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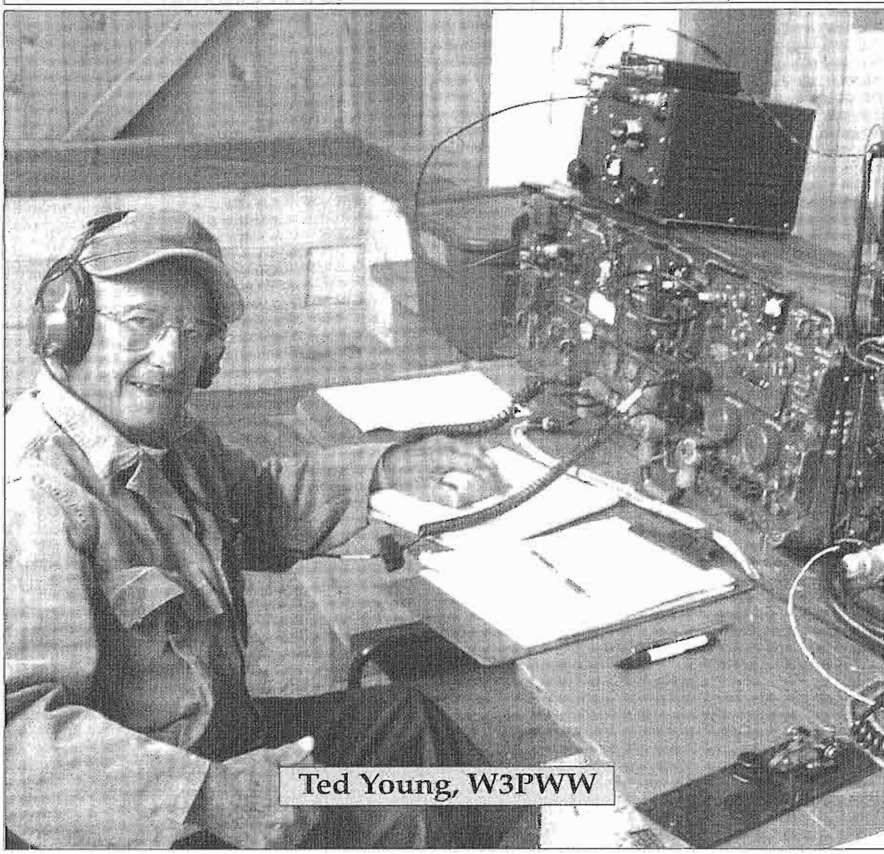
ELECTRIC RADIO

celebrating a bygone era

Number 208 September 2006



Ted Young, W3PWW

ELECTRIC RADIO

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

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

Regular contributors include:
Chuck Teeters (W4MEW), Jim Hanlon (W8KGI), Tom Marcellino (W3BYM), Bruce Vaughan (NR5Q), Bob Grinder (K7AK), Bill Feldman (N6PY), Dave Gordon-Smith (G3UUR), Dale Gagnon (KW1I), David Kuraner (K2DK), Larry Will (W3LW), Gary Halverson (K6GLH), Brian Harris (WA5UEK), John Hruza (KBØOKU), Hal Guretzky (K6DPZ)

Editor's Comments

Worse Than BPL?

The ARRL Propagation Forecast Bulletin 33 of August 14, 2006, and the Amateur Radio Newsline™ report of August 18, 2006, are both reporting on "...a proposed Defense Advanced Research Projects Agency (DARPA) project that could cause major worldwide disruptions to HF radio communication and GPS navigation. The "Radiation Belt Remediation" (RBR) system is envisaged as a method for protecting low earth orbit (LEO) satellites from damage caused by high altitude nuclear detonations or severe solar storms. Testing the system would use extremely high intensity very low frequency (VLF) radio waves to flush particles from radiation belts and dump them into the upper atmosphere...." The details of this system are necessarily incomplete, but it would seem to me that it would need billions of electron-volts from some large source generator in order to provide the required charged-particle "flushing." If there are futher relavant developments, I will report on them in future issues. At this time, the only comment I have is that H.G. Wells and Hugo Gernsback would have been interested in such a scheme. It would seem to me that thousands of users that depend on GPS daily and would not be too happy to have it become unavailable.

2006 Military Radio Collector's Association

The MRCA (Military Radio Collector's Association) meet at Gilbert, Pennsylvania will be concurrent with the Redball Express military vehicle rally at the West End Fairgrounds in Gilbert, PA. This will be 22, 23, and 24, September 2006. There will be several forums and talks concerning military radio as well as a tailgating flea market. The vehicle meet is one of the bigger east coast events and there are many interesting vehicle displays. Numerous "mil-oriented" vendors and private sellers are there with a variety of items for sale. (Courtesy of Brown Beezer, W1NZR)

73, and Keep Those Filaments Lit!

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Cover: Ted Young (W3PWW) is manning his post at the Military Radio Collector's Association meet in 2005. The equipment shown is GRC-19, and there is TCS out of view to the right. Ted has been the net control station for the Saturday morning Military Radio Net on 3885 kc for years. (Photo courtesy of Dale Gagnon, KW1I)

The National NC-98 Receiver

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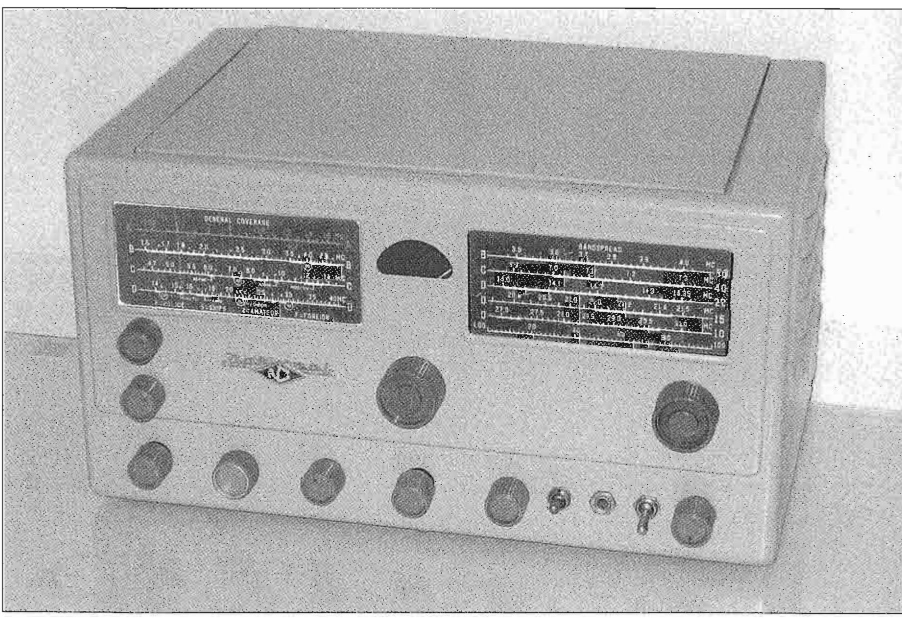
When I started in amateur radio in the thirties, ham radio advertising was mostly numbers. By the fifties it had turned to adjectives. The instruction book for my 1933 Hammarlund Comet Pro is full of numbers. For example, the sensitivity is given as less than 1 microvolt at a 4-to-1 signal-to-noise ratio, a graph of selectivity includes IF transformer coefficients of coupling and coil Qs, and the description of the bandspread tuning capacitors includes LC ratios. The instruction book with the 1955 National NC-98 receiver I bought at the Augusta swapfest a few months back is a different story, however. The only numbers in the receiver description are frequency range, BC through 10 meters, 8 meter range, 8-1 to 40 dB over 8-9, and power required, 105 to 130 volts 50/60 Hertz AC. The rest of the 2 pages are full of items like "rugged dependability" and "truly efficient on today's crowded bands".

The NC-98 was a 1955 product that National Radio used to fill a gap in their receiver line that had not been occupied since the demise of the NC-100XA in 1946. It was a single conversion AC operated receiver with one RF and two IF stages, an S-meter and a crystal filter in the $150 range. Hallicrafters had the S-85 without S meter or filter for $120 and the SX-99 with S-meter and crystal filter for $200. Likewise, Hammarlund and



The National NC-98 is a 9-tube, general-coverage superhet receiver with a separate ham-band dial that was produced during 1955 and originally sold for about $150.00. It might be considered an uncommon receiver in 2006.

RME had nothing comparable in the $150 range. The NC-98 was to be the $150 gap filler. As the NC-98 advertising said "The lowest price general coverage receiver with both crystal filter and S-meter." Apparently the price gap that National marketing saw was very narrow as sales were slow. The NC-98 was replaced the following year by the $160 NC-188, a receiver that capitalized on the NC-300 "dream receiver" advertising spreads with its look-alike styling. While the NC-188 looked similar to the NC-300, it was 98% electrically identical to the NC-98, but without the crystal filter. The NC-188, even with its new styling, was not a good seller, and as a result both the 98 and 188 are scarce in hamfest bone yards.

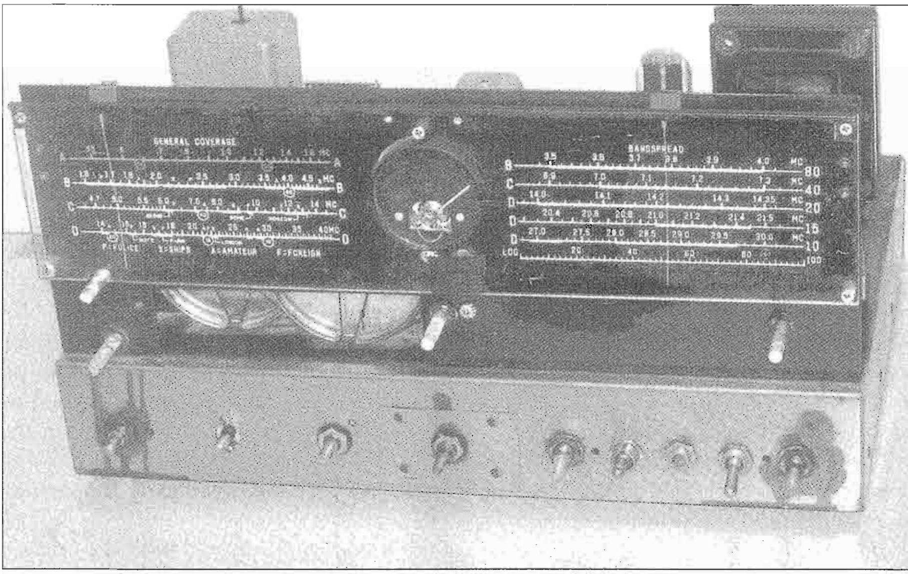
The NC-98 is an interesting look into reverse engineering by starting with the selling price and working backwards from there. Allowing for advertising and distribution costs, you have the National production cost. Development and engineering cost would have been minimal as they probably used the NC-88 as a starting point. The NC-88 had been in production for 3 years, and was exactly the same as the desired product, except it lacked an S-meter, and crystal filter. The 88 cabinet and chassis would need only minor changes in the location and number of some holes. The additional $30 price for the 98 over the 88 was supplemented by removing the built in speaker from the 88, which would open up sales for a high profit item, the NC-98TS external speaker.

The only engineering required would be the S meter and crystal filter circuits. Instead of the usual S meter bridge circuit, National elected to use the BFO tube, half of a 12AX7 dual triode, as an S-meter amplifier. This cheaper option required only the meter and one fixed and one variable resistor and does not interfere with normal BFO operation, since the BFO and S meter are not required to operate at the same time. While the NC-98 S-meter has a D'Arsonval movement, it lacks a zero set and mounting flange, which indicates a meter from a low cost supplier.

The crystal filter is interesting, as it is a National in-house product, designed for low cost. A conventional IF transformer is used at the filter input, with the internal output tuning capacitor removed. The secondary winding leads are fed to an adjacent can with a pair of 100-pf capacitors connected in series across the winding to provide a grounded center tap. The 455-kHz crystal and a 50-pf variable phasing capacitor in the second can are connected to the opposite ends of the incoming IF signal. Both the crystal and variable capacitor then feed the top of a 1-mH choke, with AGC on the bottom. The top of the RF choke feeds the first IF grid. This is a striped-down crystal filter circuit using only 6 standard components and it sure would give Jim Lamb fits if he had seen it.

My NC-98 was in a box when I bought it, as the chassis had been removed from a rusty cabinet. It had a few missing tubes, heavy yellow drapery cord used in an attempt to repair the dial drive, and a cut offline cord. The seller assured me that it had worked several (?) years before the dial cord failure. When I got it home a general clean up, adding the missing tubes, and a new line cord, and it was ready to connect to the Variac and speaker. I brought the voltage up, filaments and dial lamps lit up, B+ appeared, and the darn thing worked pretty good, just as the seller had told me.

The first order of business was to replace the dial cord. Thank goodness there was a diagram in the book, as it took 9 feet of cord to string the main and bandspread tuning systems. I have never seen a receiver that used that much cord. It must



Out of its cabinet, the NC-98 is very attractive with the large illuminated S-meter and edge-lighted slide rule dial. The receiver is very similar to the SWL NC-88 "World Master" receiver with the exception of the S-meter, crystal filter, and amateur-band dial calibrations.

have been designed by the guy who did the fan belt for the Corvair. It took over an hour and some assistance from my wife to hold the cord in position on the correct pulleys and drums until the tension springs were in place. Amazingly the dial drive is smooth with no noticeable backlash. Also no noticeable effort is required to tune the receiver, even though there is 9' of cord, and eight pulleys between the tuning knobs and the variable capacitors.

The next order of business was a touch up alignment, now that the dial pointers were working. The 455-kHz IF is aligned on the crystal IF frequency except for the crystal filter. It is tuned 2-kHz high. A strange crystal filter alignment, but so is the filter circuit. The RF alignment starts on the broadcast band with trimmer capacitors on the high end and a slug in the coils for the low end. It was really messed up and would not align. A check led to a defective 5-20 trimmer capacitor for the high end oscillator alignment. I replaced it with a 3-30 pf and the alignment went as it should. While aligning, I touched the RCA type external audio input jack on the rear apron, and simultaneously checked the 185 volts on the 6BE6 mixer plate. Low level audio inputs do not usually provide a shocking experience. A wiring check showed the jack was wired direct to the mixer plate. It was probably rewired for a panoramic adapter, or Q-multiplier. I rewired the RCA jack to original as an external audio input. The RF alignment is normal with trimmers on the high end and adjustable coil slugs for the low end. The oscillator is on the high side, except for the 14 to 40 MHz band where it is on the low side.

Dial accuracy and tracking was good during the alignment; however a check the next day, on a cold receiver, showed a major error on the low end of the BC band. By the time I had connected up my signal generator, the local 580-kHz station had moved up 15 kHz. Another fifteen minutes and the station was at 580 on the dial, where it belonged. The total drift was over 25 kHz. I have never seen a receiver drift that much on the BC band. There was very little drift on the high end of the BC band. This pointed to the tuning capacitor as the problem. Apparently in an effort to keep the cost down, the capacitors were purchased competitively (read "cheap"). There was no end-play adjustment; however a feeler gage check showed the plates were centered. An external 365-pf variable was connected in place of the NC-98 oscillator section. The drift was reduced to almost nothing. A heat gun and a cold spray on the NC-98 oscillator variable capacitor could tune the receiver 30 kHz on the low end of the BC band. On 20 meters it was over 100 kHz. Since there was nothing that I could do to the NC-98 capacitor, and nothing I had would fit mechanically, I just warm up the receiver 30 minutes before using it. Once it is warmed up it stays put if you keep it out of any drafts.

With the chassis working the way it should, I started on the cabinet. The cabinet comes apart into four sections, top, back, bottom, and a one piece front and sides making up the fourth piece. It is very flimsy when apart, but adequate when screwed together, certainly not like a HRO that you can use as a step stool, but adequate. I took it down to bare metal, and then primed it with 2 coats of gray primer. The gray looked close to the original National gray hammer tone, so I quit with the primer. I put the chassis back into the cabinet, but then almost took it back out. The receiver looked better to me out in the open, with the tubes, cans, and transformers showing, especially the black edge-lighted slide rule dials, but I left it in the cabinet since I was sure somebody would pull the dial cord off a pulley.

I put the receiver on the bench for

The rear of the NC-98 show the tube placement and the temperature-sensitive tuning condenser.

Improving the Performance of my R-390A, Part 2

Audio, AGC, and Detector Improvements

By Bill Feldmann, N6PY
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In part one, I described how I restored the performance of my R-390A. In this second part I'll describe some simple improvements I made to its local audio, noise limiter, AGC, and detector systems.

In part one I neglected to mention a few things. The S/N of my Stewart Warner R-390A is 2257 and was built on order #20139-PC-60. In order to align the IF module it was necessary to remove the covers on T501, T502, T503, and Z503 and drill a .156" diameter hole exactly in the center of their top surfaces. I drilled each cover from the inside using a drill press. The covers sat on their top surfaces and were supported on a block of wood during the drilling operation. I noticed two holes in a bracket in front of the Cosmos PTO in my R-390A. These holes provide access for aligning the PTO when it's installed and the front panel is lowered. I use an UG-971/U adapter on the balanced antenna input because I use coax in my station's console. There's an impedance mismatch, but I find it doesn't hurt sensitivity and the RF selectivity is much better than if the unbalanced input is used. The unbalanced input was designed for a whip antenna.

At the Collins Users Conference in 2002, Dan Reaves (W5OR) reported on the approximate numbers of the R-390 family that were built:

734 R-389 LF receivers
16,900 R-390 HF receivers
54,000 R-390A HF receivers up to 1984
1,440 R-391 autotune HF receivers
25,600 R-392 HF receivers
300 R-725 HF receivers

All R-390 enthusiasts should read Chuck Teeters' interesting article about the unusual and rare R-725 in issue #200 of ER.

