind can not do this. A good dummy load is one of the best pieces of test equipment you can own. It will tell you many things.

When you dip your plate current with the plate tuning capacitor and adjust your loading capacitor for the normal amount of plate current and power output into a dummy load you are ready to begin checking for proper neutralization.

When a final stage is 100% properly neutralized the following will simultaneously occur as you swing your plate tuning capacitor back and forth through resonance.

1) Final plate current will dip or go to minimum.

2) Final control grid current will peak or go to maximum.

3) Final power output as seen on a wattmeter into a dummy load will go to maximum.

4) Final screen current in the case of a multi-grid tube will peak or go maxi-

mum.

As you tune your plate tuning capacitor back and forth through resonance ideally you will see the above readings on your meters. If you see an increase in final control grid current as you decrease the value of your final plate tuning capacitor (high side of resonance) your amount of negative feedback is too small and you need to increase it either by increasing the value of your neutralization capacitor or whatever means you are using for obtaining negative feedback.

If final control grid current goes up as you increase the value of the final plate tuning capacitor (low side of resonance) you have too much negative feedback and need to decrease the value of neutralization capacitor or whatever method you are using to control negative feedback.

When you have the correct amount of negative feedback your final grid current will peak and fall off on both sides as you pass back and forth through resonance with the final plate tuning capacitor. Your final plate current will also dip and increase as you rocker your plate tuning capacitor back and forth through resonance. At this point your final stage is 100% truly neutralized and at maximum stability.

Remember to shut off the transmitter and allow sufficient time for the supplies to bleed down before getting inside to make your neutralization adjustments. In most transmitters one side of the neutralization capacitor is at full plate potential.

Trial and error will get you there!

Stuck Control Shafts

By Tom Macellino, W3BYM

Recently I won the bid on a HP 180T [spectrum analyzer] mainframe from Ebay. Everything worked fine except the focus control required a Stilson wrench to turn. What happens with old gear, whether commercial or amateur that hasn't been used in a long time, is the grease or oil within the control dries out and makes the control shaft difficult, if not impossible, to turn.

Having dealt with this issue on other gear I knew what to do. All you need is a small soldering iron in the 60 Watt range, non-gumming oil, Allen wrenches, a pair of pliers and a tooth pick.

First remove the knob, or in this particular case it was two knobs, the smaller being a beam-finder button. This button required the smallest of the small in Allen wrenches, but I finally found one in the tool box.

Next apply the heat from the iron for ten seconds first to one side then the other directly on the metal shaft. Best results are when the iron is placed very near the retaining ring. With the pliers you can slowly start to move the shaft and with repeated heat the shaft soon turns freely. To complete the job apply a drop of non-gumming oil with a tooth pick. I used commercial gun oil and this gives very long life. In one other case, I had a Yaesu 757 transceiver and the main tuning control was absolutely stuck. I treated this problem a little different. Once again using a tooth pick I applied a few drops of WD-40 and let this sit for a few hours. Then the pliers were used. In this case I elected not to use any heat. After making little progress with the pliers, I resorted to an electric drill with a smooth speed control. The shaft was the standard ¼ inch and protruded out far enough for the chuck to grip. Using only hand tightening of the chuck to preserve the shaft, the drill was started and maintained at very low speed. This sure made easy work of the problem and within a few minutes of continuous turning in both directions and a few drops of oil, the knob on the shaft soon spun effortlessly.

ER

The Skylark Radio Receiver

By Bob Dennison, W2HBE
82 Virginia Avenue
Westmont, NJ 08108

The Skylark radio receiver was designed to appeal to the beginner who is looking for a simple set that is low in cost, safe to use, and easy to build. To keep costs down, I eliminated the power transformer and the filter choke. This also helps to reduce both size and weight. To insure safety for the user, there is no B+ voltage on the headphones. In many sets which operate from the 117 volt AC line, there is some danger of an electric shock so this has been avoided by equipping this radio with a three wire AC cord set. Here the third wire automatically grounds the chassis of the radio as soon as the cord is plugged into a standard AC outlet. CAUTION: Do not attempt to defeat this safety measure by using one of those two-prong adapters.

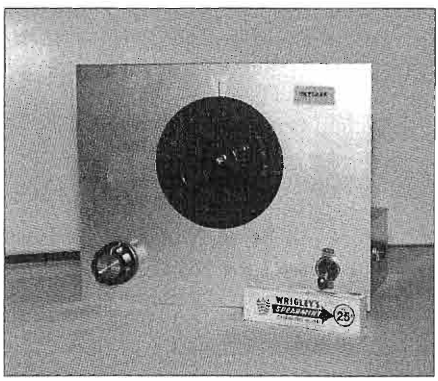
Incidentally, don't be shy or hesitant about building your first radio. This is a very old hobby and many top engineers and scientists got their start this way. I just saw an article in the November, 1934 issue of Radio Craft magazine where a licensed Ham radio operator reported that he had built a 1-tube radio and was pleased with its performance. I've been building radios since 1932 and its still fun. I hope that you find the radio-building hobby as enjoyable as I have.

The Circuit

The Skylark uses two tubes that were designed for use in portable battery sets. Since both the plate and filament current requirements are very low, a simple half-wave rectifier can easily supply these needs. And because the current required is so low, it is easy and inexpensive to provide adequate filtering.

The complete circuit of the radio and its power supply is shown in **Figure 1**. Old timers will recognize the detector circuit, V1, at once. It is a classic regenerative grid-leak detector using a tickler coil for feedback to obtain extra amplification. Tuning is accomplished by means of C1, a compact 365 pF variable capacitor. Back in the 1930's, we went to a radio repair shop and bought one that had been removed from an old farm battery radio. Cost back then was about 25 cents. Today you can still get one, but it will be much smaller physically and it will cost you about $12 plus postage. Check the ads in ER. The 10 mH RF choke is one I found in my junk box. You will find a similar one in the Mouser catalog that sells for $1.05.

The second tube, V2, is the audio amplifier. Its job is to amplify the output of the detector until it is sufficiently strong to be heard in the headphones. In order to do its job, V2 operates at a higher power level than the detector. Its plate current is a little over one milliamp. To limit its plate current to the desired level it needs a grid bias of about -6 volts.



Front panel of the Skylark receiver

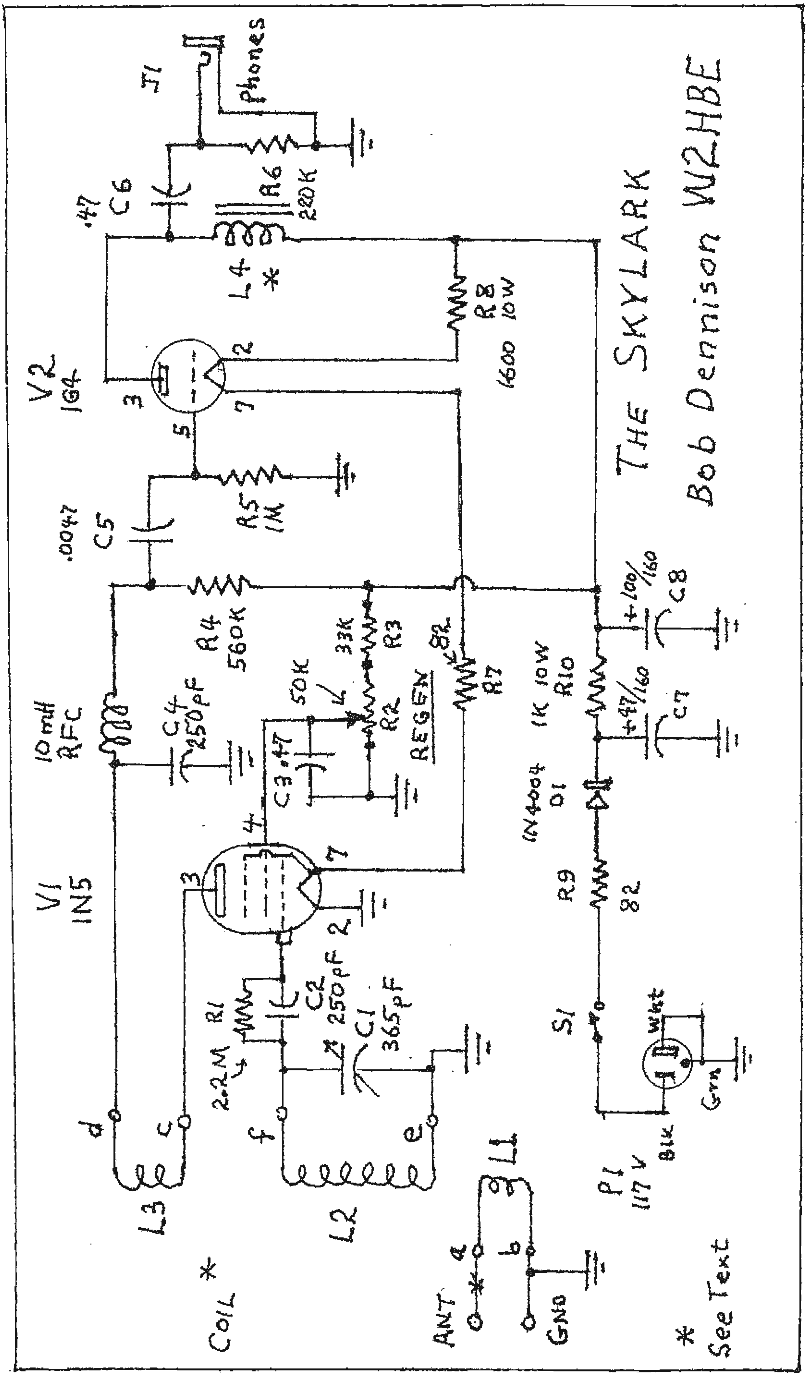


Figure 1: Complete schematic of the Skylark radio receiver

Rather than use a bias battery we can simply raise the voltage at the center of the filament of V2 to +6 volts. This is done by inserting R7 in the filament circuit. The voltage drop across R7 plus the filament voltage of V1 gives us the desired bias for V2.

Both plate and filament power is provided by rectifying the AC line voltage by means of diode D1. Input surge current is limited by R9 and filtering to pure DC is done by C7, R10 and C8. Filament current is set at 50 mA by R8.

I don't like getting an electric shock when I touch my headphones so I inserted L4 and C6 into the plate circuit of V2. You can use any small filter choke at L4. You can even use the primary winding of a small filament transformer. In the old days we used the primary winding of an audio transformer but today these are very scarce.

The Coil

You will need some wire and a form on which to wind the coil. In the old days we used the cardboard form that previously held bathroom tissue. Today, if you want to get fancy, there are bakelite coil forms that plug into a tube socket. Most of these come in the 1.5 inch diameter size. But don't worry; we are going to use a plastic pill bottle that can be obtained from nearly any drug store. My pill bottle was 1 ½ inches in diameter and after the top lip or rim was cut off the form was three inches long. Tell your druggist what you are doing and he (or she) will probably give you a bottle free of charge. Be sure to take a ruler with you when you go to the store.

Refer to **Figure 2** for details of how the windings L1, L2 and L3 are arranged on the coil form. On my coil I used #28 enamel covered wire. At each end of each winding I made tiny holes in the coil form through which to pass the wire. I use two holes, one to pass the wire into the form and then another ¼ inch away to bring the wire back out. I use a #55 drill bit to make these holes.

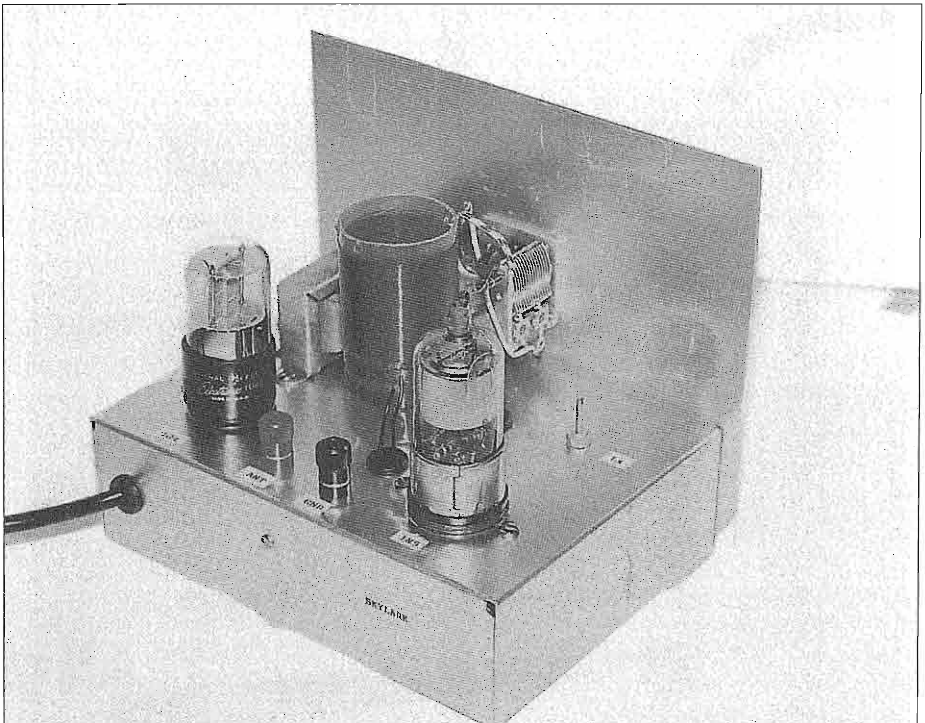
The main winding, L3, is 1½ inches long from top to bottom. Then leave a space of about .1 inch and wind L2 giving it 20 turns. Finally, leave another .1 inch and wind L1 giving it 13 turns. The letters A to E on this drawing must agree with the letters on the coil drawn in Figure 1. A common mistake often made by beginners is to reverse the connections to C and D. If this occurs, the set will not regenerate and volume will be very low.

Construction

My Skylark was built on a 5x7x2 inch aluminum chassis, a Bud AC-402. The front panel is .062 aluminum and measures 6x7 ½ inches. The panel is attached to the chassis by means of the regeneration control and the on-off switch. These are located one inch in from either edge of the panel

There are two different methods for mounting the tuning condenser. If you are handy with tools you can tap the holes in the front face of the tuning condenser and then mount it with three 6-32 flat-head screws. You will need to be very careful so that you don't damage either the rotor or stator plates. If you are a beginner I recommend a much easier and safer method and that is to simply glue the condenser to the panel. Drill or punch a 5/8 inch hole to accommodate the slight hump or boss on the front surface of the tuning condenser which encircles the rotor shaft. This hole should be 2.5 inches down from the top of the panel. You can use Radio-Shack All-Purpose Adhesive No.64-2302 to glue the tuning condenser to the panel. Follow the directions on the package and let the glue set 24 hours.

The tuning dial should be about three inches in diameter with 0-100 calibration marks. I used an old Atwater-Kent dial. The index mark is drawn on white paper and glued to the panel. After your set is finished and working you can draw



Rear view of the Skylark

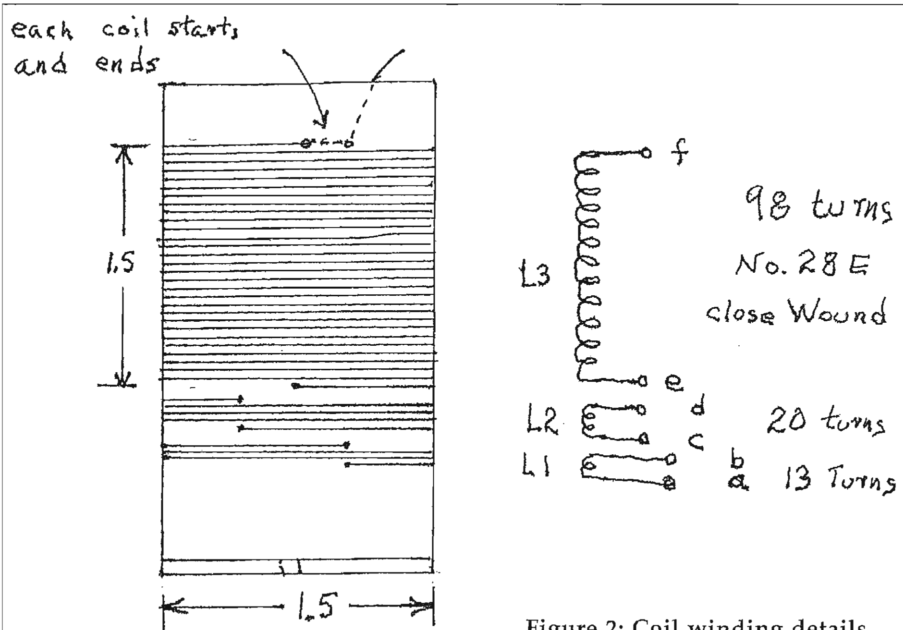
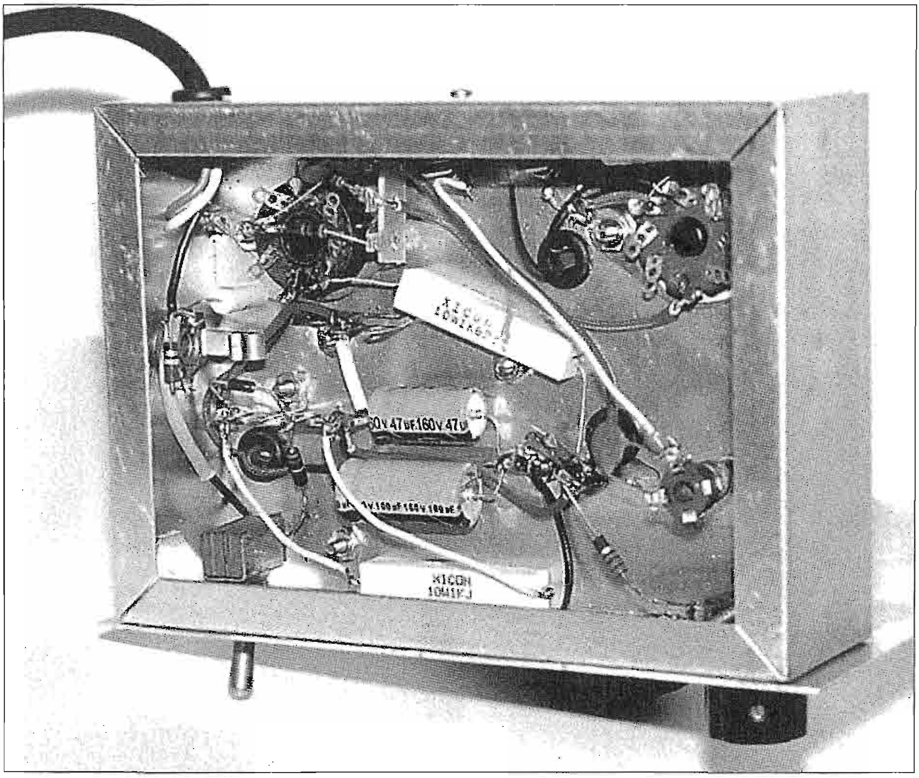


Figure 2: Coil winding details



This bottom view of the Skylark shows the component placement of the parts.

up a log sheet showing the dial setting and frequency of each station you regularly listen to.

Conclusion

After all assembly and wiring is completed check it very carefully. Check the filament wiring again. You don't want to burn out those precious tubes. If you have a radio friend, ask him to check your wiring. Now comes the moment that you've been waiting for. Plug in the headphones. Connect the antenna and ground. Plug the AC cord into a 3-prong outlet. Turn the regeneration control slowly clockwise. You should hear a "plop" or a slight "hiss" as the detector breaks into oscillation. Turn the tuning dial and tune in a station. Reduce the regeneration until the squeal goes away. Carefully adjust the tuning for clearest reception. Enjoy! You are now the proud and happy builder of a Real Radio!

NOTE: If you live near a 50 kW broadcast station you may need to add a wavetrap to eliminate interference from that station. Select a coil, Lx, and a capacitor, Cx, which together will tune to the frequency of the interfering station. It is helpful if either Lx or Cx is variable so that the trap can be tuned to the exact frequency required. Don't be afraid to experiment.

ER

Breadboard Construction? Why Not? It Sometimes Is A Logical Solution!

By Bruce Vaughan, NR5Q
504 Maple Dr.,
Springdale, AR 72764
NR5Q@aol.com

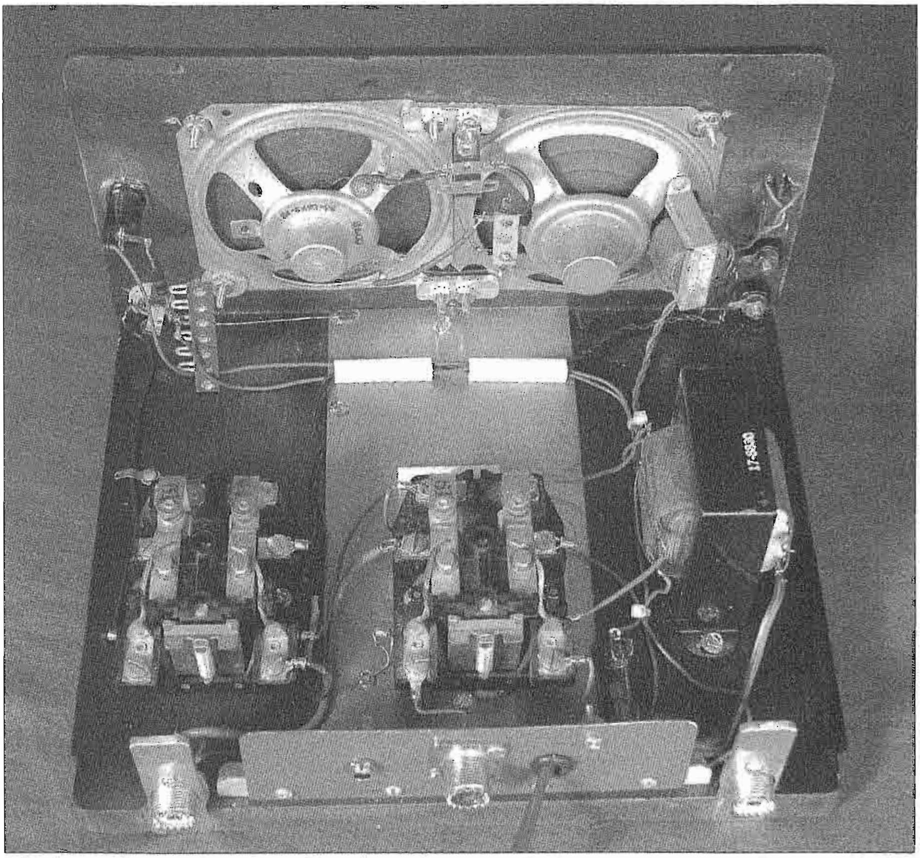
Once the most popular method of radio construction, the breadboard has slowly lost popularity among builders. When we learned of the many advantages offered by using a metal chassis, and became more skillful when working with this new method, breadboard construction articles become as rare as O1A tubes.

Before we go any further into this little story I should remind readers that this is not a how-to-do-it construction article, but rather a story of a need recognized, and the problem solved. Use of breadboard construction in this project kept the cost to a minimum, cut the time spent building by at least 50%, and enabled me to make use of a nice aluminum cabinet that had been gathering dust for years waiting for some practical use.

The need: My mail over the past few years from those who have built regenerative receivers described in articles by Electric Radio authors, often mentioned that their next project would be a simple transmitter from the 30's or 40's. Often I was asked if I had a coax relay for sale, or if I knew where they could buy one. Such relays were once commonplace, but with the advent of the modern transceiver some forty plus years ago their use was no longer needed. For a time in the 60's and 70's coax relays could be purchased at hamfests for two bucks, but today they fetch sky-high bids on ebay—often going as high as $25.00—sometimes more.

Switching from send to receive is not easy when using homebuilt separates. I remember my first station required throwing three switches to make the change. If you are using a common antenna for both the transmitter and receiver you must first have a method of switching the antenna—hence the use of the coax switch. However, this only meets one need. You also need a foolproof method of keeping transmitter RF out of the receiver. It is a good idea to ground the antenna input to the receiver while transmitting. Ideally, such a change over should be activated by the plate supply switch to the transmitter. Thanks to DPDT switches this is not a problem. Now the question arises, just how do I intend to accomplish this? You can either furnish some sort of power such as 120VAC activated by the plate switch or, as I prefer, simply use it to complete a circuit to ground.

Now, if you use either an electronic keyer or a 'bug' you probably need some sort of side-tone generator if you have any consideration for the fellows you intend to QSO. Just because the electronic keyer completes dashes does not mean it makes your sending readable. Quite the contrary—tune across the CW bands anytime, day or night, and I promise you within a few minutes you will hear a Ham using an electronic keyer send the following—"the nag here is." The Ham will then proceed to his own name—not the name of his wife. Recently I was surprised when I sent a CQ on 40-meters in mid afternoon, and received a reply from a JH. It took me several minutes to discover I was working a W6. If the sender had been listening to his own signal he would have noticed he was starting the '6' before his


My breadboard interface box has the coax fittings, relays, speakers, and the power supply mounted at convenient places around the board.

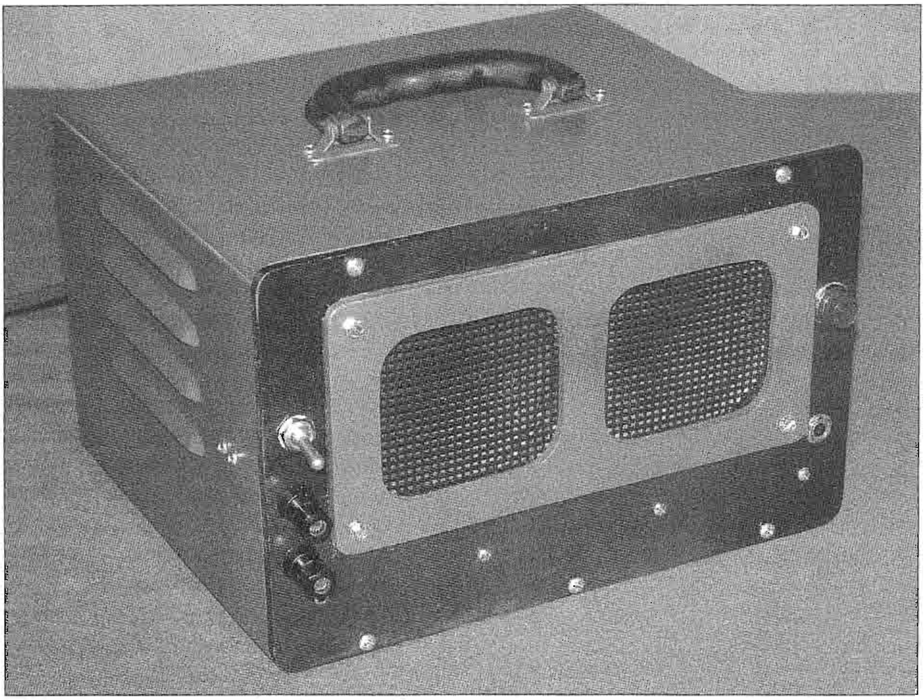
keyer had completed the letter 'W.'

While some Hams still prefer the use of headphones instead of a speaker, most do not. I prefer a speaker because while listening to the fellow I am in QSO with I am free to roam around the shack and do any number of things that need attention—such as dusting radios, filing magazines, or even building on another piece of Ham gear.

It would be convenient to have a small interface between the receiver and transmitter that incorporated the following into a single box—a speaker, an antenna change over relay, a grounding relay for the receiver input, a method of keying your transmitter, and monitoring your own fist.

The solution: As usual, I started my project by sketching several schematics. With a circuit more or less finalized in my mind I next began a systematic (read—completely random) search of my junked parts.

I soon came across several brand new Potter and Brumfield DPDT heavy-duty relays. Some years before I found this treasure trove of relays at a local hamfest, and bought the entire lot for not much more than the retail price of one relay. I suppose there was more than a dozen in the lot. I have used several of them in kW linears, and knew they were excellent relays, though they are rather large and



This is the front panel of the interface box. The power switch and binding posts are to the left, the speaker grilles are centered, and a pilot light is on the right.

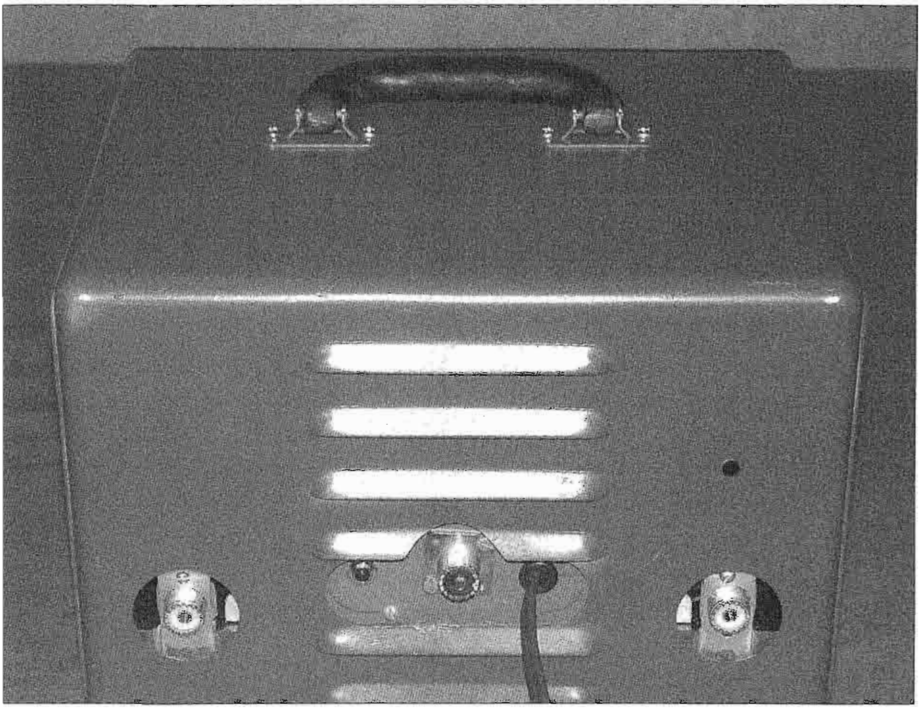
noisy. Some of the relays had 12-VDC coils, some 120-VAC coils, others had 24-VDC coils, and I found TWO with 12-VAC coils. I prefer working with DC relays, however using the AC type would eliminate my need of a rectifier circuit.

The next item on my search was a 12-volt transformer. I soon found a brand new transformer that would handle a dozen such relays with ease. I hooked the transformer up to a relay, connected the AC line, and let it cook. All appeared well, absolutely no chatter, no hum, just a good loud 'clunk' when activated.

Apparently I was on my way. About this time I spotted a long unused aluminum case that at one time housed some sort of test gear—I forget what. The hamfest price was still on the gray metal cabinet. On a three inch strip of masking tape someone had written $10.00 in big black letters.

Long ago I had stripped the unit for parts. An attractive, undamaged aluminum case was all that remained. I inspected the case and decided that with only a small amount of hole cutting and filing, I could use the box for my project. However, if I used this case it appeared I would need to buy a metal chassis—a $20.00 investment today, PLUS another $8.00 for postage. Then I had the problem of finding a piece of heavy aluminum for the panel. I could have one cut, but then I would need to factor in another $15.00. Very quickly I could see about $50.00 in my project before I even got started.