Because of my experiences refurbishing the RF module in part one, I replaced all the mica and paper capacitors and any resistors more than 10% out of specification in the audio and IF modules.

To improve carrier meter zeroing, I replaced R523, the carrier meter zero pot, with a Bourns 3540S-1-101 ten-turn pot, available at www.mouser.com, 1-800-346-6873. I also replaced C609, the 8-µF capacitor in the audio module that almost always fails. I replaced C553 that blocks B+ from the filters, but didn't replace the other military-grade silver Sangamo or Sprague oil filled paper capacitors, since they are usually reliable. I didn't replace the dual-section power supply capacitors, C603 and C606, because they tested OK. If they should fail, I'd open them and install modern electrolytic capacitors inside like I did on my PE-237 military power supply that I wanted to look stock.

I'm assuming the reader has the R-390A manual available, with schematics, and access to the back issues of Electric Radio (ER) which I'll refer to. I won't describe my modifications in a "Heathkit" step-by-step fashion because they can be understood by comparing my schematics to those in the manual. My schematics are drawn to show the way I modified my R-390A's circuits from its stock configuration. Also, reference designators are stamped next to the components in each module to aid in locating them. In my schematics, if a part has only a reference designator with no value shown, its value is unchanged from the value shown in the manual. The capacitor voltage ratings I've shown are those I used, but higher voltage capacitors will work fine.

After getting my R-390A working properly, I identified four systems I felt

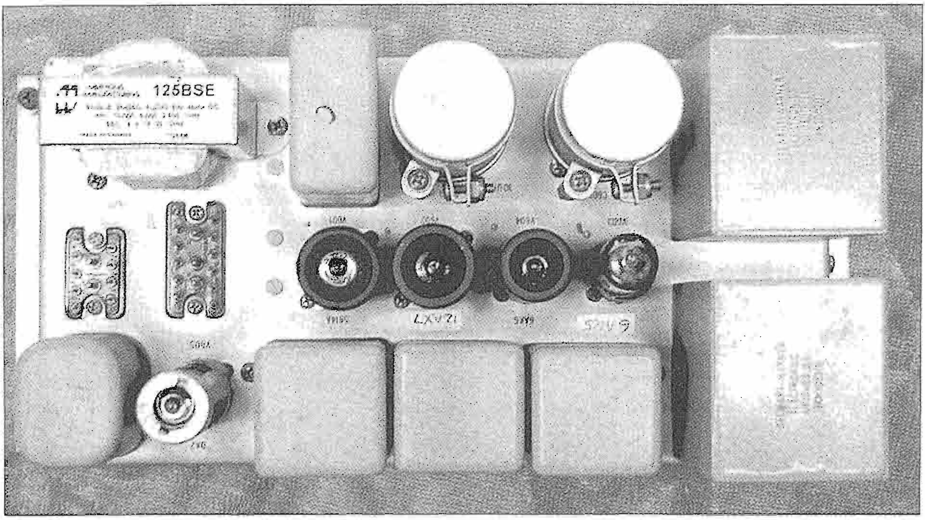

Figure 1: The R-390A audio module showing the location of the Hammond transformer to the upper left.

needed improvement. Its local audio has high distortion and lacks sufficient power to drive an 8-ohm speaker. The noise limiter hurts the communications quality of weak AM audio. Its AGC and detector systems are poor for CW and SSB reception. My requirements for the improvements were that any one improvement must not require modification to more than one of the R-390A modules; it must operate as originally designed if an unmodified module replaced a modified one. Lastly, any modifications must be easily reversible to allow a future owner to restore its stock configuration.

I first worked on the local audio. It works fine for military communications using headphones but it's not adequate for driving a speaker when listening to good quality AM. After reading many articles, I decided to try Mike Murphy's circuit Simple Audio for the R-390A in issue #181 of ER. I planed to primarily use the local audio for driving headphones, but occasionally a speaker. I modified my audio to nearly the same circuit as Mike's in Figure 3 of his article, but with the following exceptions. For still lower distortion I used a Hammond 125BSE 8-ohm, 45-mA output transformer I purchased from Antique Electronics[1]. It's the largest one that will fit onto the audio module, as shown in **Figure 1**. Because of this transformer's high quality, I didn't install the optional feedback loop from its output to the driver's cathode. To match my headphones, I placed a 220-ohm resistor between terminals 6 and 8 of TB102 on my R-390A's back panel. Its value can be adjusted to get the best audio level control for the type of headphones being used. For a local audio output load when not using a speaker, I placed a 10-ohm resistor across pins 6 and 7 of TB102.

After replacing the audio module and connecting a high-quality Jensen speaker, I tuned my R-390A to an AM station playing good quality music. The results were outstanding; the audio was the best I've heard from any radio with a single audio output tube. It sounded almost as good as the outstanding audio from my SX-28 with a push-pull audio system. But, the copy of weak AM voice signals in the QRN or power line noise was better with the noise limiter off because of a

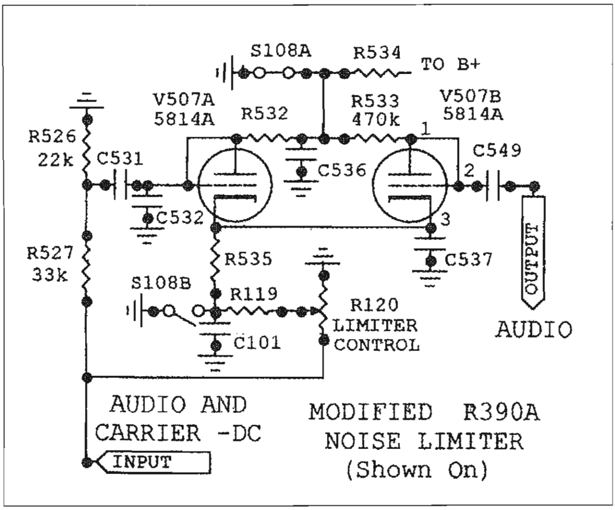

Figure 2: Modified noise limiter circuit. The noise limiter switch is not shown for clarity, and the limiter is in the "on" position.

loss of higher audio frequencies.

I next made the three resistor changes shown in the simplified limiter schematic of **Figure 2**. A half-wave limiter would work better for AM reception, but Collins used a full-wave design so it also works with non-AM modes. The limiter uses the triodes of V507 as diodes by connecting their grids to the plates. Audio current, along with a negative DC current proportional to the carrier's strength from the AM detector, is introduced into R527. R527 and R526 reduce the audio to nearly half that of the negative DC current at the plate of V507A where upward-modulated noise is blocked. The audio then goes to V507B's cathode to block downward modulated noise. Negative DC current is introduced to the cathodes of both tubes through R535, R119, and R120 to set the noise blocking level. To turn the limiter off, S108 is set opposite of how it's shown in **Figure 2**, introducing a larger current and allowing all audio and noise to pass through. It should be possible to adjust R120 for some current level where only noise spikes above the 100% audio modulation level are blocked. Unfortunately, with the stock resistor values there is insufficient current available, and that causes blocking of audio peaks. This results in a loss of the higher frequencies and causes mushy-sounding audio. This is especially true for the downward-modulated audio peaks, but reducing R533 to 470k greatly decreased this blocking. Also, changing R526 and R527 increases the ratio of negative DC current to audio current. This further reduces the blocking of both downward and upward audio peaks. These changes resulted in a significant improvement in the audio of weak AM signals with no loss of its ability to remove power line noise. Now, even music sounds good with the limiter on. However, there's still a 6-dB decrease in audio with the limiter on, as with the stock design.

Receiving CW or SSB with a stock R-390A usually requires reducing its RF gain because of the long AGC attack time. It was never designed for SSB reception without the use of an outboard detector and audio AGC system, which I've tried and didn't like. By adding the Lankford modifications, described in my article in issue #202 of ER, its AGC performance was improved but still not acceptable. To further improve the AGC I incorporated an AGC threshold improvement designed by the editor in issue #150 of ER. This changes the AGC biasing method by using a Zener diode at the detector's cathode instead of the suppressor grids of two IF tubes. I removed the wire from pins 2 of V504 and V508 going to R546 and wired pins 2 and 7 together on both tubes. I removed the ground from pin 3 of V509, added D1A, and then wired R544 to pin 3 of

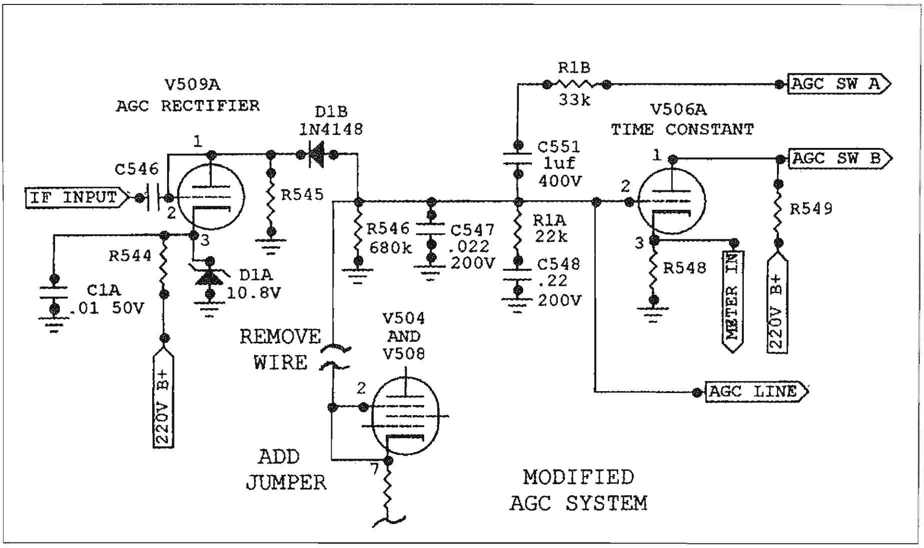

Figure 3: The modified AGC system.

V509 to bias its cathode. I removed R547, and then D1B, R1A and R1B were installed per **Figure 3**.

When I first tested this circuit, it worked much better than the Lankford modification I previously installed, but I noticed the carrier meter reading was 10 dB lower on a strong signal in SLOW AGC than in FAST, indicating C551 was leaking. This 2-µF capacitor was replaced with a 1-µF, 400-volt Mylar film capacitor. By adding R1A and R1B, the AGC attack performance was improved. It removed the popping on most strong SSB signals and helped prevent static bursts from muting the receiver. The AGC bleed-off time was now about 1/4 second in FAST, 3/4 second in MED, and 6 seconds in SLOW. It worked best for weak CW and SSB signals in FAST, for stronger CW and SSB signals in MED, and reduced noise for very strong SSB signals in SLOW.

Not having a storage scope to measure AGC attack time, I devised a simple method to judge AGC attack performance. Feeding a 1000-µv RF signal into a receiver through a cable that has a "tee" connector attached, and using a hemostat to short the connector's unused male terminal to the connector's body (which shorts the RF signal to ground), I looked for audio spikes on the receiver's audio output with an oscilloscope scope set to a slow sweep rate when the short was removed. My 75S-3B and 75A-4 receivers that have acceptable AGC performance on SSB and CW so I tested them first. (My 75A4 has the AGC modifications in issue #13 of ER by William Beatty, K7CMS.) Switching to the 1000-µv signal, both receivers had audio spikes on the scope 3 to 4 times higher than the audio envelope from the 1000-µv signal. I repeated this test on my R-390A with the AGC modifications of **Figure 3**. Spikes from the R-390A were about the same as those produced by the other receivers in all AGC settings, indicating the R-390A's attack-time performance was equal to theirs. But, when testing two newer solid-state receivers (Collins HF-380 and Yaesu FT-1000D) I found their audio spikes to be less than 1/3 of the total audio envelope.

These tests indicated my newer solid-state SSB receivers have much better AGC attack-time performance than my older

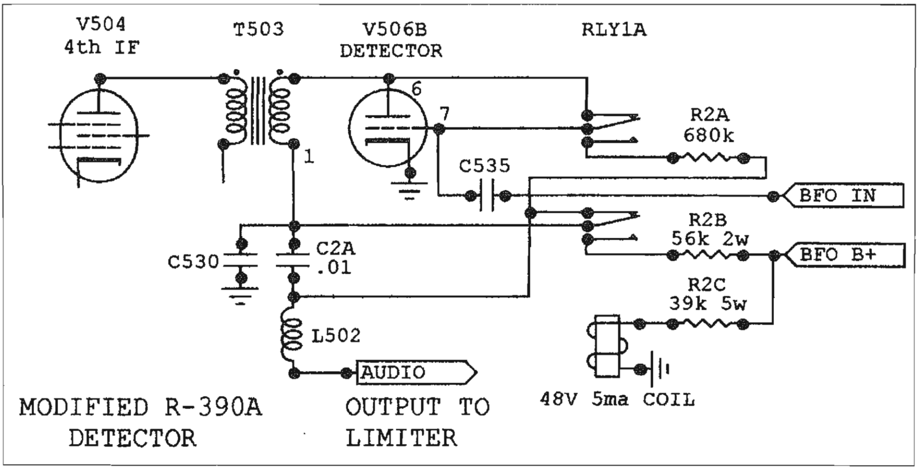

Figure 5: The modified R-390A detector. See text for a description.

I now had a robust design with more than adequate dynamic range and an audio output level nearly that of the stock AM detector. But, I needed a final design that would easily switch to the stock detector for AM. The circuit shown in **Figure 5** did this by the addition of a small DPDT relay with a 5-mA, 48-VDC coil (Mouser P/N 653-G6A-274P40-DC48). By only using the switched BFO B+ voltage, it automatically switches the configuration from the stock diode detector in Figure 4A to the product detector of Figure 4B, but with one very subtle exception. The ground return for the grid leak resistor, R2A, is now connected to the input of the noise limiter at C2A. This supplies a small negative DC current, allowing the limiter to function when receiving CW or SSB. This change had no measurable affect on the detector's or limiter's performance.

Installing the relay and other components was very easy. I mounted this normally PCB-mounted relay "dead bug" style using double-sided tape on the inside of the front surface of the IF module's chassis. **Figure 6** shows its location between the BFO and selectivity switch shafts. I also installed a ground lug to the left of the relay for an additional ground and to apply a little force to keep the relay's mounting tape under compression. I removed the wires between pins 6 and 7 of V506B and between T405's secondary and L502. The relay and other components were wired as shown in Figure 5. Both R2B and R2C were connected to a terminal post located under the BFO shaft that supplies the switched B+ for the BFO.

Receiving SSB is very easy using 4 kc of IF selectivity; just turn on the BFO switch to activate the relay. Set the BFO offset to +2 kc for LSB or to –2 kc for USB for excellent audio quality from strong SSB signals. If the QRM or QRN is heavy and the signal weak, I use 2 kc of selectivity for the best communications audio using about 1-kc BFO offset. Since the 2-kc bandwidth is very narrow, I adjust the BFO and KC knobs together for best audio quality. For accurate frequency dial readings, I recalibrate the receiver by calibrating on the nearest 100-kc marker after setting the BFO offset. CW reception is the same as for a stock R-390A, but the detector will not overload with full RF gain and the AGC on.

Because of its excellent preselector system, a properly working stock R-390A has outstanding RF and IF performance, better than many modern receivers, except for its AGC, detector and audio

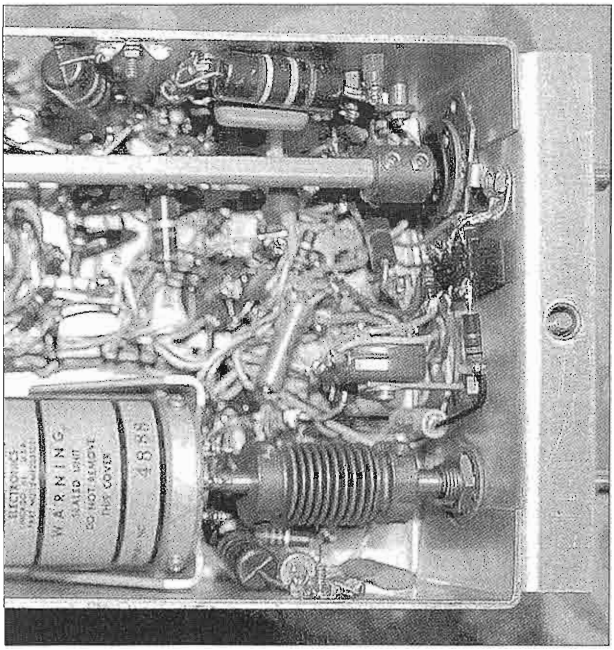

Figure 6: The location of the new relay is shown here, on the upper right side of the chassis, just above center, and slightly above the captive screw on the lip of the chassis metal.

systems. My receiver, with the above improvements, has excellent performance for all the HF modes I use. On AM, with my outboard audio system described in issue #203 of ER, it's better than the other receivers I use, except for my non-A R-390 that's slightly better for AM because of its lower distortion non-mechanical filtered IF. Both its local and outboard audio is better than my 75A-4, 32S-3, HF-380, or FT-1000D for SSB. For CW, it's very good, but could use a 500-kc filter. These improvements worked so well I'm now thinking of trying them in my non-A R-390. Hopefully, I can report on this in a future ER article with schematics for the R-390.

My R-390A is still not perfect. Even though its modified audio noise limiter works very well for AM, an IF noise blanking system would be much better for CW and SSB. An IF notch filter, like in my 75A-4, would be very useful to eliminate heterodynes. A KC tuning knob with a lower ratio would greatly facilitate the tuning of SSB and CW signals, but it should be able to switch back to a 1:1 ratio for rapid tuning over each band. The performance of my modified AGC system is now adequate for most SSB and CW. It's better than other simple R-390 modifications I've tested, but my audio spike test showed it could be further improved, as I mentioned above.