Then an idea began to take shape—why not use a breadboard, and a scrap of plywood for the panel? As I pondered this approach I found a small problem. Due to the method of attaching the panel, it would be necessary to raise the breadboard above the bottom of the chassis. The problem disappeared when I real-



The coax fittings and the power cord were placed on the breadboard to mate with the existing openings in the aluminum cabinet found at a hamfest.

ized that all I needed to do was screw a ¾ inch piece of wood to the 'floor' of the cabinet.

What about the side tone? In the interest of keeping it simple I decided to use an inexpensive Radio Shack high frequency buzzer. I found one that works with voltages from 7 to 12 volts DC. More about this later....

Construction problems: There really were no problems. All parts came from my junk box except the buzzer. I found during an initial trial run that I do not need a sidetone circuit. The heavy relay, mounted solidly on the breadboard, and enclosed in the cabinet, sounds somewhat similar to old Western Union and railroad telegraph sounders. For a period immediately after graduating from High School I worked for Western Union as a trainee. I have no trouble reading the sounder. Honestly, I find the clattering relay sound to be pleasing to my ear. Actually all I need the monitor for is to make sure I am not sending a 6 for a B, or some putting four dots in the letter 'S.'

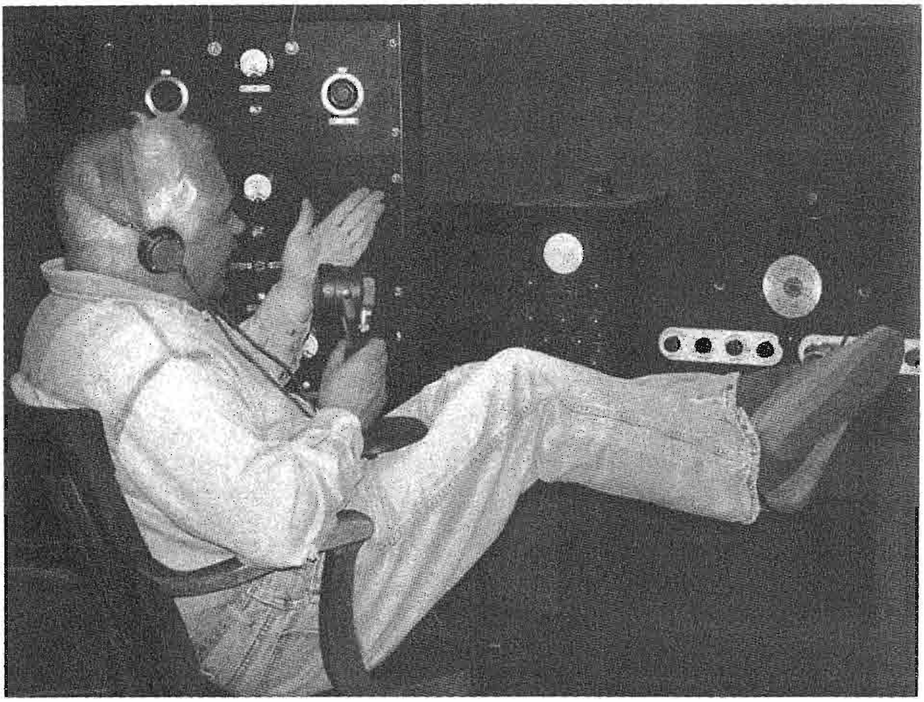
I will go ahead and install the buzzer for whoever comes along in later years. For my use I will never solder the final joint. Then again, it might be a good idea to finish it, and put a switch in the buzzer line.

I have attached enough pictures to this little story to illustrate the advantages of using a breadboard on some projects—especially smaller ones. Give a thought to the advantages of the old breadboard. It can still serve a purpose in the modern Ham shack. Should you have any questions please do not hesitate to ask. E-mail is normally answered within hours. If you request information by snail mail a SASE is much appreciated.

<u>ER</u>

The Last QSO

By Gary Halverson, WA9MZU
503 Jessica Ct.
Mokelumne Hill, CA 95245
ghal@ix.netcom.com



It's 1956. Gramps is lamenting over having recently sold his 20-year old 1936 RCA station.

"Dang nabbit, I hated to do it. Kinda broke my heart to sell the RCA stuff, but that young whippersnapper really wanted it. After all, he was born the year the stuff came out and his daddy was the chief engineer at a Texas radio station that used all RCA stuff. Be a cryin' shame to disappoint the lad. Besides, that Collins bug has done got in my blood.

Yessir, had many a nice QSO on that ole rig."

Suddenly all expression evaporated from Gramps' face. He slowly pushed himself up from his chair grunting under the pain of his arthritic joints and slowly walked over to his operating position. Reaching to a top bookshelf, he pulled down the April, 1936 issue of QST magazine. As he opened the magazine a QSL card bookmark fell to the floor. His eyes slowly moved to top of the page and he began reading:

"Fog lay low on the hilltops of the east. The middle west groaned under its fourth successive blizzard in as many weeks; the air lines were grounded; a Canadian crystal-gazer prophesied the end of the world; the Supreme Court said the TVA would get by; Haile Selassie was reported suing for

peace. That week in middle February the heavy hand of the Great Operator reached out and threw the switches that meant QRT for those two grand old men who were the much loved leaders of the American Radio Relay League, Hiram Percy Maxim, our president, and Charles H. Stewart, our vice-president. Thus passed into immortal history the man who founded our society and gave it its name and who has been constantly our leader and our inspiration, and the man who was our legislative expert and who gave of his services in a fashion never excelled in our annals.

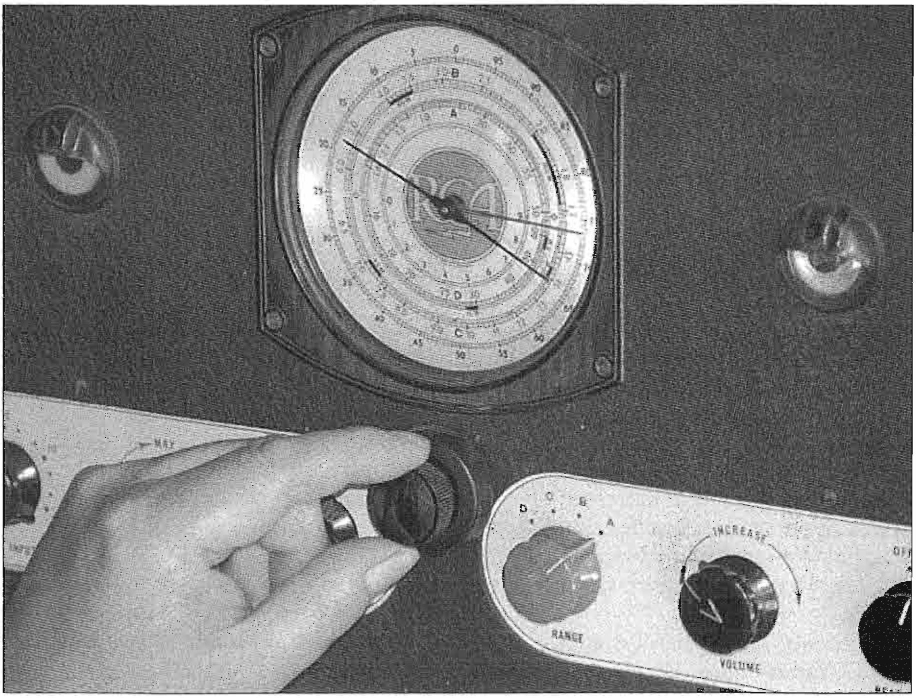
It is with an impossibly heavy heart that we address ourselves to the sad task of chronicling in these pages something of the debt that amateur radio owes these two men. As we sit before our typewriter we wonder whether, in the sorrow we feel, it will be possible for us to find anything like adequate words. That they should leave us at the same time is an appalling loss. It is the loss of friends and of wise and experienced leaders, of men who had the vision clear, a loss that will be felt through the entire structure of amateur radio."

Gramps looked up for a moment, inhaled sharply, then bent down to retrieve the fallen QSL card. Glancing at the large black type 1AW sent a shiver down his spine.

He remembered the day as if it were yesterday. The sparkling new ACR-175 receiver was barely a month old. 20 meters was wide open to the east and signals were pounding in. As he tuned into the phone band, he heard an incredibly loud W1 calling CQ. The signal was so strong it completely closed the green circle in the Magic Eye. Gramps decided he'd give him a call so he flipped the plate switch on the ACT-200 on and called him.

The W1 came back right away and gave Gramps a 5-9-plus signal report. They got to yackin' and found they both started out in Ham radio the same year. They were also the same age. As the QSO progressed, they found themselves reminiscing about the early days of radio.

Gramps recalled gettin' bit by the ra-



dio bug. It was in 1916 when he was 36 years old. A relatively "old man" coming to the hobby, he somehow got stuck with the nickname "Gramps" and never could shake it. Fortunately, he had learned code as a boy when he and his friends communicated over a primitive telegraph set they had set up between their houses. Picking the code up again came easy.

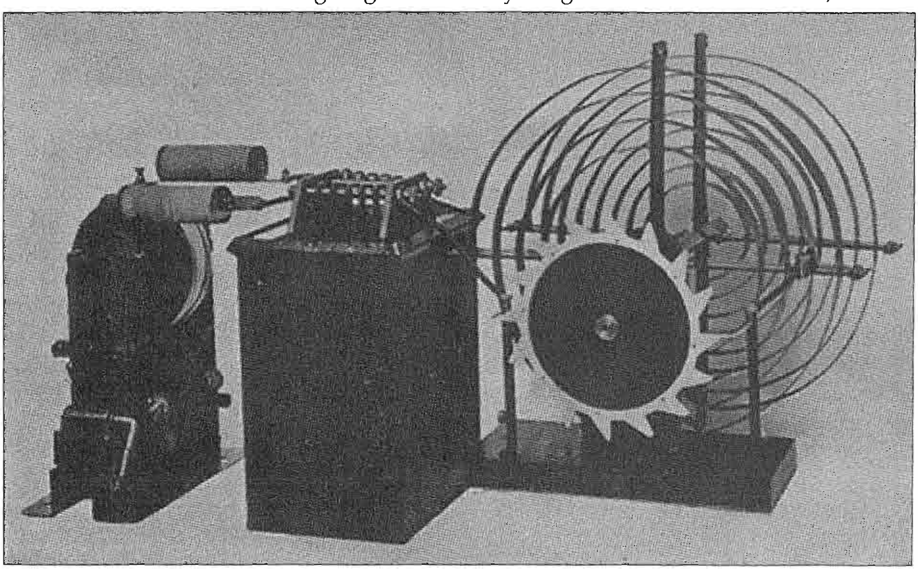
His first rig was a Ford spark coil and a fixed gap and a loose coupler for a receiver. Everybody operated on the same frequency, 200 meters. But DX then isn't what it is now. Even the big 1kW the spark stations used typically had a range of only a couple of hundred miles at night, so any long distance work on 200 meters wasn't in the cards. Because he lived on the West Coast, DX for him was listening to ships at sea at night up around 600 meters.

For Gramps, QST magazine was on the scene from the start. Back in 1916 a subscription was $1 a year. Every month when a new issue arrived, he'd read it cover-to-cover absorbing everything like a sponge. He studied intensely the photos of the stations appearing in the Amateur Radio Stations section going over every square inch with a magnifying glass. He'd go to bed at night with his head swimming with images of Clapp-Eastham rotary spark gaps, Thordarson 1KW transformers, Acme transmitting condensers, Audion detectors, Murdock headphones and Arnold loose couplers.

But operating was chaos. Every town had it's "radio bully" who ran high power and muscled out the little guys. Fist fights between Hams were not uncommon.

It was Hiram Percy Maxim who brought order to the chaos. Getting started with radio in 1910 through the interest of his son, Maxim was over 40 years of age when he learned the code. When amateurs were required to be licensed, Maxim was 1WH, then after the war became 1AW.

It was said that in 1914, the number of stations, equipment sophistication, and traffic handling techniques were in place at an estimated 10,000 stations. All that was lacking was national organization. Maxim foresaw the need for national unity in amateur matters and through envisioning a nationwide relaying network, launched the American Radio Relay League with Clarence Tuska, a smart



A Thordarson spark transmitter from 1919

young lad from Hartford. That was in 1914. By late 1915, QST magazine was started as the glue to hold the organization together and promote amateur radio.

The ARRL, under Maxim, organized traffic routes across the country into a series of "Trunk Lines" each designated with a letter of the alphabet. Each line contained typically one to two dozen dedicated relay stations.

Of particular interest to Gramps were the Seefred Brothers, 6EA in Los Angeles who were District Managers of the Pacific Coast Trunk Lines, B and F. They used a one-half kW transformer with a rotary gap and were partial to pancake oscillation transformers.

Trunk Line F ran from San Diego to Vancouver, B.C. and involved 18 stations over the span. Trunk Line B ran from Reno to Cape Girardeau, Missouri.

Every month, QST had a Monthly Report of Trunk Line Managers, and the Seefred Brothers listed the cities along the Pacific Coast route along with the call signs of the official relay stations for that city. Cities without an official relay station had a question mark. The Seefred's report would end with "We would be pleased to hear from anyone who can fill in the places marked (?)." Potential relay stations were asked to write to the District Managers giving data as to their stations and the range they have actually covered. Gramps aspired to replace the "?" for his town with his call sign, but lacked a powerful enough spark transmitter to do the job and could only listen for several months, copying traffic well into the wee hours of the morning.

Of all the material presented between the covers of QST, Gramps was fondest of the "Rotten" articles by T.O.M. (The Old Man, who was really Maxim). There was Rotten Construction, Rotten Sending, Rotten Relaying, Rotten Ground Leads, you name it, if it was a problem in the realm of radio, The Old Man "rottenized" it. These Rotten Stuff stories would start out something like "While I am waiting for the two little boys with the spark coils to get through asking each other how they come in, let me tell you about what happened the other evening at a certain Radio Club meeting." T.O.M. would then deliver a

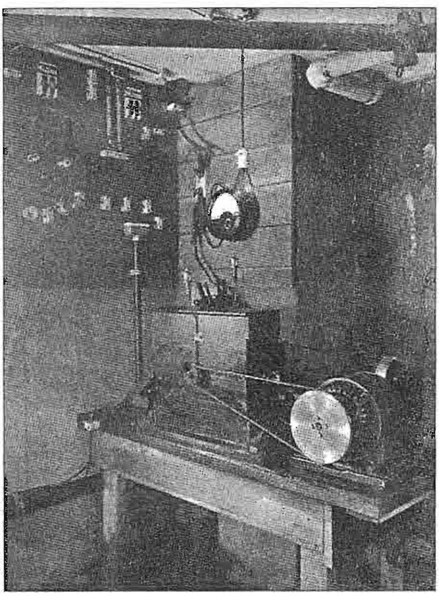
The Seefred Brothers, Lyndon and Howard

lecture that would end leaving no doubt whatsoever in your mind about the right thing to do on that subject.

Both Gramps and the W1 had a good laugh about T.O.M.'s mysterious Wouff-Hong, a strange instrument presumably from an ancient secret order used to ceremonially break the fingers of bad operators thereby sparing the brotherhood from having to listen to the offender's terrible fist. Then again, some folks believed it could be used to eliminate QRN and QRM.

The W1 talked about 1AW's old spark station. T.O.M. called her Old Betsy and she was famous throughout the countryside for her distinctive tone. She had a half-horse motor belt-coupled to her rotary gap that spun at 8,000 rpm. She could be heard almost every night from seven o-clock to one AM. Like some kind of hideous fire-breathing demon, they kept her in a box in the cellar at 1AW to minimize the racket from the arcing on the rotary gap and to contain the flames.