I sincerely hope you've found this two-part article about my R-390A project educational and food for thought. I hope I did an adequate job of describing my repairs and modifications and didn't bore or put you to sleep since I do excessively ramble on at times. Hopefully, this article will encourage others to develop additional improvements for this outstanding receiver. I definitely wish to thank the editor and other ER authors I referred to. Without their pioneering work, my R-390A project wouldn't have been possible. Also, thanks to all the others mentioned in this article for their valuable help and encouragement.

[1][This transformer is also available from Radio Daze, 877-653-8823. –Ed]

ER

Tubes Tested Free

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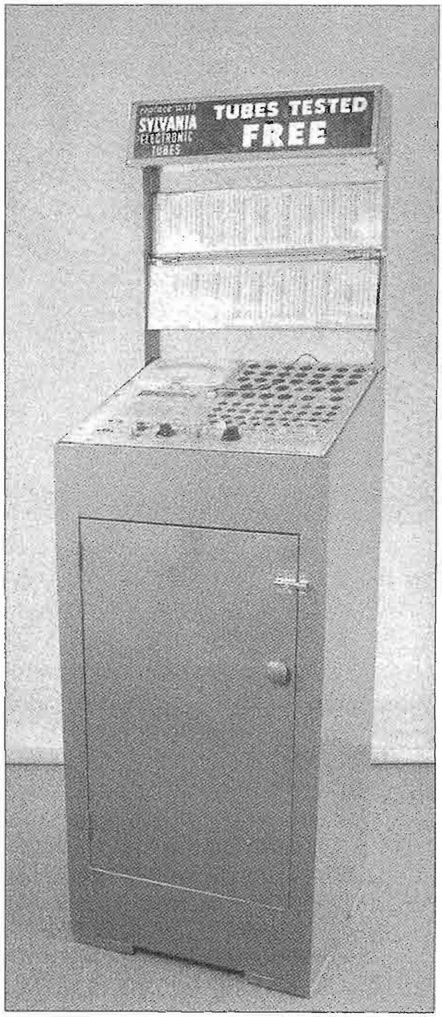
"If it were not for Philo T. Farnsworth, inventor of television, we would all be eating frozen radio dinners."
–Johnny Carson (1925-1995)

Radio owners in the Golden Age of radio were unaware of the myriad components concealed inside their radio's cabinet. I would estimate that half of our population suspected all radio technicians were dishonest. The remaining 50% had no doubts at all—they were positive all radio repairman were as crooked as a 160 meter tank coil. They were often charged for strange sounding items customers never heard of when all their radio needed to restore operation was an inexpensive radio tube—or so they thought.

This idea of radio tubes being the only thing in a radio to ever needed replacing continued until the advent of the transistor. In my shop, the days were few when someone did not bring in a radio and say something like this. "It was playing along just fine when it quit. I am sure it is nothing serious—probably the sound tube."

Let's analyze this sentence. The first part informs the radio shop owner that the problem is minor and that the customer expects a small repair bill. The second part tells the shop owner that the customer is familiar with the workings of radio, and as the radio has no sound all it needs is a 'sound' tube. Sometimes the part needed was the 'power tube' as the radio played, but not loud enough.

The technician, so informed, decides to do the repair immediately, and let the customer watch. He removes the dirty chassis from the cabinet. Mouse droppings cover the chassis, rusted in many spots by mouse urine. Cockroaches have done their damage, and three run out of the cabinet when the back is removed. The chassis is carried outside, and blown out with an air hose just to get



The drug store tube tester was once a common sight in America. This one was made by Mercury Electronics.

it clean enough to trouble shoot. Within minutes the technician finds the problem—an open primary on the output transformer. Of course the transformer is attached to the speaker with rivets. The speaker is removed, and the drill press used to drill out the rivets. A new transformer is installed and the radio comes to life. It seems to be a trifle weak on most stations.

Now, the radio is put on the signal generator and the IFs are peaked on 456 kc. The volume control and tone control are both very scratchy. A few drops of liquid cleaner does the trick, they are nice and smooth now.

The shop owner notices that the dial cord is badly frayed where it winds around the tuning shaft. It will break anytime. So, while the radio is on the bench he undertakes—and completes—the unpleasant task of stringing a new dial cord. A spot of radio service cement is touched to all knots so they do not slip. He inspects the 110-volt AC cord and finds no problems. To satisfy the radio owner the technician runs all tubes through his tube tester. All check OK.

The radio cabinet is carried outside and cleaned with compressed air. Back in the shop, the dial glass—actually a rather light plastic—is cleaned with glass cleaner. The radio cabinet is given a good rubdown with 'Lemon Oil' furniture polish, and the radio reinstalled. A final check of stations across the BC band reveals the radio repair job is now complete.

The shop owner knows full well what the customers response will be when presented with the $9.50 bill—$4.50 for the transformer, plus a $5.00 service charge. He will be fortunate if the customer ever returns to his shop again. "FIVE DOLLARS for one hour's work," screams the customer. "When I was your age I worked a lot harder than you, and I was paid $5.00 for a full day's work. I won't be coming back here again."

You think I am exaggerating? I went through this routine several times a week for almost 30 years. Customers such as the one just described paved the way for drug store tube testing.

In reality, the vacuum tube was/is one of the more dependable items in a radio. Radio tube failures more often occur in new tubes. A tube that has been working for a few hundred hours will probably outlast a brand new tube of the same type. The idea that tubes needed checking, and replacing, was not confined to household radio owners, it carried over into the Military and commercial usage. The old adage "If it ain't broke, don't fix it," is certainly true of radio equipment.

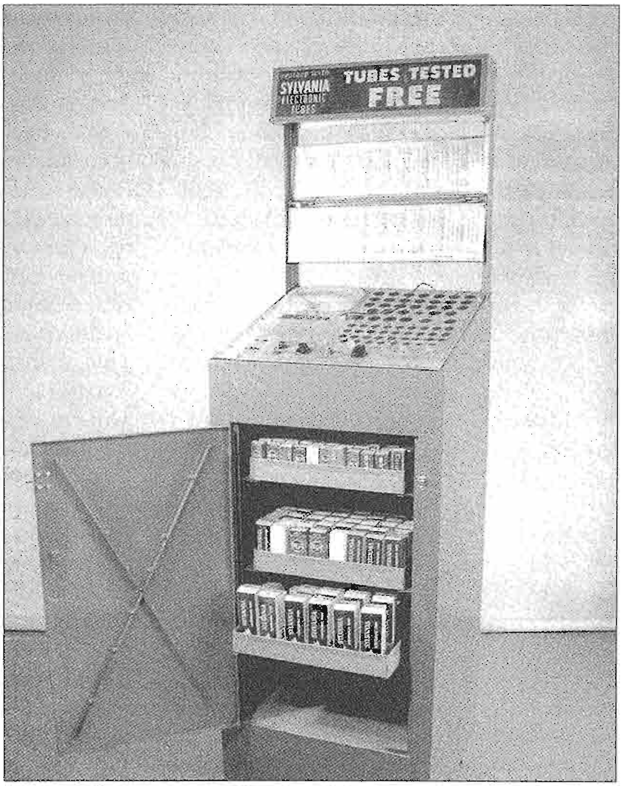
The concept of replacing tubes after a given time period might possibly be traced back to radio repairmen themselves. After all, there was good money in radio tube sales. While I never heard of the government accusing tube manufacturers of 'price fixing,' it is rather strange that the retail price of radio tubes was almost identical for all major manufacturers.

Wholesale prices were another story. When I opened my business immediately following WWII, the standard tube discount was 50%, plus 2% if paid by the tenth of the following month. Within months, some distributor offered a 50, 10, and 2 percent discounts. Not to be outdone, other distributors offered 50, 10, 10, and 2 percentages. This discount remained in effect until I closed my business. Now, as any elementary school student can tell you, 50-10-10-and 2 is not 72% discount—but it is a substantial profit. A profit of $2.41 on a $4.00 sale is not exactly peanuts. I was still buying tubes for 50-10-10-and 2 when I closed my shop.

Long before the 201A became obsolete, radio shop owners had large signs painted on their front windows, "Tubes Tested Free." My shop was not one of those. I never charged for testing tubes; it was a service that I offered reluctantly. Any radio repairman knows that the only reliable test for a tube is replacement of the tube under suspicion. Tube testers, while necessary, are of limited value in radio service shops.

Let me say here that the most valuable piece of test equipment any shop owner can acquire is experience. Familiarity with certain makes and models of radios, and their weak points is what makes a really good repairman.

With annoying regularity customers came in my shop with a paper sack full of tubes to be tested. I really disliked testing tubes for customers because of the pitfalls involved. I knew many tubes that test low on emission will work, probably for many more years, in the customer's radio. Do you recommend the customer replace all tubes that test in the 'low' or 'doubtful' range? There is really no good answer to the question.



The front door opens to reveal a fully-stocked selection of new tubes. Usually, the store clerk had to disappear momentarily to find the key to the door once the customer decided a tube was bad.

Let's take one example and analyze it from both the customer's viewpoint, as well as that of the radio repairman. A customer arrives with 9 tubes in a sack. "My radio sounds like it has a 'cold'—the voices are weak and distorted. I think one of the 'sound' tubes is weak. I just pulled all of 'em out for you to test."

The repairman, if he has a moderate amount of experience, suspects that he customer's problem is either a coupling capacitor or a plate resistor in the audio circuit. Of course he could be wrong. I remember one case when a customer's radio sounded very weak and distorted, and the problem turned out to be that mice had eaten most of the speaker's paper diaphragm. That was not a usual case—I stick with my original diagnosis—distorted sound in home radios can usually be found with a basic VOM in less than five minutes.

But right now, with a customer standing by with a sack full of tubes, the repairman must make a decision. I always handled it this way: 'Sir, your problem is probably not a tube. I suspect one of the audio stages is not receiving enough voltage—or possibly too much. This can be caused by several things—the most likely is an open resistor, or a defective capacitor. I will be glad to test your tubes for you, but the decision as whether or not to replace the tube will have to be yours. I will tell you that the very best tube testers sometime lie to you. This approach worked best for me.

Suppose you leave your customer waiting and disappear into the shop with his sack of tubes. Ten minutes later you return and say, these two tubes test in the BAD scale. This one is in the doubtful (?) range. The others test fine.

"That's what I expected," says the gentleman. Give me the two bad ones and the one that tests doubtful. I figured those tubes were getting weak."

The customer now pays you $11.70 for the three tubes and goes home. He installs the tubes—hopefully in the correct socket—and prepares to listen to the evening news. The radio plays exactly as it did before he spent money with you. Now, one of three things will happen: 1) He gets angry, and assumes you sold him tubes he did not need. 2) He becomes angry, and is convinced you sold him used or defective tubes. 3) He becomes moderately annoyed, and early the next morning brings the radio to you for repair. Since new tubes did not change anything in his radio, he wants his old tubes back in the set, and a refund on the tubes. Ninety percent of the time he will have discarded the tube boxes. Many times the poor repairman tossed his old tubes in the trash bin the night before.

So where do you stand now? You have probably 20 minutes invested, you have an irate customer, and you have three tubes—without boxes, and his old ones are in the city dump. Tube testing is not profitable for most repair shops. That is the reason I was overjoyed when drug stores started testing tubes for free. They caught the flack, and I ended up getting a repair job. Some shop owners probably figured out a way to make tube sales, and keep customers happy at the same time—I never did.

I sold mostly RCA, GE, and Philco tubes in my shop. The three brands of tubes cost practically the same. Some jobbers like Arkansas Radio and Appliance, the Philco distributor, often offered incentives like free test equipment with the purchase of tubes or other merchandise. I obtained a free Philco signal tracer, and signal generator from them. I found early on that I could make money by taking a day off every ten days or so and driving 70 miles to Fort Smith. There were three wholesale distributors there and none in Springdale.

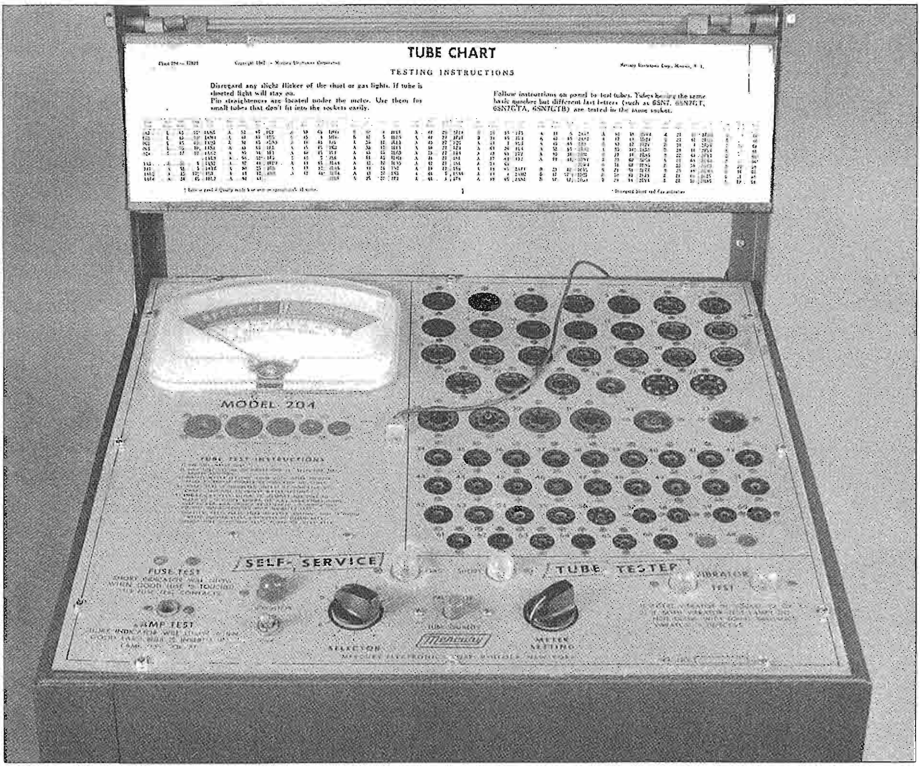
One of our biggest sellers was the so-called 1000-hour battery pack used in farm radios. The REA had yet to complete electric lines to many outlaying areas. Philco often tied free merchandise into the sale of battery packs. I remember one deal they offered was a free phonograph stylus assortment with a retail value of over $300.00 with every dozen Philco battery packs. This was offered, I am sure, to counter Eveready advertising of a battery pack with 300 more hours of 'playing time'—the so-called 1300-hour battery. Needless to say, I bought a lot of Philco tubes and batteries.

I was in Arkansas Radio and Appliance one morning when a gentleman came in carrying a small five or six-tube radio under his arm. "I'd like to get a new power tube, and a new electric cord put on this set," he said.

The salesperson explained to the gentleman that he was in a wholesale parts distributor store, and that they did no repair work, then said; "By the way, there is a local repairman over there at the counter. He operates a radio shop here in town—why don't you ask if he can take care of your problem." The salesman then introduced the potential radio repair customer to 'Harry' of 'Harry's Radio and Appliance Service.'

The potential customer asked Harry, "How long would it take you to put in a power tube, and a new electric cord on this radio?"

"I can take it to the shop right now; I am only a few blocks away. I can replace the audio output tube, install an electric cord on your set, and have it back here in



The tester was designed to be easy to operate. The tube type was looked up on the flip-down chart, the tube was plugged into the proper numbered socket, and the instructions could be followed complete an emissions test. Lamps would come on if the machine thought the tube was gassy or shorted.

45 minutes."

"Well," asked the radio owner, "How much is all this gonna' cost me?"

Harry looked up the tube price and said, "The tube is $2.75. The electric cord is $1.00. My minimum service charge is $2.50. That adds up to $6.25."

"That's fair enough," said the customer. "If these folks don't mind, I'll just wait here for you to bring it back."

I was still in the store buying parts when Harry returned. He handed the gentleman the radio and said, "That will be $6.25."

The radio repair customer paused—then asked, "How does it work now?"

"I have no idea," said Harry. "You never mentioned that you wanted the radio repaired; you told me you wanted a power tube, and an electric cord. I did exactly what you ordered—no more—no less. I did check the tube, and your old one was good and did not need replacing, but you asked that it be replaced. You diagnosed your problem, and it is now fixed according to your orders."

I thought Harry was a little hard on the man. I could not help but feel a bit sorry for the middle-aged gentleman as he shelled out $6.25, and walked out the door with a dead radio.

'Tubes Tested Free' service began very soon after the first tube testers appeared on the market. You can be assured that thousands upon thousands of perfectly good tubes found their way to the city dump. Those who tried to avoid a repair charge often ended up paying dearly for each dollar they saved. From the very beginning, 'Free Tube Testing' was highly profitable for the unethical and a losing proposition for honest repairmen. When drug stores, service stations, and even grocery stores put in self service tube testers I was delighted. Believe me, the end result was an increase in revenue for most radio and TV servicemen.

How did the self-service tube business operate? The usual manner was similar to the juke box business. An operator bought a number of tube testers and a big order of tubes. Most self-service testers had a lockable door on the lower part of the cabinet. Inside the cabinet were three or four drawers. Each drawer was fitted with cheap, lightweight cardboard separators much like the old fashioned egg crates. A printed sheet under the drawer dividers had the tube numbers printed on it. When the route man checked the tester station for sales, all he needed to do was open the door, look at the empty spaces and write down the missing tube number. He then restocked the test console with the missing tubes, and collected for those sold. A route man normally serviced the tube testers on a regular basis—every two weeks seemed the choice of most route operators.

The tube discount granted the site owner varied with the company installing the testers. I have tried to track down a store owner who actually had one of these but so far I have had no success. I read that the discount offered store owners was from 25% to 33%. As you can see, the more testing consoles one placed in stores, the more money the route operator could make. Therefore, it was of prime importance that the Tube Tester be inexpensive to buy, reliable and simple in operation, not extremely heavy to transport, and attractive enough to get attention.

Recently, a friend of mine who is a building contractor called and said he had found a drug store tube tester in a barn that he could get just for hauling it off. He asked if I would like to have it. Of course, I answered in the affirmative. I expected an abused and neglected tester, but it was even worse than I imagined. The lightweight metal case looked pretty hopeless. The tube tester appeared to have either a defective switch or an open primary in the power transformer. The Sylvania sign was inserted backwards, and all lettering covered with duct tape—now rotted from age and exposure. Apparently whoever owned the tester last did not want to offer free tube testing. There was considerable rust on the steel cabinet, and the door was badly bent. The bottom of the unit appeared to have never had wheels, or glides—just the bare metal against the floor.

This tube tester was manufactured by the Mercury Electronics Corp. of Mineola, N.Y. It is their Model 204. The tester is not what I would call an exceptionally well built piece of electronic gear—it is not military specification gear. However you must admire the Mercury Corporation for their ability to fulfill a need. I have no idea what this unit sold for but I will hazard a guess that it is not much more than what any good counter-type tube tester would cost—perhaps in the $400.00 bracket. The cabinet is well designed and serves the purpose for which it was intended. If my estimate is correct, then an operator could get into the route tube business with a tube inventory, 40 machines, service van, and office equipment for less than $25,000.00. That was a low start-up cost even for the 1950s.

Though the tester was in terrible condition, I made a decision to attempt restoration–provided I could get the tester working properly.

I removed the tube tester unit and applied power. Nothing happened. I measured filament voltage to the tube sockets and found it was zero. I panicked. There was a good chance the primary was open on the transformer. I was lucky—

the problem was simple. Someone had tried to wire the sign to come on when the tube tester came on. He had three cold solder joints. I suspect he used one of those liquid solder items. Once cleaned up, the tester came to life. I could now proceed with my restoration. Before calling my tester repair complete, I installed a fuse holder and a 1-amp fuse. I would assume the absence of a fused circuit was a cost cutting decision.

After the door was straightened I made an 'X' brace for the back side of the door panel from aluminum angle stock. Then all dings, dents, and cabinet damage were hammered out with a ball-peen hammer and a handheld anvil. After this, I reinforced the bottom corners of the cabinet and installed some heavy floor glides. The plastic sign was removed and the duct tape carefully removed. Of course, it left a residue that was very difficult to remove. I tried a commercial glue remover which worked moderately well, but I still had a lot of residue from the duct tape. I tried spraying it with WD-40 and it did the job. The metal channel that held the sign in place was rusted out. I found some aluminum channel stock at Lowe's and installed it. After cabinet repair it was sanded to remove all rust, and smooth out a few scratches. The cabinet was finished with a dark gray Hammertone spray paint. This paint works very well. It is durable and is easy to apply. I have been using it for years without a problem.

The cabinet was re-wired. I installed an outlet strip with breaker, inside the cabinet back. Then I rewired the sign, and put it on a separate switch. The light, and tester, are plugged into the outlet strip. Now, I had double protection—the overload breaker in the strip and a 1-amp fuse on the tube tester. New wire was used throughout. The added feature is that the light or the tester can be unplugged by simply opening the door and reaching for the strip on the cabinet back. This makes for easy service of the unit without unsoldering wires.

I installed a plain wood knob on the door panel. In place of a lock I used an inexpensive brass cabinet latch.

The flip charts that can be seen in the photograph cover most popular tubes of the period. The emission tester requires only two settings. First you set the filament voltage, second the meter scale, or load, and then plug the tube into the appropriate socket—of which there are many—but they are all numbered; very fast and simple. I have tested at least 100 tubes, some known to be weak, others completely dead, and some brand new tubes. So far it appears to be telling me the truth. Of course we all know that this is only a guide to go on—the only real test is how the tube operates in actual use.

We will be exploring more radio tube stories in future articles and your input is always welcome.

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Rebuilding the E.F. Johnson Viking Adventurer
50-Watt CW Transmitter, Part 1

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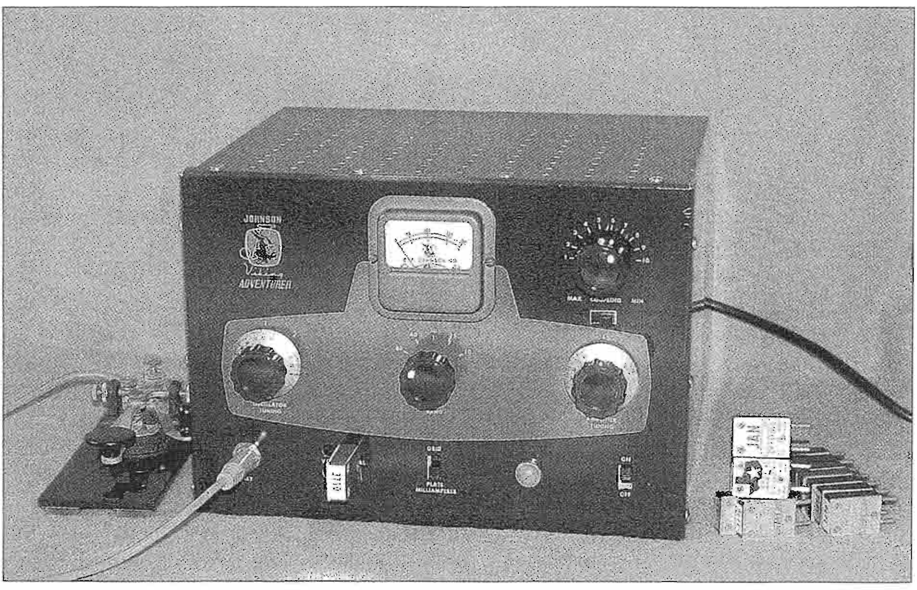
With its 6AG7, 807, and 5U4G tube lineup, the E.F. Johnson Adventurer 50-watt CW transmitter could have come right out of the pages of QST and/or the ARRL's "The Radio Amateur's Handbook". Both the electrical and mechanical designs are conservative and very traditional for the period, and the 10-3/8"W x 8-1/8"H x 7-3/8"D maroon aluminum cabinet is "utilitarian" in appearance. The front panel is aluminum and painted maroon and gray with green silk-screened lettering. I don't think the Adventurer would win many "beauty contests" along side such favorites as the Heath DX-20 or DX-35/DX-40, the EICO 723 or 720, Hallicrafters HT-40, WRL Globe Chief 90, etc., but it remains a "classic" nevertheless.

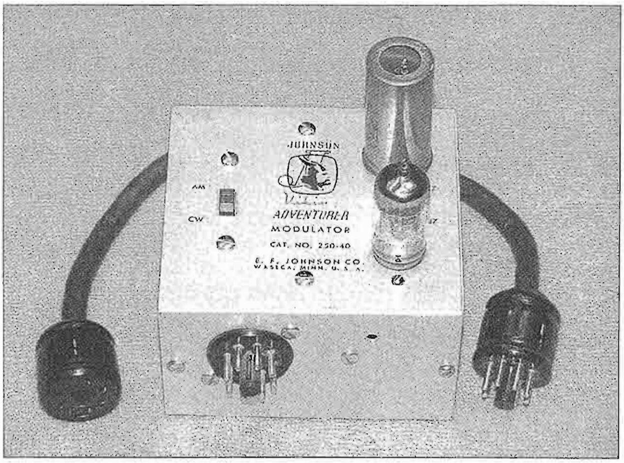
First sold in '54 (reference E.F. Johnson Transmitter Sales Figures, ER #27, pg.11), 6,142 kits were shipped before being discontinued in 1964. In '54, the Adventurer sold for $54.95 in kit form which was a bit "pricey" compared to the Heath AT-1's $29.50, and later, the DX-20's $35.95. A separate Model 250-40 Johnson Viking Adventurer Modulator was available, giving the Adventurer AM capability, for $12.25. By the time the Adventurer was discontinued in '64, the price had increased to $69.95. '64 also marked the last year that the Adventurer appeared in the advertiser section of the ARRL Handbook.

The Adventurer is a 50-watt input, crystal-controlled, CW transmitter w/single-knob band switching on 80-10 meters.



Front view of the E.F. Johnson Viking Adventurer

The pi-network will accommodate output impedances in the range of 50-600 ohms. A MIN/MAX slide-switch on the front panel adds a 700-µµF silver mica capacitor across the 700-µµf COUPLING capacitor in the MAX position. An RCA phono jack is used for the antenna output. The tube lineup consists of a 6AG7 power-pentode pierce-type crystal-oscillator (which serves as a buffer when an external VFO is used), 807 beam-power final amplifier, and 5U4G full-wave rectifier. The vertically-mounted 807's socket is mounted 1-1/16" below the chassis which is responsible for the relatively short 8-1/8" front panel height. As a result, the Adventurer is about 17% and 20% smaller than the Heath AT-1 and DX-20 respectively.



The Johnson 250-40 modulator accessory could be purchased for use with the Viking Adventurer.

The Adventurer's original power supply uses a capacitor input filter and 11-Hy filter choke that delivers 450 VDC key-down @100 mA. The input and output filter capacitors are 8 µfd @700 VDC. The 20k/25k divider/bleeder across the output of the power supply provides 200 VDC for the 6AG7's screen. The power transformer uses the same EI lamination as the AT-1's power transformer and has about a 1/4" more iron in the core – not exactly a "husky" supply for the 50-watt input power, but certainly adequate for CW duty cycles.

A dual-scale (0-20 mA/0-200 mA) undamped 2" meter indicates 807 grid or plate current. The CRYSTAL or VFO inputs use an octal socket mounted behind the front panel. An accessory socket is available on the rear apron for powering the Johnson Viking Model 122 (or similar) remote VFO or the Johnson Viking Model 250-40 Adventurer Modulator. The Adventurer's point-to-point wiring is very clean and straightforward and would have been relatively easy to assemble and wire.

My first introduction to the Adventurer was in September 1993, thirty years after it had been discontinued, when I purchased a very clean unit from an ER reader, Bob Braeger (WA6KER). It was among about a dozen or so Novice-type transmitters that I was researching and testing and I sold it the following year. That was twelve years ago. During that 12 year period, I have (slowly?) reached the conclusion that the Adventurer is not only representative of Novice-type transmitters; it is probably the epitome of a Novice-type transmitter in terms of style and design. It utilizes a very traditional tube lineup and actually uses an 807 "transmitting" tube instead of the more popular 6DQ6A/B sweep tube or 6L6G. In addition, has anybody that got a Novice ticket not used a 6AG7 in a homebrew project? In any event, I once again started looking for an Adventurer in original condition, and finally bid on one I found on eBay in late '05 and was the highest bidder. The seller sent me additional photos and I was able to verify that it was indeed in original condition.

A few comments about the condition

of the Adventurer as received:

• The S/N tag on the chassis indicates catalog number 240-181 and S/N 80912. The few date codes available on the original components suggest that this is an early version and may have been kitted among the first 935 kitted in 1954. The Adventurer that I described in ER#78, Oct.'95, was S/N 80128 and had similar date-coded parts.

• Other than a replaced filter capacitor, and possibly the tubes, this unit was original. It even had the original RCA phono jack for the antenna which is almost always replaced by a standard SO-239 connector.

• I had decided from the beginning to rebuild this Adventurer. The seller had indicated that it "powers up", so I made no attempt to verify operation as received.

• **The Adventurer was double-boxed for UPS Ground shipment by the seller as requested**. In spite of the very good double-boxing and in spite of the chassis being secured front and back in the Adventurer's cabinet, the unit was damaged in shipment. The 5-1/4 pound power transformer was just too heavy for the aluminum chassis when the shipping box was "tossed" around by UPS and it arrived with a 5/16" bow/buckle in the chassis. Incidentally, the outer box was undamaged. This isn't the first time that this type of shipping damage has occurred and it's not a "packaging problem" per se. The Adventurer was designed as a kit and originally shipped as a kit. The aluminum chassis was never designed to accommodate the magnitude of g-forces and shock with a 5-1/4 lb. transformer mounted on it that it experiences when shipped UPS or FedEx. After removing the components, I used a length of 2" x 6" lumber and hammer and straightened the chassis against the flat concrete garage floor. The last "ding" was removed by gently tapping the flat-faced hammer against the inside of the chassis against the garage floor with the chassis sitting on newspaper.

• For an entry-level kit and a kit of this complexity, the wiring was above-average. I would have been hard pressed to rewire it had it not been for that bow/buckle in the chassis. Interestingly enough, I did find two unsoldered connections during the disassembly.

When I removed the filter choke from the chassis, there were obvious signs of overheating. The outside wrapper was blackened and the wax had run down into the rubber grommet. I suspect that the output filter capacitor had failed and shorted, because it had been replaced. Fearing the worst, I pulled the end bells off of the power transformer. The smell was unmistakable and it had gotten very hot. At this point, I thought the power transformer was a "goner". I made some preliminary resistance measurements, connected the 5-VAC and 6.3-VAC windings to the 5U4G and 807 for a 21-watt secondary load and brought the transformer up using a Variac. To my surprise, all the secondary voltages were OK and after three hours of operation, the transformer was just a bit warm to the touch indicating no shorted turns. The high-voltage secondary was about 1,500-VAC P-P unloaded, so it appeared that the insulation was still OK. A clue was that the original 2A, 3AG fuse had been replaced by a 5A, so it's possible that the original 2A fuse blew saving the power transformer from further damage. Any further damage would have been catastrophic! I took both the choke and power transformer to work. The choke measured 11 Hy at 288 ohms and it passed 700-VDC dielectric testing between the coil and the frame and the power transformer passed 700-VDC dielectric testing as well between all primary and secondary windings and the core. I chose to use both in the rebuild, but I'm keeping my eyes open for a replacement power transformer.

Rebuilding the Adventurer was straightforward and presented no problems. I started this project during

The Viking Adventurer has been converted to "kit form" prior to its restoration.

Christmas-break '05 and it took me six weeks start-to-finish. Each of us will approach a rebuild differently, but here are the highlights of my Adventurer project:

• By far the most labor-intensive operation of the rebuild was preparing the original components for the rebuild. I spent several days over the period of a week removing the solder, any component or wires, and flux from the pins. In most cases, I re-tinned the pins. A small bench-vise was used as my "third-hand" and was indispensable as was the Weller® Model Number WLC100 5-40W Soldering Station with 1/4" "screwdriver tip" and Edsyn Model DS017 "SOLDAPULLT®".

• In most cases, I made no efforts to save the discreet components, especially if saving them compromised my efforts to clean up the original parts. My goal was to use as little heat as necessary and as little mechanical force as necessary to prepare the major components for the rebuild. With the exception of RFC1, parasitic chokes L2 & L3, R13, and assorted silver mica caps, most discrete components were replaced. I made no attempt to find NOS replacement components from the '50s.

• I salvaged the 20-turn, air-wound coils wound with red 20 gauge solid wire for the AC line-filter and cathode circuit (RFC2-RFC4) and tightened and straightened them up using a 3/8" diameter dowel rod.

• The aluminum chassis and shield were cleaned with #0000-grade steel wool and then coated with "Krylon® Crystal Clear Acrylic". The E.F. Johnson S/N tag was protected with Scotch 3M® "blue painter's tape" during cleaning, although removing the tape removed some of the original serial number tag. NOS rubber grommets were used as required.

• The front panel was cleaned in warm soapy water with a very soft cloth and then rubbed-out several times with Meguiar's Cleaner/Wax (available at auto-care counters everywhere). The front panel isn't pristine, but it's in very nice shape. It has the "traditional" scratches around the CRYSTAL socket and a few other "battle scars", but it's in very nice shape.

• The knobs were cleaned with "Novus® No. 2 Plastic Polish" (available from Antique Electronic Supply (AES) in 2 oz. (S-C217) or 8 oz (S-C227) containers). A little goes a long way.

• The pins of the original Amphenol octal sockets were very robust and relatively easy to clean.

• The coil assemblies L1 and L4 and bandswitch SW4 required a lot of patience – you just can't get in a hurry. After I finished preparing SW4, I used DeoxIT™ D5 and a small bristle brush to clean the contacts on both switch-decks. I also used DeoxIT™ D5 to clean the three DPDT slide switches.

• The dual-range meter (M1) was tested. The full-scale current measured 10.49 mA with 9.718 VDC across the terminals. The full-scale measurements are consistent with the 50-ohm current shunt (two 100 ohm, 1-watt resistors in parallel—R5 & R6) in the 807's plate lead. However, the indicated 5, 10, and 15 increments were not accurate and mid-scale readings were >10% low. The outside of the meter was cleaned with Meguiar's Cleaner/Wax.

• Replacement filter capacitors for the original Sangamo 8-µfd, 700-VDC "dry electrolytic" (C15 & C16) are basically "unobtanium". As a result, I designed a drop-in 3-1/2" x 6" single-sided filter printed circuit board (PCBA) that uses four NOS Mallory Type TCG (Industrial Grade) or TC79 50-µfd, 450-VDC, axial-lead, aluminum electrolytic filter capacitors. Because of the relatively high ripple currents experienced in the Adventurer during transmit, I chose physically large replacement caps with their increased square inches of foil to minimize their temperature rise. The composite input capacitor C15 uses two in series with two 141-k, 3-watt equalizing resistors (three 47-k, 1-w resistors in series). The composite output capacitor C16 uses two in series and uses the existing 20-k (R7) and 25-k (R8) divider string for the 6AG7's screen as equalizing resistors. Those divider resistors and the 807's 20-k screen resistor (R11) are also mounted on the filter PCBA to reduce "clutter" under the chassis. The filter PCBA is mounted using 1" 6-32 threaded 1/4" hex standoffs using original mounting hole locations. **No new mounting holes are drilled in the chassis**. However, using original mounting holes required installing one of the 1" standoffs at L4 and the other on the filter PCBA. One lead of one of the filter caps was not soldered so that it could be lifted to install the 6-32 screw for the L4 standoff. The 1" standoff mounted on the filter PCBA mates up with one of the screws used to install the filter choke.