And then there were the "transcons". The object was to relay a message from coast-to-coast round-trip in the shortest



Old Betsy

possible time. Gramps remembered the record for quite a spell was six and a half minutes with 1AW the eastern terminal.

Over time Gramps felt like he knew T.O.M. The Old Man was a friend, a mentor, and a father figure all in one. Maxim stood for the very highest principles in everything. When Gramps first started in radio, he remembered it was Maxim who fought the first battles for amateur radio. He went before the Commissioner of Navigation in late 1914 to secure the concession of using 425 meters for special long-distance relay work. Then, in 1918 after the end of the War, the Navy wanted to control all of radio. Again it was Maxim and his American Radio Relay League who got the wartime ban lifted and orders issued permitting the resumption of amateur radio in 1918.

Anyway, over the course of that glorious QSO, Gramps and the W1 covered pretty much the whole history of amateur radio. They talked for nearly two hours while propagation between them held rock solid. Then as Gramps turned it back to the W1, a loud "BREAK!" intervened. Gramps told the breaker to go ahead.

"Been reading the mail on you fine gentlemen for a few minutes and heard you talking about Maxim." The breaker's voice began to falter. "I'm sad . . . to have to tell you that . . . that Mister Maxim died today in Colorado.

Gramps reached over to the ACR-175 and switched it and the transmitter off that February 17, 1936.

That was 20 years ago and he never turned that rig back on.

As Gramps raised the QST magazine back up to the top shelf, he noticed the logbook he had dedicated to the RCA station. He pulled it out and opened it to the last entry. On that page he had copied the first verse of a poem entitled "On February 17" by VE3GG from the April QST. It read:

Across the jeweled curving dome of night
He flashed these words to me, "Maxim

. . . is dead."

And then his key was silent.

So was mine.

Feeling a little fragile, Gramps turned in for the night early. As he lay in bed, he reflected on how things have changed since the old spark days. With the new bands arriving in the mid-1920's and vacuum tubes coming to maturity the relay network was bypassed with direct point-to-point contacts. The vacuum tube era also brought phone operation into popularity.

As he slipped into the misty cosmos of dreamland, he thought of the young man who now had the old RCA rig. What would the next 40 years have in store for him?

Hiram Percy Maxim
1869 — 1936

Hiram Percy Maxim was a genius from a family of exceptional men. His father was

Sir Hiram Stevens Maxim, inventor of the Maxim machine gun. His uncle, Hudson Maxim, invented high explosives.

H.P. Maxim graduated from MIT's School of Mechanical Arts in 1886 the youngest member of his class. At the age of 17 he was a practicing engineer.

While he held 59 patents, he was best known as the inventor of the Maxim Silencer, which was conceptually used on guns, the exhausts of huge diesel engines, air conditioners and even a window-mounted unit that allowed ventilation while excluding street noise.

Maxim also designed the Columbia Gasoline Carriage, which won the first automobile track race ever held in America. That was in 1899.

His book "Life's Place in the Cosmos" created quite a stir when he suggested the possibility of life on other planets.

Maxim was also a pioneer glider enthusiast, an amateur motion picture photographer, an accomplished student of astronomy, and a retired lieutenant-commander in the U.S.N.R.

Hiram Percy Maxim was 66 years old when he died of a throat infection in LaJunta, Colorado while vacationing in the southwest with his wife. A remarkable and gifted daughter of a former governor of Maryland, his wife joined him on the other side a week later.

ER

The RF Ammeter

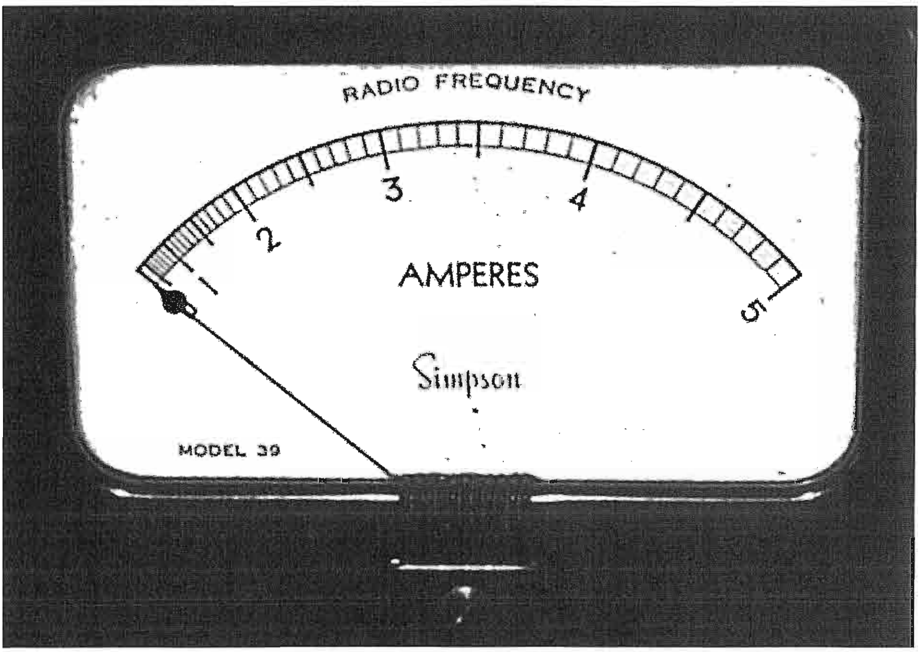
By Tom Marcellino, W3BYM
13806 Parkland Drive
Rockville, MD 20853
w3bym@fastdialup.net

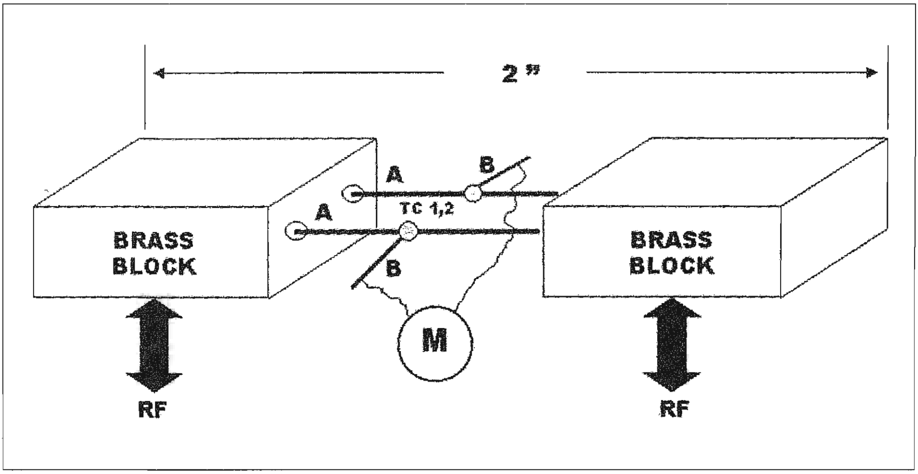
The use of the RF ammeter in conjunction with a known resistance has been used as one method to measure transmitter output power for a long time. I researched my collection of ARRL Handbooks dating back to 1930 and the first mention of the RF ammeter was in 1951. One other reference was found in the 1944 Radio Masters. Triplett Instruments sold Thermo Ammeters for high frequency usage. These meters used external thermocouples.

RF ammeters can be constructed using the common diode rectifier bridge, current transformer, or by using an internal RF connector with a thermocouple among other methods. This article will address the self contained internal RF connector with a thermocouple type.

Thermocouple RF ammeters are self contained, only requiring the RF connections and mounting. A brief explanation of the thermocouple and how it works may be helpful at this time. A thermocouple is made from two dissimilar metals. Typical metals are iron-constantan or copper-constantan (Type T). At one end the metals (wires) are joined together either by soldering or welding. The other ends of the wires are connected to a measuring device like a voltmeter or panel DC current meter.

The thermocouple is an efficient means for measuring temperature because it produces a voltage which is a function of temperature. When the thermocouple wires are connected to the measuring meter a voltage will be read that is proportional to the temperature at the other end of the thermocouple wires. The ther-





Component layout of a typical RF thermocouple

mocouple is a nonlinear device therefore the measurement instrument (meter scale) will be compressed at the low end. One would think this is all that is involved for an accurate measurement. But by connecting the two thermocouple wires to the meter you have now created two more thermocouple junctions (dissimilar metals) that will generate additional error voltages.

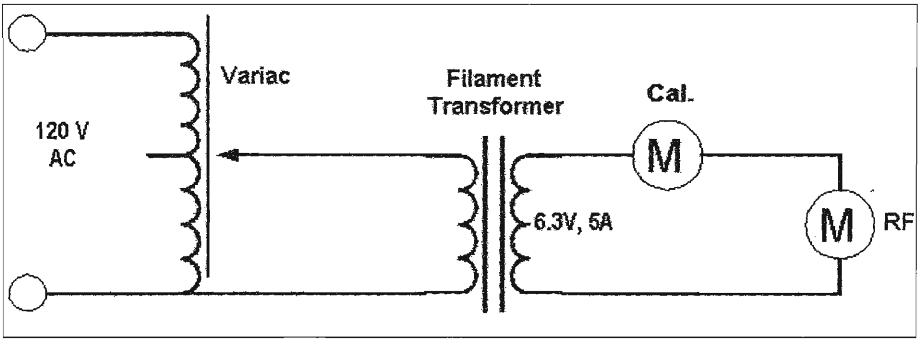
To maintain the accuracy of the reading, things now become complicated. The use of an ice bath with another reference junction (thermocouple) is used to stabilize the reference junction at a constant temperature. The use of the ice bath or the use of internal compensation networks is how laboratory scientific temperature measurements are made. To continue this discussion would be of no benefit for this article. Suffice it to say that all these exotic methods are not employed in the thermocouple RF ammeter.

What I have found after dissecting a few of my test samples is the use of two thermocouples attached to internal RF connectors, or feedthroughs. The connector wire is one half of the thermocouple. This configuration seemed to be the norm and most likely using two thermocouples provided for internal error compensation. For stability, two small brass blocks separated by about 1 inch are bridged with RF connecting wires. The other thermocouple wire is then welded to these wires and routed to the meter movement.

I was surprised at the number of Hams who don't use a RF ammeter in the line for one reason or another. One reason would be you don't really need it to transmit or receive and transmitter power can be measured with an inline power meter. I've used a permanent inline RF ammeter for several years and find it very useful in conjunction with my 2.5 kW dummy load for measuring the output power of any of my transmitters.

Thermocouple RF ammeters are not expensive and typically can be had for 10 dollars at the hamfest. Beware, because you can purchase a dud. Often the internal RF connector and thermocouple have been destroyed, rendering the meter useless. Once this happens the meter is virtually impossible to repair.

Since the internal RF connector is a very low resistance wire, less than one ohm, you can measure this with an ohmmeter or continuity tester before you make the purchase. Sometimes the meter may appear to contain the internal RF connector and thermocouple, but doesn't.



Schematic diagram of my RF ammeter test circuit

There isn't anyway to tell without opening the meter. So another suggestion is to ask the seller if the meter has the internal parts. The meter scale may say 0-5 RF Amperes, and if it doesn't have the internal connector and thermocouple its terminals will go directly to the sensitive D'Arsonval movement and could be damaged by external continuity testing.

Another interesting fact is the RF ammeter isn't polarity sensitive. In other words it doesn't make any difference which terminal is connected to either the transmitter or antenna. Since the RF is only used to heat the internal RF connector, direction isn't a concern. The internal polarity for the meter movement is determined by the thermocouple wire types. Remember now, we are not talking about large amounts of heat on the connecting wires, or large voltages being generated from the thermocouple. For instance, a 3-amp meter at full scale will see about 30 mV at the thermocouple.

I have several thermocouple RF ammeters in the "laboratory" with various ranges. Of the seven test samples, I knew all the internal RF connectors and thermocouples were OK, but it would be a real pain to mount each one with SO239 connectors in a box to verify the scale calibration. So I started experimenting with high current AC and DC sources as a substitute for RF current. The test circuit consisted of a Variac, a filament transformer, a diode bridge, and a filter cap. The test current, be it AC or DC, was measured using a calibrated current meter in series with the test RF ammeter.

To make a long story shorter, using DC as the source is not the way to go. Large errors upwards of 47% full scale were read. On the other hand, using 60-Hz AC as the source produced errors of less than 3% full scale which are good enough for me. So now we have a very simple method to verify the scale calibration of the thermocouple RF ammeter. Remember, I said "verify" and not "calibrate." Calibration implies some physical adjustment for compliance.

With a thermocouple RF ammeter there is nothing to adjust, except the normal zero adjustment, so you are left with scale verification only. For example, the RF ammeter needle may read 3 amperes but the actual current may only be 2.8 amperes. There is nothing you can do about the error except keep a mental note of the inaccuracy of that particular meter.

Since thermocouple RF ammeters have compressed scales you will want to pick the correct full scale reading for a particular power level transmitter. A reading in the upper two thirds of the meter is preferred. A 4-ampere, full-scale meter will work well for a 375-Watt carrier but will just barely move the needle with a 25-Watt carrier.

Mounting of the meter requires some special attention. Since it will be connected to the RF transmission line shunt capacitance must be kept to a minimum. This shunt capacitance is created between the grounded metal panel and the meter's internal electrical parts. This is easily solved by mounting the meter to some insulating material then mounting this to the metal panel. In actual practice I've experienced no meter errors due to shunt capacity when the meter is mounted to a grounded metal panel at frequencies of 7 MHz and lower.

The thermocouple RF ammeter can be left in the line all the time as I do, but keep in mind that while the thermocouple is rugged, the internal RF connector makes a perfect fuse during lightning storms. Proper antenna grounding during non-operating hours will reduce this hazard. Placement of the meter in the transmission line isn't very critical. If you use an antenna turner it must be placed between the transmitter and the transmitter side of the tuner. It will work if placed on the antenna side of the tuner but the readings will have large errors because the line impedance may be far from 50 ohms.

As mentioned earlier, pick the correct range for the particular power you have in your transmitter. For instance, a Ranger running 50 watts of carrier into 50 ohms will yield a current of 1 ampere. So a 2-ampere full-scale meter fills this requirement. A Valiant running 150 watts of carrier into 50 ohms will yield a current of about 1.7 amperes. A 2 or 3 ampere full-scale meter will work ok. Now, when running 375 watts into 50 ohms, you will see a current of about 2.7 amperes. A 3 ampere full-scale meter will work but will peg on voice peaks, so either a 4 or 5 ampere full-scale meter would be a better choice.

I hope this article has given those not acquainted with the RF ammeter some solid background and perhaps answered some questions. The next time you see one sitting on the tailgater's table at a reasonable price you now know a little about them and be in a better position to purchase a good unit.

ER

[...Comments, from page 1]

internet at lower prices, viewed slightly more important than speed for Internet connectivity...however for those with existing broadband service, price is not sufficient to induce a switch to BPL. Further, a low-cost strategy is likely to result in unprofitable "price wars". Therefore an optimal pricing strategy involves offering tiered service and deep product bundles."