• The original 20-k and 25-k IRC 10-watt resistors used in the 6AG7's divider and 807's screen were replaced with 20-k and 25-k, 10-watt "cement-block" resistors available at AES with P/N's R-R20K and R-R25K respectively. The 20k and 25k in the 6AG7's divider dissipate 4.0 watts and 5.1 watts respectively under key-up conditions at 115-VAC line voltage. The 10 watt "cement-block" resistors provide approximately 50-60% increase in surface area and run significantly cooler. The new resistors are mounted approximately 1/16" above the PCB to keep their power-dissipation/operating-temperature from discoloring the PCB material during key-up conditions.

• The 807's socket is originally mounted 1-1/16" below the chassis and was replaced with a NOS 5-pin ceramic socket found on eBay. I replaced the original spacers with 1" 6-32 threaded ¼" hex standoffs so that I could add additional ground lugs and "float" the 807's ceramic socket. I also used a

National 3/8" ceramic plate cap for the 807 instead of the original metal cap.

• Terminal strips were replaced with two packages of AES P/N P-0501H (package of 5—similar to Keystone P/N 817 or H.H. Smith P/N 866) and were added as required to facilitate point-to-point wiring. Radio Shack P/N 274-688 (package of 4) can also be used. None of the original terminal strips were used, not necessarily at their original locations. These new 5-lug terminal strips get cut down as required. The "skyhook" connection on the top of the chassis involving RFC1 and C17 was replaced with a terminal strip.

• With the addition of the filter PCBA, some wiring changes were inevitable, but as usual, I managed to go well beyond just those changes. The original Adventurer is wired exclusively with red insulated 20-gauge solid wire. I salvaged enough of the original wire to rewire above the chassis, but the color code and wire type under the chassis has been changed. The wiring of the accessory socket also reflects the use of the E.F. Johnson catalog number 250-40 Johnson Viking Adventurer Modulator. The Adventurer's Assembly and Operator Instruction Manual is pretty "skimpy" when it comes to wiring diagrams (e.g., don't expect a "Heathkit Assembly Manual"), so I drew my own to avoid having to follow that awkward step-by-step assembly/wiring procedure, and significantly changed the point-to-point wiring in the process. For example, the wiring of the 6AG7 socket is very "busy". After several iterations, I physically rotated the 6AG7's socket on the mounting plate until pin 4 was aligned with the mounting axis of the socket. This improved the point-to-point wiring and really cleaned up the 6AG7's wiring. I also took quite a few photos of the Adventurer before I disassembled it for additional reference.

• When the Adventurer is modified for use with the 250-40 Johnson Viking Adventurer Modulator, the 807's 20-k screen resistor (R11) is removed from the Adventurer and installed in the modulator. This requires that the modulator always be connected to the Adventurer and switched between CW and AM modes. I decided to use pin 5 on the accessory socket, kept R11 in the Adventurer, and now use a shorting plug on the accessory socket for CW operation. This provides a bit more flexibility, is "transparent" when using the modulator, and keeps the modulator "stock" when it is used.

• My wiring changes to accommodate the modulator also assumed that I wouldn't be using an external plate modulator. The pin 4 to 5 jumper on the accessory socket and the wiring associated to pin 5 has been eliminated and it is now connected to one side of R11 as noted above.

• The filter choke (LP1) had new leads attached.

• The power transformer (T) had new leads attached and the core was painted gloss black. A couple layers of "crispy-critter" outside paper wrapper was replaced by 3M Scotch 69® glass cloth "transformer" tape. The end bells were cleaned but not repainted. The core was turned on its side and several teaspoons of Dolph's Synthite® AC-43 Clear Air Drying (transformer) Varnish was dripped into both exposed winding layers and then a hair dryer was used to improve penetration into the windings. The windings absorbed the varnish like a "sponge". The core was turned over and the operation repeated. I was still concerned that it had been so badly overheated and wanted to buy a little "insurance" with the varnish. In addition, the varnish completely eliminated that smell so characteristic of a burned-up power transformer. The power transformer was installed with NOS 8-32 Phillips pan-head hardware and external-tooth lockwashers.

• As usual, I discarded the original

unpolarized line cord. I would typically replace it with a 2-wire polarized line cord, and the black Radio Shack P/N 61-2852 6' line cord has been my line cord of choice. Having said that, the use of a 3-wire grounding line cord should be considered because the Adventurer's design has a line filter that uses a 0.005-µfd capacitor to ground from both sides of the line. This causes a 220-µA leakage current no matter how the 2-wire line cord is connected—a polarized line cord doesn't "buy" you anything. As a result, I used a 3-wire, 18-AWG, 6-foot line cord. I also changed the Adventurer's primary wiring and placed F1 and the power switch in the hot-side (black) of the AC line. That way, there is no 115 VAC connected to the primary winding when the power switch is OFF. The neutral (white) lead is connected to the unswitched side of the primary winding.

- I replaced the .005-µfd capacitors in the line filter with .0033-µfd, AC-rated ceramic caps and all the .005-µfd bypass capacitors with .01-µfd ceramic caps that I had on hand.
- Aside from the original 4-40 hardware used to secure the octal socket and slide switches between the chassis and front panel, the 6-32 hardware was replaced with new nickel-plated 6-32 binder-head screws. The "old" 6-32 nuts were used. Lock washers were used as required to guarantee good grounds. The 6-32 ground stud on the rear panel was replaced with brass 8-32 and the corresponding hardware. All front panel hardware was replaced with NOS. Incidentally, I highly recommend the use of a 1/2 inch nut-driver to install the front panel hardware instead of the more "traditional" Crescent-wrench to avoid adding "battle-scars" to the front panel. Ground lugs were replaced with NOS (similar to Keystone P/N 7332) and were added as required to facilitate wiring.
- A used RCA 5U4G and NIB 807 were selected using the TV-7D/U tube tester. A NOS HP 6AG7, given to me by Barry Wiseman (N6CSW) when I visited ER in Durango, CO in July 1993 (see ER #53, Sep.'93), was used.

The assembly and wiring of the Adventurer required a total of 12 hours spread over four days. An additional hour was spent checking the completed wiring for errors. Here's a simplified sequence of assembly:

- The chassis was assembled and wired. This included 6AG7 and 807 circuitry, metering wiring, power switch and fuse holder, and part of the accessory socket.
- The front panel was assembled and wired.
- The chassis and front panel were mated and all above chassis wiring was finished. Don't forget the spacers between the front panel and chassis installed on the key jack and pilot light assembly.
- The shield was installed between the switch-decks.
- The filter choke was installed and wired.
- The power transformer and line cord was installed and wired along with the AC line-filter components.
- The filter PCBA was installed and wired.
- The wiring was checked against my wiring diagrams and schematic.

After everything was checked out, I installed a 2A fuse (Radio Shack P/N 270-1007, package of 4), plugged it into a Variac, and very slowly brought the Adventurer to 115-VAC nominal line, while monitoring the various voltage levels. No problems were encountered, and all key-up voltages were as expected: 640 VDC at C16 and 340 VDC at the 20k/25-k divider and the 6AG7's screen (pin 6). I then recorded key-up voltages from 100-VAC to 125-VAC line in 5-VAC increments.

[Part 2 of Dave's Adventurer rebuild will run in next month's issue, ER #209–Ed.]

ER

High Performance AGC for the R-390A

By Clark Hatch, WØBT
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I have spent many hours working on AGC circuits. I have tried to adapt circuits that others used and I was not satisfied with the results. I have tried hang-type circuits that used solid-state devices such as FETs and these designs had terrible overshoot in the AGC. Some other designs had slow attack time, and some that I tried were not any better than stock.

In my AGC design, the need for fast attack time is provided by the low-output impedance of the triode amplifier, V509A. It is an untuned voltage amplifier providing some gain. The original 5749 amplifier circuit has very high output impedance and that makes it impossible to charge the .1-µF and 1-µF timing capacitors before a strong signal overloads a previous stage. This is largely what is responsible for the AGC problems in the stock R-390 and R-390A.

The 100-k resistors in series with the C1 and C2 timing capacitors keep short-duration noise pulses from charging them and causing the AGC to hang.

In **Figure 1**, the RC network at TB102 that is in series with the RF deck limits the AGC voltage applied to the 6DC6 grid. This keeps the tube from cutting off on high signal levels, which will cause the AGC to "pump" with some brands of 6DC6 tubes. R1, the 470-k resistor, is mounted on TB102 terminals 3 and 4, after removing the U-shaped shorting bar that is normally installed. C3, the .22-µF capacitor, and R1 can be mounted on the outside or alternatively soldered out-of-view to the TB102 terminal 4 on the inside of the back panel.

RCA 6DC6 tubes do not always require the network because they have a more remote cutoff characteristic than do other brands. Sylvania 6DC6 tubes have more gain and a sharper cutoff, and that is why I had to use the network in receivers using them.

I charted the performance of a modified Motorola R-390A with the AGC network shown on TB102, and it has just 2% total harmonic distortion with a 50-µV input signal. If the Motorola didn't have the RC network, the keyed CW waveform on signals above 50 millivolts became highly distorted. I tested this AGC circuit with up to a -10 dBm (70 mV) CW signal keyed at a speed of 5 to 40 words per minute. I monitored the IF output port and the audio with an oscilloscope. The CW keying waveform had very little distortion. There was just a slight rounded transient at key-down. No pops or clicks could be heard in the audio. No other receiver that I tested could pass this test, and the Collins 75S-3B didn't even come close. I do not have the test equipment to measure AGC voltage transients. To me, IF and audio response is the bottom line.

This is just a basic AGC circuit. It leaves out most all of the AGC-controlled circuitry. When you just look at the new V509A amplifier, the 1N914 diodes that resemble a voltage doubler, and the time constant capacitors, it is really a simple circuit. However the overall modification is not so simple.

I have been using this AGC circuit in the R-390A for about 13 years. It has been installed in 10 receivers with great success. This AGC circuit works so well that I do not find it necessary to add a relay and product detector modification for CW and SSB. I increase the BFO injection voltage level by increasing coupling capacitor's value in step 22 in the modification procedure.

Modification Procedure

Refer to the schematic, **Figure 1**, and **Figure 2**, the photo that shows locations

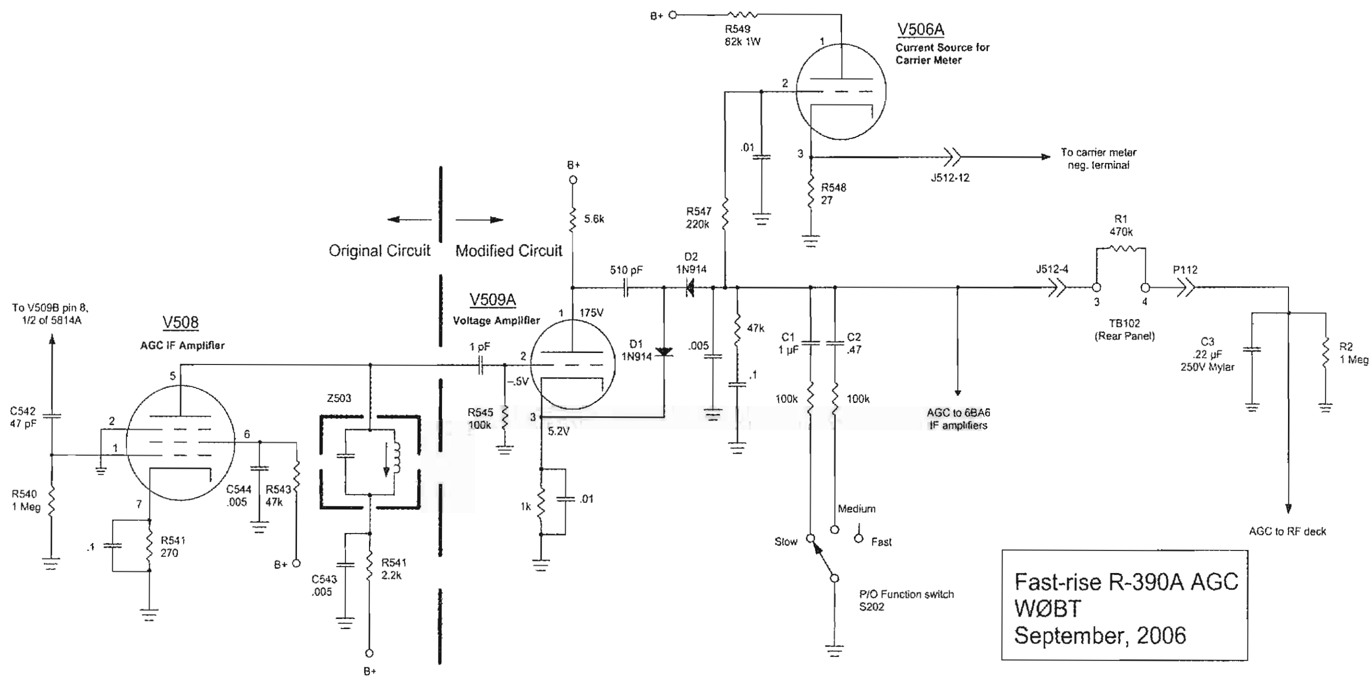

V506A
Current Source for Carrier Meter
B+
R549 82k 1W
.01
R548 27
J512-12
To carrier meter neg. terminal
R547 220k
Original Circuit
Modified Circuit
B+
5.6k
510 pF
D2 1N914
R1 470k
J512-4
P112
3
4
TB102 (Rear Panel)
V509A
Voltage Amplifier
175V
D1 1N914
.005
47k
.1
C1 1 µF
C2 .47
100k
100k
AGC to 6BA6 IF amplifiers
C3 .22 µF 250V Mylar
R2 1 Meg
AGC to RF deck
To V509B pin 8, 1/2 of 5814A
V508
AGC IF Amplifier
1 pF
-.5V
R545 100k
5.2V
Z503
C542 47 pF
R540 1 Meg
C544 .005
R543 47k
R541 270
.1
B+
C543 .005
R541 2.2k
B+
1k
.01
Medium
Slow
Fast
P/O Function switch S202
Fast-rise R-390A AGC
WØBT
September, 2006

Figure 1

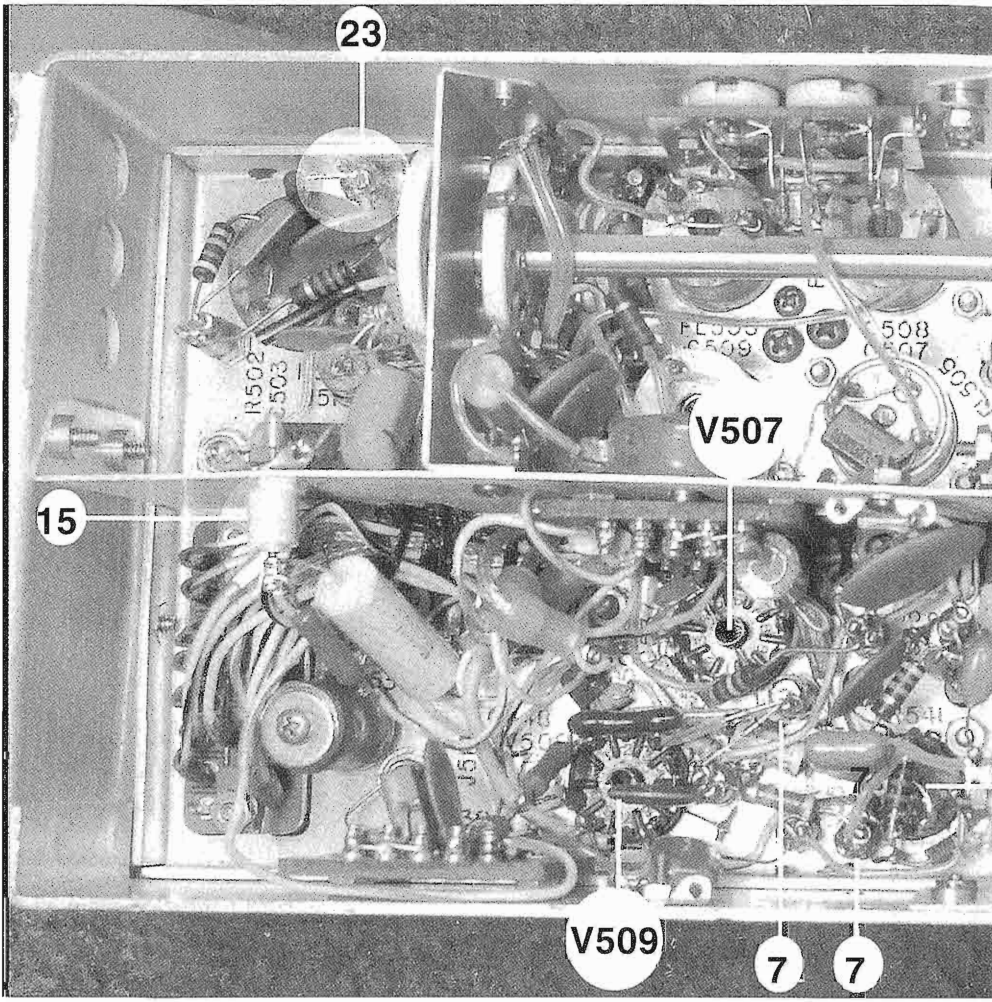


Figure 2: Underneath the R-390A IF deck. In the highlights, the numbers refer to corresp of places talked about in the procedure.

1) Near V509, use a solder sucker to remove solder from the standoff terminal that has R546 (180k) on it and lift R546 lead and the short white/brown/green wire that goes to pin 2 of V509 from this same terminal.

2) Use solder wick to remove the ether end of R546 (180k) from V509 pin 2.