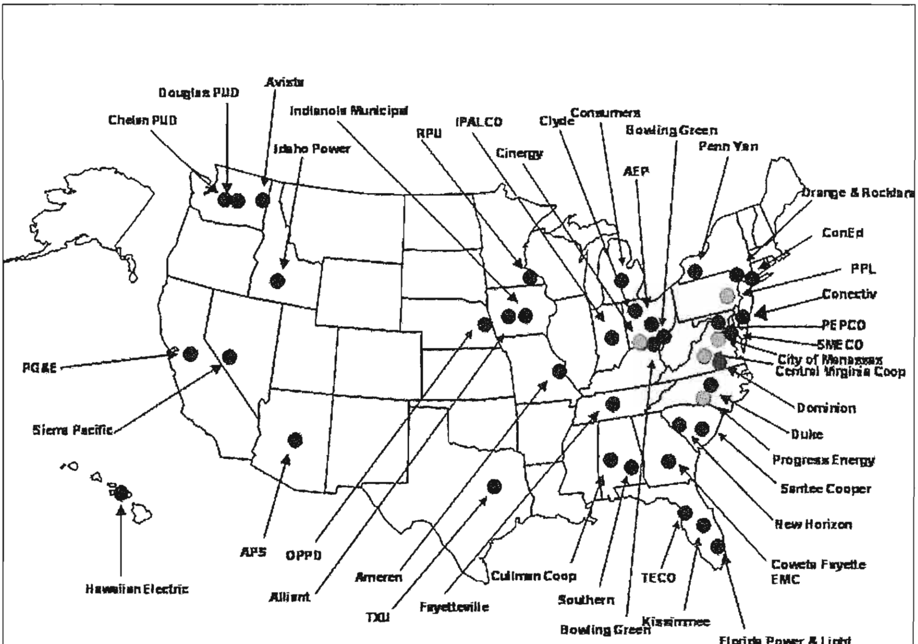
So, to test their so-called "tiered service and deep product bundles" UTC created financial models in three key market areas in the Eastern U.S. A chart, which is reproduced below, summarizes the results of the UTC market study.

Column two, "Cellular," lists the "Key Disadvantage" as high backhaul cost. This is the cost that a cellular company charges to carry the BPL data on their systems. From my own experience, I know these costs are very high and would not be competitive.

The last entry in the top row is also very interesting, "Powerline/Wireless." Notice that Powerline/Wireless delivery of the BPL service ***can not be sent*** across the distribution transformer, known to Hams as a backyard "pole pig." Secondly, the "Key Disadvantage" to Powerline/Wireless is wireless interference. A key disadvantage indeed! Third, there is ***no connection*** between the BPL injection point at your local power substation and the homeowner who would be the potential Powerline/Wireless customer. This is known as the so-called "last mile." The UTC chart lists "last mile delivery" being the domain of "Wi-Fi" technology, which is a radio-based system. I find it curious that other studies have found that "Wi-Fi" ***causes and receives*** BPL interference.

	Classic	*Cellular*	*Powerline/ Wireless*
Typical Injection Point	Substation	Close to Customer Area	Substation
Repeated on MV Lines?	Yes	Yes	Yes
Signal Sent Across Transformer?	Yes	Yes	No
Last Mile Delivery	Powerline	Powerline	Wi-Fi
Key Advantage	Full use of power grid	Low capital cost in low density areas	High potential reach
Key Disadvantage	Extensive need for repetition	High backhaul cost	Wireless interference

Readers should notice the three types of delivery for broadband internet service is across the top row of the chart. The first entry across the top is "Classic," which I assume means Classic BPL. Its "Key Disadvantage" is extensive need for repetition, or BPL repeaters. Every one of these repeaters adds installation and maintenance costs.



BPL Trials and Installed Systems

The chart makes me wonder what thinking is powering the BPL bandwagon, and where the opportunity is that they are studying. Would anyone knowingly pay for access to a system that is either more expensive than what is already available, or can't technically be connected and is self-blocking?

Lastly, a few BPL tests are underway in our country. The map above is reproduced from the same BPL press release and shows the locations of, and the utility companies involved with the BPL testing. Of these 42 test locations, the lighter circles are deployed systems that are offering commercial service. I count only 5 of these little circles.

Unfortunately, the UTC press release stops there, and readers are advised to send between $500 and $18,000 to obtain the complete report.

Unless I can no longer count, 2010 is just 6 years away and the technology is either to expensive to be competitive, is unproven, or no customers are being lured away from established broadband service, and is hardly a rural alternative.

Address Changes

Please remember to update your mailing address with me if you move. The post office charges every time they notify me of a new address. This is something that subscribers can do to help keep Electric Radio subscriptions at the present rates.

The ER FAX Number

The FAX number for Electric Radio is printed every issue in the Classified Advertising banner. Please note that our FAX machine shares another phone line, and that the line may be in use by something else at any time. The FAX machine is only on during business hours, and may be disconnected during lightning storms. For these reasons, please call ahead first before sending your FAX so that I will be sure to receive your message.

73, Keep Those Filaments Lit!

Ray, NØDMS

The RF-LO Tracking Problem in Superhet Receivers, Part 2

By Joel Ekstrom, W1UGX
PO Box 391
Cabin John, MD 20818

Before starting to read this article, the reader is advised to review the material in Part 1 [July, 2004 ER #182] where many of the symbols and ground rules used here are defined.

The first step is the design of the RF tuned circuit or circuits. The schematic is shown in Figure 1, where C_1 must include the minimum capacity of the tuning condenser, which is assumed to have identical sections for the RF and LO stages.

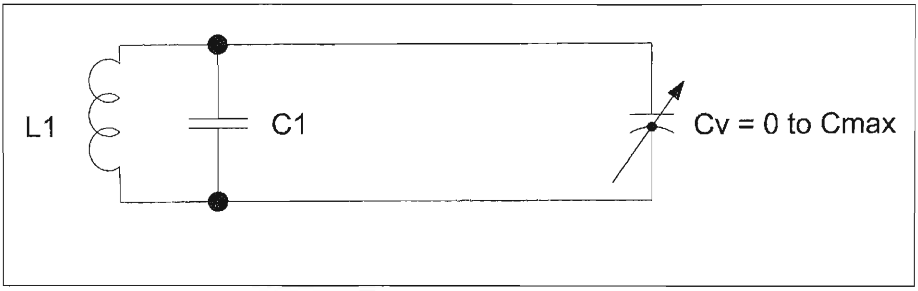


Figure 1: RF Tuned Circuit

The value of C_1 is obtained from

$$C_1 = \frac{C_{max}}{\left(\frac{F_2}{F_1}\right)^2 - 1} \qquad (1)$$

while L_1 is obtained from (Terman, Radio Engineers' Hand-book, 1943, p.651)

$$L_1 = \frac{25330}{C_1 (F_2)^2} \qquad (2)$$

where the units are microhenries, picofarads, and Megahertz.

At the three zero error RF frequencies f (in MHz) we will need the corresponding value of C_v, and this will be given by the formula:

$$C_V(f) = \left(\frac{25330}{L_1(f^2)}\right) - C_1 \qquad f = F_a, F_b, F_c \qquad (3)$$

Next we need to specify the zero error tracking fre-quencies F_a, F_b, and F_c. One simple approach was suggested by M.J.0. Strutt in a book on receiver design published in the late 1940's. He proposed using the following values:

$$Fa = \frac{1}{2}[F_1 + F_2] - .433[F_2 - F_1] \qquad (4)$$

$$Fb = \frac{1}{2}[F_1 + F_2] \qquad (5)$$

$$Fc = \frac{1}{2}[F_1 + F_2] + .433[F_2 - F_1] \qquad (6)$$

which are based on the approximate idea of an equal-ripple cubic polynomial tracking error curve. Limited experience with this approach indicates that excessive errors result, particularly at the lower frequencies in the tuning range. Therefore we abandoned it in favor of the somewhat more complicated approach discussed in the Second Edition of the Radio Receiver Design book by K.R. Sturley. The method begins by computing some constants. We have (f_i = IF frequency)

$$k_1 = \frac{1}{2}[F_1 + F_2] \qquad (7)$$

$$k_2 = F_1 + .25[F_2 - F_1] + fi \qquad (8)$$

$$k_3 = F_2 - .25[F_2 - F_1] + fi \qquad (9)$$

Next we will have

$$Fa = F1 + \left[\frac{F2 - F1}{13.32}\right]\left[\frac{5 - \left(\frac{k3}{k2}\right)}{1 + \left[3.2\left(\frac{k2}{F1 + fi}\right)\right]}\right] \qquad (10)$$

$$F_c = F_2 - \left[\frac{F_2 - F_1}{13.32}\right]\left[\frac{3+\left(\frac{k_3}{k_2}\right)}{1+\left[3.2\left(\frac{k_3}{F_2+f_i}\right)\right]}\right] \qquad (11)$$

and now we have two more constants given by

$$k_4 = F_2 - F_c \qquad (12)$$

$$k_5 = F_a - F_1 \qquad (13)$$

which are used to compute

$$F_b = k_1 - \left[.33\left(k_4 - k_5\right)\right] - \left[.125\left[\frac{\left(k_3 - k_2\right)\left(F_2 - F_1\right)}{k_2}\right]\right] \qquad (14)$$

Now that we have the three frequencies of zero tracking error, we can proceed. With reference to Figure 1 in Part I, at each of the 3 zero error frequencies we will have an equation of the type

$$\frac{25330}{L_2} = (f + f_i)^2\left[C_3 + \left(\frac{1}{\left(\frac{1}{C_p}\right)+\left(\frac{1}{C_2 + C_v(f)}\right)}\right)\right] \qquad (15)$$

where "f" is F_a, F_b, or F_c, and as mentioned in Part I we will start by picking a value for C_2 somewhat greater than the minimum value of the tuning capacitor. Since the 3 values of $C_v(f)$ are also known from the RF stage computations, and since the left sides of the 3 equations are identical, we can equate any two of the right sides to solve for C_3. Then we can equate one of the two equations already used to the right side of the unused third equation and again solve for C_3. These values of C_3 are then set equal, and the remaining equation contains only C_p and other known parameters. After some algebra (an exercise for the curious reader!) we finally get a linear equation for C_p given by

$$C_p = \frac{L(Y-X)+N(Z-Y)-M(Z-X)}{MY(Z-X)-LZ(Y-X)-NX(Z-Y)} \qquad (16)$$

with

$$L = \left[F_a + f_i\right]^2\left[F_b + f_i\right]^2 \qquad (17)$$

$$M = \left[Fa + fi\right]^2 \left[Fc + fi\right]^2 \quad (18)$$

$$N = \left[Fb + fi\right]^2 \left[Fc + fi\right]^2 \quad (19)$$

$$X = \frac{1}{C2 + \left(Cv\left(Fa\right)\right)} \quad (20)$$

$$Y = \frac{1}{C_2 + \left(Cv\left(Fb\right)\right)} \quad (21)$$

$$Z = \frac{1}{C_2 + \left(Cv\left(Fc\right)\right)} \quad (22)$$

(Where Cv(Fa) is the value of Cv at the frequency Fa, Fb, Fc.)

Next we compute

$$C_3 = \left[\frac{1}{\left[Fb + fi\right]^2 - \left[Fa + fi\right]^2}\right]\left[\frac{\left[Fa + fi\right]^2}{\left(\frac{1}{Cp}\right) + X} - \frac{\left[Fb + fi\right]^2}{\left(\frac{1}{Cp}\right) + Y}\right] \quad (23)$$

(Note the subtraction in the second grouping on the right side of the equation.)

$$L_2 = \frac{25330}{\left[Fa + fi\right]^2 \left[C_3 + \frac{1}{\left(\frac{1}{Cp}\right) + X}\right]} \quad (24)$$

If C_3 is not large enough to reflect the realities of the LO tuned circuit, a smaller value of C_2 must be chosen and the computations repeated. Then the tracking errors at various frequencies have to be calculated, and if one or more of them is excessive, the zero error frequencies may have to be changed, the RF circuit Q's reduced, or the IF frequency reduced. None of this would be much of a problem if the computations were programmed on a PC, but the computations cannot be done using a slide rule because small differences of large numbers occur in several places. A pocket calculator would be OK, however, provided it has at least 8 significant figures, all of which are carried through to the end. That's what I used to generate the design example in Part 3. [Editor's note: Next month, W1UGX will present the conclusion to his work. This material is a truly simplified approach to an old problem.]

ER

Installment 14

W. J. Halligan
Newspaper Reporter and the State of Radio 1923-1924, Part 5
Amateur Radio State Of The Art, 1923-1925

By Robert E. Grinder, K7AK
7735 N. Ironwood Dr.
Paradise Valley, AZ
atreg@asu.edu

Full Outline of Part 5*

A. General Happenings
   Calling CQ
B. The American Radio Relay League (ARRL) at work
   ARRL Conventions
   Transatlantic Receiving Tests And Contest
   1-MO–French 8AB Two-way Contact
C. The Silent Period And The Crises Of Interference At Every Turn
   Prevalence Of Interference
   Silent Period: Practices And Regulations
   In Defense Of Amateurs
   Legislation–The White Bill
D. WNP ("Wireless North Pole")
   Macmillan's Expedition To Arctic Re-Gions
E. Irving Vermilya, 1ZE
F. Epilogue
   1. Traffic Handling And Calling CQ
   2. Intermediate/Interval Sign "U" Supplants "DE"
3. Amateur License Regulations And Frequency Allocations
4. Silent Periods And The White Bill
5. The Hoover Cup Awards
6. Transatlantic Receiving Tests
7. The Second ARRL National Convention
8. The 1MO–French 8AB Two-Way Transatlantic Contact, November 27, 1923
9. WNP ("Wireless North Pole")
10. Irving Vermilya, 1ZE

***Topics formatted in bold are covered in this installment.**

Silent Period: Practices and Regulations

We have been asked to once again explain the law on amateur transmission, particularly that part which states the hours when amateur transmitters are required to remain silent.

To begin with, the stamped inscription on every amateur's station license clearly defines the silent period, the time when amateurs are to observe silence, as between the hours of 8 and 10:30 p.m. local standard time. It also says that amateurs are required to remain silent during Sunday morning church services.

While there may be some room for misunderstanding as to the exact meaning of the words "local standard time," we are of the opinion that the many miles of publicity which attended the misfortune of 1-CPI, must have cleared up any uncertainty there may have been in this regard.

The regulation controlling amateur transmission was framed at Washington. In order to simplify the wording of the law, the phrase "local standard time" was employed, which was intended to mean and which can mean nothing else than that standard time observed locally. Here in the east, we have our Eastern Standard Time; in the central states, they have Central Standard Time, and on to the Pacific coast, where Pacific Standard Time is observed. It is obvious, then, that the only simple phrase which would carry the meaning intended, would be the one now used, "local standard time."

Silence during church services must be enforced. On that point the Radio Supervisor is particularly determined. Someone has asked the exact hours of such service. There are no set hours, so far as we know. But amateurs are required to observe silence while services are being broadcast, and it is a simple matter to tune in the local broadcasting stations, and after a moment of listening, determine whether a church program is being broadcast.

We hope this definitely clears up all uncertainty on this most debatable point. If any amateur is still in doubt as to the meaning of the law we refer him to Radio Supervisor Kolster at the Custom House. [5/25/23]

Countless BCLs and Hams have entered complaints against what they term 1-SI's unnecessary QRM. He delights, particularly, in opening up during the silent periods, which isn't quite the thing, you know. It's not for us to read the riot act to SI on this account. We feel that he's big enough and old enough to know the consequences of this kind of thing. We will say in passing, however, that if all the Hams played the game in just this way Congress and the rest of the lawmakers would make short shrift of the amateur. [6/1/23]

If you don't believe that the boys are appreciated, read the following communication from a BCL: "1-XE, Brookline, appears to be a very efficient operator, for we heard him the other night as he was trying to get in communication with another station in Washington. His signals on 108 meters were received by the writer very clearly, and without distortion. Another good point in favor of this operator is that he waited until the local broadcasting station had signed off before he opened up."