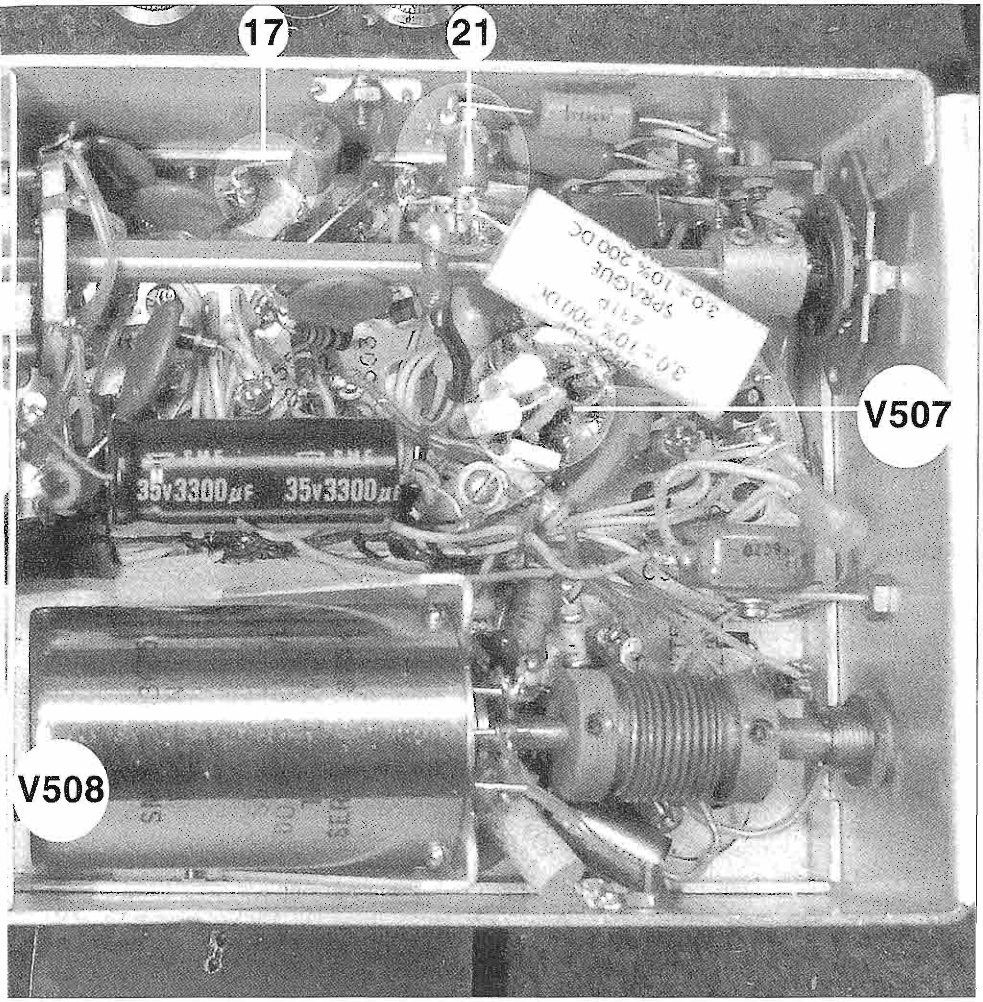
3) Use solder wick to remove R545 (100k) lead from V509 pin 1. Also remove the wire jumper from V509 pins 1, 2 and 3.

4) Use solder wick to remove C546 (220 pf silver mica) from V509 pin 2 and V508 pin 5.

5) Remove the short white/brown/green wire and disconnect C547 (.1 µF) from V508 pin 2. Save the short wire, it will be used later. Ground pin 2 with a short bare wire. _Do not remove C547 (1µF) from the ground lug_.

6) Remove C548 (.1 µF) from C551 (2 µF) and the ground lug and place in the junk box. Don't remove the ground lug.

7) Install two new standoffs terminals; one should be near V507 and the other near V508. Connect a 47-k, 1/2-watt



onding steps in the modification procedure, and the relavant tube locations are shown.

resistor from the new terminal near V508 to the existing standoff terminal. Connect C547 (.1 µF) to the new standoffs terminal near V508.

8) Reconnect R545 (100k) to V509 pin 2.

9) Connect a 1-k, 1/2-watt resistor from V509 pin 3 to the ground lug to which C548 (.1 µF) was soldered.

10) Connect a 1-pf disc capacitor from V509 pin 2 and V508 pin 5.

11) Connect a 510-pf silver mica from V509 pin 1 to the new standoff terminal near V507. Connect a 1N914 anode to this standoff terminal and the cathode to V509 pin 3. Connect a .01-µF, 50-volt disc cap from pin 3 to ground.

12) Connect a 1N914 cathode from the new standoff terminal near V507 and the anode to the existing standoff terminal that has a white/brown/green wire connected to it. Connect a .005-µF disc cap from this standoff terminal to ground.

13) Connect a 5.6-k, 1/2-watt resistor from V509 pin 1 to the white/red wire on TB501 (B+ terminal).

14) Cut the white/red/blue wire from C551 (2-µF metal can).

15) Solder a .47-µF, 250-volt Mylar cap to the C551 (2 µF) terminal that has the white/blue wire connected to it. Connect the other lead of the .47-µF cap to a tie point added to the screw on the wall near the bottom of C551, the large 2-µF cap in a metal can. Mount a 100-k, 1/2-watt resistor on this terminal and connect the white/red/blue wire (previously cut in step 14) to the 100-k resistor. The other end of the 100k is connected to the .47-µF capacitor.

16) Use a solder sucker to remove solder from the standoff terminal near V506. It has R544 (2.7 Meg), R547 C220k), the white/brown/green wire and a wire from V504 pin 2 connected to it. Remove the 2.7-Meg resistor from this standoff terminal, clip the other end and discard the resistor. Remove the wire that is connected to the standoff terminal that comes from V504 pin 2 and connect the wire to a ground lug. If the white/brown/green wire is routed near C535 (12 pf) and pins 6 and 7 of V506, then disconnect it from the standoff terminal and reroute it to the other side of the tube socket and reconnect it to the standoff terminal.

17) Using solder wick, remove the white/blue wire from V506 pin 1. Remove the white/black/blue wire from V506 pin 2 and connect it to the existing standoff terminal near V506. Connect a .01-µF, 500-volt disc from V506 pin 2 to ground. Connect the short white/brown/green wire that was removed in step 5 to the standoff terminal and the other end of the wire to the standoff terminal that has R516 (22 k) on it. (This step connects AGC to the IF amplifiers.)

18) Reconnect R547 (220k) to the standoff terminal that it was originally connected to.

19) Connect a .01-µF, 500-volt disc cap from V506 pin 1 to ground.

20) Connect a .01-µF, 50-volt disc cap from V506 pin 9 to ground. (This cap is a bypass for the heater string.)

21) Install a new standoff terminal near V506. Connect a 1-µF, 250-volt Mylar from the new standoff terminal to the existing standoff terminal that has R547 (220k) on it. Connect a 100-k, 1/2-watt resistor to the new standoff terminal and connect the white/blue wire that was removed from V506 pin 1 to the ether end of the 100-k resistor.

22) If you have a stock R-390A detector, add a 39-pf silver mica cap in parallel with C535 (12 pf). If you have a product detector modification, ignore this step.

23) There are two white/green wires attached to the standoff terminal near C502 and R501. Disconnect and insulate <u>one</u> of these wires. The wire to disconnect is the one that connects to pin 6 on J512. Use an ohmmeter to determine that the wire that was removed from the standoff terminal is connected to J512-6.

24) Transpose the white-wire (Medium) and the red/orange/green wire (switch common) on the AGC switch.

25) Install the IF module and make the following adjustments and measurements:

a) Inject a –74 dBm signal at 7.050 MHz into the balanced antenna port.

b) Adjust Z503 for 2.2 volts RMS of 1 kHz-audio measured across the Line Level pot, (R104) with the BFO on.

c) Tune T503 for minimum distortion. Readjust Z503 as required to maintain 2.2 volts audio on R104 during this adjustment. Distortion should be 2% to 3% or less. Make certain that tuning slugs in T503 are positioned as in **Figure 3**, page 35.

d) Turn the RF gain control fully CCW. Check the voltage at the diode load terminal. It should be 20 to 25 volts. If not, return the RF gain control to full CW rotation and peak it by tuning T503 top and bottom slugs then repeat the previous adjustments of T503 and Z503.

d) If, when turning on the limiter, the BFO frequency shifts, it is likely that the slugs in T503 are incorrectly tuned.

26) A 10-ohm, 1/2-watt resistor is connected across the 22-ohm, 1-watt resistor and the 100-ohm carrier level meter zero-adjust pot. This makes the "zero" adjustment much less critical and

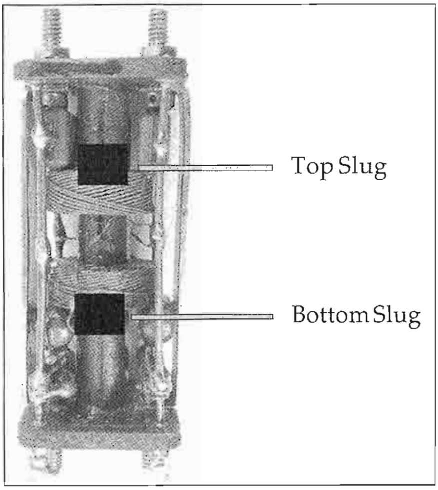


Figure 3: Recommended positions of the top and bottom slugs in T503 are shown with the black rectangles.

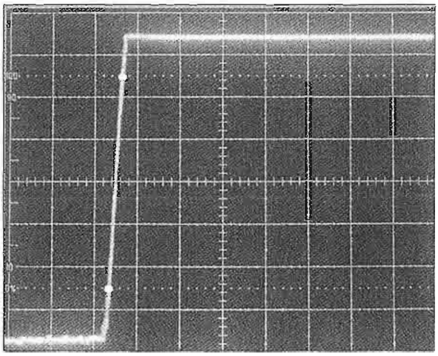
increases the stability of the setting.

Parts List

- Two 1N914 silicon diodes
- One 1-pf disc ceramic capacitor
- One 39-pf silver mica capacitor
- One 510-pf silver mica capacitor
- One-.005-µF, 500-volt disc ceramic capacitor
- One .01-µF, 50-volt disc ceramic capacitor
- Three .01-µF, 500-volt disc ceramic capacitors
- One .47-µF, 250-volt Mylar capacitor
- One 1-µF, 250-volt Mylar capacitor
- One 1-k, 1/2-W carbon resistor
- One 5.6-k, 1/2-W carbon resistor
- One 47-k, 1/2-W carbon resistor
- Two 100-k, 1/2-W carbon resistors
- Three 4-40 thread standoff terminals

[Editor's comment: I have installed Clark's AGC circuit in my R-390A and it is a "keeper." My receiver has been used almost daily for nearly 30 years and I highly recommend this modification because it is the best performing AGC circuit I have ever used.

It is necessary to carefully follow the recommended final alignment, step 25, for best performance.



Above is a scope photo showing its outstanding performance. A RF signal generator was switched from "off" to "on" at a Ø dBm (224 mV) level. The test was made with a Tektronix digital storage scope that will store single-shot events. The horizontal scale is 2 mS per large division, and the vertical scale is 1 volt per large division. (The negative-going AGC waveform was inverted.) The risetime is just *611 microseconds* between the two bright dots. There is no ringing, overshoot, or other instability in the AGC.

The AGC was additionally tested with a +20 dBm (2.2 volt) input from another generator. The risetime was unchanged, and just 4% audio distortion was measured.

I got the best risetime without R1 across TB102, and without C3. I use 680k for the R2 discharge resistor at TB102. During heavy summertime noise, I have used 270k at R1 to speed up the decay time. You may need to experiment with these parts to fine-tune AGC response times to match different receivers, RF amplifier tubes, and preferred operating conditions.

The annoying receiver blocking I used to get when switching into–or out of–the AGC "Slow" or "Medium" positions is gone because the large C551 2-µF capacitor can't discharge into the AGC line. It's no longer used. This design works so well that it could probably be used with many receivers that have poor AGC performance, and is the ideal AGC to use in a experimental homebrew receiver.]

ER

The AM Broadcast Transmitter Log

Part 14, The 250-Watt Broadcast Transmitters

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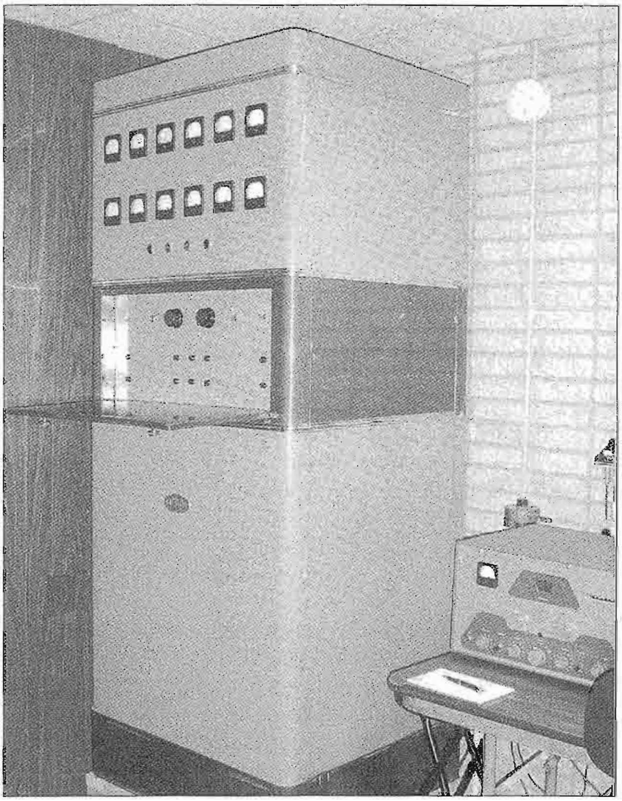
In previous issues we have been discussing the commonly available 1-kW boxes with the standard power reduction to 250 watts. Many stations running 1 kW day and 250 watts nighttime had two separate transmitters for each power level with one backing up the other as a standby. The high-power rig had the lower power reduction while the low powered night time box serviced as a lower power secondary for the day time unit. Often, stations were authorized 250 watts only and were later granted the increase to 1 kW, so an older 250 watt version was still in the transmitter plant. In my early years as a broadcast Chief Engineer, I worked for two stations with 10 kW mains and 250-watt auxiliaries using these older rigs.

Many of these 250 watt rigs have found there way to the ham bands and occasionally are unearthed. In almost all instances, they are either pre-war or late 1940s vintage. Many pre-war rigs are beautiful works of art, while others are plain-Jane work horses.

Much of the information to be presented has been derived from many different sources. I will present as much information as possible from the actual conversion. In other cases, a general description of the unit will show the similarities, and the conversion should be very similar. My intent with this series has been to pass along what people have done with the various rigs to both provide a clear road map for specific transmitters and offer ideas and suggestions for those not specifically addressed.



A king-size transmitter, this Raytheon RA-250 is owned by Jay Greenberg, N3WWL. (Photo courtesy of N3WWL)

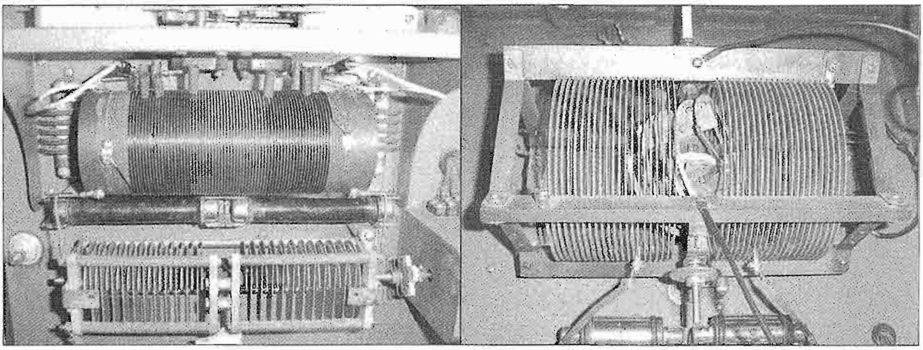


Figure 1, left, is the RA-250 input grid coil. Figure 2, right, is the output tank circuit.

Transmitters to be discussed include the Raytheon RA-250, the Collins 300G and the Gates BC-250 series. Others will be discussed next month. All models are known to be in the hands of amateurs and at least some are known to be operating on the ham bands. Since we have a detailed conversion for the Raytheon, we start here.

The Raytheon RA-250

The one being described here was converted by Bob Raide, W2ZM. The unit is presently owned by Jay Greenberg, N3WWL. This transmitter uses an 813 to drive push-pull 810 finals. The 810 is the common output final in this power class for this era. The 813 has been modified to be a grounded grid input with a broadband input circuit. It needs about 25 watts of drive which comes from a Kenwood 870. Jay uses the accessory jack on the back of the Kenwood which would normally key a linear amplifier to trigger the RA-250 through an intermediary relay. A T/R coax relay (**Figure 3**) is mounted inside the big transmitter. The system is controlled from the second floor operating position while the big box is on the first floor. This is an excellent idea for a box weighting at least half a ton.