The above speaks for itself. Why comment further? [6/1/23]

Very soon local Hams will be able to forget at least part of their worries about the silent period. Massachusetts will be back again on standard time and the gang won't have to stay up till nearly dawn to work the old key. Won't the married men welcome standard time with joy? Not to mention the fellows who go to work at six in the morning. [9/6/23]

Guess Mr. Kolster knows how to put a stop to the QRM during silent periods. He has asked John G. Barrett, Jr., president of the Commonwealth Radio Association to help him in locating several stations which have been causing interference during church services on Sunday morning. [9/12/23]

Despite all our pains in pointing out the law, and the undeniable clearness of the wording of the inscription at the top of every amateur's station license, reports continue to come in that a few Hams, kids no doubt, are transmitting Sundays during church services. They will not be able to offend for long, as they are all being checked up by the QRM committee of the Commonwealth Radio Association, and if their jamming doesn't soon cease their cases will be turned over to the radio supervisor. [9/29/23]

We have been asked for the streets and addresses of members of the CRA [Commonwealth Radio Association] QRM or interference committee. The group of fellows which checks up on all local interference during broadcast hours. Waldo J. Kelley, chairman of the committee, lives at 26 Winsor ave., Watertown. 1-CSX, R. C. Mortensen, 171 Cherry st., Malden, and 1-AJA, G. J. Etter, 66 Adams st., Dorchester. Anyone who is being interfered with during the broadcast hours of 8 to 10:30 p.m. and during Sunday morning church services should communicate with one of these men, who, assisted by other able operators, keep a constant watch on the air during hours that amateurs are required to observe silence. It is particularly pleasing to notice that interference has been reduced more than 50 per cent since this committee began its work. [10/1/23]

A few years ago, a Ham was not a Ham until he kept his clock in resonance with NAA time signals. With the increase in broadcasting stations it is not necessary that one listen in for NAA, because we hear nearly every broadcasting station give the time when they sign off. Yet it is surprising the number of Hams whose clocks are a couple of meters off the correct time. Ignorance of the correct time excuses no one from interfering during the quiet period. Hams, if your clock is not a jeweled timepiece, or if you believe it may not be correct, stop sending a few minutes before 8 and don't start again until a few minutes after 10:30. That will keep you off the log. [10/12/23]

A Sunday paper had a lot of bunk to the effect that amateurs are required to remain quiet from 8:30 to 11 p.m., and that because they are silent there is no interference to broadcasts. Bunk, all of it. Evidently written by someone who wouldn't know static from a banjo selection. In the first place, the regulation concerning amateur transmission very plainly states that the period of silence shall be from 8 to 10:30 p.m. This is stamped on every amateur's license so there should be no reason for any Ham taking stock in the article in the said Sunday paper. Secondly, as has been pointed out by any number of men who know most about it, the amateurs, working on wavelengths of 200 meters and below, cause practically none of the interference to, let us say, stations working on 450 meters. That wavelength, 450 meters, has also been assigned to commercial stations and ships. Is it not more probable that one of these latter would cause more interference to WJZ [New York City] on 455 meters than an amateur on 200 meters or below? Commercial stations, be it known, are not required to observe the silent periods, nor should they be, if lives at sea are to be properly safeguarded. [10/16/23]

Radio Supervisor Charles C. Kolster is pleased with the lack of interference from amateur stations in this district. He gives the Commonwealth Radio Association entire credit for the correction of what threatened to become his greatest problem. [11/1/23]

Life for the Ham, is getting to be just one silent period after another. With all the publicity which attended Supervisor Kolster's interference investigation, one fact should be definitely settled in the minds of the many and that is that the HAMS DO NOT CAUSE THE INTERFERENCE. It might be well if the radio followers up Worcester way could either see or hear what Mr. Kolster and other radio experts had to say about this. [11/14/23]

Had occasion to drop in on Radio Supervisor Charles G. Kolster and Radio Inspector Walter Butterworth at their office in the Custom House. Both of these men are as busy as any one-armed paper-hanger ever dared to be. Their territory includes the whole of New England, which as time goes on becomes more and more densely populated with radio enthusiasts. But despite the enormous size of their task these men, very capably assisted by Chief Clerk McCarthy, continue to carry on with most amazing success. [3/28/24]

In Defense Of Amateurs

Though the present radio laws are rather liberal in regard to the amateur, certain members of that gentry have voluntarily imposed a 100-meter wave restriction on themselves in order to avoid interference with the broadcasts. The average listener doesn't give the amateur credit for being that considerate, but the above is a statement of fact. [3/14/23]

A case of nation-wide interest to radio fans, in which Edward McWilliams of Dwight, Ill., brings a complaint against G. Wiley Bergman, a fellow townsman, in which he charges that the latter interfered with his concert reception, will be tried before the fall term of the Circuit court of Livingston county, Ill.

Irving Herriot, prominent Chicago attorney and counsel for the American Radio Relay league, in commenting on the case, said: "The American amateur, while not admitting that any person or class (with the exception of the federal government) has a superior right to use the air for radio communication, realizes that the owners of radio receiving sets are entitled to equal consideration. While the A. R. R. L. is opposing any effort to deprive the amateur of his right to use the air, it nevertheless desires to have the subject of interference between amateurs and radio listeners settled along amicable lines and desires to offer its assistance in working out an agreement based on mutual concessions by both amateur operators and listeners. In defending the suit against Bergman, it is not actuated by any desire to deprive listeners of the use and enjoyment of their apparatus, but is simply endeavoring to protect the rights of the amateur." [4/12/23]

In this day nearly every one has a radio receiving set and such persons as city councilmen, chiefs of police, mayors, congressmen, senators and even the President himself listen in to the nightly ether concerts, and when these men, who though wise in affairs of state are somewhat uninformed in ways pertaining to radio, experience this interference they inquire its source. The blame almost invariably falls upon that group of experimenter-technicians who for the want of a better classification are known as radio amateurs.

Now when any group of individuals is accused, no matter how unjustly, of interfering with the pleasures of the people, something usually happens, especially when the people have first hand information on the subject.

The amateurs are good scouts, though, and believe it is high time that something was done to relieve the situation. So the traffic manager of their national organization, the American Radio Relay League, has appointed 300 stations, all over the country, manned by expert operators, to keep record of all the interference in their vicinity on the 360-meter wave.

When this data is [sic] compiled the public can see just what percentage of interference come from amateur sources and what the commercials are responsible for. [5/7/23]

In connection with the subject of interference, the June issue of "QST," the amateur publication of the American Radio Relay League, has a very interesting editorial which says: "Happily the day is rapidly passing when the public believes that the amateur is [the] one and only source of all poor broadcast reception, from ordinary garden varieties of interference to such thing as auroras, dirty contacts, static, and sulphated batteries. The crisis in our young lives when the slogan of the general radio public was 'Dern the Amateur' has passed with the coming of a better understanding of the realization of what the helpful hand of the amateur means.

"The observations reported in Prof. Jansky's paper extended from last summer until March of this year, and thousands of data sheets were gathered and analyzed. The first things that strikes one upon looking at the results is the fact that only about 23 percent of the time can one hope to get a desired station without interference. But the most startling thing in the report is the fact that during 68 percent of the time broadcast reception is interfered with by something inherent in the system itself, such as fading or static, or other broadcast stations, or howling receivers; and only 9 percent of the time is reception bothered by some form of man-made interference exterior to the fabric of broadcasting itself. The report shows that of all the broadcast programs listened to, about 91 percent were received perfectly excepting for interference that originated with the broadcast system or else was of natural origin.

"Interference of some sort was experienced something over three-quarters of the time, and of this, roughly 88 percent was in the system itself or from natural causes, with but 12 percent from other man-operated devices. [5/21/23]

1-WM reports that a BCL living just across the street from him is unable to hear his CW sigs while tuned to the lowest concert wave. Which is a strong argument for CW as a solution of the QRM problem, and might be construed as being a point toward the removal of the silent ordinance. [6/4/23]

An era of closer harmony between the BCLs and Hams is, with us, and it's all due to the splendid work of such fellows as 1-VV and 1-CPI. Whatever misunderstanding there was on the part of the BCLs is rapidly disappearing. Most of the concert listeners know now that all interference isn't caused by amateurs. In fact, carefully compiled statistics have definitely shown that the Ham creates less QRM than anyone or anything else.

This is what VV, CPI and, we suppose, many others are doing: They set aside certain nights of week when they hold open house to all BCLs in their vicinity. They, in turn, have visited many BCLs, and have helped many of them in the construction of their sets and in other ways. These younger radio men, younger in point of contact with the game, get a truer perspective of the amateur and a clearer understanding of what he's trying to do.

Not only have these BCLs begun to understand the Ham, but they have been seized with a desire to learn the code and become one of us, which is the finest thing possible for the amateur, as future developments will probably show. We therefore urge other Hams to follow in this regard, the good work of some good amateurs. [6/4/23]

The telephone rang insistently at the home of 1-PF. Enter Mr. 1-PF, senior, from an adjoining room. Follows the removing of the receiver and usual "Hello."

"Hello nothin'," someone roars from the other end of the line. "If you don't stop sendin' on that set I'm going to report you."

Bang! It was all over as suddenly as it began.

Now 1-PF wishes the world in general and this fellow in particular to know that he wasn't even in his house for two weeks surrounding the date of this particular complaint. So how, he argues, could he be operating his transmitter at Watertown when he was down at Ipswich or Scituate or some such place.

Who said remote control? [8/15/23]

Have you noticed on whom the burden of proof has shifted in this interference business since the Commonwealth Radio Association got into the field? It looks as though the non-code amateur or BCL is pretty well satisfied that the 360 and 450 meter code interference is not caused by the amateurs, as was at first supposed. "Whit," in his Sunday article showed that ships handling traffic on the 450 meter wave are more likely to break up concerts than are amateurs transmitting on 200 meters or below. [10/3/23]

Radio Snobs, that's what they are, and they're killing the greatest game in the world. For the most part they're kids, fellows who are just feeling their radio oats, as it were. But it is this group that is doing a lot to make the position of the amateur misunderstood. [10/9/23]

Thousands upon thousands of complaints against the 450 meter code interference have been pouring into Supervisor Kolster's office. Probably after the hundreds of ships which sail the bounding main, not to mention a couple of well known naval stations, are forced to boost their waves several hundred meters, the non-code radio world will realize that the maligned Ham is innocent of all charges which have previously been hurled at him. [11/19/23]

Ran into a clergyman BCL at 1-PF's store recently who is dead against the Ham phone men. Says all he hears from those fellows is "Well, old man, er—how do you get me now, old man er——er? Well, old man, er— come in," and such as that. Probably he's right. But he needn't forget that experiments such as these made his pleasures in radio possible. [11/19/23]

To quote G. R. Entwistle: "Some listeners-in keep complaining that amateurs interfere with broadcasting. They do not actually know who is interfering: they only know that some one transmitting code is interfering with their reception." Then, he suggests that these BCL's learn the code and satisfy themselves that ships and not amateurs are causing the code interference. Which, as anyone who has probed the radio depths knows, is the only real way to clear up whatever difficulty there may now be over this matter. [11/27/23]

One paper points out continually that "code interference was particularly bad last night." Information such as that does no good unless the readers are told from whence the code interference comes. [11/27/23]

Despite the analysis of the world's radio experts that the code interference which they experience from time to time is being caused by ships and shore stations working on the broadcast wave lengths, there are many who continue to malign the amateur even though he uses a wave length a hundred and some times more meters below the broadcast bands.

It is not our contention that the amateur does not cause interference. Prof. Jansky, a government expert has submitted figures to the Bureau of Navigation which show that code interference from transmitting amateurs is two percent of the total things which go to mar ideal concert reception. More than 15 percent of the interference is caused by re-radiating receivers, Prof. Jansky has found. [See Part 6 for a discussion of "radiating receivers."]

We do contend, however, that the method of attacking him is most unfair. Persons who have not the slightest knowledge of code seemingly become obsessed with the idea that the amateur who lives in their district is the source of all the code interference which they experience. Many of them make formal complaints to the office of Radio Supervisor Charles C. Kolster, while other of them stoop to the low practice of writing anonymous threatening letters and other forms of hoodlumism.

It has many times happened that while complaints continued to pour in against some amateur, that individual was many miles from his transmitter, entirely innocent of the charges.

If you cannot read the code which breaks in on your concert reception, why not enlist the aid of that amateur in your neighborhood? He will readily identify the offender. If the person causing the interference is an amateur, he will takes steps to have the interference ended, for he realizes that in so doing he is working for the entire amateur fraternity.

If you are not acquainted with amateurs in your neighborhood, write this department and we will be glad to put you in touch with one or more of them who will be glad to help you. [2/7/24]

Legislation—The White Bill

Radio inspectors all over the country are continually receiving complaints from broadcast listeners concerning "interfering amateurs." In our own experience, said amateurs aren't such bad fellows when you get to know them. A good part of their interference is unintentional.

Just the same, they shouldn't hog the air. There are any number of free born citizens who are not in the least interested in the trans-continental tests or any other tests that have to do with code. They want to listen to concerts and they have a perfect right to remonstrate when anyone interferes with their concert reception.

But the amateur has something to say about the matter. Since he was on the air first, and since he has contributed his little bit to the advancement of radio to its present state, he feels priority rights.

There's only one solution, and that is the adoption of the White bill. The bill proposes so to distribute the use of wavelengths among the various kinds of transmitting stations as to reduce interference to a minimum. It then rests with the listener to acquaint himself sufficiently with his apparatus so that he may be able further to reduce interference by careful tuning. [3/5/23]

Congress adjourned, just as Senator Lodge said it would, without acting on the White radio bill. The bill will sleep until the next session of Congress, which will be in December. Manufacturers and fans are all interested in the bill, because, if it is passed, changes will have to be made in apparatus designed for broadcast reception, which means that the bill will affect practically everybody. [3/7/23]

Invitations have been issued to men prominent in radio to attend Sec. Hoover's radio conference, which is to be held in Washington, March 20. The purpose of the conference is to straighten out the interference tangle, Congress having failed to act. [3/8/23]

Representative White, framer of last year's radio bill, has asked the National Association of Broadcasters and the American Radio Relay league to assist him in obtaining opinions as to what his new radio bill should cover. He asks that all interested in radio give careful thought to this subject, urges that a study be made of all of the Radio Laws of 1912 and suggests changes be mailed to the N.A.B., 1245 Broadway, or the A.R.R.L., Hartford, Conn. [1/12/24]

Wonder what Congress had in mind when it added $10,000 to the annual appropriation for the upkeep of the government radio service? A sum such as that distributed through the various radio offices throughout the country would hardly pay for omnigraph hire, let alone enable the heavily handicapped government radio force to keep abreast of the times and properly regulate radio communications.

With the millions of the nation's citizens in some way concerned with the progress of radio, it is only right and fair that the radio supervisors and inspectors should constitute a last court of appeal in all matters concerning radio. But they can never give satisfactory service if their number is to be held to an absurd minimum and they are denied a fair appropriation for carrying on their work. [3/28/24]

[Next month, Bob continues with installment 15..Ed]

ER

AM Calling Frequencies

160 meter band: 1885, 1945 kc
80 meter band: 3870, 3880, 3885 kc
40 meter band: 7200, 7290 kc
20 meter band: 14.286 Mc
15 meter band: 21.400 to 21.450 Mc
10 meter band: 29.0 to 29.1 Mc
6 meter band: 50.4 Mc
2 meter band: 144.450 Mc

[Editor's note: Please send in your updates and corrections to the calling frequency list. I'd like to keep the frequencies as accurate as possible. Many newer AM'ers are not familiar with the traditional gathering spots.]

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

An on-line, searchable index to the entire 15-year history of Electric Radio Magazine is maintained by Don Buska, N9OO, and may be found under the "links" tab at www.ermag.com or at Don's web site: www.qsl.net/n9oo/ersearch.html

VINTAGE NETS

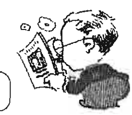
Arizona AM Nets: Sat & Sun: 160M 1885 kc at sunrise. 75M 3855 kc at 6 AM MST. 40M 7293 kc 10 AM MST. 6M 50.4 mc Sat 8PM MST. Tuesday: 2M 144.45 7:30 PM MST.
Boatanchors CW Group: QNI "CQ BA or CQ GB" 3546.5, 7050, 7147, 10120, 14050 kc. Check 80M winter nights, 40 summer nights, 20 and 30 meters day. Informal nightly net about 0200-0400Z.
California Early Bird Net: Saturday mornings at 8 AM PST on 3870 kc.
California Vintage SSB Net: Sunday mornings at 8AM PST on 3860 +/-
Colorado Morning Net: An informal group of AM'ers get together on 3875 kc Monday, Wednesday, Friday, Saturday, and Sunday at 7 AM MT.
Canadian Boatanchor Net: Meets daily on 3725 kc (+/-) at 8:00 PM ET. Hosts are AL (VE3AJM) and Ken (VE3MAW)
Collins Collectors Association Nets: Technical/swap sessions meet every Sunday on 14.263 mc at 2000Z. Informal ragchew nets meet Tuesday evening on 3805 kc at 2100 Eastern time, and Thursday on 3875 kc. West Coast 75M net is on 3895 kc 2000 Pacific time. **10M AM net starts 1800Z on 29.05 mc Sundays, QSX 1700Z.**
Collins Collector Association Monthly AM Night: Meets the first Wednesday of each month on 3880 kc starting at 2000 CST, or 0200 UTC. All AM stations are welcome.
Collins Radio Association nets: Mon. & Wed. 0100Z on 3805 kc., also Sat 1700Z on 14.250 mc.
Drake Technical Net: Meets Sundays on 7238 kc, 2000Z. Hosted by John (KB9AT), Jeff (WA8SAJ), and Mark (WBØIQK).
Drake Users Net: This group gets together on 3865 kc, Tuesday nights at 8 PM Eastern Time. Net controls are Gary (KG4D), Don (W8NS), and Dan (WA4SDE)
DX-60 Net: This net meets on 3880 Kc at 0800 AM, Eastern Time on Sundays. Net control is Mike (N8ECR), with alternates. The net is all about classic entry-level AM rigs like the Heath DX-60.
Eastern AM Swap Net: Thursday evenings on 3885 kc at 7:30 PM Eastern Time. Net is for exchange of AM related equipment only.
Eastcoast Military Net: Check Saturday mornings on 3885 kc +/- QRM. Net control station is W3PWW, Ted. It isn't necessary to check in with military gear, but that is what this net is all about.
Fort Wayne Area 6-Meter AM net: Meets nightly at 7 PM Eastern Time on 50.58 mc. This is another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.
Gray Hair Net: The oldest (or at least one of the oldest at 44+ years) 160 meter AM nets. Net time is Tuesday evening on 1945 kc at 8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn
Hallicrafters Collectors Association Net: Sunday on 14.293 mc, 1730-1845 UTC. Control op varies. Midwest net Sat. 7280 kc 1700Z. Control op Jim (WB8DML). Pacific Northwest net Sunday 7220 kc at 2200Z. Control op Dennis (VE7DH).
Heathkit Net: Sunday on 14.293 mc 2030Z right after the Vintage SSB net. Listen for W6LRG, Don.
K1JCL 6-meter AM repeater: Operates 50.4 mc in, 50.4 mc out. Repeater QTH is Connecticut.
K6HQI Memorial Twenty Meter Net: This flagship 20 meter net on 14.286 mc has been in continuous operation for at least 20 years. It starts at 5:00 PM Pacific Time and goes for about 2 hours.
Midwest Classic Radio Net: Meeting Saturday morning on 3885 kc at 7:30 AM, Central Time. Only AM checkins are allowed. Swap and sale, hamfest info, and technical help are frequent topics. Control op is Rob (WA9ZTY).
MOKAM AM'ers: 1500Z Mon. thru Fri. on 3885 kc. A ragchew net open to all interested in old equipment.
Northwest AM Net: AM activity is daily 3 PM to 5 PM on 3875 kc. The same group meets on 6 meters at 50.4 mc. Times are Sundays and Wednesdays at 8:00 PM. 2 Meters Tues. and Thurs. at 8:00 PM on 144.4 mc. The formal AM net and swap session is on 3875 kc, Sundays at 3 PM.
Nostalgia/Hi-Fi Net: Started in 1978, this net meets Friday at 7 PM Pacific Time on 1930 kc.
Old Buzzards Net: Daily at 10 AM local time on 3945 kc in the New England area. Listen for net hosts George (W1GAC) and Paul (W1ECO).
Southeast Swap Net: Tuesday at 7:30 PM Eastern Time on 3885 kc. Net controls are Andy (WA4KCY) and Sam (KF4TXQ). Group also meets Sunday on 3885 kc at 2 PM Eastern Time.
Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM on 50.4 mc. Net control op is Will (AA6DD).
Swan Nets: User's Group meets Sunday at 4 PM Central Time on 14.250 mc. Net control op is usually Dean (WA9AZK). Technical Net is Sat, 7235 kc, 1900Z. Net control is Stu (K4BOV)
Vintage SSB Net: Sunday 1900Z-2030Z 14.293 & 0300Z Wednesday. Net control Lynn (K5LYN) and Andy (WBØSNF)
West Coast AMI Net: 3870 kc, Wed. 8PM Pacific Time (winter). Net control rotates between Brian (NI6Q), Skip (K6LGL), Don (W6BCN), Bill (N6PY) & Vic (KF6RIP)
Westcoast Military Radio Collectors Net: Meets Saturday at 2130 Pacific Time on 3980 kc +/- QRM. Net control op is Dennis (W7QHO).
Wireless Set No. 19 Net: Meets the second Sunday of every month on 7270 kc (+/- 25 Kc) at 1800Z. Alternate frequency is 3760 kc, +/- 25 kc. Net control op is Dave (VA3ORP).

CLASSIFIEDS

Advertising Information

Subscribers receive 1 free 20-word ad per month. **Extra words are 20 cents.** Here is how to count the words in your ad: "For Sale" or "Wanted" and your contact information counts as 7 words. Hyphenated words count as 2 words. **Please count the words in your ad as described above, and if you are over 20 words, send payment for the extra words at .20 each.** Note: Not all readers use email, so it is a good idea to include phone numbers. Non-subscribers: $3.00 minimum for each ad up to 20 words. Each additional word is 25 cents. Email ads are fine.

Please call or write for display rates.



VINTAGE EQUIPMENT ONLY!

ER
PO Box 242
Bailey, Colorado 80421-0242

Telephone: 720-924-0171
FAX (call first): 303-838-3665
NEW email: 1editor2@indra.com

Deadline for the September 2004 issue: Monday, August 30

SERVICE FOR SALE: Repair and restoration on all vintage equipment; 45 years experience. Barney Wooters, W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. 303-770-5314

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

FOR SALE: NIB BC-746 Pogo Stick tuning units, channels 1, 4, 6, 11, 12, 13, 71, $4 each plus shipping. Mike Bittner, 27215 Sunnyridge Rd., Palos Verdes, CA 90274. 213-377-4797

FOR SALE: Johnson Invader 2000 + P.S. $600. National HRO 60 + coils, $300. Hallicrafters "TO Keyer" $60. Heath 10-4205 scope $50. 6KD6 pulls $10 each. Richard Cohen 813-962-2460

FOR SALE: BC-611, $300. BC-191F w/ TU-6, TU-10, no tubes, $450. BC-625 mine detector set, no tubes, $75. SCR-543 = BC-669 w/wood chest, $750. BC-312, $125. BC-652 rcvr, $75. 2 mF 4kV = 1000 S36 WWII modified $25. I-177 tube tester, $140. Hickok 532, $140 + ship. Steve Bartkowski, 4923 W. 28 St, Cicero, IL 60804 1-708-863-3090

FOR SALE: 75A-4, nice, call for details. Dennis, K6RCL, 805-683-2876 k6rcl@cox.net

FOR SALE: National HRO-5, 9 coils, pwr sply, nice radio, $350 + shipping. John Walsh, W3GCE, 577 First St., White Hall, PA 18052 610-264-4645

FOR SALE: Motorola's T69-20A AM mobile transmitter, 1939-40's, police band, $75. Delivery between KS and PA. KØRMK, 316-941-4318. rklingman1@yahoo.com

FOR SALE: Pair of RT68GRC, PP112GR, accessories. RT70, AM65GRC. R392, speaker, manual. Radio set ANGRR5. Bill Coolahan, 1450 Miami Drive NE, Cedar Rapids, IA 52402-2933 319-393-8075

FOR SALE: Signal One CX7 transceiver with manual $800. George, 480-986-5797, w8qbg@yahoo.com

FOR SALE: Western Union 3-way sender promotional telegraph, $20 postpaid, works, QST August 1997 p.21. Louis L. D'Antuono, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

FOR SALE: Johnson Viking Mobile AM Transmitter, very clean, with prints, $150. Fred Clinger, 417 Beechwood Dr., Galion, OH 44833 419-468-6117 after 6 PM.

FOR SALE: VHF VFO's: Globe 6-2, Ameco 621, 24-25 MHz output, internal pwr sply. $30 each + shipping. Henry Mohr, W2NCX, 1005 Wyoming St., Allentown, PA 18103 610-435-3276

FOR SALE: Test Equipment: RCA WR-64B color generator, WR-69A TV/FM sweep generator, WR-70A RF/IF/VF marker adder, WG-307B bias sply, cables & manuals. Looks new, works excellent. $200. Joe Whisnant, 1233 Newcastle Way, Maryville, TN 37803, 865-977-9024.

FOR SALE: 70 switches, 1 pole/12 pos/ 125V 3A, R.S. #275-1385 NIB, $35 lot + shipping. Henry Mohr, W2NCX, 1005 Wyoming St., Allentown, PA 18103 610-435-3276

FOR SALE: Military whip antennas, EH Scott RBO-2 rcvr, $295. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777 989-595-6483

FOR SALE: GR Experimenter 1937, 1938, complete years, $24 each. L&N Wheatstone bridge, $20. Weston 722 VOM, $10. GR 726A VTVM, manual copy, $20. GR 1192 frequency counter, manual copy, $30. Ross Wollrab, 229 N. Oakcrest Avenue, Decatur, IL 62522-1810. 217-428-7385.

FOR SALE: Tektronics Rep catalogs: 69, 70, 1979 year $35. Knight tube tester $35. Paul Recupero, 265 Union St., Portsmouth, RI 02871 1-407-847-8589

FOR SALE: HT32B, KWM2, R4B, SX117, HT-44, R46B. Bob Ryals, KIØGF, 719-

265-9950, joebob1@adelphia.net

FOR SALE: Hallicrafters S40b A/O N/D Clean $85.00 Webcor Recordio 5 In. Reels (2) Mod. 3a10 W/Mi Clean Case @8 no damage $30.00. B-K DynaSweep circuit analyzer Mod 1070 W/Booklet and leads $40.00. Power sply, FRB 24-2-24 Nje, Dayton,NJ. Clean @ lo $50.00 Bernie Samek, 113 Old Palmer Rd., Brimfield MA, 01010, 413-245-7174, FAX 0441.

FOR SALE:.McMurdo Silver model 700 144 Mc & 220 Mc transmitter, $50. Tom Berry, W5LTR, 1617 Highland, Chicago IL, 60660. 1-773-262-5360. Cell: 773-301-7640

FOR SALE/TRADE: Original manuals: CE 20A, Clegg 66'er, Gonset Communicator IV (6M) RME 45, EICO 722, 753. Ni4Q@juno.com 407-351-5536

FOR SALE: Johnson Matchbox, 250 Watt version with original manual $125 plus shipping. Vern Snyder, 5 Parkview Dr., Winder,GA 30680

FOR SALE: Sangean ATS-803A AM, FM, SW rcvr w/BFO, $100. Al Jenkins, WA1RWB, 508-325-7122 evening only.

FOR SALE: Vintage Heath station, minty. SB-101, AC&DC sply, spkr, manuals $250 all. Jim, K7BTB, 928-635-2117 jeldge@safeaccess.com

FOR SALE: National NC98 fine $150. BC639A rcvr VG $150. RA42B rect. $60. Homebrew modulator 807's $50. Grundig YB400 $64. Ron, MI 517-374-1107

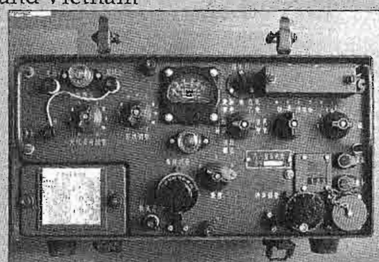
SERVICE FOR SALE: Repair, upgrade, performance modification of tube comm.

FOR SALE

Chinese Military HF radio set Type 81(102E), Korean War

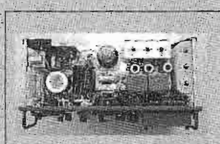
- -Very rare military field HF tube radio
- -15W max transmit power on CW mode, 4W max on AM mode.
- -Frequency range: RX 2-12 MHz, TX2-10 MHz
- -The type served in Korean War and Vietnam War
- -Never used, still in original military sealed package
- -Set includes a type-81 transmitter, a type-139 receiver, a handcrank generator, full set of spare tubes and a multi-meter of the era, fire heated iron for field emergency repair, other tools and accessory.

- -The radio set is a highly collectible and fun to operate piece of the history on the other side of the wars. We also have other Chinese military radios of Korean War and Vietnam War era for sale.



- -For more information and pictures, please visit our web site at www.redstarradio.com or email us.

REDSTAR RADIO
111 Telson Road
Markam Ontario
Canada, L3R 1E4
416-738-2628
email: info@redstarradio.com



& 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, Box 187, Wheatland, WY 82201. 307-322-5858 feltondesign@yahoo.com

---

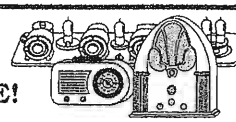
FOR SALE: General Radio lab equipment, over 250 pieces, manuals, write wants, SASE. Stuart T. Carter II, W4NHC, 680 Fernwood Dr., Melbourne, FL 32904, 321-727-3015

FOR SALE: FT243 Crystals: 1815, 1822, 1885, 1945, 1985, 3535, 3560, 3579, 3875, 3880, 3885, 3890, 7035, 7045, 7050, 7143, 7280, 7285, 7290, 7293, 7295, 8400, 10106, 14286 kHz. Many others available. See list at: http://www.af4k.com/crystals.htm or call Brian, AF4K on 407-323-4178

FOR SALE: Waters 369 Directional Wattmeter, $85. Palomar Keyer w/paddle, $40. Cordless Soldering Iron, $30. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973-728-2454. rprester@warwick.net

---

FREE SAMPLE!



ANTIQUE RADIO CLASSIFIED

Antique Radio's Largest Monthly Magazine – 5000 Subscribers!

Classifieds - Ads for Parts & Services
Articles - Auction Prices
Meet & Flea Market Info.
Radios, Ham Equip., Telegraph, Hi-Fi
TV, Books, Art Deco, 40s & 50s Radios
Free 20-word ad each month.