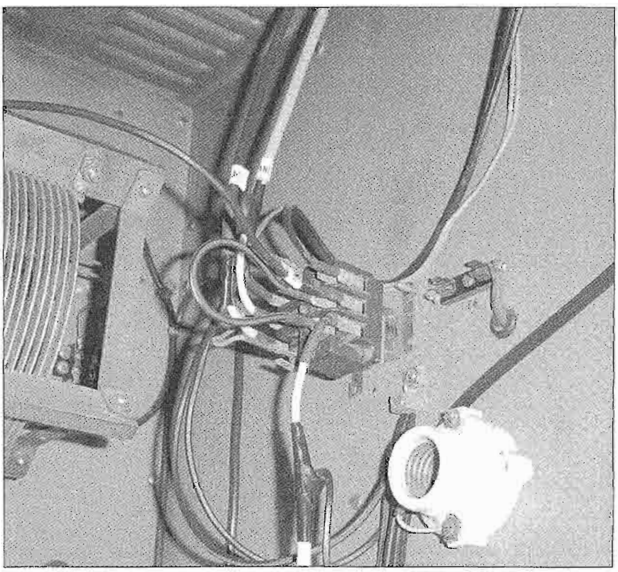
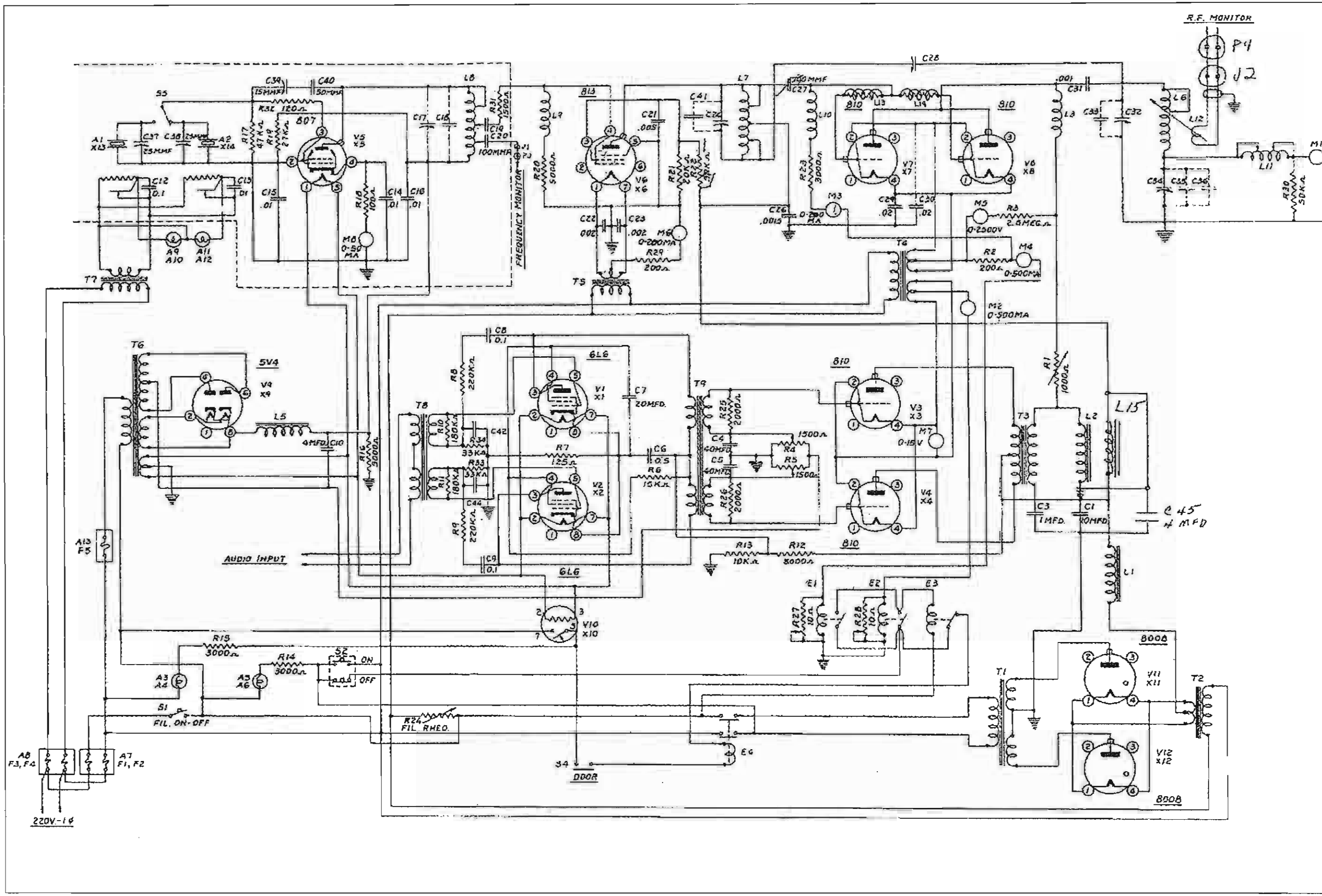


Figure 3: The RA-250 T/R relay is shown in the center of this photo.

This rig was originally converted for 80 meters. It now resides on 160. For 80 meters, the grid coil (**Figure 1**) was tapped at 12 turns either side of center-tap. To get back to 160, additional taps are set, starting at 24 from center and then every other turn for the remainder of the coil. The photo in Figure 1 shows the final position of the alligator clips for 1885 MHz. The tank circuit photo shows the taps again



Gates BC-250GY Schematic

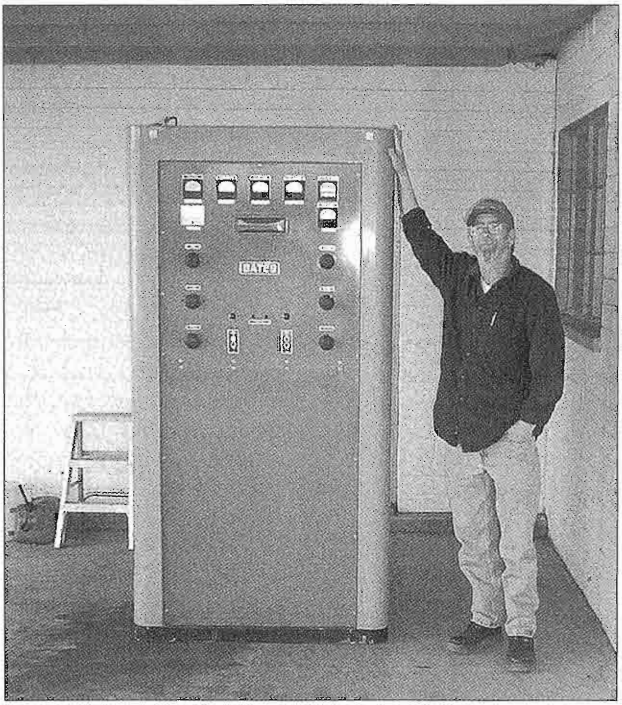


Figure 4: Doug Crooks (KA9RHB) and the Gates BC-250GY.

for 1885 MHz. For 80 meters, the fixed vacuum capacitors shown in **Figure 2** are removed. Notice the variable link coupling for loading adjustment in the output tank coil. Having the ability to set the taps on the driver permits the correct Q to be maintained as the transmitter changes frequency.

The Gates BC-250 Series

The Gates BC-250 series and the RCA BTA-250 series are very similar to the Collins 300G and the Raytheon RA-250. They all use the 810 and the conversion would be quite comparable. The Gates series includes the GY, L, T and GY-1 suffixes. Physically these are the same size as the later 1-kW boxes and they weigh about the same. Similarly, the RCA series includes the L and M suffixes.

The schematic on **page 38** shows the BC-250GY and is dated 6/27/50. Note the 807 oscillator, 813 driver and 810 finals and modulators. The finals are paralleled, but some of the transmitters in this class were push-pull. Clearly, these tubes are hardly breaking a sweat with the ultra-conservative plate dissipations.

Under normal use, the 807 oscillator is running 250 volts at 30 mA. The 813 driver is run at 1400 volts and 130-160 mA. The 810 finals are at 1350 volts and 250 mA. The filament control is set to 10 volts and final grid current is 100 to 120 mA. The modulator static current is 50 mA. At the rated output into 50 ohms, the line current is 2.24 amps.

One BC-250GY owner, by resetting the power transformer primary taps, claims to have gotten 800 watts out. Fortunately, the box is being run under ICAS conditions. The plate voltage is now said to be at 2000 volts. The maximum for the 810 is 2250 volts. Still, that power increase may be pushing the HV transformer a bit too much. The combined finals are rated at 300-watts dissipation and can easily take the two thousand volts in AM service. One tube alone can produce 350 watts, if not more. And, the modulator can match the increased final input. I would be a bit more comfortable with less of a power increase. These tubes are sleeping at the 250-watt level. It is clear that these 1/4-kW boxes can be run at a much higher level.

Although the last time I saw a BC-250GY in person was close to 40 years ago, I technically own one. The one pictured in **Figure 4** is currently with my friend Bob Henry at his QTH in New Mexico. I have no good justification to make a four thousand mile round trip to


Paul Courson's Collins 300G transmitter.

finals. Jim reworked the original output network into a PI configuration. It should be mentioned that there was a design flaw with the original motor's tuning drive, resulting in failure. He retained the motor-driven tuning but with his own redesign. Of those using the Collins 300G, no one else specially mentioned that they had experienced failures. This design flaw may only have affected certain production runs. The transmitter Jim was describing was a later serial number in the production run.

He drives the transmitter with a Boonton Labs signal generator. Several other people are also using signal generators instead of VFOs. Dave Huddleston (W3NP) is using one for his Gates BC-1T. And, Jim also built protective bias supplies for both the driver and final stages similar to those described for the Gates BC-1 series.

The Collins 300G is that classic art-deco style and sounds just as good as more modern BC transmitters.

It's interesting to note that the later Collins design for the 1-kW 20V series uses one 807 to drive two 4-400s. Collins, and the rest of the manufacturers, either decided that one driver tube was sufficient for reliability or wanted to save money with the design. It would seem that two tubes capable of one hundred watts output used to drive two that are developing 250 watts (and those fully capable of 500 watts plus), is excessive over-kill even for a commercial 24/7 piece of equipment.

Next month, I will continue with more 1/4 kW boxes.

retrieve it. So we are trying the next best thing—remote control. By the time you read this, we hope to have the station up on 1915 kHz and then possibly 7290 during the summer months next year. So, you guys in the mountain states stay tuned!

The Collins 300 G

This 250- watt transmitter is pre-WWII and weighs well over a half ton. Numerous people on the east coast are using them. Like the McMartin BA-1K described earlier, this box uses motor-driven tuning. Jim Young, W8MAQ described his conversion in the November 2003, QST, for all three ham bands. This was in conjunction with Paul Courson's (WA3VJB) article about rescuing the WFOY 300G in St. Augustine Florida.

The rig uses parallel 810s driven by 807s. The 807s are driven from a 6L6 which was originally un-tuned. As was necessary with the Bauer conversion, and others, it was necessary to tune the buffer stage to obtain sufficient drive to the

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The American VHF-AM Equipment Gallery

Part 7, The Gonset Sidewinder 2-Meter Transceiver

By Jim Riff, K7SC
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Gonset pioneered the introduction of 2-meter AM activity to hams in the early 1950s, and tried to pioneer single sideband to the 2-meter hams in the 1960s. This unfortunate timing of SSB to a market that was quickly converting to FM was the end of an era for Gonset. While HF users were grudgingly switching from AM to SSB, the 2-meter users had little interest in this complex mode, owing to the adaptation of FM repeaters that could not accept suppressed carrier (SSB) emissions. Additionally, no other manufacturers released 2-meter SSB equipment to compliment the Gonset products – leaving only Gonsets able to talk to Gonsets. Luckily, Gonset chose to incorporate AM and CW into the Sidewinder design, which prolonged their existence and provided future boatanchor status.

The compact 2-meter Gonset Sidewinder 900A was a hybrid design with a solid-state receiver and a tube transmitter. There was a companion 6-meter version, model 910, released at about the same time. This was a very complex and, at the time, quite the state of the art design because this was Gonset's first and last solid-state receiver design. After passing through many owners, Young Spring and Wire, Altec Lansing, LTV Aerospace, Ameco, and possibly others, Gonset branded products were gone for good in 1966. Introduced in 1963, the Sidewinder was possibly the last Gonset- branded product to be produced. According to Robert Gonsett (W6VR), his father, Faust Gonsett, went on to start Sideband Engineers (SBE) after

The unique Gonset Sidewinder 2-meter transceiver was the end of an era.

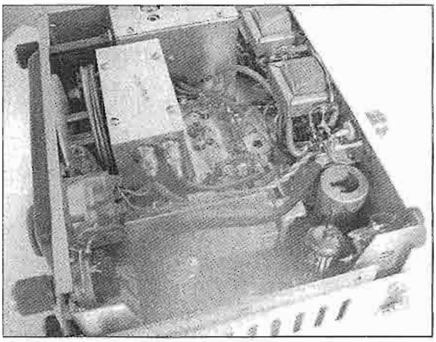

Figure 2: The Sidewinder's bottom-chassis view.

selling the Gonset Company in 1958.

Throughout this series, I have labeled all of the reviewed equipment as "transceivers", but in actuality only the Gonset Sidewinder is a true transceiver. The receive and transmit frequency controls are incorporated into a single knob, and therefore must always utilize the same frequency for both transmit and receive; much as our modern transceivers do today. There are no provisions for RIT or offset tuning in the design, so both parties must be on the exact same frequency. By utilizing a quite narrow 3-kc filter for both transmit and receive, the AM bandpass becomes a little touchy if the other stations are slightly off frequency. Other modern functions that are missing include a squelch control, but the receiver is remarkably quiet and this feature is generally not missed. The VFO in both transmit and receive is very stable, and with a 10-minute warm up drift is almost not noticeable. Because of its excellent stability, Gonset eliminated the need for a transmit crystal position; which is normally not missed.

Operating the Sidewinder almost rings of modern day operation, except for the need to null the sideband carrier and add a carrier for AM. A carrier balance knob is provided for this injection adjustment, see **Figure 1**, and its function is quite simple after the manual is studied. AM receive audio is normal sounding, but due to the narrow 3-kc filter, FM slope detection is not as easy as on other AM-only rigs. While power output is somewhat low, 10 watts on USB and 5 watts on AM, the injected full audio on AM yielded great reports from all that worked the station. Likewise, the USB reports were more than sufficient when operating in the "DX" window of 144.100 MHz. The sideband is not selectable.

The chassis is compact and well laid out, but not easy to work on, see **Figure 2**.

Unlike most previous dual-voltage Gonset products, the Sidewinder was powered by an external clamped-on power supply that could be either a 120-volt module or an optional 12-volt module. Together, they made the Sidewinder a lengthy 23-inch long, and somewhat heavy 23-pound system.

• **Pros:** Modern push-pull 6360A RF output tube and 12BY7 drivers, stable VFO, sensitive and selective receiver, smooth variable-ratio frequency tuning control knob, and a pleasant and interesting looking front panel. Tuning frequency is switch selected in four 1-MHz steps yielding very adequate bandspread. It's operation is easily mastered.

• **Cons:** Complicated as boatanchors go, it has somewhat low output power, is expensive and difficult to repair, and lacks RIT and crystal control. It uses a PL-68 microphone plug.

• **Specifications:** 120-v or 12-v operation using optional power supplies. .5µv receive sensitivity, dual-conversion receiver, 3-kc IF selectivity, weighs 23 pounds, was 8.7" wide X 4.7" high X 13" long.

• The cost of the 900A and a power supply, in 1963, was $400.00 and $480.00 in 1966.

• **Conclusions:** The 900A is very expensive in today's market and not usually encountered. It was a unique AM transceiver that will also operate SSB and CW and was the last of the Gonset era. It lives on as a great AM rig to operate the 144.450 MHz AM nets around the country. ER

Renaissance in Amateur Radio

By Ron Weaver, W6OM
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There has been a quiet but steady Renaissance in Amateur Radio the last few years as many Hams have rediscovered the joys of operating AM along with the fun of collecting and restoring vintage gear from the 1950s and 1960s.

For this writer, it came after fulfilling all my DX objectives and obtaining Honor Roll plaques for everything imaginable. Suddenly, one morning I looked at the rig and said to myself, "what's next?" I had no answer and fell into inactivity for over two years.

Then, one night out of sheer boredom, I turned on the rig and happened to tune across the 75-meter phone band and stumbled onto beautiful sounding AM signals from restored old vintage gear and heard hams from Texas to British Columbia and all around the West enjoying AM round table QSOs like a big family.

I was immediately struck with the same visions I had as an 11-year old boy in Pasadena, California. Images of Hallicrafters, Collins, Heathkit, National and World Radio Labs, the big-power rigs with full, rich audio that I could never afford on my paper route money.

After listening for a few nights, I figured out how to put my Kenwood on AM and checked into this "August" group, fearful that I would somehow not be accepted. What happened was just the opposite, with everyone welcoming me to AM, followed by encouragement to continue with them.

What followed in the next few weeks was eBay, flea markets and swap meets until I had found and assembled a vintage AM station like I had dreamed of as a small boy. Wishing to duplicate that big, rich, full sound I heard, I searched the Internet for circuit improvements for my vintage transmitter and receiver.

Much to my delight I found numerous sources for tubes, high voltage capacitors, and big resistors plus the exact paint to begin restoring and improving my newly acquired treasures from the 1950s. With power supplies rebuilt, audio circuits tailored and receivers recapped and aligned, I joined AMI–Amplitude Modulation International–and became part of a wonderful group of young and old hams around the world who covet and continue the AM Renaissance on all of our bands, during sometime every day and night.

Many Internet AM reflectors, chat boards and swap nets abound, so you are never alone with this one, and there is always someone around who is eager to help.

My perception that AM Vintage Ham Radio was for the more "mature" among us could not have been more wrong. I have come to understand how attractive this to the younger generation of hams because they can get their hands into it and customize the gear like an old hot rod.

These days, AM groups abound around the world. Depending on the time of day, you can find a frequency and group of AMers to join in with, and "YES" they welcome new boxes, ice boxes, cigar boxes or anything which can put out an AM signal.

The photo on the next page shows my current vintage station, which has become somewhat of an addiction with my purchase of numerous transmitters and

The vintage station at W6OM includes a lot of familiar U.S.-made equipment made by National and Heathkit.

receivers over the last few years to restore and then pass on to others who enjoy the warm glow of blue mercury vapor rectifier tubes at night and big boxes which glow in the dark and bring friends together.

Due to the size and weight of this vintage gear, mine is housed in the garage and I keep the new, small modern stuff upstairs in my "DX" room but its funny how I spend more time in the garage now.

Current FCC regulations support AM operation, however a little math is required when converting SSB peak envelope power into AM if you are using an amplifier. To save you the work, I will tell you it comes out to 350 watts of modulated carrier which has been more than enough for me to work all six continents on AM with just a simple antenna.

At field day, I met a couple of you who told me you have old Johnson, Collins and Heathkit AM gear stored away that has not been used in years. I encourage you to pull them out, bring them up slowly on a Variac and join in the fun.

If you ever want to listen in, the best place to start is on 75 meters in the evenings after 8:00 PM around 3870, plus-or-minus QRM. You will hear me along with many others who enjoy using our restored old "Boat Anchors", or if you want, just stop by my house some evening and take a look under the hood, I'll let you take these beauties for a test drive to feel the thrill again.

It's sort of like taking a restored 1957 Chevy out for a Sunday afternoon drive!

73, Ron, W6 "Old Modulation"

ER

VINTAGE NETS

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

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

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

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

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

Colorado Morning Net: Informal AMers on 3875 kc daily @ 6:00 to 6:15 AM, MT. QSX KØOJ

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

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

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

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

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

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

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

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

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

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

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

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

K6HQI Memorial 20 Meter Net: Flagship AM net 14.286 Mc daily for 25+ years. Check 5:00 PM Pacific Time.

Lake Erie Boatanchor CW Net: Sat. mornings, 7143 kc, 10:00 Eastern time. QSX op Steve (WA3JJT) or Ron (W8KYD).

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

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

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

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

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

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

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

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

Swan Nets: User Net Sunday 2200z winter 14.250Mc ±QRM. QSX op rotates Jim (WA5BDR), Jay (WB6MWL), Norm (W7RXG), Bill (W4WHW). Tech Nets: Wednesday 2300z 14.251Mhz / Saturday 1900z 7235 kc QSX op Stu (K4BOV)

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

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

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

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

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

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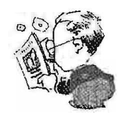

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SERVICE FOR SALE: Repair and restoration on all vintage equipment; over 50 years of experience. Barney Wooters, W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. 303-770-5314

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

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

FOR SALE: Collins 671UE receiver exciter. 1930s Collins transmitter power supply 409F. Galaxy Five. RCA 88. SP600 with ISB. URM-25C signal generator. TS382A audio oscillator. Heavy stuff, pick up. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402, 1-319-393-8075

FOR SALE: Collins 51J-4, beautiful condition, restored by Howard Mills (W3HM). Virgil, W4OLJ, 423-337-6484

FOR SALE: Hallicrafters SX-24. Works & looks great, manual. $175 Buyer pays pkg & shipping Don, K1DC, W. Bridgewater, MA. 508-587-7045, don.k1dc@comcast.net

FOR SALE: Ameco 6 meter converter $15. 1930s RME DB20 $75. SX28 parts unit $50. Collins 6.3V 5A fil xfmers $10 each. Richard Cohen, 813-962-2460

FOR SALE: Meissner Signal Calibrator as described in November 2005 ER. Excellent condition. Please write, I have limited time for phone calls. Jerry Van, W9VOW, 1150 Kellogg St, Green Bay, WI 54303


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FOR SALE or SWAP: Hallicrafters HA-6 and HA-2 transverters vgc, with power supply, cables, and manuals. Central Electronics AP-1 plug-in for the MM-1 (455kHz). **WANTED:** HV swinging and smoothing choke, 10 VAC filament transformer. Gary, 209-286-0931 or K6GLH@volcano.net.

FOR SALE: Scott 800B all chrome with 15" speaker and schematic $500 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: R392, cosmetically good, works all bands, gain is low and intermittent IF switch, asking $130. Several 32 mfd 5000V filter capacitors, pay shipping only. Carl, W2IQK, 845-355-1596

FOR SALE: Convoy Model CON-320 Transceiver Test Master exc, $35 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: B&K Model 467 CRT Restorer-Analyzer exc cond with manual $40 plus shipping. John Snow, 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: Johnson 275 watt Match box with meter and coupler, $75. BC-1206 LF rcvr, $25. Radio Handbook, 11th edition, $20. HP-3469B digital multimeter $35. HP-410C voltmeter $50. Norbert Wokash, WAØKJE, 3312 W. Bijou, Colorado Springs, CO 80904, 719-633-5661

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

FOR SALE: Sencore Model TC-28 "The Hybrider" tube- transistor checker with manual very good to excell-ent condition $75_plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: B&K Model 747B Solid State Dynamic Mutual Conductance DYNA-JET tube tester with manual very good to Excellent condition $150 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: Homebrew Class-C 4-1000 amp with power supplies and modulator. Also a lot of old parts and junque. Bob Blaney, 127 Westlawn Dr., Decatur, IN 46733 w9fru@skynet.net

FOR SALE: Hammarlund clock reproductions, **12 or 24 hours**. 12 hour (easier to read) or 24 hour, $35 each, S&H included. Telechron name removed, replaced with Hammarlund symbol. Rob Hummel, WA9ZTY, 202 Midvale Dr, Marshall WI, 53559-9616

FOR SALE: *"Unique Radio Parts", LLC.*

www.wa9tgt.com (Replacement parts for "Drake" radio equipment)

FOR SALE: Parting out National HRO-50, let me know what you need. Sam Letzring, KE5IRZ, 47 Banco Bonito Road, Jemez Springs, NM 87025 505-829-4011, sletz@msn.com

FOR SALE: HQ140 speaker, good, $150. HQ180 speaker $75, poor. Lafayette HE30 $100, good. NC57 $100 fair. NC105, wood cabinet, good, $100. All with reprint books. S-38E mil version, book, $150, good. Knight T60, book, $75. Pickup or pay shipping. Bill 301-868-7495 (H) or 310-906-5768 (mob.) or wyoensky@yahoo.com

FOR SALE OR TRADE: WWI SE 1420/ SE 1000 Heinz & Kaufman modified for Robert Dollar Steamship Lines, exc., orig. & historic; Kennedy 220/525 SF; Grebe RORK amp; BC 654 w/remote; Abbott TR 4's (2); deco Philco 39-9; DZ 2 National RCH communication receiver; Magnavox R3 B horn. See wanted this issue. Ward Kremer, 1179 Petunia Rd., Newport, TN 37821, Ph/fax: 423/625-1994, E-mail: witzend99@bellsouth.net, website: http:// www.radioattic.com/kremer.

FOR SALE: NC HRO-7 cabinet, some scuffs, could use a paint job. Complete, top, bottom plate. $40. Jim, K7BTB, 928-635-2117. JELDGL@AOL.COM.

DONATE: To a Ham that has no working radio: Drake TR4C, new finals, AC supply. Swan 500CX/500 AC, VOX (2 radios, 1 PS). All working. Legit Only! Freight paid. Don, K5AAD, 713-942-9747

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

FOR SALE: Collins 32V-3. QSTs: 1923-1991, 1993-6/94, 7/97 to 5/2005. Rudy, W2ZIA, 716-937-9279.

FOR SALE: Swan 350, $75. RCA CR-91A, $200. **WANTED:** antenna tuning knob (light brown) and manual for Knight SX-255 50W transmitter. Carter 434 979-7383,celliott14@earthlink.net

FOR SALE: B&W 5100A transmitter, Johnson Viking II transmitter, Hammarlund SP600 (with case), Drake B Line, Hallicrafters Cyclone III SR400A, Yaesu FTDX401, Yaesu FTDX 570, Hallicrafters SX 28 (needs recapping); all working well, excellent to mint condition; KB0W/6, 916-635-4442, fdellechaie@sbcglobal.net.

FOR SALE: Elenco SG 9500 RF signal/ counter $69. Leader LAG 120A audio generator $39. RCA xmitting tubes manual TT5 $5. Sylvania tube manual $5. Your choice, plus shipping. Jesus Moreno, 634 15th St, Douglas, AZ 85607. 520-364-3127.

FOR SALE: Dismantling Hammarlund BC-1004 Super Pro, homebrew PS. What do you need? Joel, W1UGX, Box 20887, Sedona, AZ 86341, 928-284-5419

FOR SALE: HQ-180, HRO-50, HQ-145XC, Valiant I, parts SX-101, 5 element 10 meter beam. Priced to sell, pickup only. Herb, K9GTB, 618-451-1605, Cell: 217-851-2585

FOR SALE: Transformers, chokes, meters, tubes, (other parts, ask), consider offers plus shipping. E.F. Hayes, WØJFN, 3109 N. Douglas Ave, Loveland, CO 80538-2548

FOR SALE: Dentron 160-10AT 500 watt transmatch, internal balun, near new, $45 + shpg. Henry Mohr, 1005 W. Wyoming, Allentown, PA 18103-3131

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

FOR SALE: Modern selective and sensitive galena crystal radios $50 ea. Parts to make your own. Also tubes and thermistors. Write Len Gardner, 458 Two Mile Creek Rd, Tonawanda, NY 14150, radiolen@att.net

ZIM ELECTRONICS INRUSH CURRENT LIMITERS

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

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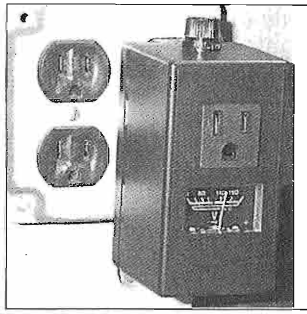
(4 or more limiters are shipped free for US orders. Overseas customers please ask for shipping quotes.)



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

FOR SALE: Military whip antennas, NOS, $45 ea. plus shipping. Bruce Beckeney, 5472 Timberway, Presque Isle, MI 49777, 989-595-6483

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

FOR SALE: Books: ARRL (4) 1954, (2) 1955, 1964, $15 ea. Power Supply, NJE model FRB 24-2-24 $25. CB battery eliminator model 6BE10, $20. Halli S-38D, clean, $70. Bernie Samek, 113 Old Palmer RD. Brimfield, MA. 01010, 413-245-7174, bernies@samnet.net

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

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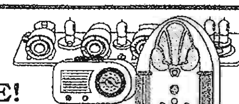
FOR SALE: DRAKE TR-7/TR-7A/R-7/R-7A Service kit. Includes 13 Extender Boards and Digital Jumper Card. $63.85 includes postage. See http://pweb.amerion.com/~w7avk, Bob, W7AVK, 807 Westshore J28, Moses Lake, WA 98837, w7avk@arrl.net, 509-766-7277.

FREE SAMPLE!



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FOR SALE: Military R-390 Receiver $600. Central Electronics 20-A Exciter w/458 VFO $150. Prefer meet or pick-up. Steve Davis, KD2NX, 71 Oak Street, Keansburg, NJ, 07734, kd2nx66@yahoo.com ,732-495-8275 .

FOR SALE/TRADE: Original Manuals: WRL, Swan, Drake, Hammarlund, Johnson, Hallicrafters, National, Heathkit, Clegg, B&W, Collins. NI4Q, POB 690098, Orlando, F1 32869 407-351-5536 ni4q@juno.com

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

FOR SALE: FT243 CRYSTALS: 3500, 3505, 3515, 3520, 3546, 3548, 3558, 3645, 3686, 3702, 3805, 3825, 3830, 3837, 3855, 3875, 3880, 3885, 3890, 3983, 5355, 5360, 7000, 7025, 7030, 7035, 7037, 7040, 7044, 7045, 7047, 7050, 7060, 7125, 7146, 8025, 8400, 10106, 10116, 10120, 12500, 14060, 14286kHz. See: http://www.af4k.com/crystals.htm or call Brian, AF4K, at 407-323-4178

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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

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

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

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

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

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.

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

WANTED: Sencore models CB42 and SS137 and SG165. Larry Redmond, 770-487-0164

WANTED: CQ Magazine, May and June 1945 to complete my collection. Lynn Stolz N8AJ 614-885-5428 n8aj@yahoo.com

WANTED: Radio correspondence course lessons by National Radio Institute (NRI) of Washington, DC. George Reese, 380 9th St., Tracy, MN 56175, 507-629-4831

WANTED: Brown beehive standoff insulators for vintage project, thanks! Richard Cohen, 813-962-2460

WANTED: HP 710A, 710B, 711 or 712 tube variable power supply, or equivalent from other manufacturers. Will pay paypal and have the item shipped USPS Airmail to Italy. Francesco Sartorello, francesco.sartorello@virgilio.it

WANTED: Original CQ magazine for July 1949. de Clyde Sakir, 4243 E. First St., Tucson, AZ 85711 "Thanks!"

WANTED: DX100B with good front panel. Will pay for packing. 760-837-3670 dicbutler1@aol.com Richard Butler, 133 Chelsea Circle, Palm Desert, Ca.92260

WANTED: Cash or trade, see goodies for sale this issue. LF coils for black face HRO, 50-100 kc, 100-200 kc, 180-420 kc; HRO 7 & 60 receivers; Case for National NC 100, 101, HRO black face, will buy part set. Also could use original transformer for same. Johnson Matchbox 275 or 1 kilowatt; Johnson SSB exciter 240-305-2; others. ALWAYS LOOKING FOR: Vintage broadcast mics; tube pre's; compressors; amps. Ward Kremer, 1179 Petunia Rd., Newport, TN 37821, Ph/fax: 423/625-1994, E-mail: witzend99@bellsouth.net, website: http://www.radioattic.com/kremer.

WANTED: Heath HX30 and HA20, no mods, and good condition please. Paul, K8NPF, 734-856-7396

WANTED: Hickok 600A tube tester. Ron, AA2QQ, 718-824-6922

WANTED: Cabinet for Pierson-Delane PR15 receiver. Patterson PR15 cabinet will also fit. JC Jackson, KD7TUE@aol.com or 406-642-3253

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

WANTED: Bezel and push buttons for a Philco model 42-395 console radio. Finder's premium paid. Ed Allen, 17677 Stonewall Rd, Prairie Grove, AR 72753, 479-846-2442

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

WANTED: QSL cards from W6JYS, Carl Lunghart. Clayton Vedder, 1037 Route 23A, Catskill, NY 12414

WANTED: Bias and filament transformer from HT-33A or B, also HT32B transmitter parts unit. John, W8JKS, 740-998-4518

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

WANTED: Hallicrafters SX-73/R-274D junker with good main tuning capacitor. Tom, W4PG, wtw@rti.org, 919-382-3409.

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

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WANTED: Altec Lansing horns: 811B, 511B. Drivers 808-8A, 806-8A. Ron, 262-673-9211, karenson87@yahoo.com

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

WANTED: Zenith chassis with speaker, model # 12S-232 or near equivalent for Walton cabinet. Please contact: Mike Grimes, K5MLG; 5306 Creekside Ct.; Plano, Texas, 75094, 972-384-1133. Email: k5mlg@verizon.net

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WANTED: National NC-183DTS speaker, NFM-83-50 adaptor and SOJ-3 Selectojet. Contact Ric at C6ANI@arrl.net

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

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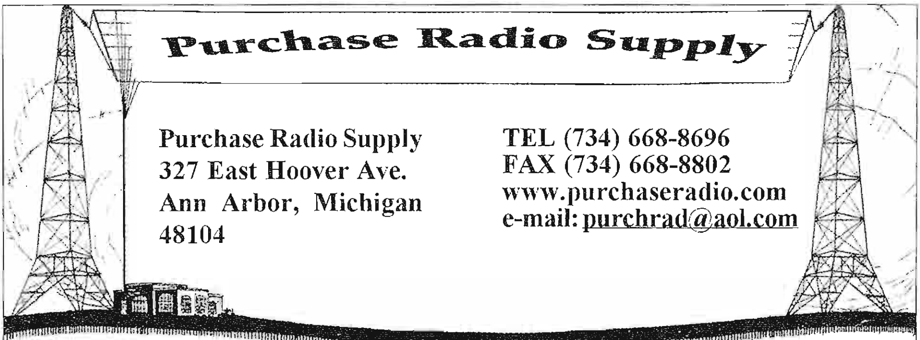

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WANTED: One of my "KN8GCC" QSLs from the mid-1950s. Tom Root, 1508 Henry Court, Flushing, MI 48433, wb8uuj@arrl.net, 810-659-5404.

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

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

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

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

WANTED: Need two 0-1 RF amps, 3-1/2" round Weston, Mod 435. Steve Bartkowski, 1-708-430-5080

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

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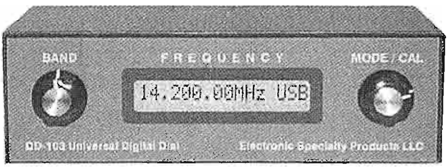

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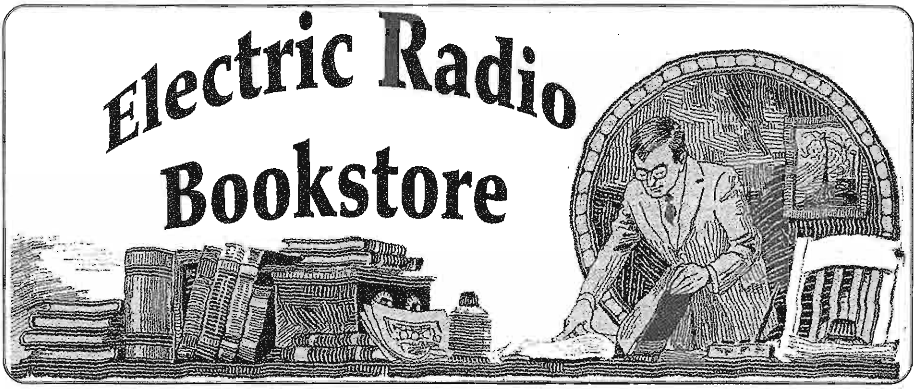

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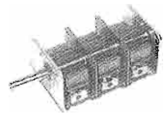

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