U.S. Rates: 6-Month Trial: $19.95
1-Year: $39.49 ($57.95 by 1st Class)

VISA A.R.C., P.O. Box 802-E20
Carlisle, MA 01741
Web: www.antiqueradio.com
Email: arc@antiqueradio.com
Toll Free: (866) 371-0512; Fax: (978) 371-7129

FOR SALE: TV-7, A,B,D/U ,tube checker maintenance manual with addendum ('66). TM 11-6625-274-35, in original 9+ condition $20 shipped. k4deejim@aol.com or 864-855-9570

FOR SALE: Microphones - Shure 55S "Elvis" mic, $125; Heil Classic Pro, $175;Johnson Matchbox, 275W unused/ mint, $175; BC-610 modulation and driver transformers by Chicago Trans, $240/ both. Parting out functional Globe King 400B, inquire with your needs. 1937 Western Electric 1KW transmitter on 1925KHz, excnlt, $7500/swap. Gary, WA9MZU, 209-286-0931 ghal@ix.netcom.com

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

PARTS FOR SALE: Request free vintage flyer. USA only. 50 years of mail order electronics. Bigelow Electronics, POB 125, Bluffton, OH 45817-0125

FOR SALE: Countermeasures receiving set AN/WLR-1D, 50-10750 MHz, 9 bands, simultaneous display of frequency, spectrum, and modulation info on dual displays, manual, 1200 lbs., $4,500. Carl Bloom, 714-639-1679, carl.bloom@prodigy.net

FOR SALE: Galena radios, crystals, detectors, and parts to build your own. Radio tubes, old to modern. Len Gardner, 458 Two Mile Crek Rd., Tonawanda, NY, 14150. email: radiolen@att.net

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

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

SERVICE FOR SALE: 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.

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

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

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

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

JOHNSON PARTS FOR SALE: 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. bak@provisiontools.com

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

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

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

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

TUBES FORSALE/TRADE: Transmitting/ Receiving tubes, new & used. $0.55 & LSASE for list. I collect old & unique tubes of any type. **TUBES WANTED:** Taylor and Heintz-Kaufman types and large tubes from the old Eimac line; 152T through 2000T for display. John H. Walker Jr., 13406 W. l28th Terr. Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

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

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

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

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

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

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

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

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

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

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

N4PZ@aol.com

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

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

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

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

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

PARTS FOR SALE: Ships radio room clock repros, boatanchor mugs and t-shirts, more. http://www.cafeshops.com/amradio,amradio2 1-877-809-1659

SERVICE FOR SALE: I built hot-rod receivers; R390A, SP-600, R-388/51J. NC-183D...and transmitters: Valiant, DX-100, T-4X-A-B, HT-32. 51J-4 filter replacements, R390A Hi-fi AM $245.00 ea. Chuck Felton, KDØZS, Wyoming, 307-322-5858, feltondesign@yahoo.com

PARTS FOR SALE: Collins reproduction items available through the CRA on www.collinsra.com. Join the CRA and subscribe to the Collins Journal. Dave, W3ST

SERVICE FOR SALE: PANEL AND CABINET REFINISHING; Johnson, Hammarlund 180(a), R390(A), & others total restoration & sales; My updated web site: http://w4pnt.8k.com Patty & Dee's Marina; Dee Almquist, 534W. Main St., Waynesboro, VA 22980. 540-249-3161 Cell: 540-480-7179, FAX 540-249-5064

FOR TRADE: Two good RCA 833A's for one Taylor 833A. Also looking for Taylor 204A, 813, TR40M. John H. Walker Jr., 13406W. 128th Terr., Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

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 Bartowski, 708-863-3090

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

WANTED: BC-348 with unmodified case and front panel, please contact Mike at: mike46@shaw.ca or phone 604- 988-0112.

WANTED: PYE, Fairchild, Syncron,Langevin. Richard P. Robinson, PO Box 291666, LA CA 90029 323-839-7293 richmix@erols.com

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

WANTED: Icom UT-34 tone board. Don, W4GIT, 352-475-3306 call collect.

Electric Radio Tuning Meter

Eliminates Tune-Up QRM!

This popular meter allows you to tune up right on top of a QSO with only milliwatts of RF going to the antenna. In the tune position, your dummy load is connected and the rig is tuned and loaded normally. A small amount of RF power from the dummy load drives the tuning meter bridge. Then, adjust your antenna tuner for a null on the meter, flip the switch to operate, and you're on the air without causing interference! Standard SO-239 connectors are available on the rear. For reviews, see ER #60 or QST for April 2002.

$49.95 plus $5.95 S&H
Money back guarantee
Visa, Mastercard, American Express, and PayPal

Now available on-line at WWW.ERMAG.com
ER Store, PO Box 242, Bailey Colorado 80421-0242
720-924-0171 1editor2@indra.com

WANTED: For SCR-178 Generator GN-37, Insulator IN-85, Lamp LM-18, Insulator mounts, leg supports, other parts. Robert Forte,518-696-2400 rvforte@frontiernet.net

WANTED: Audio amplifier. 50's, 60's Bogen DB-20 or DB-10 or similar Bell, other makes with output 6V6's. Condition unimportant. Charles Graham, 914-666-4523. 4 Fieldwood Dr., Bedford Hills, NY 10507

WANTED: Johnson Viking II/VFO, Viking Courier, Viking Navigator, Viking Thunderbolt, kW+ Rated antenna Tuner, Please Call Justin Korpal KØRPL 1210 N. Danz Ave. Green Bay, WI 54302 920-680-0416, Jkorpal@Baycominc.com

WANTED: Audio transformer (T1) in Elmac AF67; "U" frame filter choke 5 HY 250mA 600V or greater in sply-2V. K9GTB, Herb, 618-362-6539

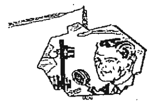
WANTED: Heathkit SP-620 "Scanalyzer" w/3396 kc IF, also 1963 ARRL handbook. Shannon Latham, W3FML, 570-524-7797, w3fml@hotmail.com

WANTED: RCA communications receivers, ACR-175, ACR-111, CR-88, AR-8516, CRM-R6A, SRR-13. Dan Gutowski, 9753 Easton Rd, Dexter MI, 48130. 734-718-7450, dg16ms26@msn.com

PURCHASE RADIO SUPPLY

Founded in 1930, Purchase Radio Supply is the Midwest's popular vintage parts dealer. We specialize in friendly service providing components for Real Radio that other "antiseptic" radio stores can not match. If you are looking for transmitting and receiving tubes, components, hardware, or publications please give us a call because we may just have your parts for that special project. We are also a stocking distributor for major electronics manufacturers and modern components.

Purchase Radio Supply
327 East Hoover Avenue
Ann Arbor, Michigan 48104



TEL (734) 668-8696
FAX (734) 668-8802
www.purchaseradio.com
e-mail: purchrad@aol.com

WANTED: Fully functional with manuals: Johnson AN/FRT505 transmitter, Swan F51 and FC76. Contact Ric at C6ANI@arrl.net

---

WANTED: A Collins R-389 LF rcvr to complete my SWL shack. Have quality trades/pay cash. Dan Gutowski, 9753 Easton Rd, Dexter MI, 48130. 734-718-7450, dg16ms26@msn.com

---

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

---

WANTED: Technical Materials Corp. model DCU combiner, DVM monitor, LPP patch panel, LSP speaker, DCP power panel VOX V.F.O., CFA converter, and PSP-1 power sply. K8CCV, Box 210, Leetonia, OH 44431-0231, 330-427-2303.

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

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

WANTED: Collins 310B-3, basket case OK, 70E-8A PTO per 1948. Chicago CMS-2, pair of Taylor T-21. Jerry, W8GED, CO, 303-979-2323.

WANTED: James Millen coils 42080, 42040, 42015, 43015. Navy SE2511/SE2512 rcvr, SE2513 coil set. Gary Carter, WA4IAM, 1405 Sherwood Drive, Reidsville, NC 27320. Phone: 336-349-1991. Email: gcarter01@triad.rr.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: 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, www.r-389.com

---

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

---

WANTED: QSL card from my Grandfather, W9QLY, from before 1957. Also seeking original National Company logos from Ham or military equipment. Don Barsema, KC8WBN, 1458 Byron SE, Grand Rapids, MI 46606. 616-451-9874. dbarsema@prodigy.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 email: tubes@qwest.net See www.fathauer.com or send for catalog of tubes for sale. George H. Fathauer & Assoc., 688 West. First St., Ste 4, Tempe, AZ 85281. 480-968-7686, Call toll free 877-307-1414

WANTED: Old military radar displays, scopes, antennae, receivers, manuals, etc. Even half ton items! William Donzelli, 15 MacArthur Dr., Carmel, NY 10512. 847-225-2547, aw288@osfn.org

WANTED: Seeking unbuilt Heathkits, Knight kits. Gene Peroni, POB 7164, St. Davids, PA 19087. 610-293-2421

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

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

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

WANTED: Info on xmtrs made by Clough-Brengle Co. Used by the CCC, in the mid to late 30's. Any help would be greatly appreciated. Ron Lawrence, KC4YOY, POB 3015, Matthews, NC 28106. 704-289-1166 hm, kc4yoy@trellis.net

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. 541-

923-1013. klakin@aol.com

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:.Looking for information on radio and radar equipment aboard the Navy PB4Y-1. Warren, K1BOX, NC, 828-688-1922, k1box@arrl.net

WANTED: WW II German, Japanese, Italian, French equipment, tubes, manuals and parts. Bob Graham, 2105 NW3Oth, Oklahoma City, OK 73112. 405-525-3376, bglcc@aol.com

WANTED: Heath Gear, unassembled kits, catalogs and manuals. Bill Robbins, 5339 Chickadee Dr., Kalamazoo, MI 49009. 616-375-7978, billrobb@net-link.net

WANTED: I wish to correspond with owners of National FB7/FBXA/AGS coil sets. Jim, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511 j.c.clifford@Juno.com

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

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

WANTED: Books about flight simulators, aircraft instruments, panel meters, or tube computers. Chris Cross, POB 94, McConnell, IL 61050.

WANTED: JOHNSON RANGER CABS & or BEZELS. Or the whole cab set. Dee Almquist, W4PNT w4pnt@w4pnt.8k.com 540-249-3161 (msg). Cell: 540-480-7179 Virginia. Willing to trade.

WANTED: Westinghouse MW-2 Transmitter (RF Unit, Modulator, Power Supply, Coils, Transformers, Parts). Will pickup anywhere. Gary, WA4ODY, Seabrook, TX. 281-291-7701, myctpab@earthlink.net

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

WANTED: Clock/timer for Hammarlund HQ-100, or 110. Sam, W3NFK. 781-631-6510. sbaker7596@aol.com

WANTED: 75A4 Coil Section Cover. PRC-1099A or similar HF manpack radio. Brian Roberts, K9VKY 130 Tara Drive, Fombell, PA 16123 724- 758-2688 k9vky@arrl.net

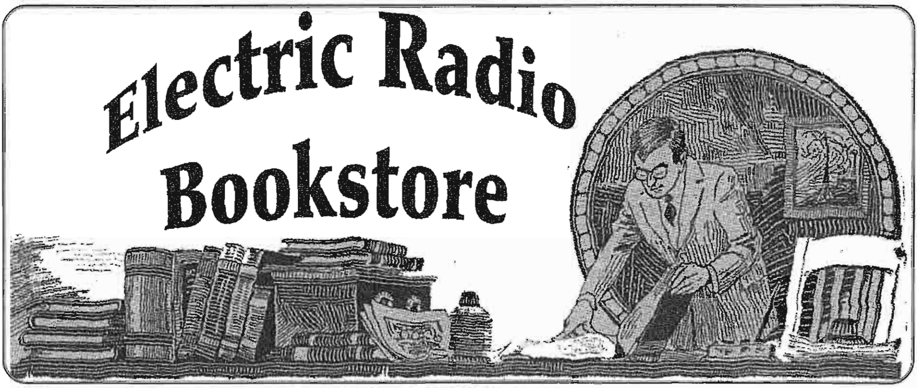
WANTED: Classroom demonstration radio board with AC/DC tube type radio for our radio club. Contact: Mike Grimes, K5MLG; 5306 Creekside Ct.; Parker, Texas, 75094, 972-384-1133. Email: grimesm@flash.net

WANTED: T-368 cabinet back panel. Condition unimportant. Your price, and I'll pay for all packing and shipping charges, of course. K3HVG 301-831-6022

WANTED: Unmodified, good condition, Heath AT-1, VF-1, AC-1, Hallicrafters S38D, 5R50, 51,52, Tom Root, wb8uuj@arrl.net, 810-659-5404

WANTED: Manual, schematic for VLF antenna couplers CU-532/BRR & CU-2065/BRR. Harry Weber, 4845 W. 107th St. Oak Lawn, IL 60453-5252

WANTED: Coils Forms for National FB-7 and preselector. Mike Sanders, 18169 Hwy 174, MT Vernon, MO 65712-9171 k0az@arrl.net



BACK ISSUES

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

COMPENDIUMS

Collins 75A-4 Modification Compendium: All the factory modification bulletins from Collins Radio Co., and all the articles printed in CQ, Ham Radio, QST and ER over the last 45 years, 85 pages, **$20.00 plus $4.00 S&H.**
Collins S-Line, KWM-1, KWM-2, KWM-2A Service Modification Compendium: 260 pages, **$45.00 plus $5.00 S&H.**
Collins KWS-1, 32V series, and 75A series (A1 thru A-3): 42 pages, $15.00 plus **$4.00 S&H**

BOOKS

A. Atwater Kent, The Man, the Manufacturer and His Radios: This 108 page paperbound book describes Atwater Kent's biography, and his rise from a saleman and inventor of electrical equipment to become one of America's foremost radio manufacturers and a household name. There are historic photographs and diagrams on nearly every page, and color plates with vintage AK advertising, by Ralph Williams and John P. Wolkonowic. **$25.95 - 10% = $23.35**
A Pictorial History of Collins Amateur Radio Products: Jay Miller's (KK5IM) classic volume describes the amateur radio products produced by the Collins Radio Company. It has high-quality historic photographs on nearly every page, and the text is backed up by Miller's personal research. -- **$39.95 - 10% = $35.95**
A Family Affair, The R.L. Drake Story: The complete story of the R.L. Drake story, as told by John Loughmiller, KB9AT. 273 pages all about the history of the company, product descriptions, technical repair tips, and great shack photos make a must-have volume for Drake users and collectors. -- **29.95-10% = $26.95**
Arthur Collins, Radio Wizard: 394 pages by Ben Stearns tell Arthur Collins biography from his early years until retirement. Stearns is a professional journalist and was employed by Collins from 1962 to 1977. Many historic photographs and stories from former employees.
-- **$18.95-10% = $17.05**
Miller's Collecting Science and Technology: 160 pages of high-quality color photographs from museum collections make this hardback volume an excellent introduction to this new collecting field. Written by Lindsay Sterling ---------------------------------- **$29.95-10% = $26.95**
Communications Receivers, The Vacuum Tube Era: 1932-1981: This is the classic136 page volume that has much invaluable information about vintage receivers in one handy volume. By Raymond S. Moore, 4th edition -- **$19.95-10% = $17.95**
NEW! **Heathkit, A Guide to Amateur Radio Products:** This is the new revised second edition including some 30 additional products, a tube chart, sales data, a separate ER article index, a completely new introduction, and a new section devoted to Heath's CB equipment. The book is 75 pages larger than the original. By Chuck Penson, WA7ZZW--------------------------**$29.95-10% = $26.95**
Heath Nostalgia: Written by Terry Perdue, K8TP, an ex-Heath employee, this 124-page book is a great history of Heath and the Heathkits that we all remember. ---- **$14.95-10% = $13.45**
SPECIAL DEAL! Heath Nostalgia *and* Heathkit, The Early Years CD both by Terry Perdue
-- **$27.00**

Subscription Information

Published Monthly

Rates within the US:

1st Class: $42 (mailed in envelope)
2nd Class: $32

Rates outside the US, by airmail only:

Canada : US $48
All other countries: US $60

The Electric Radio mailing date is posted monthly at www.ermag.com

Electric Radio
PO Box 242
Bailey, Colorado 80421-0242
Office Hours: 9:00 AM to 5:00 PM MT, Monday to Saturday

Subscriptions and renewals may now be purchased on-line at WWW.ERMAG.COM

Visa, Mastercard and American Express, PayPal

Telephone: 720-924-0171
FAX Line: 303-838-3665
email: 1editor2@indra.com

Electric Radio
PO Box 242
Bailey CO
80421-0242

PERIODICAL

TO: