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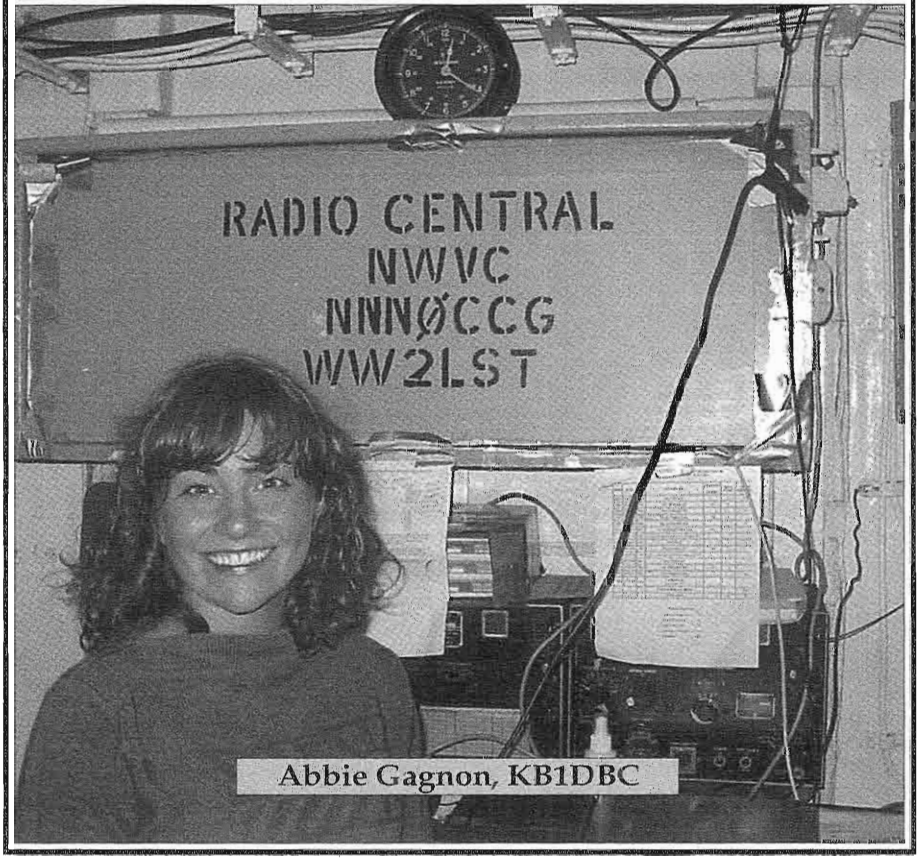
ELECTRIC RADIO

celebrating a bygone era

Number 197 October 2005



Abbie Gagnon, KB1DBC

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

Editor's Comments

Hurricane Season

I am very concerned about many Electric Radio readers in the Gulf Coast region that have been affected by the recent severe hurricane season. I would like them to know that they are in our thoughts and prayers during this most difficult time. The post office has certain zip codes to which they are currently not delivering the mail. All the issues of the magazine that are not deliverable will be held until the post office is once again accepting mail for that area. At this time, they have no estimate of when that might be.

I have spoken with Stan Bryn (AC5TW) about his radio restoration project on the USS Alabama, currently on display in Mobile, Alabama. Stan says that the ship was not seriously damaged, but is listing for reasons not yet known. The memorial park surrounding the ship was mostly destroyed. Stan will be working on the equipment he previously removed for restoration over the coming winter season, and is still gathering documentation on shipboard facilities.

The Electric Radio Photo Contest

I'd like to thank everyone who sent in their photos during the summer months for helping to make this project work. I am sure there will be enough to have the Electric Radio calendars printed, and I'll have the details in next month's issue.

Fall and Early Winter Radio Conditions

We are all looking forward to improving conditions on the bands this fall. I think this winter should be nearly ideal for 160 and 80 meter operations. There are many popular radio events during this period to take part in. I will have the announcement next month about the popular Heavy Metal Rally, which will be on Friday, December 30, this year. I would like to bring back the trophy award for the highest-scoring station, and the announcement, rules, etc. will be in the November issue. Any comments about the timing of this event would be appreciated.

73, Ray, NØDMS

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Cover: Abbie Gagnon (KB1DBC) visited the main radio room on board the WWII LST-325 vessel while it was tied up at the Maritime Academy in Boston, MA. Abbie is the daughter of Dale Gagnon (KW1I) who wrote the Coastwatchers article that begins on page 2.

Coastwatchers of Buzzards Bay

By Dale Gagnon, KW1I
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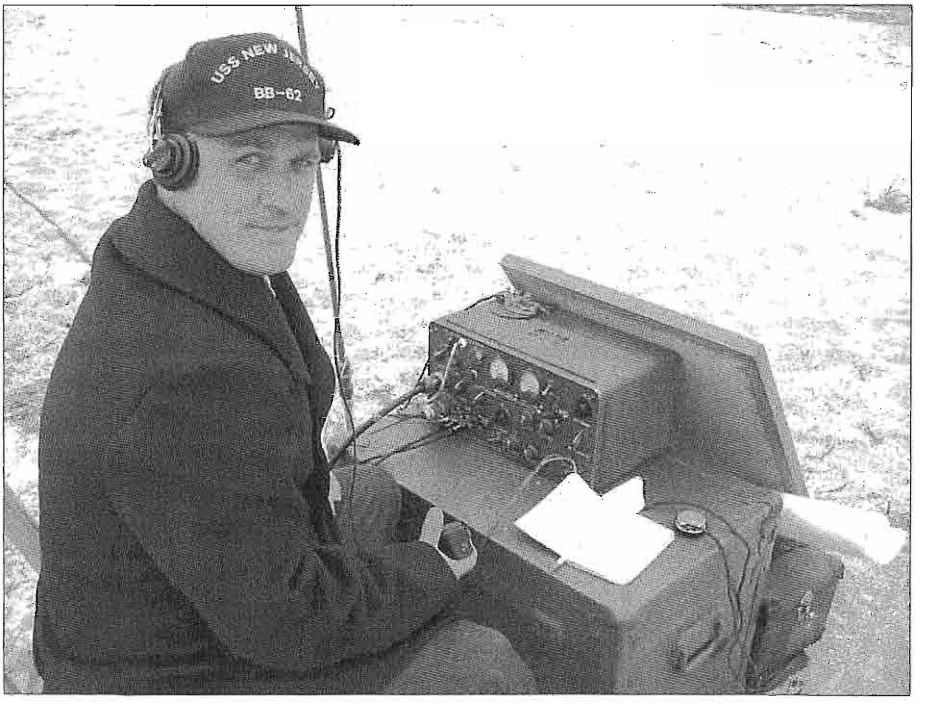
Bow, NH 03304

One of the most interesting radio stories to come out of World War II was the saga of the coastwatchers of the Solomon Islands. These Australian servicemen and island administration people stayed behind after the islands were evacuated as the Japanese invaded early in 1942. They used radio sets that were developed earlier for use in the interior of Australia that consisted of a DC-powered receiver and transmitter, batteries and a charging motor/generator. Pictures of these radios show them to look very much like a desktop low-power amateur AM station.

The coastwatchers with native bearers would lug their gear up into the island mountain ranges ahead of Japanese search parties so they could continue to report on enemy naval and aircraft traffic headed for Allied forces. Some of their communications were encrypted and sent by Morse code, but frequent use was made of voice communication in the clear to give a few minutes warning of enemy aircraft so that our planes could get off the ground to intercept.

The idea of looking out over a body of water, taking note of local shipping and communicating with vintage radios with hastily erected antennas led a number of amateurs to plan a coastwatcher event overlooking Buzzards Bay in southeast



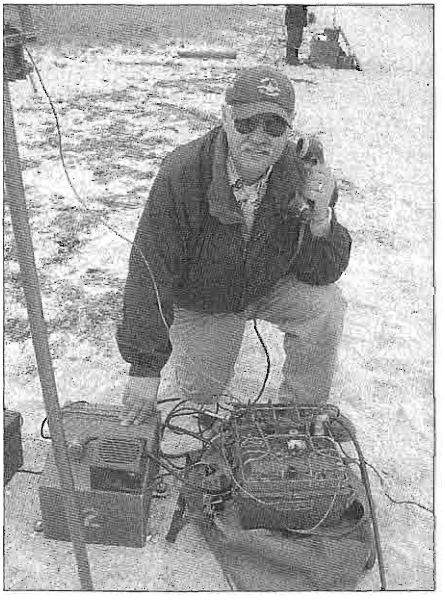
Rob Flory (K2WI) operates his TBX set up on West Island.

In the background, Brown Beezer (W1NZR) is using his PRC-77, and in the foreground Tom Mackie (W2ILA) is running a TBX. This action occurred during the "dry run" operation in April 2005.

Massachusetts earlier this year. On the north end of Buzzards Bay is the busy Cape Cod canal, so our original idea was to set up stations on both sides of the bay along its length and report on commercial shipping coming into view at one end of the bay and pass the information along the route to the other stations to simulate a coastwatcher network. While we were planning the event and picking out suitable vantage points, it came to our attention that the WWII vessel LST-325 would be making a historic East Coast voyage in late spring passing through Buzzards Bay, providing a very interesting subject for a coastwatcher network. As a bonus, an amateur radio operator, Perry (W8AU), would be on board the LST.

Our initial planning had been focused on April 9 for a coastwatcher event, so we decided to use that date as a dry run for the LST arrival scheduled for June 3. On the day of the dry run four coastwatcher teams were fielded. Brown (W1NZR) and Tom (W2ILA) were at the southwestern end of the bay on windswept Gooseberry Island equipped with GRC-9 and GRC-19 radios, Rob (K2WI) and Glen (N1SNG) were on the beach at West Island about half way up the bay using a TBX-4 set, Charlie (KA1GON) and friend Van were north of Falmouth on the east side of the bay with a TCS set, Dale (KW1I) and Larry (N1PHV), with GRC-9 and GRC-19, were at the northerly end of the bay at the entrance to the Cape Cod Canal on the grounds of the Massachusetts Maritime Academy. W1NZR and KW1I stations were 29 miles apart, the length of the bay, and K2WI and KA1GON were 9 miles apart across the width of Buzzards Bay. Radio conditions were very good in spite of daytime propa-

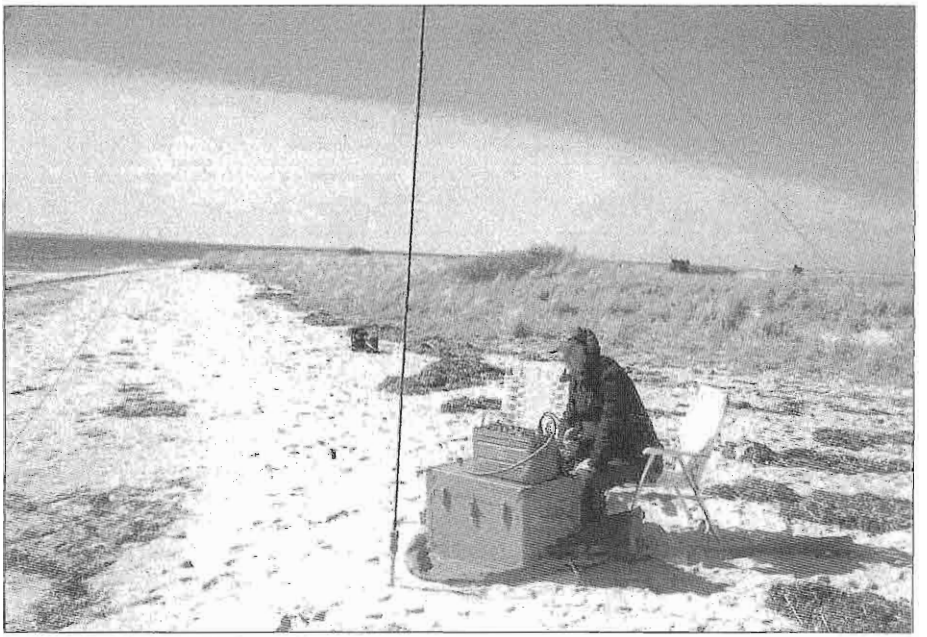
Above: The WWII LST-325 is tied up in Boston.

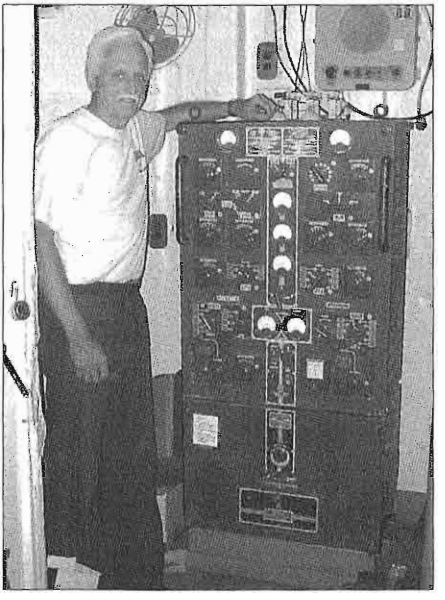


Chris Bowne (AJ1G) used a GRC-9, powered by a PE-162 gasoline generator, while operating on the beach.

gation on 75 meters and compromise antennas. Mid-day contacts were made over the 29-mile length and 10-mile width. As it turned out, it was wise to have planned a dry run. Rob (K2WI), with his central location, had the best copy on everyone, but the TBX manual RF gain control had to be turned down when the GRC-19s were in use. Unless the RF gain was then turned up, the TCS across the bay could not be heard. Rob also had some unusual modulation products when his transmitter was keyed; probably due to the bugs working out of his newly acquired EF-8 generator for the TBX. The Gooseberry Island and Falmouth teams had antenna matching issues. The GRC-19 at the Maritime Academy location would not operate for long without battery charging and then ignition noise became a problem. Happily, these were non-critical issues. Other radio activity was successful. Six-

Above: Copying on the mill, Perry Ballinger (W8AU) is at the original operating position in the radio room on board LST-325. Below: A Coastwatcher's lonely duty station on West Island.





Left: Perry (W8AU) is with the TDE transmitter that was used during MF and HF operations.

meter FM contacts were made using PRC-25 and PRC-77 backpacks. W1NZR, at the southern end of the bay, and KW1I at the north end both worked Rob's TBX using WWII BC-611's. The ranges of 13 miles and 15 miles respectively were way beyond that equipment's normal capability. We attribute this feat to good conditions, low QRM, and the fact that each path was line-of-site over water. After we had exercised all our radios, we gathered at the KA1GON QTH on the eastern shore to inspect his coastwatcher station on the beach and participate in an after-actions cookout.

In the intervening weeks between the

The coastwatchers and Perry gathered for a late dinner after the LST-325 tied up. From left to right are Charlie (KA1GON), Chris (AJ1G), Dale (KW1I), Perry (W8AU), Rob (K2WI), Larry (N1PHV), Chris (N1UXJ), Brown (W1NZR), and Dick (K1GUG).

dry run and the LST arrival we worked on improving our coastwatcher station shortcomings and we established contact with Perry (W8AU) on a weekly CW net. When the LST left Mobile, AL on May 17, we kept in contact with him under the ship's amateur call WW2LST. On June 2, W1NZR operating the TAJ transmitter on the battleship USS Massachusetts in Battleship Cove, Fall River, MA under its original call NEPL on 512 kHz, was heard by WW2LST about 150 miles south of Montauk on the east end of Long Island, NY. Perry was in the final stages of repairing the MF section of the LST's TDE transmitter and had it ready to go on June 3 when they were closing in on New England about 50 miles south of Montauk and 200 miles from Fall River. Brown, from NEPL on the battleship, worked Perry using the LST's WWII call sign NWVC on 512 kHz. The TAJ was running 400 watts to an 861 and the TDE was running 150 watts to an 803. Later, on June 3 as the LST came closer to Buzzards Bay, the coastwatcher teams were again deployed. On the west shore Rob (K2WI) and Chris (AJ1G) were on West Island. Charlie (KA1GON) was again on the beach on the east side of the bay across from West Island. Dale (KW1I) and Larry (N1PHV) were at the north end of the bay at the Maritime Academy where the LST was scheduled to tie up that evening. Rob was running his TBX with the generator problem fixed, and Chris had his GRC-9 running with a PE-162. Charlie's TCS was louder with a matched antenna this time and the Maritime Academy team was using a BC-1306/DY-88 that ran fine on battery power. By mid afternoon the coastwatcher teams were in contact with each other and with Perry (WW2LST), who was using a TCS on board the LST. The USS Massachusetts, manned by Brown (W1NZR) and Chris (N1UXJ), was also on frequency. The West Island team scanned the ship channel for the LST as Perry's signal increased. Out of the haze the LST appeared some 5-6 miles east of our position. (See an interesting image of the LST as it came out of the haze on Rob's website: www.home.earthlink.net/~navyradio/id5.html.) Perry contacted the coastwatchers on both shores on HF and also on six-meter FM. As the LST got closer the coastwatchers gave directions and landmark positions to Perry so that he could get an idea of each team's location. At one point, Perry was using the LST's signal lamps on the bridge and the radio to coordinate with KA1GON on the eastern shore in preparation to receive visual CW. Perry commented on the radio, "I only see a light sending dashs." To which, Charlie responded "That's all I'm sending!" The passage of the LST up the bay took several hours, so there was plenty of time for additional signal and visual reports. At the Maritime Academy, quite a crowd was gathering to see the vessel. There were more than a few veterans who had served on LSTs over the years. Our coastwatcher station was set up right along side the docking location for the LST. A number of onlookers came over to see the radios when they realized the voice on the BC-1306 speaker was coming from the ship they were waiting to see. The LST docking was completed by 10:00 PM. By that time, all the coastwatchers had gathered at the academy and we took Perry out to a nearby restaurant. We had a lot of fun and we got to know our equipment a bit better. In a very small way we experienced some aspects of what it was like to be coastwatchers in the Pacific more than a half century ago. We hope to make a coast watching get-together an annual event.

ER

Tom's AM Transmitter Bench Mate

By Tom Marcellino, W3BYM
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This little project stemmed from the ever-changing test bench in the R&D (Repair & Destroy) lab at this QTH. Here's how it began. My good old trusty Ham scope with a 300-watt dummy load attached to the rear panel had to go. It just didn't have enough bandwidth in the vertical amplifier for bench work, although it was great as a monitor scope. So, it went on eBay to another happy owner. That left me with the 300-watt dry dummy load and no scope.

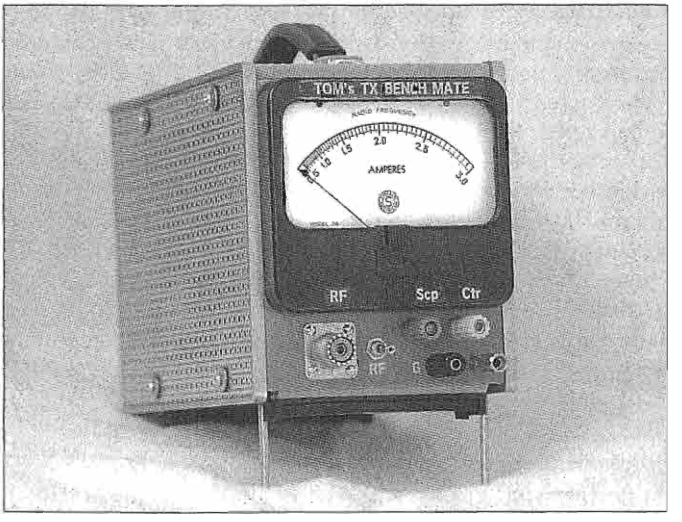
The scope issue was easily solved with the purchase of a 60-MHz, dual-trace unit. There was only one problem–it didn't have the capability to connect the 300-watt dry dummy load.

So, here's where Tom's TX Bench Mate starts to form. Along about this same time, my HP 427A portable VOM decides it doesn't want to play anymore and it was gutted for that nice cabinet. By the way, this VOM can be purchased at a hamfest for five dollars or less, and the little cabinet is suitable for many projects.

The "bench mate" is very useful when testing any AM transmitter. You can think of it as a junction box that feeds various equipments. It can connect to your bench scope for monitoring the RF envelope. Connect it to your bench frequency counter to monitor frequency drift. Connect it to a pair of headphones and hear how the audio sounds before you put it on the air. There is even a RF voltage test point on the front panel. If you own a RF voltmeter such as the HP 410B, you can measure the RF voltage at the dummy load. The obvious plus is that big RF ammeter on the front panel. Now that just has to wow you!

A look at the circuit [**Figure 1**] shows a generous use of toroid cores. If you have followed some of my previous articles, you know how I love to use these tiny little devices. They make life so easy when you want to pick off a small amount of RF for uses like in the "bench mate." Actually, I found these at a hamfest at the low price of 10 for two dollars. So, at that price I really stocked up. They had no markings but appear to be like the T68-2 cores. They are painted red with an OD=0.7", ID=0.35" and a thickness of 0.27".

The primary of each transformer has a



Left: A front view of the Bench Mate showing connections for RF input, the scope, counter, and ground. The RF tap occupies the original location for the gain control.

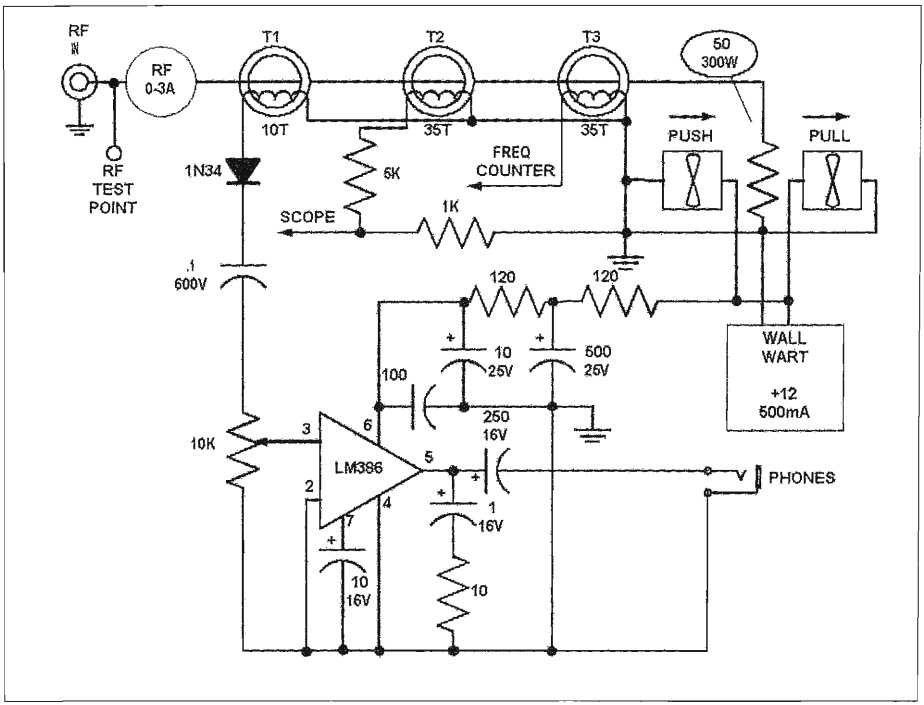


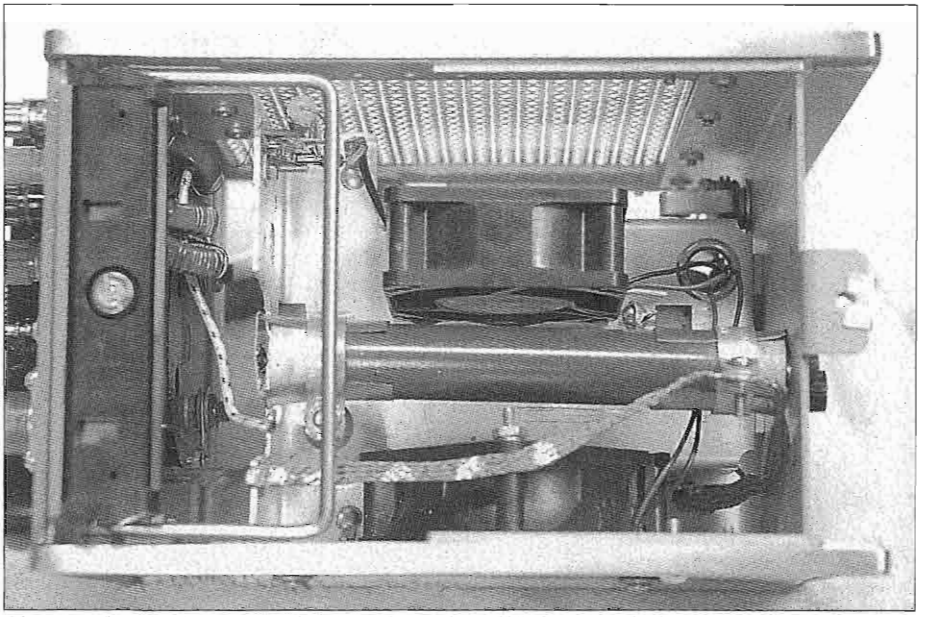
Figure 1: Complete schematic of my Bench Mate AM transmitter test unit.

single turn. The secondary turns count is indicated on the circuit diagram. The secondaries were wound with 0.018" Formvar-insulated wire. Enamel insulation would work just as well. You may be wondering where in the world I came up with the 0.018" wire size. It actually came from a defective 1960 Ford T-Bird starter solenoid. When the solenoid failed I tore it down to determine the root cause. That's where I found about a half pound spool of the wonderful wire.

I've used this same audio amplifier circuit before and it performs very well. It uses an 8-pin LM386 and is configured for a gain of 20. The output will drive a headphone impedance of 8 to 2000 ohms with no problem. I did run into one problem with the physical placement of the gain control. Originally, it was placed on the front panel beneath the meter. It had to be small to fit the space and I only had one 10-k miniature pot in stock and it was a wire wound. What I forgot about was the large RF field surrounding the RF ammeter. There was so much RF getting into the LM386 that no amount of bypassing could cure it. Of course, I didn't discover this until I had soldered 100-pf caps from nearly every point to ground. The audio amplifier is very happy and quiet with the wire pot mounted to the rear panel.

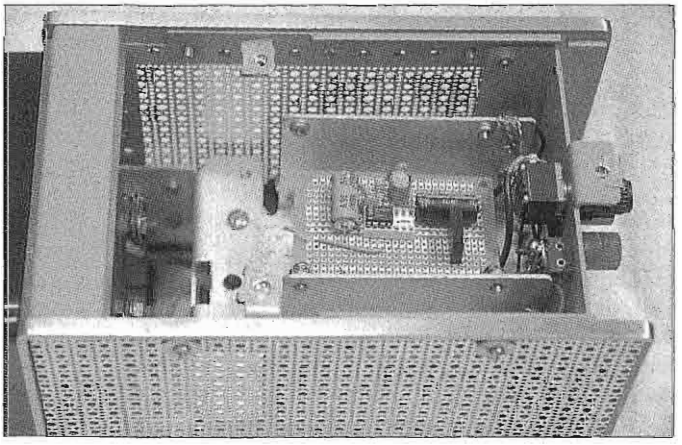
The 50-ohm, 300-watt carbon resistor is under-rated in my opinion. It was originally housed in a small metal perforated cabinet with no fans. Oh yes, you can feed 300 watts into the load, but within a short time, less then 20 seconds, it will start smoking. The RF source used for testing the "bench mate" was a Johnson 500. It just so happens that the 500's PA, a 4-400A, puts out better than 300 watts in the AM mode.

So, wanting to make the unit as useful as possible and to take RF power levels from QRP to QRO, two twelve-volt fans were installed. These also were found at



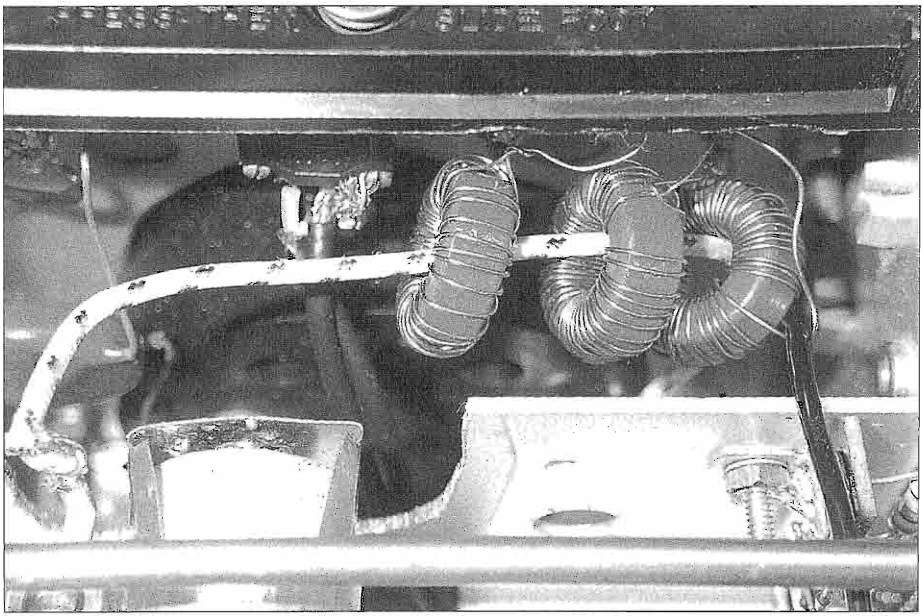
Shown clearly here are the "push and pull" fans and the center-located load resistor. The wide ground strap connects directly to the SO-239 on the front panel. The transformers are clearly visable in the upper left of the photo.

the hamfest for about a buck apiece. They were installed with one pushing and one pulling the hot air generated by the dummy load. When the fans operated, and 300 watts of RF, the RF current would remain steady and then start to fall off after two minutes. The current fall-off was due to the change in resistance in the dummy load. The fall-off was very slow, and showed about a 20-watt reduction in power, but the power could continue to be applied for several minutes without damage to the carbon load resistor. At 150 watts and below, the fans provided sufficient cooling to prevent current fall-off. The cabinet sides were replaced with perforated aluminum to assist in the cooling process.



Here is the audio amplifier board and its components and the gain control mounted on the rear panel.

Again, one thing leads to another. The installation of the cooling fans caused grief for the audio amplifier. Let me explain. The power supply is an inexpensive "wall wart," and like most of them, it didn't have much



This is a view of the three torroid coils and their one-turn primary. They may be placed randomly along the primary wire with no interaction.

output filtering. With the fans running, the output ripple was a whooping 1.6 volts peak-to-peak. This equated to a small buzz-saw sound in the headphones. That's the reason for the extra filter capacitors on the B-plus line. The measured ripple at pin 6 of the LM386 was reduced to .02 volts peak-to-peak, and the headphones are now buzz-saw free. Note that DC motors make electrical noise. The only place I used shielded wire was in the input circuit of the amplifier. Specifically, the wire runs from the .1-µf cap to the top of the pot, and from the center of the pot back to pin 3.

The voltage divider for the scope output was selected for levels from QRP to QRO power. For example, at a scope setting of 2-volts per division, a 300-watt RF carrier will yield about 2 centimeters on the scope face. The same is true for the audio pick-off. Using a gain of 20 in the amplifier required only 10 turns on the secondary of T1 to provide good clean audio from QRP to QRO. I used my DX-60 barefoot for the QRP RF source.

I like using RF ammeters. In the shack I have a nice large four-inch, 0-to-5 amp unit. The one used here is only 0-to-3 amps because no 0-to-5 was in stock. With a pure resistive load as the carbon resistor provides, the scale could just as well be calibrated in watts. When using the "bench mate," I mentally "see" RF power; one amp = 50W, two amps = 200W, three amps = 450W. I have this same "vision" using the shack RF ammeter because the tuner provides a 1:1 match, thus a resistive load. Now, everyone knows that power varies as the square of the current with a fixed resistance, don't they?

So there you have it. This is one small and very versatile package. Tom's TX Bench Mate provides convenience for measuring RF power output and RF voltage, monitoring output RF current, frequency, audio quality, and the output waveform. Whether you are a builder, restorer, or you just want to check your AM transmitter into a dummy load, maybe this little unit will help.

ER

The DX-60: It Works CW Too

By Richard Lucas, K4JEJ
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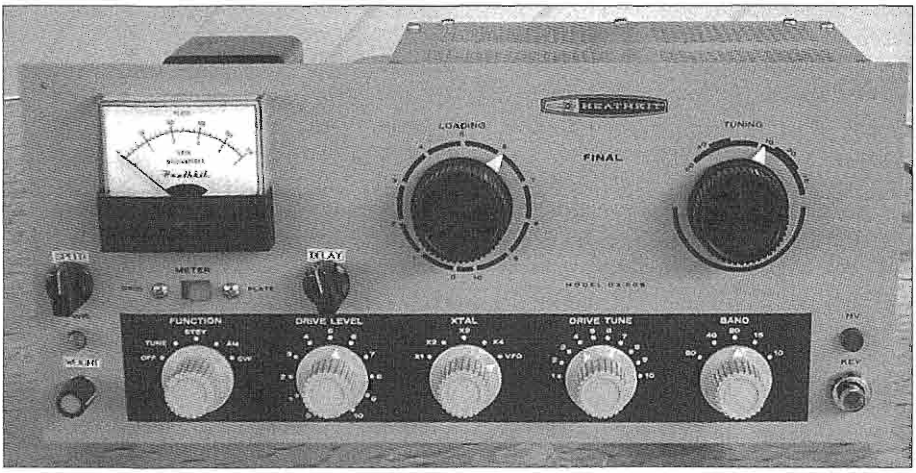
I've read a lot in ER about fun stuff to do with the DX-60 on AM, but no one seems to mention what a great CW rig it is. I'm a CW-only guy these days but I enjoy working on vintage equipment just like the AM guys do. With a few additions and minor changes, the DX-60 will work even better on CW.

The Power Supply

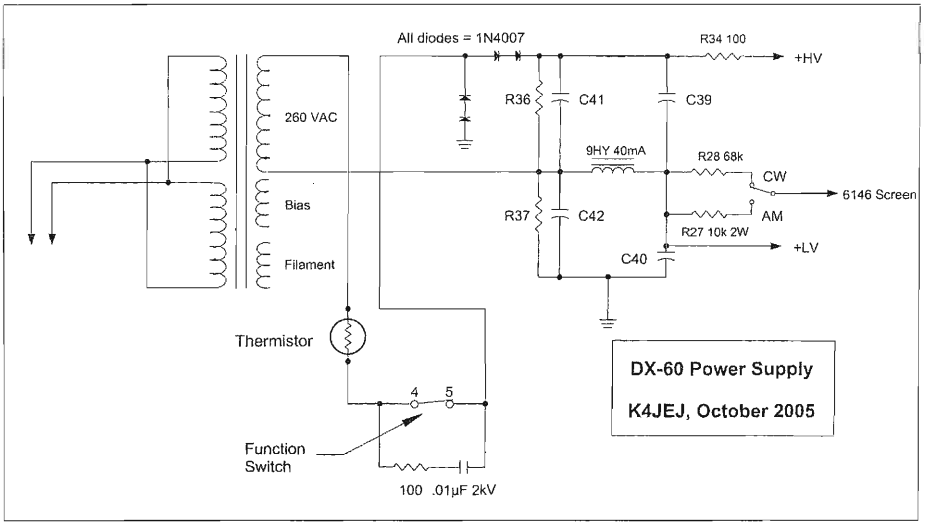
All of the electrolytic condensers and diodes were replaced and some cleanup was needed. It's just amazing how a thing can work all those years with all those cold solder joints! I replaced the original 7-watt, 100-ohm filter resistor, R34 with a 9-Hy filter choke. It does a much better job of smoothing out the ripple from the low voltage supply, but better yet it improves the shape of the keying. The choke is a Hammond 156G unit rated 9 Henrys, 40 mA, and is available from Antique Electronic Supply[1]. There is plenty of room for it on top of the chassis, just in front of the can-type filter cap. Also, to save a few watts of transformer power I pulled the audio tubes.

Screen Voltage

I made a minor wiring change to the function switch (see schematic) that removes the old 6DE7 audio circuitry from it. Now, the AM & CW screen voltage resistors are fed directly from the low voltage supply. In the AM position you select R27, normally a 47-k resistor. I changed it to 68K to set the output level to 5 watts. In the CW position, you raise the screen voltage to normal by switching in R28, normally a 10-k resistor. I changed that to a 8.2-k, 2-watt resistor to bump up the power output a bit, without stressing the tube. The 5-watt output is handy for antenna tuning and/or an occasional QRP QSO. The" Tune" position cuts the screen voltage completely and is perfect when you're getting the VFO on frequency.

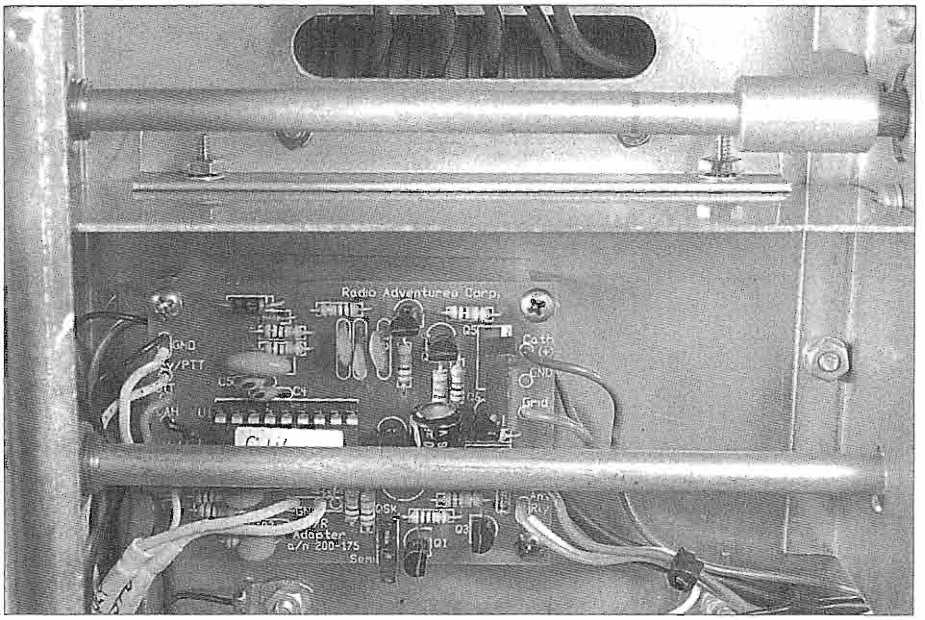


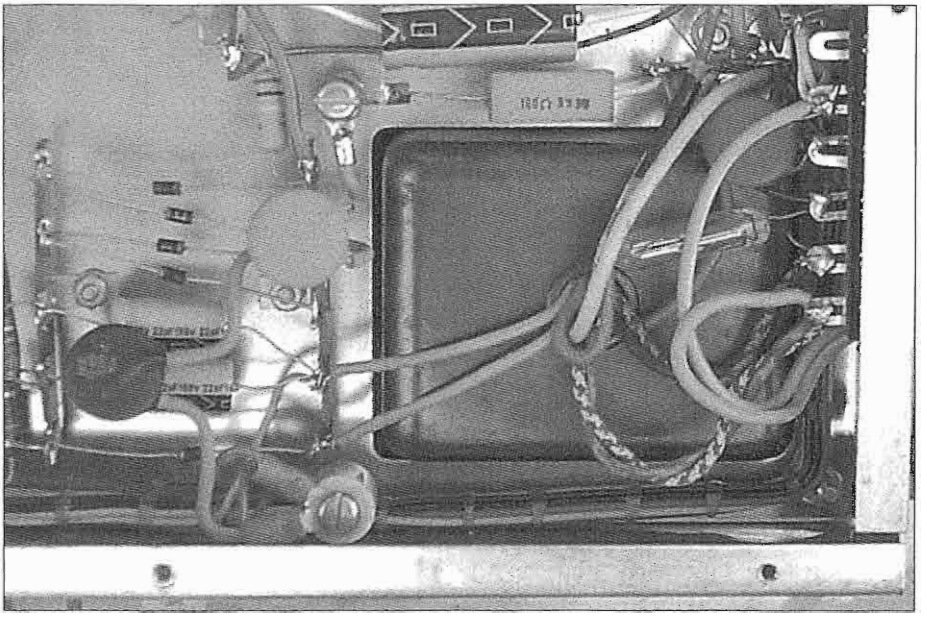
This front view of the DX-60 B shows the newly-installed speed, delay and weight keyer controls on the left side, and on the right a handy latching pushbutton replaces the key jack. The key jack is now located on the transmitter rear, and feeds the Radio Adventures module.



Above: A simplified, re-drawn schematic showing the power supply changes. Note the new thermistor and an R/C network that has been added to the transformer secondary and function switch contacts. The low B+ filter choke replaces filter resistor R34.

Below: A close-up of the installed Radio Adventures module also shows a new aluminum RF shield partition between the final bandswitch wiring and the module. The RA module fits nicely under the crystal-select shaft which comes out after loosening one screw. The 100-mfd, 35-v cap had to be turned sideways on my installation to clear the shaft, just one more example of the "measure twice, cut once" rule.





Above: A close-up of the power transformer showing the new thermistor and the R/C snubber added to B+ switching. The thermistor is in series with one side of the 260-volt power transformer secondary. The arc suppression network goes across the function switch HV control leads. Insulated posts are used as tie points and were screwed onto two transformer mounting screws. The .01-µF cap and 100-ohm resistor are in series and wired across the function switch HV leads.

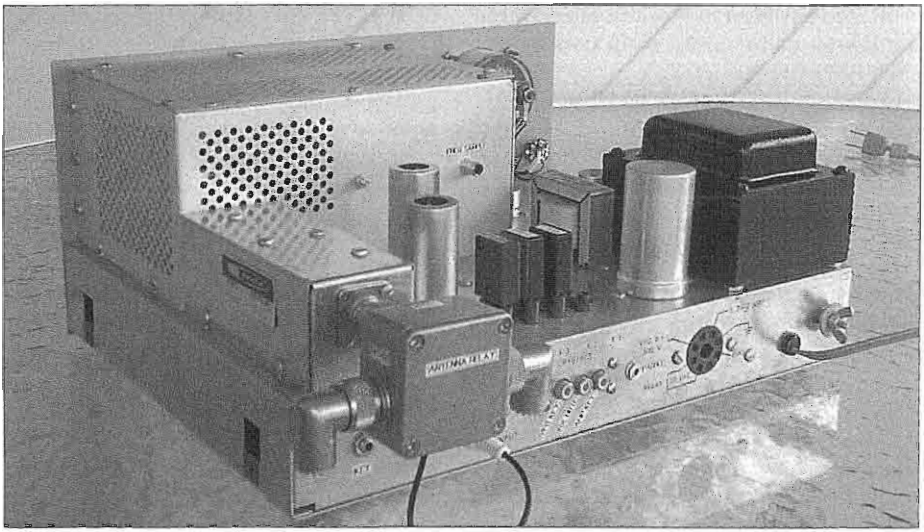
The Antenna Relay

The original RCA-type RF output connector was changed to an SO-239. I built an external 12-volt DC relay in a small shielded box (see photo p.15, above). It screws right onto the DX-60 output connector using a male chassis connector. The relay is DPDT and it switches the antenna between transmitter and receiver and also grounds the receiver input on transmit. The little Bud box is well shielded and is stuffed with cotton to eliminate any audible relay clicking. I used a Radio Shack 275-249 for both the antenna and the auxiliary relay. A good electronic T/R switch would be a worthwhile addition. Anyone have a good circuit?

Radio Adventures

For those not aware of it, Radio Adventures[2] offers a T/R adapter that is just made for this kind of vintage conversion. On-board are a basic keyer (no memories), relay drivers, and the timing circuitry necessary for semi or full QSK break-in operation. It offers variable speed and optional weight controls along with a pot to change the T/R delay time. There are outputs for both cathode and grid-block type keying. I mounted it near the front, under the shaft of the crystal switch. (See photo, p. 13) I also added a small aluminum RF shield between the board and the final band switch wiring. The module runs on 12 VDC and is sold as a kit.

I added some mini jacks to the rear apron of the DX-60 chassis (see photo, p. 15) for the paddle and key and other RCA connectors for the antenna relay, receiver muting and VFO control. The actual on-air signal is monitored on trans-



Above: The new antenna relay is attached to the transmitter output with a male PL-259 connector. It has a 12-VDC coil and plugs into an RCA jack. The rear apron now sports several other new RCA and mini jacks. The added low voltage choke can be seen just in front of the filter condenser.

mit so you can hear your keying in real time. Contacts from the auxillary relay for a partial receiver mute function are wired to an RCA jack. I have a preference for semi break-in operation, but the module will work full QSK, providing you have a good T/R switch, etc.

The Radio Adventure's negative "grid" output is wired to the DX-60's keying line, and the positive "cathode" output feeds one of the RCA jacks for QSK use. As an alternative, the VFO control could come from the auxillary relay, so that the VFO comes on and stays on while the relays are energized.

I provide the necessary 12-volt DC operating voltage for the module through an unused pin on the DX-60 accessory socket. When it's all wired correctly, a touch of the paddle will instantly switch the relays, fire the transmitter and silently put you on the air.

To save drilling holes in the DX-60, the Radio Adventures module could be

Right: All of the keyer controls are located on the left side of the front panel. The weight control replaces the old mike jack. The new speed and delay controls are located on either side of the meter switch.

built into an external box and wired into the DX-60 using a multi-pin connector or by rewiring the octal accessory socket. I like the built-in approach, but either way will get you on the air. I'm an end-user, not a collector!

VFOs and Such

I have built a few VFOs of my own and tried some of the usual commercial tube types, but always with disappointing results. They do OK on their fundamental frequencies, but trying them on 20 CW and up is an entirely different story. It takes some pretty good stability to compete on today's CW bands where narrow bandwidth and synthesized receivers are the norm.

We have Collins and Drake to thank when it comes to improved VFO stability. They ran the VFO at about 5 Mc and heterodyned it with crystals to reach the operating frequency. Those VFOs were beautifully designed and worked well, but there's a big difference between a stable 5-Mc oscillator built into a controlled environment that feeds a mixer vs. one that runs on 7.0 Mc or higher and then gets keyed and/or multiplied several times. Not all VFOs can be successfully keyed, especially when their 2nd or 3rd harmonic is in use. Also, there almost always is a problem running the VFO directly on the operating frequency. It takes very little RF fed back into the shack to cause any number of weird stability and/or hum problems. Stray RF can easily find its way back into the VFO.

When you think about it, staying on frequency within 50 cycles or so on 20 CW is asking a lot from analog VFO. Ask anyone who was operating CW before the mid 70's when phase-locked loops first appeared. I can't think of any other radio service that needs this kind of agility and stability at the same time.

I use an Oak Hills Research QRP rig for a VFO. It's varactor tuned and the signal is clean and remarkably stable. The output is on 40 but the harmonics are good right up through 10 meters. The stability of the VFO is plenty good enough to work right along with modern radios.

I made one mod to my QRP driver that makes it much easier to use as a VFO. I enabled the RIT function on transmit by clipping a resistor lead. This gives you an effect much like the band-set and band-spread tuning on vintage receivers. The coarse main tuning will get you close to the desired frequency then, using the fine-tuning RIT control it's an easy thing to get zero-beat.

The grid drive can be increased if necessary. Bypass the Xtal/VFO switch with a one-inch piece of wire between the input jack and the tube. No more crystals, but now you have more drive. Hey, it's reversible.

A Potential Problem with a Solution

If there is one weak spot in the DX-60 it's with the control circuitry. For B+ control, the 260-volt AC secondary of the power transformer is switched on and off by one wafer of the function switch. But the way the switching works, you have to go through "Tune" to get to "Standby." So, it creates a spike of B+ for a few milliseconds each time the power is turned on.

As a consequence, the filter caps, diodes, tubes, and more importantly, the function switch, each get a good zap each time the switch is turned on and/or when you switch in and out of the "Tune" position for VFO spotting. I don't know what the rating is for the switch contacts but a visual inspection of mine tells me they have already started to burn. If we must switch the B+ on and off like this, there should be some insurance against collateral damage.

One Solution

RF Parts Company[3] and Radio Shack sell thermistor current limiters to handle situations like this. They look a lot like large disk condensers but they have some interesting characteristics. At no-load they have about 47-ohms resistance, but in a second or so, after current is drawn, they drop to less than an ohm. So this

device, when inserted in series with the primary or secondary of a power transformer, will add a nice time delay, or soft start, to the power-up sequence. They are meant for use in transmitting tube filament applications to limit inrush current. I installed one at the junction of the transformer HV secondary, near the diode string (see photo and schematic, pages 13 and 14)

And while I was at it, I added a spark snubber across the function switch contacts. It's just a little more insurance against burning up that precious switch. Ever try to find a replacement for those special order rotary switches? My snubber consists of a .01-μF, 2-kv disk condenser in series with a 100-ohm resistor. This network gets wired across the 2 leads that go to the function switch. I found some space very close to the thermister, adjacent to the power transformer. Again, see the photo and the simplified schematic on pages 13 and 14.

30 Meters

Its only fitting that a CW rig should work on 30 Meters, even if it was never intended to. I'm happy to report that the rig works fine, running the same output power as the other bands. I even had a few QSO's and got good signal reports. Getting adequate grid drive, however, is a bit of a challenge.

I used the 20-meter band position, since the final will tune to 10 Mc with no changes. Both the "Tune" and "Load" controls peak at about the 11 o'clock setting. Nudging the two driver stages to 10 Mc is a little more complicated.

The final neutralizing circuit is deceptively simple. The problem is that the frame of the driver-tuning condenser, C9, is grounded and not placed directly across the driver coil, L2. C9 is actually in series with C8. Re-tuning that circuit becomes a juggling act between retuning and keeping the final in neutralization. The easiest way I found was to add fixed capacitance directly across the active turns only on L2 until the circuit was resonant at 10 Mc. I'm open for suggestions on this one.

The first stage in the DX-60 is fixed tuned and broadly resonant at 7 Mc using L1 and stray circuit capacitance. Moving it to 10 Mc is a little tricky. It should be possible to shunt another coil across L1 and move it up to 10 Mc. I didn't try that, but instead chose to substitute another coil/cap combination for L1.

With all the above mods soldered in place, I was able to get proper grid drive and output from the 6146. The real problem is working up a quick and easy band switching scheme. Separate relays, with adequate insulation for the B+ and RF voltages, could be used to switch the two stages together. There's a lot to think about. I have decided to save the finished version of the 30-meter mod for another day or a new inspiration, which ever comes first.

Summing Up

That pretty well sums up my list of CW mods for the DX-60. If you don't drill any holes, all of the above are reversible. I'll bet the engineers at Heathkit never in their wildest dreams thought they were designing a transmitter that would be in use and written about 40-some years later. They probably thought they were just building an entry-level Novice rig. I think it says a lot for the old "build it right the first time" cliché.

[1]Antique Electronic Supply
Tempe, AZ 85283
480-820-5400
www.tubesandmore.com
[2]Radio Adventures Company
RR #4 Box 240 Summit Drive
Franklin, PA 16323
814-437-5355
www.radioadv.com
[3]RF Parts Company
San Marcos, CA
760-744-0700
www.rfparts.com

ER

J.H. Bunnell & Company: Past, Present, Future

By Dr. Joseph Jacobs
Northport, New York
(Originally presented at the 1994 AWA Conference, reprinted by permission of Dr. Jacobs)

Jesse Bunnell, founder of the company to manufacture telegraph apparatus and other electrical supplies, was a kind of folk hero, a man about whom songs and stories should be written. Being born one year before Morse's invention provided Jesse with a fertile field to become a champion telegrapher, a wartime operator, and to establish the company bearing his name by the age of 35. Becoming a messenger boy at 11, subjected to cannon fire, long hours, hunger, and privations, he nevertheless found time to stand up for better pay, witnessed a wired observation balloon ascension, and played practical jokes and earned the respect of the generals and colleagues with whom he worked. Jesse deserves a trip down memory lane. Let's begin at the beginning.

Jesse was born in Massillion, Ohio, in 1843. (Remember 1844?) By age 11, he was delivering telegraph messages and at 13 he was a full-fledged operator serving at offices in Ohio, Pennsylvania and West Virginia from 1859-1861. He set a record at age 17 of 32 words per minute as an average, when for a steady two hours, he forwarded President Buchanan's last message to Congress (including the fancy words politicians of that day loved to use). After the attack on Fort Sumter, April 1861, Jesse, not yet 18, joined the Union Military Telegraph Service (UMTS), which had been recently organized by Andrew Carnegie, who was an operator himself at age 15. At the war's start, operators were the Army's Cinderellas. They were (and remained) civilians. Their value was not appreciated and they were given very little support and $60 per month, less than that of a quartermaster clerk. They were often under fire as their main duty was to relay troop movement observations and orders, in part replacing military couriers. Jesse, in December of 1862, was one of 50 operators who signed a petition to the USMT headquarters for an increase in pay and support. As their importance was recognized, they got merit raises and more regular transport and supplies. Later, however, a group of operators in one area threatened to resign unless pay was raised to $100 per month. The first telegraph strike aborted when they were threatened with charges if they resigned en masse instead of individually as was their right as a civilian Army employee.

Moving with the Army, the operator would cut his wire keeping a few yards with his instrument to reattach to the line at the next stop. During battle lulls, operators were kept busy receiving and relaying casualty information for the Army and concerned relatives. Working

Jesse Bunnell, c. 1885

long hours, operators would often fall asleep at their instrument; yet always awaken when the sounder clicked their call sign.

Being young operators, they were not averse to using their skill and wires for practical jokes. Early in the war, Jesse, "a great wit and very young," was fired when he pulled a hoax on Wheeling, West Virginia, newspapers about a great Union naval loss off the "Rip Raps." Of course he had to be fired, but then, because of his great skill, Jesse was rehired elsewhere at higher wages.

Jesse observed one of the few ascensions of a wired balloon operated by a balloonist and a telegraph operator to relay troop movements and dispositions. At first, Jesse was assigned to the threatened Washington, D.C., area in May of 1861, as telegraph service was needed to connect the surrounding encampments and forts with the War Department and the President. At the end of June, he was sent to Annapolis as part of a relay with the capitol, but during that time, operators were "moved from place to place as the occasion required." Jesse Bunnell's tenure on the relay might have allowed him to serve Lincoln, as his company maintains. Lincoln used the War Department's telegraph office as a refuge for relative peace and quiet. At a desk unofficially reserved for him, Lincoln wrote part of his Emancipation Proclamation and his second inaugural address ("— with malice towards none — "). Lincoln sent his last telegram, two days before his assassination, to Richmond, VA, opposing reconvening the Virginia Legislature.

From about June of 1862 to August of 1864, Bunnell served with the Army of the Potomac as General McClellan's personal telegrapher, with the sign MC, and with Sherman's Army of the Cumberland through the bloody battles in Tennessee and on to Atlanta. Exposure and starvation in the winter of 1864 weakened Jesse severely, forcing him to resign on the 16th of August in 1864 and the UMTS lost one of its "ablest and bravest operators." Jesse's return to non-army work from 1864 to 1872 led him to Philadelphia and a partnership with James Partrick, a successor to Chester, Partrick and Co. Later, from 1875 to 1878, he worked for L. G. Tillotson and Co.

In 1878, Jesse created J. H. Bunnell and Company. In 1879, he took on Charles McLaughlin as a partner, who was in charge of sales and administration, while Jesse concentrated on manufacturing and innovations. Bunnell received a patent the 15th of February, 1881, for his steel lever key. Stamped from one piece of steel, with minor machining, this was Bunnell's answer to the loosening of the steel trunion inserted in the brass lever. So successful, the steel lever continues to this day in keys. Early production bore the patent date on the lever. Later, this gave way to a logo containing the letters BUNNELL over a letter S, and with its general acceptance, later levers had no engraving. In 1888, Bunnell introduced his double-speed (sideswiper) key to help telegraphers avoid a "glass arm" (today called carpal tunnel syndrome). The original sideswiper, Style G, did not have spring tension adjustment. Most photographs show the style W, with a spring tensioner. An article on the Bunnell Wave Motor, published in 1898 in "Electrical Engineer," noted Bunnell was heavily into other electricals. Bunnell, like other companies, had their castings made for them.

In 1899 Jesse caught a severe cold, which worsened. He died of heart failure on the 9th of February 1899 at age 56. He was buried in Brooklyn's garden Greenwood Cemetery. McLaughlin took over the company. In the 1920s, J. J. Ghegan became president and introduced many electrical innovations. Ghegan was suc-

ceeded by J. G. Doughetery, followed by his wife, who sold the business in the early 1960s to Inso Electronic Products with C. J. Meislich as president. In 1989, J. H. Bunnell and Co. was acquired as a division of MNJ Industrials, Matthew Jacobs, President.

The company, which started in Manhattan, moved to several locations in that borough. In the 1930s it moved its operations to a number of locations in Brooklyn, then to several locations on Long Island including Kings Park where it is today.

Starting with telegraph item production, Bunnell shortly branched into a huge variety of electrical items both as manufacturer, wholesaler and retailer. Theirs, and other companies, produced fire equipment for NYFD and other fire departments, burglary, security, and medical eqipment. In the 1930s through 1950s, they made commercial radio and FAX transmitters. Bunnell produced equipment for Postal Telegraph and Western Union, both to Bunnell's or the ordering company's specifications. Bunnell produced telegraph items through 1988 for Mexico and other Latin American countries. Pre WWII, Bunnell was one of the largest telegraph key suppliers. Recently, an Amelia Earhart documentary maintained that her tragedy may have been avoided if she had better code skills and hadn't left without a key for CW backup. As one of the country's main telegraphic manufacturers, Bunnell equipment can be found displayed in the Smithsonian's Museum of American History as well as in railroad and other communications museums.

With the introduction of the semi-automatic key (the bug), Bunnell produced and won the right to use the generic name "bug." Bunnell also sold Vibroplex keys and later, in association with Martin (inventor and founder of Vibroplex), produced these bugs.

Bunnell produced for the military from the Spanish American War through the present. Bunnell made keys for Great Britain's military. Together with other companies, Bunnell produced the flameproof key, but for three decades to 1988, Bunnell was the only company to supply the flameproof key meeting the Table of Equipment needs of ships and planes. During WWII, Bunnell employed 600 people in a number of plants to produce a variety of electrical items, and later supplied the military during the Cold, Korean, and Vietnam wars.

In the 1890s, Bunnell introduced fully functional miniature versions of their key, sounder, and KOB, selling them as a tie pin or with a bale for use as a watch fob. The sounder was also included in an earpiece for privacy or for use in especially noisy areas. They were sold to ardent telegraphers and presented as special awards, such as to Jesse's Civil War boss, Andrew Carnegie. They were presented at a 1908 telegraphic dinner to RCA's Sarnoff (of Titanic fame), other radio luminaries, and in 1954 to President Eisenhower. As a collectible today, they are extremely rare and desirable.

[Editors Note: J.H. Bunnell & Company is currently doing business as a division of MNJ Industrials in New York. Readers may be interested in their apparently current offer of an authentic, limited "Centennial Edition," fully functional miniature telegraph key and sounder. I am only reporting on the offer, this is not a product endorsement. Bunnell can be reached at 631-360-1967 or on the Internet at http://www.racoon.com/jhbunnell/

ER

The AM Broadcast Transmitter Log

Part 4, Transmitter Output Networks

By David Kuraner, K2DK
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This month we present the issue of redesigning the transmitter's output network. The oversized components and high power can be very intimidating to the non-broadcast experienced amateur. The black magic is about to be exposed! This discussion applies to high-power homebrew as well as broadcast equipment.

When converting an AM broadcast transmitter to amateur radio frequencies, one is presented with the existing output matching network components. Typically, this is a PI-L which uses the standard PI configuration with an extra coil in the output section. Bear in mind that any such network is an impedance matching device. To fully understand adjustments and what components and values to salvage or replace requires an understanding of the circuit. Here is a discussion of the theory and requirements that provides practical target values for PI and PI-L networks for the 160, 80, and 40-meter amateur bands. Values will be for a typical 1-kW AM broadcast transmitter. The information presented can be applied to any transmitter employing these matching networks.

The basic impedance matching network is the L circuit. The capacitor or coil can be in either leg. The ability to transform impedance is due to the fact that for any series circuit, there is an equivalent parallel circuit. The impedance matching ratio is fixed, based on the square of the circuit's "Q + 1." So, with a Q of 3, that ratio would be 10:1 ((3X3)+1). If the matching circuit is used in the output of an RF amplifier, a Q of 10 to 15 is required for acceptable harmonic suppression. Thus, the fixed transformation ratio being the square of the Q would yield at least a 100-to-1 ratio.

Normally the output impedance to be matched is 50 ohms. The plate circuit impedance is several thousand ohms. At most, a step-down ratio of 10:1 would be required. A simplified formula for determining the resonant plate impedance is one half the plate voltage divided by the plate current. For the typical 1-kW broadcast transmitter, the parameters are approximately 3000 volts at 400 milliamps. This yields 3750 ohms to be matched to 50 ohms. A usable Q with an L-matching circuit would transform the higher value to only several ohms. An L-matching network can not be used.

The more familiar PI circuit can be thought of as two L networks with a single inductor acting as two separate components. A portion of the inductor is associated with the left side and the other portion with the right side of the network. The portion of the inductor associated with the left or tuning side, is about the same value as would be found in a parallel resonant, link-coupled circuit. The tuning capacitor, likewise, is about the same. Thus the tuning capacitor and the first portion of the coil resonate at the operating frequency. You can think of the output impedance of the circuit as being very low requiring a step-up transformation.

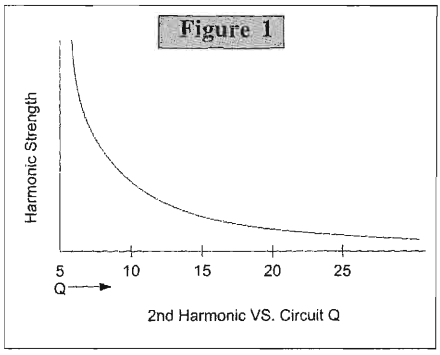
The required step up is now provided by the second L network consisting of the right portion of the inductor and the loading capacitor. The entire matching process is going from a high-impedance series circuit to a very low parallel im-

pedance with the first L of the PI. The low parallel impedance goes to the required moderate series impedance with the second L of the PI network. Values are shown for 160, 80, and 40 meters. Normally, 80 and 40 meters would not require the addition L for harmonic suppression, and 160 would normally be adequate with a PI network for amateur purposes.

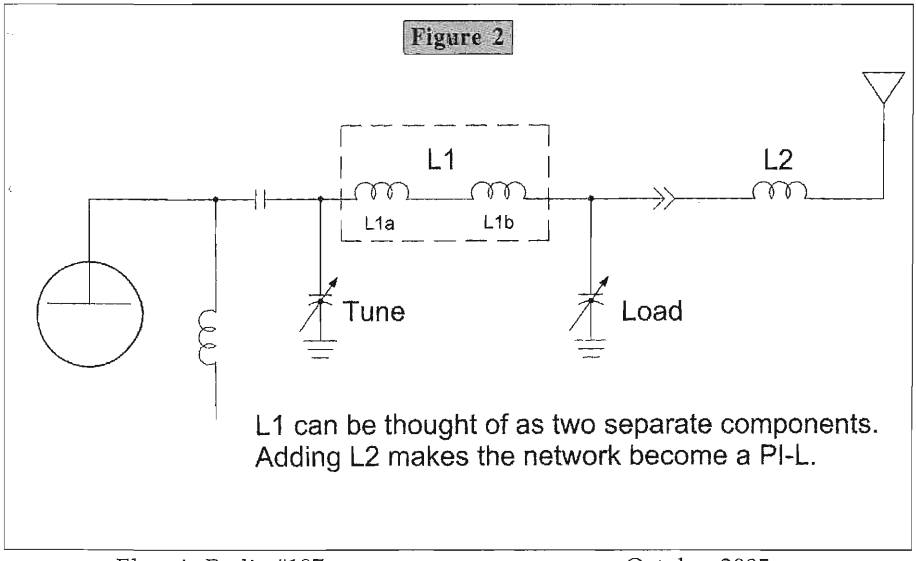
The PI network provides much greater harmonic suppression than just the simple L network, and excellent flexibility in matching ratios. However, at AM broadcast frequencies, even greater harmonic attenuation is required. The additional L on the end of the PI network is to provide that attenuation as well as even greater transformation flexibility. The PI network will transform the plate impedance to an image impedance of 300 to 700 ohms. The last L network with its "shared capacitor" brings the impedance down to the actual output value, as its Q is very low.

Q and Tuning

Another issue in a broadcast transmitter regarding Q is the ability to pass all audio frequencies up to at least 7500 Hz,



and preferably beyond. If the final tank circuit were to have a very high Q, the transmitter's audio bandwidth would be restricted, especially at low RF frequencies. So, many tank designs are low Q and must use the PI-L configuration to achieve adequate second harmonic suppression. They may include a second harmonic trap in the output circuit. (Often, multi-tower broadcast phasing and matching networks can have an influence on the audio bandwidth.) For Ham transmitters, the audio bandwidth is not an issue. Also, the frequencies and Q tend to be high enough so the second-harmonic suppression is adequate. See **Figures 1 and 2.**



In broadcast transmitters, an additional reason for selecting a low Q is tank circuit efficiency. With a loaded tank circuit, a low Q results in more energy being transferred to the load. Mathematically, it can be expressed as: Tank Efficiency = 1 - (Ql/Qu), where Ql is the loaded circuit and Qu is unloaded. It becomes clear that a low-loaded Q is best for efficiency while a high Q is best for harmonic suppression. A compromise is chosen for amateur equipment resulting in a design target for a Q around 12, or slightly greater. This is where the target should be for a broadcast conversion. In commercial equipment, the design leans toward efficiency and incorporates sufficient harmonic suppression networks to compensate.

Often, maximum RF output in Ham transmitters does not coincide with the minimum plate current dip. This condition is especially true with broadcast transmitters where the Q of the tank circuit is low compared to the typical Q of 10 to 15 we are used to. It tends to go unnoticed in amateur transmitters at 7 MHz and above. A detailed analysis is beyond the scope of this article. However, its explanation is that the maximum impedance yielding minimum plate current and zero reactance (which is resonance) do not occur at the same point. When tuning a Ham transmitter, it is noted that on the lower Ham bands maximum output is found to be just off "resonance," as indicated by the dip in plate current. The broadcast transmitter's manufacturer will include in its tuning instructions to tune to one side for maximum output, and may specify a specific amount of increased plate current for maximum efficiency. Do not be surprised by this phenomenon when doing the conversion on 160 and 80 meters.

Practical Component Values

The following tables on page 24 are based on data originally published by William I. Orr, W6SAI. In **Table 1**, the plate impedance value of 3750 ohms for the typical 1-kW broadcast transmitter is used. The four Q values of 10, 12.5, 15, and 20 are shown so that the reader will be able to choose or otherwise work with the components available. The Q value of 12.5 is included since this is the "ideal" value for a PI network.

In **Table 2**, the component values for the PI-L are based on charts originally published by William I. Orr, W6SAI for Eimac. All numbers are in values as stated above for the previous tables.

Interpreting the charts, it becomes obvious that the capacitor values increase and the inductor values decrease as the circuit Q rises. The data presented should be thought of as estimates of component values and the given plate impedance. The tables, charts, formulas and assumptions employed to produce them, are subject to interpretive errors. Components should be chosen to be variable or otherwise adjustable and be centered within the target values given. It should be noted that the voltage across the loading capacitor is higher in a PI-L circuit because of the greater impedance. Also, when choosing components for the capacitors, in addition to the voltage ratings, the current rating has to be addressed as well. The fixed types found in broadcast transmitters (G-2 or vacuum) should be used. Vacuum variable capacitors are preferred for tuning control. If an air variable is used, an absolute minimum spacing should be 0.15 inch and preferably greater. Availability and cost considerations will most likely dictate the design.

In the introductory article in ER #194, I mentioned that the only commercial Ham transmitter–to my knowledge–to include the PI-L was the Globe Scout. Well, it seems that Collins invented the PI-L. An article "Network Tank Circuits" by Klippell and Pappenfus appeared in

Table 1

PI Network 3750 Ohm Plate to 50 Ohm Output

	Q=10			Q=15		
	160	80	40	160	80	40
Tuning	250	120	60	350	180	70
Loading 1100	500	250		2000+	800	375
Inductor 40	20	9		20	11	5

	Q=20			Q=12.5*		
	160	80	40	160	80	40
Tuning	500	200	x	300	150	65
Loading 4000+	900	x		2000	650	300
Inductor 17	10	x		30	15	7

Note: capacitor values in pF and inductor values in uH

Table 2

PI-L Network 3750 Ohm Plate to 50 Ohm Output

	Q=10		Q=15		Q=20	
	160	80	160	80	160	80
Tune	250	120	350	180	500	200
Load	1300+	700	1500+	800	1800+	1000
L1	37.5	20	25	15	24	12
L2	12	5.5	12	5.5	12	5.5

September 1950 CQ magazine showing how the KW-1 was the first commercial rig to employ it. And, it is employed in the Collins 32V-2. Many thanks go to Mike Dorworth, K4XM, for enlightening us.

The Maintenance Log

There is a Yahoo group devoted to finding and restoring the Collins 20Vs. Just do a Yahoo group search for Collins 20V. And, the Bauer and McMartin transmitters are still supported by the manufactures. A Google search will bring you to their web sites.

References:

William Orr, Radio Handbook, W6SAI, 22nd edition.
William Orr, EIMAC Ham Notes, William Orr,W6SAI
The ARRL Handbook, 1994, American Radio Relay League

ER

ACG Modifications for the R-390A and R-725

By Ron Deeter, K6FSB
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I have always marveled at the performance of the 390-series receivers, in particular the R-390A. They have proven to be reliable and excellent performers, no wonder the military ordered so many and production lasted for more than three decades. There is, however, one major flaw–SSB reception. Despite the number of published modifications, none in my opinion made SSB reception acceptable. This is primarily due to the lack of addressing proper AGC action. The original Collins concept was to use an external SSB demodulator, the CV-591. This does a wonderful job however, is not what I consider a satisfactory solution for a radio that is capable of outperforming the modern equipment of today.

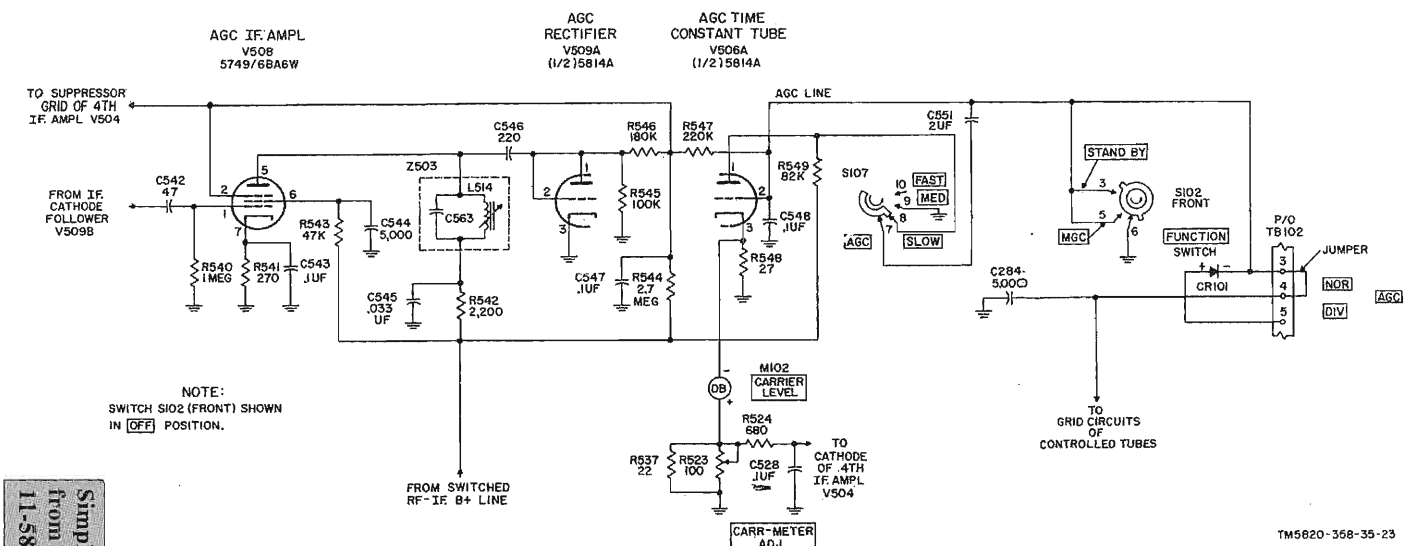
The R-390A that I had acquired many years back had been modified with a nonworking product detector (tube type 7360). It was a nonreversible modification with plenty of ventilation (nice way to say "unauthorized holes"). There were many other issues as well, most were not difficult to solve. This particular receiver was a complete, very low serial numbered Collins unit. Luckily, it was not a depot dog, just a butcher job. Finally, after getting everything fixed, the radio played great except on SSB. I later acquired another R-390A, and it has become my favorite as an R-725 because it has an R-390 IF subchassis.

The goal of this article is to address the AGC problem while complying with three requirements: no holes, the mod must be portible (it stays in the IF deck), and should have the ability to be restored. It is presented as a procedure combining the modifications by Ray Osterwald, NØDMS, from ER #150, and myself by changing the circuitry and time constants of the AGC. I have left out several pages of calculations; they can be generated by use of the formulas in the RCA Radiotron Designers Handbook, 4th Edition. The result will place the AGC in the category of fast attack and slow decay, providing a smooth AGC action that will work for SSB, AM, and CW. The AGC times should be as follows; fast attack times of 12 ms, 73 ms and 2 sec with decay times of 1, 3.5, and 6 seconds respectively for settings of fast, medium, and slow. The carrier level meter will also reflect this by being more active and register far differently than before, becoming useful and functional.

There are two separate sections in this article; each will deal with the specifics of the R-390A or the R-390 IF deck. Each of these sections contains specific notes and an overview of the procedure. Read everything first, take your time, think, pick off the varnish if any, and keep the heat down to a minimum. A copy of the original schematics and parts locator will be helpful. With the IF deck upside down, "down" is near the tube sockets and "up" is closer to you. A de-soldering tool is not necessary. There is no reason why it can't be done with braid. There are times that a de-soldering tool will not fit, let alone all the tools. It is going to get a bit crowded at times (especially on the '390), so use insulation on bare wires as necessary, and double-check your work.

Overview of the R-390A Changes

Begin the mod by making sure the IF deck is working as originally designed. Replace all leaky caps, this means the Black and Brown Beauties all gotta go! Use high-quality metalized-polyester caps with an epoxy coating such as Sprague Orange Drops® or similar. Please refer to **Figure 1**, page 27, and the



Agc circuit, simplified schematic diagram.

Simplified R-390A AGC schematic from Army Technical Manual TM 11-5820-358-35, 8 December, 1961.

simplified original R-390A schematic on page 26.

More than likely, C551 is leaky. If by chance it is good, you may wish to leave it alone, but the delay times will be a bit longer on "medium" and "slow." Five of the ones I've checked were bad (.5 to 7 mA leakage), so plan on rebuilding it and putting in a 1.5-µf, 400-volt, metalized poly capacitor in the can. Take your time; drill a small #68 hole in the bottom to let the vapor out and then gently heat it to unsolder the bottom (Please think *"SAFETY FIRST"* and don't breathe the vapor.). Do this upside down to keep the PCB oil in the can. There is not much oil, about a teaspoon, just enough to make a big mess! I used a small torch to melt the solder and clean up the can. Remove and dispose of the innards properly, solder in the new capacitor, and then either tack solder the bottom back together or use screws (0-80 will work).

- C551 is hopefully already changed to 1.5µf, 400V.
- C548 is replaced with .47µF, 400V and 33k, 1/2W in series.
- R547 and R544 are removed.
- C547 is replaced with .022µF, 400V or .033µF, 400V (each IF deck is slightly different, use .01 to .047 µF).
- R546 is replaced with a 1N4148 diode from V509 pin 1 to V506 pin 2.
- Add a 2.0-Meg resistor from V506, pin 2, to ground.
- Add a 30-ohm 1/2 watt resistor in series with carrier level meter.

Following Ray's AGC mods from ER #150:

- V504 pin 2 to ground.
- V508, connect pin 2 to pin 7.
- Remove the ground on V509 pin 3 and replace with 1N4733 in parallel with .01µF to ground.
- Add 15 Megohm, V509, pin 3 to B+.

Regarding the zener, the resting AGC voltage will depend on your receiver. You may need to shift the resting voltage one way or the other. The same goes for C547's replacement, as it is somewhat subjective.

The R-390A Working Details

Remove the BFO bellows and C535 (12 pf) and replace it with a 47 pf. Of course, insulate the leads as necessary. Reassemble the bellows. Find the terminal next to V506; completely remove everything: R547 (220k), R544 (2.7Meg), the wire going to pin 2 of V504 (connect this to the ground lug closest to V504) and

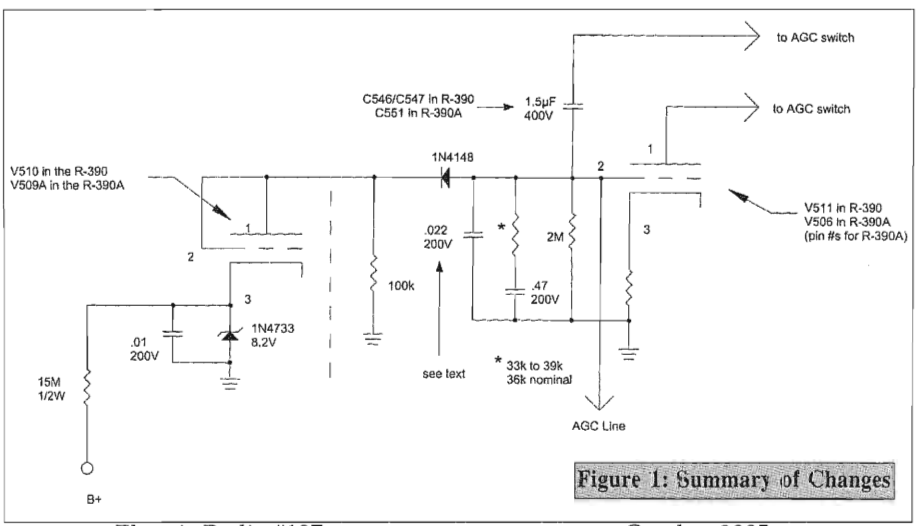


Figure 1: Summary of Changes

the white wire w/green and brown stripes (it will no longer be used), and insulate the end. Remove the wire attached to pin 3 of V506, white with orange and blue stripes. This wire runs back to J512, pin 12, and verify its routing. Attach it to the now-empty terminal. Install a 30-ohm, 1/2-w resistor from pin 3, V506 to the terminal (this may be changed for different meter deflection).

Find the terminal next to V509 and remove everything. Insulate the wire that led back to the terminal next to V506. See the previous paragraph, the other end is also insulated.

Now look at V508, pin 2. Disconnect everything and remove C547 completely, but save the wire because it will be re-used. Connect pin 2 to pin 7 on V508 using a short, insulated jumper.

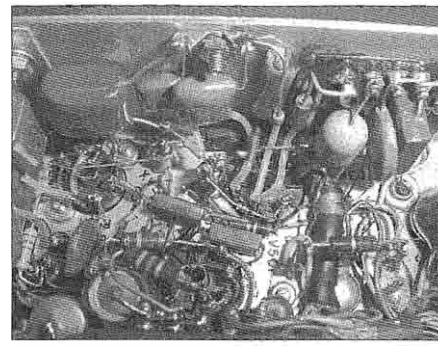
Remove C548. Reusing the wire, connect it from the C551 terminal that had C548 attached to the terminal next to V509. Connect a 2-Meg resistor from this same point on C551 to the most convenient ground lug.

Remove the ground on V509, pin 3. The replacement for R546 (180k) is the diode, with the cathode (banded end) going to V509, pins 1 and 2. Attach the anode (no band) to the terminal.

Attach the .022-µF or .033-µF cap to the terminal and lay it along side C541, attaching the other end to the ground lug on the side above V509. Actually, you will want to install C541 last just in case you wish to try a different value. The space is needed for the parts layout.

Next, attach one end of the 33k (which is in series with the .47uf cap) to the terminal, and then the capacitor lead goes to the ground lug.

Connect one end of the .01-µF cap, 1N4733 diode (band end), and the 15-Meg resistor (use insulation on the ungrounded leads) combination to pin 3 of V509. All three can lie along side C541. The other end of the .01-µF capacitor and zener diode connect to the ground lug. The other end of the 15-Meg resistor connects to the tie point on TB501 closest to the ground lug; it has a wire colored white w/red striping attached to it.



Closeup of the new components around V509.

Be sure to double-check everything against the schematic, as well as all solder work.

Touch up the alignment on Z503 and neutralize the BFO with variable capacitor C525.

Voila, you are done. Enjoy the nice AGC action for all modes.

AGC Modification for the R-390 and R-725 Receivers

Now, the question is, does it work for the R-390? It should. I unfortunately let the R-390 go (it was trashed and without its IF deck) just as I acquired the correct IF deck. However, an R-390A with an R-390 IF subchassis becomes an R-725. It works great with no more ringing from the mechanical filters and far smoother audio. Working in the R-390 IF subchassis is a pain and quite cramped.

During development, I noticed an interaction problem between the last IF amplifier and the AGC line. I found that by using the existing cathode follower (V511A) to isolate the AGC system from the last IF amplifier stage solved the problem. In the original R-390 circuit, the cathode follower wasn't doing anything; it was just waiting to be utilized! It was easiest to use an almost exact dupli-

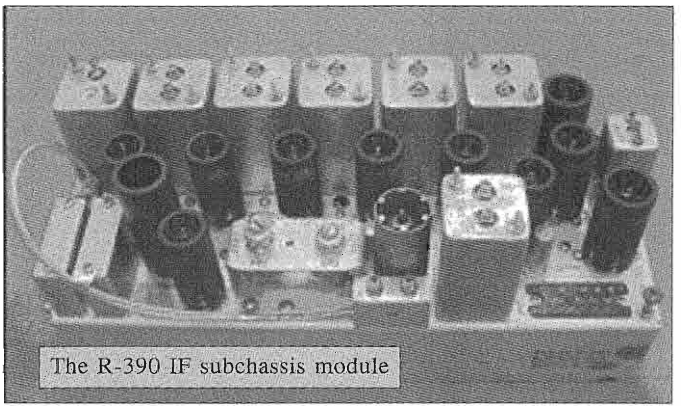
cation of the R-390A cathode-follower circuit. The original choke in the R-390A is 130µh (the resonant frequency calculated with capacitors is approximately 483 kHz) and I used 150µh (this calculates to 452.5 kHz, which is closer in resonance and the choke is more readily available). Completing the cathode portion of the circuit are the resonating capacitors (.001 and .0047 µF), which also act as a voltage divider, and the 27-ohm resistor going to the IF output jack, J512. This circuit also has better isolation characteristics between the IF output and the AGC amplifier input than the original, which was designed for IF-output purposes only. In the R-390, the insertion of the cathode follower is easily accomplished by moving one side of C539 from pin 1 of V506 to pin 3 of V511 (remember, pin 2 of V511 is already being fed from the output of T505). Changing the AGC amplifier tube, V509, to a 5749 (6BA6) provides a bit more gain prior to rectification, and is a more reliable tube in this application.

Several other changes are made including wiring changes, removing the original AGC voltage divider and replacing it with zener-diode bias, increasing the BFO injection, and removing parts no longer needed. The differential voltage in the carrier-level meter bridge circuit is now greater, so addition of a 15-ohm resistor in series with the carrier level meter the resistor corrects for this, making it a useful indicator. Now, S9 sits at about the 30-db mark.

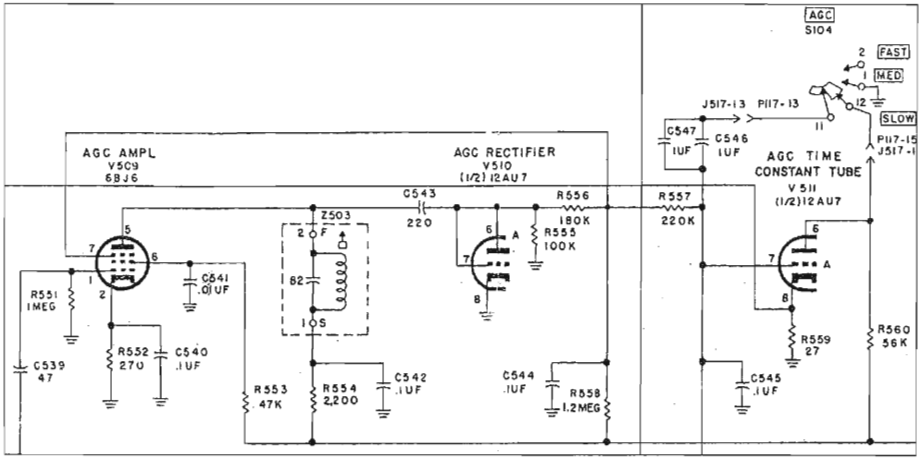
Note, for those of you carefully studying both cathode follower circuits, I did not add the 1-k plate resistor and the .1-µF bypass cap to V511A in the R-390 that were originally in the R-390A. The R-390 is already very well bypassed and I could find no discernable improvement while looking for the 455-kHz signal on the B+ line in the IF chassis with a scope. Good engineering practice suggests they should actually be installed, however, it will necessitate working in an extremely tight place (not fun at all), removal of the wire on pin 1 and moving it to the added tie point above V511, pin 1, and installing the 1-k resistor and .1-µF bypass capacitor. This might read "drill a hole to install the tie point, oops," and I don't like leaving a 200-VDC point flopping around! The final analysis is "leave it out." Therefore, this procedure is not included.

Parts List

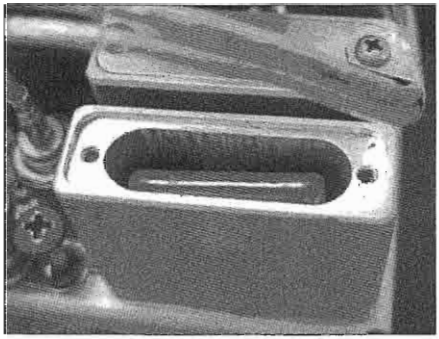
- 5 ohm, 1/2w
- 27 ohm, 1/2w
- 33k-ohm, 1/2w
- 2 Meg, 1/2w
- 15 Meg, 1/2w
- 150-µh choke (Mouser Electronics, Fastron, P/N 434-22-151)
- .001µF, 400V
- .0047µF, 400V
- .01µF, 400V
- .022µF, 400V
- .1µF, 400V
- 1 or 2 each, .47µF at 400V, or 1 or none if 1.5µf @400V is installed. See article.
- 47-pf mica cap, 500V
- 1N4148 diode and a 1N4733 zener diode



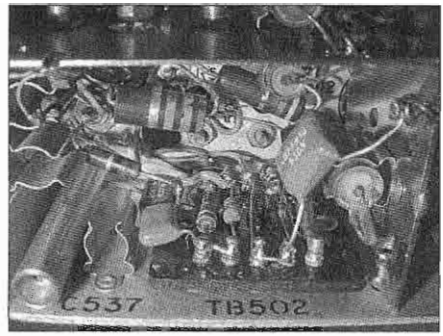
The R-390 IF subchassis module



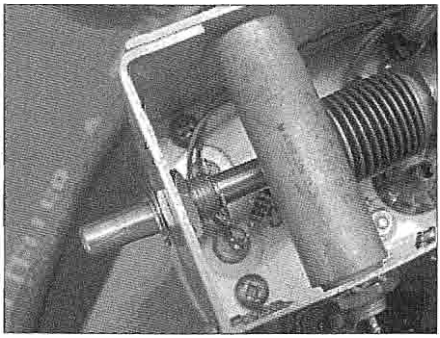
Partial schematic of the R-390 AGC electronics from the Army Technical Manual.



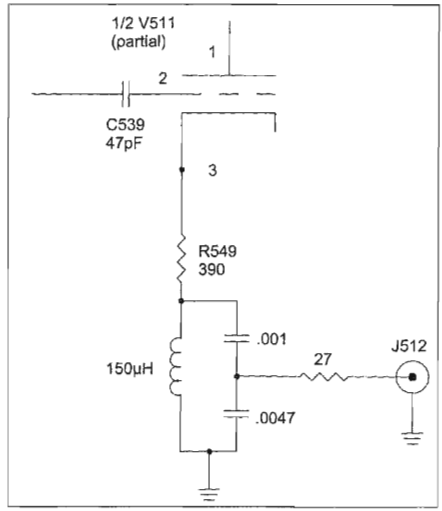
A top view of C547.



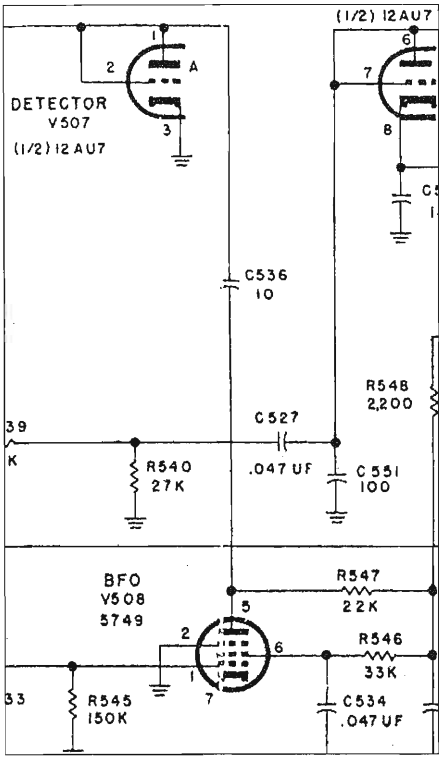
Above: Location of TB502.



Bottom view of the R-390 IF subschassis in the area of C536.



New AGC cathode follower.



Partial schematic of the R-390 BFO circuit. BFO coupling cap C536 is in the center of the drawing.

Overview

Here is a general overview of the following upcoming changes in order for an R-390 IF subchassis to better match the R-390A RF deck.

1) Use the .001 and .0047-µF capacitive voltage divider and a 27-ohm series resistor going to the IF output jack. Move C539 from pin 1, V506, to pin 3, V511.

2) Change V509, AGC amplifier, to a 5749(6BA6).

3) Increase the value of the BFO injection cap to 49pf.

4) Follow Tom Marcotte's ER article ["Conversion of the R-390 IF Deck..." in ER #139] to change the filaments to 6.3 VAC operation and add a B+ dropping resistor. Do this first and check the IF deck operation.

The R-390 IF chassis is really cramped. I used braid for most desoldering after chipping away the MFP (Multi-Fungus Proofing, a military designation) varnish with dental tools.

C547 and C546 were slightly leaky. I manufactured two new cans to hold them, see the photo on page 30. All other components are of high quality.

C547 became the 1.5-µF, 400-V cap and C546 became .47µF, 400V.

I will figure that C546 and C547 are "good enough." The delay times will be a bit longer on the medium and slow settings. Alternatively, you could use only one of the 1-µf caps and parallel it with a .47µF to make a 1.5-µF cap. I will use these capacitors as a connection point.

The R-390/R-725 Changes in Detail

There is only one place where there is room to mount the larger components for the AGC, and luckily the connecting wires are already in place. It is here where we will begin. Remove the bellows and the BFO tuning shaft to gain access. Add a ground lug under the RT512 mounting screw, closest to the caps (C546). Determine which wire on C546/547 goes back to TB502, this is the wire/terminal desired (other wire goes to J517-13). Connect one end of a 33-k resistor to this location, and the other end to a .47-µF, 400-v cap and then finally connect the capacitor to the ground lug. (The resistor and capacitor are in series per **Figure 1**.)

I did have a problem with the BFO decoupling, but changing C535 from .01 to .1µF solved this problem. If desired, you can use the old C535 across the zener later, but just be sure it is a good part.

While we're in here, now is a good time to increase the BFO injection voltage for better SSB reception. Remove C536 and replace it with a 47-pf cap. Reassemble the BFO tuning shaft and bellows.

Unsolder the ground on C530; gently move it out of the holder and towards the rear. This will allow easier access to the

terminal having R536 (820 ohm) and two other wires. Determine which wire goes to J517, pin 14. Carefully unsolder and unhook this wire. There should be enough wire to pull it up along side C528, about 1 inch above the original terminal. Attach the 15-ohm resistor to the terminal, attach the other end of the resistor to the wire, and cover with either heat shrink or insulation. Allow the assembly to lie along C528. This 15-ohm resistor is in series with the carrier meter and can easily be changed later, should a different meter deflection be desired. Note that this is not shown in the picture. Now move C530 forward to access the V510 pins. Remove the ground from pin 8. B+ is obtained from same terminal as C530. Connect the 15-Meg resistor from this terminal to pin 8, also attaching the zener diode, 1N4733, (band side) and the .01µF capacitor. I created my own ground point by soldering to the center divider. Replace C530 and the ground connection, but don't solder it yet as a .022-µF capacitor ground also attaches to the same point

Remove C544. Push the lead to TB502 out of the way. Leave the cap in its holder, as the other end is grounded. Completely remove C537, C538, and C545.

On TB501, remove R550 (68 ohm), R556 (180k) and R557 (220k). Disconnect the wire going back to pin 7, V509, (light green w/orange stripe) and insulate the end. Install a jumper where the 220k including the next top terminal where the 180k was attached. Install the 1N4148 diode (band down) in the 180k's former location. Now install a .022-µF cap from where the jumper and 1N4148 connect with other side to ground, the same ground point as C530.

Install the 150-µh choke in the R550 location. Use excess lead length to connect to the 390 ohm that is on top of the terminal strip. Make an assembly of the .001 and .0047-µF capacitors butted end-to-end, leaving the junction intact. Call the junction "AA," this will connect to a 27-ohm resistor later. This assembly will lie next to the 390 ohm on TB502. Connect the .0047-µF capacitor to ground (insulate the lead), jumping over the 390-ohm connection on the bottom of the terminal strip. The other end goes to the 390-ohm/150-µH connection on top of the terminal strip.

Install the 2-Meg resistor in place of C545, pin 7, V511, and ground. Now, connect the 27-ohm resistor from J512 center pin to the junction of "AA."

Position of Components on TB502 and the Removed Components

Remove the bandwidth shaft; it needs to be moved forward so you can work below it.

On V509, pin 7, remove the wire and insulate it. This is the other end of the one removed from TB502.

Completely remove R558 (1 Meg).

On V509, install an insulated jumper from pin 2 to 7.

Carefully remove one end of C539 from pin 1, V506. Gently twist and rotate it to pin 3 of V511 (make sure there is space on the lug).

Reassemble the bandwidth shaft.

Carefully double-check everything against the schematics, as well as all solder work. The alignment held even after the mods, except for the BFO neutralization.

Enjoy a nice smooth sounding radio in all modes. The AGC times are similar to the R-390A, as is the AGC voltage.

ER

Milestones in the History of Amateur Radio:

The Hoover Cup Awards

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Herbert Clark Hoover was elected in 1928 the 31st President of the United States. A huge margin in the popular vote ushered him into office. He was 54 years old, and by all odds, he was one of the more highly revered men not only in the United States but also in the entire world. After graduating with a degree in mining engineering from Stanford University in 1895, mining projects led him from 1901 to 1914 to four continents. He served as chairman of the American Relief Commission from 1915 to 1919, and he became instrumental in securing food and clothing for millions of inhabitants of war-devastated Europe. He served in 1920 as vice-chairman of an Industrial Conference for President Wilson, and in 1921, President Harding appointed him Secretary of Commerce. After Harding's death in August 1923, Calvin Coolidge succeeded him; then when Coolidge was elected President in 1924, he reappointed Hoover to a second term as Secretary of Commerce. Coolidge was among Hoover's strongest supporters when he embarked upon his 1928 presidential campaign.

The 1923 Hoover Cup, Won by 9ZT-9XAX

From QST of May 1924, p.47

Hoover's Department of Commerce was extraordinarily proactive. He sponsored conferences of businessmen on unemployment, organized campaigns to reduce industrial waste, and initiated national engineering enterprises such as the St. Lawrence Waterway and Boulder Dam ("Columbia Encyclopedia," 1938). The advent of radio broadcasting was surely the most momentous surprise and perhaps the biggest headache of his watch. Commerce inherited administration of the Radio Act of 1912, and Hoover worked heroically to interpret its legislation on behalf of both broadcasting and competing radio constituencies.

Amateurs who volunteered many hours relaying messages all over the country impressed Hoover; however, he was especially appreciative of the contributions of a significant proportion of them to technical advances in radio and to developments in contemporary receivers and transmitters. Hoover regarded these amateurs to be at the forefront of progress in the radio sciences, and he came to believe that they warranted special recognition in that they were providing leadership worthy of emulation.

Shortly after Harding appointed Hoover Secretary of Commerce, he announced that during the four years of his administration, the Department would

award annually a "trophy cup" (see Figure 1) to "the amateur who each year produces America's best all-around home-made amateur station" ("That Hoover Cup," 1922, p. 41). Secretary Hoover established the competition to encourage original design and construction by amateurs themselves; therefore, he stipulated explicitly that primary consideration be given to stations in which the equipment was "homemade."

Hoover assigned to the ARRL responsibility for administering the competition annually and selecting each year a winner. The ARRL Board accepted the task enthusiastically. It appointed C. A. Service, Jr., S. Kruse, and F.H. Schnell as its three-judge "Hoover Cup" committee. The Board announced that all licensed amateurs in the United States were eligible candidates, that the annual award would be based on the calendar year, and that entries for the 1921 competition had to be submitted by March 1, 1922. Amateurs were exhorted to compete each year on the grounds that it would be a great honor to attain the Cup and to be known and distinguished for a given year as having the station in which "the greatest individual effort" had been shown ("That Hoover Cup," 1922; Warner, 1923a; Service, 1923, p. 25).

The ARRL Board of Directors developed the following criteria to serve as guidelines for the judges as they evaluated applications: (1) extent to which equipment is homemade; (2) ingenuity of design, construction, and arrangement; (3) efficiency of transmitter, including consistent transmitter range and performance of receiving equipment; (4) conformity relative to U. S. Laws and cooperation with local community expectations regarding interference; (5) quality of operator's sending, including general operating skills and magnitude of traffic handled; and (6) accuracy, completeness, and neatness of the station log. The judges were also instructed to take into consideration the wavelength and power allowed competing stations under their licenses (Warner, 1923a, p. 28; Service, 1923, p. 25)

Louis Falconi, 5ZA, of Roswell, New Mexico, was awarded the Hoover Cup for 1921. His station included two powerful transmitters: a one-kilowatt, rotary spark transmitter, and significantly, a 200-watt vacuum tube transmitter, which utilized four 50-watt tubes in parallel. His receiver consisted of a conventional regenerative set with two stages of audio amplification. He used a four-wire, 90-foot flat-top aerial at 67 feet (Desoto, 1936, p. 80). 5ZA employed his station mainly for relaying traffic. It was heard often and reliably throughout the United States and Hawaii.

A QST editorial (Warner, 1923a, p. 29) asserted "the race is now on" for the 1922 Hoover Cup award. The Cup was proclaimed, as before, to be "the biggest honor available in amateur radio." All amateurs were urged to participate, and to remember that "a rich man's station hasn't a ghost of a show in this contest—it is purely for the amateurs who build their own apparatus." The assumption that "rich men" do not build their own equipment had attained apparently some credence at this early stage of amateur radio. It gave rise to the inference that amateurs who could afford to purchase their stations were basically appliance operators. But the contention that monetary investment in one's station is correlated inversely with the extent to which one's equipment is homemade has never been warranted. Indeed, a "rich man" who invested heavily in constructing an elaborate station probably had a better opportunity than a penurious amateur of winning the coveted Cup.

The ARRL Board imposed for the 1922 competition intimidating, formidable application requirements. Perhaps it intended to ensure that committee judges obtained abundant data for evaluating candidates. For example, a 1922 candidate was required to submit by February

1, 1923, a thorough description of the station apparatus and its antenna, a wiring diagram of all aspects of the station, a station log, an album of photographs of the transmitting and receiving equipment—with emphasis on homemade features, and, finally, sketches of commanding features that merited special attention.

F B. Osterman, 2OM, of Ridgewood, N. J., was awarded the 1922 Hoover Cup (Service, 1923). The 2OM station featured solely a high-powered spark transmitter, a fact that prompted a sizeable segment of the ARRL membership to express dismay at the selection of 2OM. The forward-looking members believed that only contemporary, vacuum-tube, continuous-wave transmitters should be afforded consideration. The Committee of three Judges, however, defended its decision.

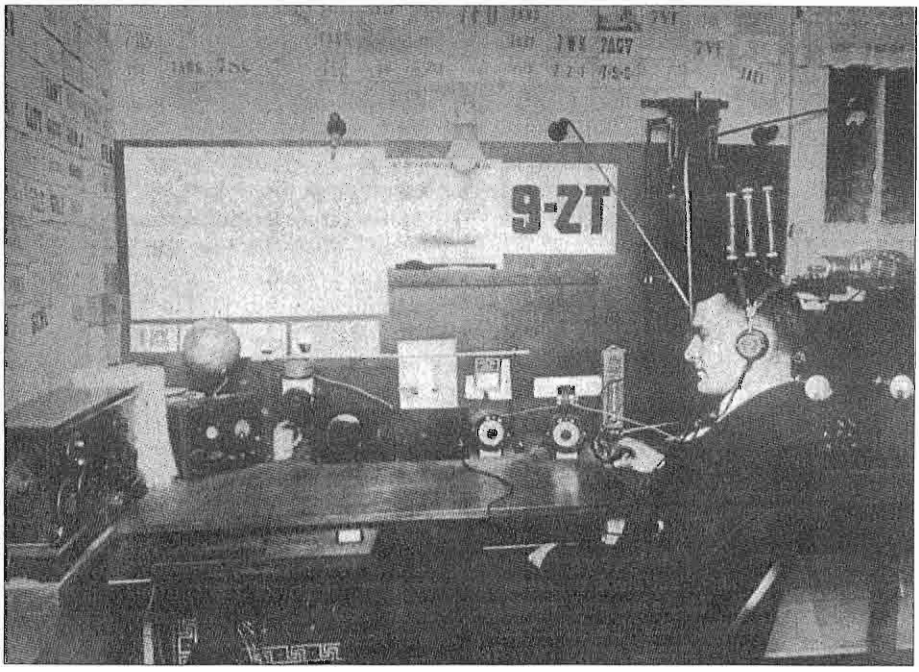
First, it insisted that it made no distinction between spark and vacuum-tube transmitters in applying with equal weight the several established criteria; the 2OM station simply accumulated the most points. Second, the Committee acknowledged that "it may seem strange" that the "highest honor that can be won by any amateur in the United States" should go to a spark station; however, it declared, in an inadvertent putdown of 2OM, that a spark station probably would not have won the competition except for the fact that "the total number of entries in the contest was exceedingly small in comparison with the large number of excellent amateur stations throughout the country that could have entered and received favorable consideration." The Committee thus concluded condescendingly: "It's a shame, gang, that more of you didn't come in and put up a better fight for the highest award in amateur radio. Moral: it's the early bird [that] gets next year's Cup. Start to begin to commence now" (Service, 1923, p. 26)!

The process of soliciting entries for the 1923 award of the Hoover Cup thus began early. To stir up interest, QST (Warner, 1923b, p. 26) stated happily in November, 1923, that "the race is going to be a good stiff one this year." No record exists to indicate whether the race for the 1923 Cup was actually "stiff;" nonetheless, the ARRL Judges showed considerable clairvoyance when they selected Don C. Wallace, 9ZT- 9XAX (and eventually, W6AM), of Minneapolis, as the winner of the 1923 Hoover Cup competition.

Don Wallace was born in 1898 and died in 1985. He was only 25 years of age when he bested the competition in 1923. His station consisted of a one-tube, 250-watt transmitter, which he operated as 9ZT on 215 meters and as 9XAX on 115 meters—he had received the experimental call designations shortly before he was awarded the Cup. As shown in Figure 2, his receiver incorporated a "low-loss" tuner, designed for selectivity, in front of an otherwise simple regenerative receiver. The tuner, he said, was needed to attenuate interference from other amateur stations in the twin cities (Wallace, 1924; "Who's Who," 1924).

Don Wallace handled 2500 messages during 1923, and during one month he handled a peak load of 308. 9ZT was heard in Alaska, New Zealand, Australia, Hawaii, Mexico, Panama, South America, Puerto Rico, Cuba, England, and France. Wallace in 1923 had worked stations in every U. S. state and Canadian province (DeSoto, 1936, p. 91).

Don Wallace spent his boyhood in Long Beach, CA, where he obtained the call, 6OC. At eleven years of age he discovered electricity when his father gave him some old college physics books. Shortly thereafter, 6OC was on the air, working stations up and down the California coast. He later entered Hamlin University, St. Paul, Minnesota, played football, and, following the onset of WWI, enlisted in the Navy. He served as a radio operator at West Coast Naval land stations and on submarines and ships. On



This photograph of Don Wallace and his station, 9ZT, originally appeared in Radio Broadcast magazine for June 1924, p. 127.

one of the ships, he and Fred Schnell, 1MO, shared duties pounding brass. After the war, Wallace graduated from Hamlin, became manager of the radio department of the Peerless Electric Company, Minneapolis, obtained an apartment, and set up station 9DR. Marriage led to obtaining a home for his family and the development of station 9ZT-9XAX.

The apparatus that won Wallace the Hoover Cup was situated neatly in one bedroom of his five-room bungalow. The room functioned also as a sewing room, nursery, and guest room. Wallace, an exceptionally self-disciplined, young amateur, accustomed himself to going to bed at nine o'clock, getting up shortly after midnight for a couple of hours of station operation, and then back to bed again—so as to get about eight hours sleep. The family bungalow was not far from Peerless Electric, and owning a "flivver" to drive to work afforded him a extra half-hour sleep in the morning.

Like so many boys early in the twentieth century, Wallace permitted amateur radio to consume virtually every waking moment of his life. The Hoover Cup, he insisted, validated his formative years. When he learned that he had been awarded the 1923 Hoover Cup, he exulted: "Radio for me until 90 years old" ("Who's Who," 1924, p. 60)! He nearly made it. Wallace held top positions in DX honor roles for decades as he exemplified consistently the highest tier of operating skills and station effectiveness. He was a peerless traffic handler, contributed articles prolifically to amateur periodicals, and as KGWE-30, served as net control during WWII of the Long Beach, CA, district of the "War Emergency Radio Service." The magnificent array of rhombic antennas that he possessed on 120 acres around mid-century on the Palos Verdes Peninsula, twenty miles South of Los Angeles, may never be equaled by another amateur.

Don Wallace was acclaimed in 1923 because he possessed the best all-around homemade amateur station in the United States. Our praise resounds today for he possessed, successively through the decades of the twentieth century, amateur stations that were always among the best in the world. Indeed, if a committee of judges today were to select the premier, "number one" amateur of the twentieth-century, using a broad range of criteria, including enduring prominence, Don Wallace would be a strong candidate for the honor.

Warner (1924, p. 8) noted in the September, 1924, issue of QST that the it was time for amateurs to begin thinking about entering the competition for the 1924 Cup. This time, he said, entries had to be filed at ARRL headquarters by January 1, 1925, and the award would be announced March 1, 1925. Bartholomew Molinari, 6AWT, of San Francisco was the successful contestant. 6AWT used a homemade 250-watt, vacuum tube transmitter. He had handled about forty messages a month during 1924, and he had been in regular communication with New Zealand and Australia. The 1924 Hoover Cup was the last of the amateur trophies authorized by the Department of Commerce (Naylor, 1925; "Amateur Radio Stations," 1925).

References:

Amateur Radio Stations. (1925, May. QST, 9, 54-58, 170.

Columbia Encylopedia. (1938). Herbert Hoover. New York: Columbia University Press, 845.

DeSoto, C. B. (1936). Two Hundred Meters and Down: The Story of Amateur Radio. West Hartford, CT: The American Radio Relay League.

Naylor, L. P. (1925, April). California Radio Amateur Gets 1924 Hoover Cup. Amateur Radio, 4, 152-155, 170.

Service, Jr., C. A. (1923, April). 2OM Wins Hoover Cup for 1922. QST, 6, 25-26.

That Hoover Cup. (1922, February) QST, 5, 41.

Wallace, D. C. (1924, May). A description of 9ZT. QST, 7, 43-47.

Warner, K. B. (1923a, January). The Department of Commerce's 1922 Cup. QST, 6, 27-29.

Warner, K. B. (1923b, November). Entries Solicited for 1923 Hoover Cup. QST, 7, 25-26.

Warner, K. B. (1924, September) Entries Solicited for the 1924 Hoover Cup. QST, 8, 8.

Who's Who. (1924, November). QST, 8, 59-60.

[Editor's Note: I wonder what effect a similar technical competition promoted by ARRL would have in 2005 with a similar emphasis on homebrew stations. Were amateurs of 1923 were more capable technically than the average amateur of today, even with adjustments in the comparison to allow for advancements in technology?]

ER

AM Calling Frequencies

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

Vintage CW Calling Frequencies

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

The SX-101A

Hallicrafters' Heavyweight Champion, Part 2

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

Restoration of the SX-101A

Part 1 of this article described the Hallicrafters selectable-sideband receivers and gave an overview of the design history behind the SX-101 model. In closing the first part, I mentioned how an SX-101A can be an excellent receiver. This is true if they are properly restored, adjusted, and aligned. This work will be the topic of Parts 2 and 3.

The SX-101A that came to me was fortunately in good cosmetic condition except for the typical chipped and cracked main tuning knob. It was missing no parts and was basically operational. It did have many electronic problems and was a typical example of equipment that had not been taken care of. After trying to use it for a few days, I realized the receiver would require a complete restoration before it could become a reliable piece of communications equipment. I decided that the purpose of my restoration would be to bring the SX-101A's performance close to what it was when it left the Hallicrafters plant and then to find out how good a receiver it really was. I wanted to see if its performance matched the glowing claims in the sales literature. Hopefully, what I learned during the restoration will be useful to readers who might be either currently working on an SX-101A or who are planning a future restoration.

The Pre-Restoration Conditions

Here is a summary of the problems I encountered during my initial few days operating the SX-101A:

• The power-off position of the "Response" switch was broken, and was causing the receiver to stay on as long as it was plugged into the AC mains. I got around this problem initially with a fused Variac.

• The receiver was extremely unstable. It would "take off" and start drifting somewhere between 5 and 20 kc when I first turned it on, and was hardly what I expected of the '101A. After 4 hours, it still drifted and "wobbled" badly. When zero beat with the calibrator signal, normal small line voltage changes caused an abrupt 2 or 3 kc of drift. After 6 hours of use, the stability was much improved, and after running for 12 hours it actually resembled a working communications receiver. Walking around in the radio room or causing vibrations with hammer blows on my workbench caused little change in stability. This let me know the remaining stability problems were electrical in origin.

• There were extremely strong images of shortwave broadcast stations on the 20-meter band, many times louder that the strongest amateur stations. After the VFO quit drifting quite so badly, I did a quick image rejection test and measured a mere 20 dB, indicating likely problems in one of the IF stages. It did have high sensitivity and fairly good dynamic range, so I was encouraged enough to hope that somewhere inside the cabinet a good receiver might be found.

• Many SSB amateur stations on the 20M band were demodulating on a single frequency because of multiple images and harmonics of multiple images from shortwave broadcast stations. Their car-

riers were acting like RF BFOs, a very confusing situation.

• Standard broadcast band images were audible as high as 20 meters.

• Multiple shortwave broadcast images were heard on 10 and 15 meters, but at least I knew those bands were working.

• Standard broadcast band stations transmitting on 1650 kc were loud on 80 meters, indicating very little IF rejection.

• The calibrator was 2 kc high, and very weak on 10 and 15 meters.

• It had poor sensitivity on the 10-Mc WWV band and had multiple harmonics and images of the calibrator signal.

• The antenna trimmer had a very broad peak on all bands, and almost no effect on 10 and 15 meters. The control was very stiff and had a lot of backlash.

• The tuning dial was very stiff with extreme backlash in its movement. The dial glass was loose, and the dial pointer was hanging up over the left 1/3 of the dial scale. The pointer reset was very stiff with a lot of backlash.

• The bandswitch was very intermittent, and had to be positioned in exactly the right place or the selected band wouldn't work. The gain controls had the normal amount of noise for an unrestored piece of gear.

• The ANL caused severe distortion with any signal level or mode.

• The AGC was working, but had a limited range of automatic control.

• The 2-kc position of the selectivity control was wider than the 3-kc position, and the 1-kc position didn't work at all.

• The pitch control couldn't be set for zero beat per the instruction book.

• The receiver was only receiving AM in the "AM Upper" position of the "Response" switch.

• The "Notch Frequency" and "Notch Depth" controls were ineffective.

• The S-meter read differently on every band and every position of the "Response" switch.

• There was some kind of hardened, congealed oil all over the underside of the chassis and the tuning mechanism. The chassis smelled like old motor oil after it got warm.

• The front panel had a thick coating of nicotine and dirt from many years of use by a smoker. A thick haze of this mixture made the S-meter markings fuzzy and indistinct behind three layers of glass. I actually think this mixture had helped to protect the original paint and lettering on the front panel.

Mechanical Restoration

This receiver required a complete disassembly in order to remove the old oil and factory grease. How far you need to go with your receiver depends on its initial condition and the time available for the project, but complete disassembly, cleaning, inspection and lubrication of the moving parts will result in a tuning system that is smooth and free of backlash. It should give good service for years to come.

I use full-strength janitorial ammonia[1] for removing dirt and corrosion from chassis parts, and dilute it 1:1 with water for cleaning the front panel and knobs. Ammonia takes off the crud and leaves a sparkling clean finish, but won't disturb the silk-screened markings or the anodizing, if any, on the chassis. For removal of old hardened petroleum-based grease, ammonia won't work. I use ultrasonic cleaning solvent, available from Micro Tools[2] or Micro-Mark[3].

I use synthetic oil and grease exclusively for lubrication of moving parts. Nice assortments are available from Micro-Mark and Micro Tools. I don't recommend using grease or oil on gear teeth. Instead, what I prefer is dry molybdenum powder that is spread over the gear teeth with a Q-tip®. The moly powder is available from Micro Tools.

Tuning System Disassembly

This receiver is very easy to work on. Begin disassembly by removing the receiver from its cabinet. Support the 13-gauge hard-aluminum chassis on a 21" piece of 1 x 2 lumber and remove the front panel. The front panel is made up of an 11-gauge steel panel and the dial bezel, a painted aluminum casting. This

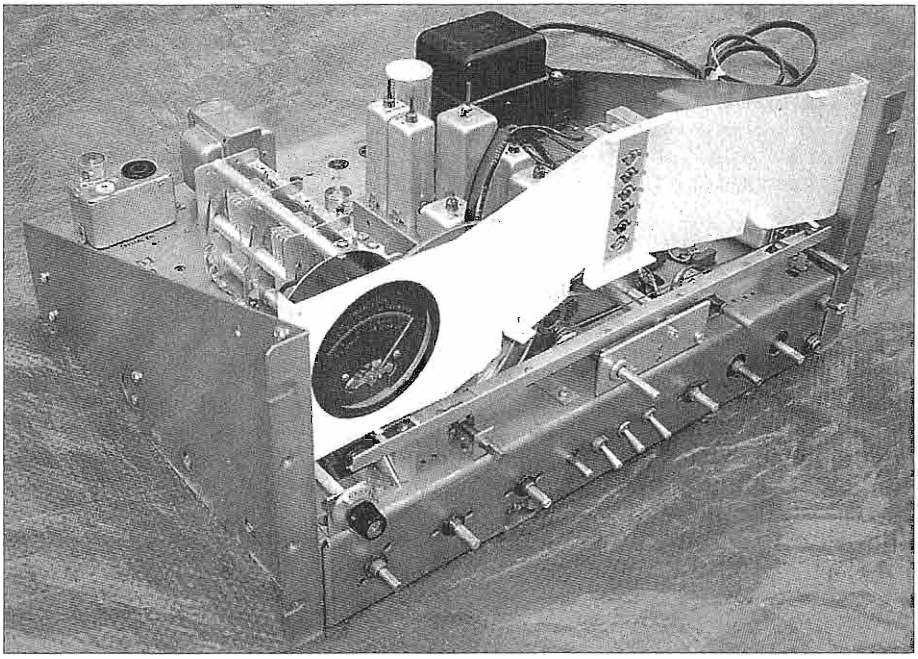


Figure 1: Partially disassembled SX-101A. The white cross-support piece is mounted to the side brackets. It positions the S-meter, dial lamps, the light diffuser, and the dial glass. The metal ledge that supports the diffuser assembly and dial glass is visable at the bottom of the support piece.

assembly weighs over 5 pounds and is held to the chassis by the mounting hardware for the control switches and pots. A heavyweight champion indeed! During removal, be very careful of the dial window glass. It is held in place at the rear of the panel by small steel angle clamps that are press fit around cast posts. Between the clamps and the glass are rubber channels that may have disintegrated over time. This is what was causing my dial window glass to be loose in the frame. I used neoprene gasket material from the auto parts store to duplicate the old channels. Carefully remove the outer dial glass for cleaning and set it aside. I placed my glass in bubble wrap packing material until it was time to clean it.

With the front panel off of the chassis, remove the sheet metal shrouds fitting around the dial lamps and the tuning condenser by removing several small sheet-metal screws with a 1/4" nut driver, and lifting the shrouds up and out of the way.

There is a white-painted metal cross bracket that is supported on the left and right sides by screws through the 15-gauge side-support braces, see **Figure 1**. It was faded and yellowed, and required sanding and repainting so that the dial illumination would be even. This bracket holds the S-meter, the 6 lamp brackets for the band-in-use indicators, the glass dial scale, and the acrylic light diffuser assembly. The light diffuser is shown in **Figure 2**.

Begin further disassembly by removing the lamp brackets. From the rear, pinch them gently and pull to the rear to clear the cross bracket. The dial scale can't be removed until the dial pointer is removed. It is made of rather thin stamped brass and is held to the dial cord with bent metal tabs and sealing lacquer. The lacquer can easily be softened with a small amout of Acetone on a cotton swab. Loosen the brass tabs and slip the pointer

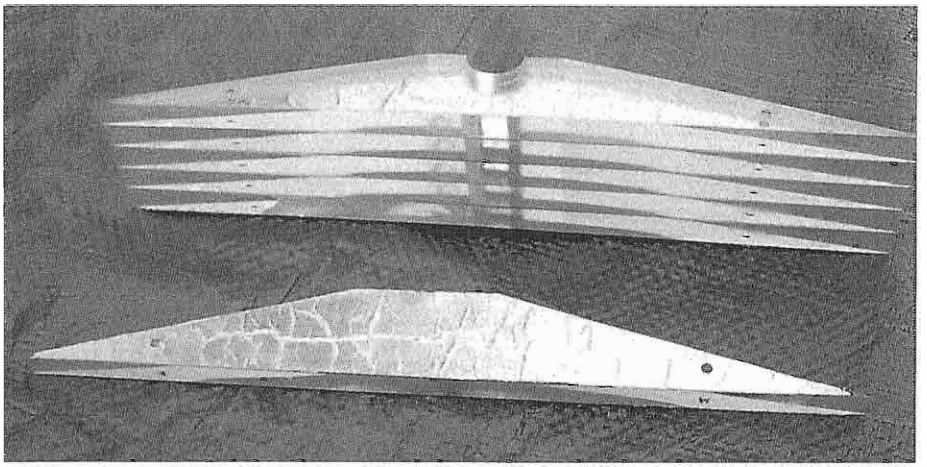


Figure 2: The SX-101A light diffuser assembly is made from 6 triagular-shaped pieces of polished acrylic plastic, with thin aluminum-foil sheets sandwiched between each section. The semi-circular cutouts at the rear are where the type 47 lamps illuminate each individual band.

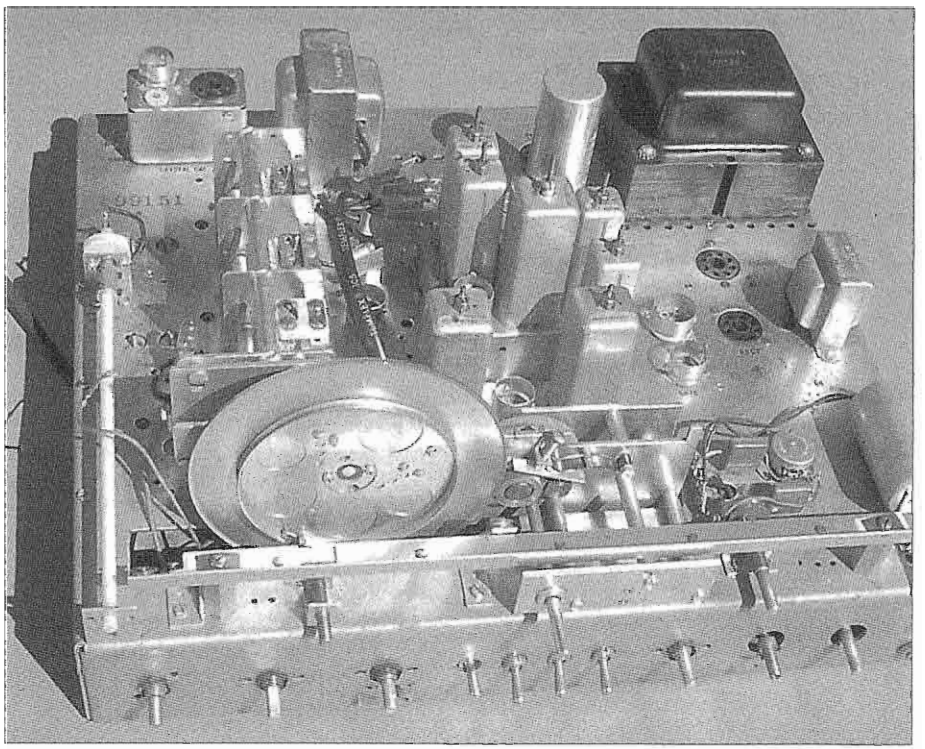


Figure 3: Although taken after the clean-up was completed, this is what can be expected to be found after the front panel, dial pointer and cord, dial scale, light diffuser, and cross support panel are removed from the chassis.

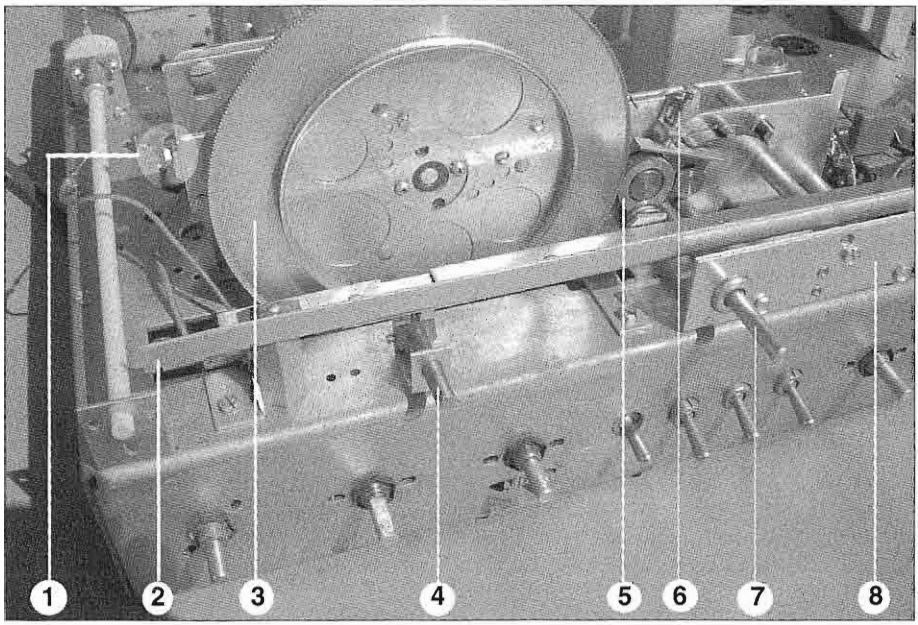


Figure 4: Outer tuning system parts locations discussed in the text.

1) Sideplay adjustment
2) Dial pointer positioning rail
3) Large geared drive wheel
4) Pointer reset control assembly
5) Spiral-cut idler gear
6) Backlash adjustment screw
7) Tuning shaft
8) Flywheel support assembly

away from the dial cord.

The dial glass is held in position at the sides with with 4 metal clamps and rubber channels that cushion the glass, and it sits on a metal ledge that is part of the white cross panel. Be extremely careful with the large reverse-painted dial glass because replacements are completely unavailable. It is held at the top with rubber channel pieces similar to the method used with the dial-window glass. After making notes of how the dial glass is mounted to the cross support, remove it and wrap it up for protection. The front surface of the light diffuser is now exposed, and the complete assembly can be lifted off of the cross bracket because nothing else holds it. Being careful of the aluminum foil that is exposed, wrap the diffuser up for protection.

Remove two wires from the S-meter and remove it from the panel. Notice that the meter mechanical zero adjustment is at the lower rear of the meter case.

The cross panel is held to the side brace panels with 2 screws on each side. Remove 5 screws from each 16-gauge side brace and remove them from the chassis.

The next step is removal of the dial cord. This is easy, just bend one metal clip up and unhook the spring from the large drive wheel, #3. The reassembly instructions in the Hallicrafters instruction book are accurate, so dive right in! The dial cord is .045" nylon braid. If your dial cord is broken, new .037" nylon-coated stainless steel cable is available from Small Parts[4].

All of the setscrews in my receiver had spline heads and were not lacquer sealed nor overly tight.

Referring now to **Figures 4 and 5**, remove the dial pointer positioning rail, #2. It rides on Nylon spacers, a circular one underneath and a rectangular one above. It is held down with two screws at the outer ends.

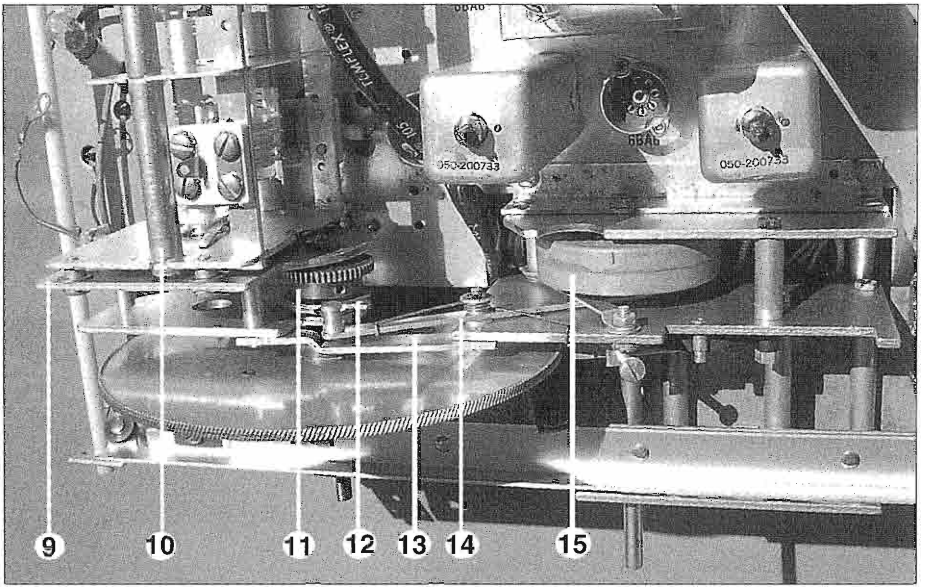


Figure 5: Location of inner tuning system parts.

9) Capacitor drive frame assembly
10) Tuning capacitor frame
11) Drive gear
12) Stop cam assembly
13) Fixed link arm
14) Drive stop link
15) Flywheel

This is a good time to become familiar with the tuning system and to investigate how all the parts work together to drive the tuning capacitor. The large geared drive wheel (#3) accepts motion from the tuning shaft and flywheel through the spiral-cut idler gear (#5). The cut of this gear limits tuning backlash. Tuning motion is limited when the drive stop link, #14, rides up on one of the cams of the stop cam assembly (#12) and rotary motion of the flywheel drive shaft is blocked when its opposite end drops down into a cut-out that is out of view in **Figure 5**. There is a spring-loaded split gear attached to the 1/4" tuning capacitor shaft that prevents backlash. It is not visable in the photos, but is driven by gear #11.

From here on, disassembly is straightforward mechanical work. Every receiver might not need complete disassembly, and in many cases flush cleaning may be appropriate. Only remove the parts that are actually necessary, and make detailed notes of where the various parts came from. Reassembly is the reverse procedure, with some adjustment suggestions given later.

With the drive mechanism apart, I noticed several cold solder joints where the 1/8" copper ground straps were soldered between the capacitor frame and the chassis. There was also a cold solder joint at the wire coming from the oscillator compartment. These were undoubtedly contributing to the oscillator stability problems. Using a propane torch[3] with a pencil tip, I unsoldered the ground straps from the capacitor frame. The wires going to each section of the tuning capacitor were unsoldered, the mounting screws were removed, and the capacitor easily came off of the chassis for inspection and cleaning.

The power switch was repaired at this time. It was mounted to the rear of the "Response" switch, and was held in place with two small aluminum tabs that could be carefully bent out of the way just

enough to remove the switch assembly. It turned out that only the return spring was broken. This is a small torsion spring with each end bent at right angles to fit into some mounting holes. It keeps the switch contact in either the "on" or "off" positions. I wound a new spring from #25-guage, spring-steel wire[6]. 2 turns were wound around the body of a 3/32 drill, keeping the turns close. I shaped the angled ends to match the original spring with pliers. Before remounting the switch, I put a small dab of grease on the switch cam inside the assembly.

Cleaning and Reassembly

The main tuning capacitor was cleaned by dunking it in full-strength ammonia for about 20 minutes in a plastic container. It came out sparkling clean and looking like new. I was suprised to find out that the rotor plates and contact wipers were originally silver plated. I lubricated the four contact wipers with conductive grease[5], and the front ball bearing race and the rear spindle bearing with light synthetic oil. Use only a minumum amount here. If you can see it, that would almost be too much. Notice how the outer rotor plate of the oscillator section is bent in different places. Do not straighten these bends, and be very careful of all the rotor plates. Even a slight kink will change the factory tracking adjustments. Making a multi-section tuning capacitor track properly is one of the most tedious jobs in radio work!

The chassis required many hours of work with Q-tips® and paper towels to get it clean, but eventually all the "grunge" came off. The tube socket pin receptacles were cleaned with Caig DeOxit D5L[5], applied with minature bristle brushes from Micro Tools[2], and flushed with denatured alcohol to be sure they were clean.

The tuning capacitor ground straps and the connecting wires to the receiver circuitry were resoldered using Multicore SN-62[5] silver-bearing solder.

Mechanical Reassembly

• If the tuning cap was removed, the drive frame plates, #9, will have to be seperated to get everything reassembled. There is a ball bearing at the rear of the #11 drive gear that will be loose. For reassembly, the ball can be held in position with a dab of Super Lube grease.

• The split gears in this receiver were frozen in postition by hardened grease and several steel burrs on the gear facings. They required complete disassembly, cleaning, and de-burring with a file and a Arkansas slip stone[2].

• To reassemble the drive frame, leave the 3 screws holding the rear drive plate loose so it can move slightly laterally. Mount the split gear in the slots on the tuning capacitor. Load the split gear by 1 tooth and hold it in that position with a hemostat[2]. (Do not jam anything between the gear teeth.) Engage the #11 drive gear, screw down the front drive plate, and remove the hemostat. Tighten the rear drive plate slightly and use the sideplay adjustment, #1, to set the engagement between the #11 drive gear and the spit gears so that the drive action is smooth and not "toothy." If the sideplay adjustment was not disturbed from the original factory setting, it should be possible to shift the rear plate just enough to find the proper mesh between the two gears using the original marks from the screw heads as guides. Tighten the front drive plate screws and seal the adjustment, #1, with cement or lacquer as necessary.

• Note the correct routing of the wiring harness for the dial lamp assembly. It should fit between the chassis cutout and the left side of the flywheel assembly, not in front of it. It is held down by an aluminum strap.

• Replace the fixed link arm, #13.

• Sparingly lubricate the bearing surfaces of the flywheel support assembly, #8, and replace it. I didn't disassemble this piece because flush cleaning was enough.

Now, re-synchronize the drive system with the drive stop link, #14:

1) Loosen 2 spline setscrews in the hub of the large geared drive wheel, #3, and in the hub of the #11 drive gear.

2) Rotate the tuning condenser to full mesh by hand.

3) Be sure the cutout in the rim of the large drive gear, #3, is about in the position shown in the dial cord stringing diagram in the Hallicrafters instruction book, their Figure 14. This gives the initial timing position for the dial cord.

4) Tighten 1 setscrew in #3. By hand, rotate the #11 gear CCW until the stop lever rides up on the left-most cam to a position just before it reaches the peak of the cam. Tighten the setscrew in the hub between the two cams.

5) Rotate tuning shaft CW and tighten the remaining 2 setscrews.

6) Check your assembly work at this point. Be sure that the stop link limits tuning shaft rotation in the full CW and CCW positions. The capacitor should be fully meshed with full CW rotation and fully open with full CCW rotation. It may be necessary to repeat the synchronization a few times to set the capacitor accurately, but it is not difficult. Almost 20 turns on the main tuning shaft will move the tuning capacitor 180 degrees.

Don't lubricate gear teeth with grease or oil because doing so will only attract dirt. Use dry moly powder. It will fill in the pores in the metal and make a smooth surface that slips easily. It is permanent lubrication unless removed with a solvent.

When the tuning system is reassembled, temporarily mount your tuning knob to the shaft. The amount of backlash can be adjusted with a long setscrew, #6 in **Figure 4**. Turning this screw CW pushes the idler gear #5 away from the large #3 drive gear. There should be one place in its rotation where the tuning feels smooth, without backlash. It may need a locknut to hold your adjustment, if not already present.

Lube the sliding contact surfaces of the dial pointer positioning rail with dry moly. This is at each end where the Nylon washers are mounted. There is a cam on the pointer reset control that engages a slot underneath the pointer rail. It moves the rail laterally. Put a dab of grease on the cam, and be sure it engages the rail properly. Leave the mounting screws on the pointer rail loose until the dial cord and glass are back on the receiver.

Replace the light diffuser and the dial glass, then follow the instructions in the Hallicrafters book to restring the dial cord, and replace the dial pointer. When you are done, tighten the pointer rail mounting screws just enough to keep the rail from moving when you are tuning around, but not so tight that the pointer reset control is stiff. Lube the contact surfaces for the dial pointer with dry moly, and then use the instruction book to reposition the dial pointer and reseal the mounting tabs with lacquer.

Next month, I will discuss the electrical restoration and alignment.

1) Ace Hardware: Ammonia, Janitorial Strength Formula, #10183A

2) Micro Tools:
P.O. Box 6505
1236 Callen St., Suite A
Vacaville, CA 95696
800-359-2878, www.micro-tools.com
Ultrasonic cleaner: P/N 23-0202
Lubricant Kit: "Hobby-Kit"
Dry Moly Lubricant, stock # "MPP"
Micro-wire brushes, P/N H700

3) Micro-Mark:
320 Snyder Ave
Berkeley Heights, NJ 07922
800-225-1066, www.micromark.com
Cleaning solution, P/N 81870
Lubricant Kit, P/N 83267
Propane Torch Kit P/N 83035

4) Small Parts Inc.:
13980 NW 58th Ct.
Miami Lakes, FL 33014
800-220-4242, www.smallparts.com
P/N B-MCX-37, Nylon-coated stainless steel cable, .037"

5) Newark Electronics:
800-463-9275, www.newark.com

6) S. LaRose Inc.
3223 Yanceyville St.
Greensboro, NC 27405
888-752-7673
P/N 057005-25, B&S #25 gauge spring wire. **ER**

VINTAGE NETS

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

BFO CW Net: Tuesdays, 7PM local ET, 3693 kc. QSX WY3D in Southern NJ. Vintage gear welcome!

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. @ 9PM CT, 3885 kc, QSX control op W4GCN in Pensacola.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

FOR SALE: Collins R390A. Globe Champion. National NC100XA+Speaker. Hallicrafters S36A. Johnson Valiant. Heathkit DX100. Apache. Mohawk. Two ART 13s. All very clean to mint and fully functional. Frank, KBØW/6, 916-635-4994, fdellechaie@sbcglobal.net

FOR SALE: Heathkit Color TV. Assembled never used? Pick up. Best offer over $200. Henry, W3NDY, 1-570-654-2347 8AM-10PM PST.

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: Nice Drake 2NT $125. R47 speaker $35. HRO50 speaker $65. Plus ship. Ed Sauer, 787 N. Peterman Rd., Greenwood, IN 46142, 317-881-1483

FOR SALE:,Heathkits: DX-100/M 150. TX-1 Apache/M 300. SB-10 Conv/M80. HW-101/ps 175. Pick up. Mike Smaga, N1GVX, N1gvx1@juno.com 203-488-0197

FOR SALE: Hammarlund HQ-170 with clock. Excellent condition. Original manual. $225. Pick up. Harry Vaught, KT4AE, Maryville, TN 865-982-3304 kt4ae@bellsouth.net

FOR SALE: Globe King 400, working, good condx, photos available $750. David, 501-744-4678

FOR SALE: Hallicrafters HA-2 & HA-6 with power supply and manuals great condition $175.00.That's A Good Deal! BOB, W1RMB, 508-222-5553

TUBES FOR SALE: Radio club stock reduction. Tubes from 2A3 to 5692. SASE for price list. E.F. Hayes, WØJFN, 3109 N. Douglas Ave, Loveland CO 80538

FOR SALE: Hallicrafters SX-115, very nice, $1650. McElroy S-600 chrome, teardrop-shaped bug, $575. Richard Prester, 131 Ridge Road, West Milford, NJ 07480 rprester@warwick.net 973-728-2454.

FOR SALE: 8x12x9 Portacab cabinet, Bud #WA-1541 equivalent, new, undented, $20 postpaid. **WANTED:** Clean, working BC-344. Louis L. D'Antuono, WA2CBZ, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

FOR SALE/TRADE: QSTs, various issues and condition 1928 to 1976; total about 300lbs. Newell Smith VE7AEC@rac.ca 250-629-3435

FOR SALE: National HRO-50T $300. Hammerlund SP600-JX-17 $300. Both in VGC with manuals. No shipping. Burt, 989-736-8020 kc8fbr1@netzero.net

FOR SALE: Hallicrafters Skyfone Model CA-4; needs restoration; $50 plus shipping. Please contact Mike Grimes, K5MLG, 5306 Creekside Ct., Plano, Texas 75094 972-384-1133 grimesm@flash.net

FOR SALE: Homebrew AM transmitter, 6146 final, nice cabinet. Power supply, speech amp, and modulator separate cabinet. See 1955 QST. Also plate transformer, 120V input to 850 and 1250V. 22 lbs. E.F. Hayes, WØJFN, 3109 N. Douglas Ave, Loveland, CO 80538

FOR SALE: Military signal generators URM-25 and URM-26 with accessories. Clean, working, manuals. $225 pair. Stuart T. Carter II, W4NHC, 680 Fernwood Dr, Melbourne, FL 32904 321-727-3015

FOR SALE: QSTs from 1930s into 1980s, SASE for contents pages. State subjects, months, years. One dollar up plus postage. Charles Graham, W1HFI, 4 Fieldwood Dr, Bedfore Hills, NY 10507 914-666-4253

FOR SALE: Two NIB, unbuilt Heathkit GD-160 mobilink intercoms from 1979. Gary, KØCX kzerocx@rapidcity.net 605-343-6739 evenings.

FOR SALE: RCA ACR-175 receiver w/ speaker, 5-60 Mhz in 4 bands, working condition, looks very good, w/manual, $450. WRL 755 VFO, looks and works good, $150. Harman-Kardon T-60 belt-drive turntable w/NAD cartridge, Like new, $95. George Shute, W4BDG, 208 Marquis Drive, Mountain Home, AR 72653 870-492-6977 geshute@mtnhome.com

FOR SALE: Globe Champion $395. Hammarlund HQ-140X w/speaker, manual, works $200. Palomar Skipper 300 linear $150. Ron, MI, 517-374-1107

FOR SALE: Military Ant. mount, side bracket type. W/ Sig. Corps loudspeaker. LS-7 $10. Lafayette HE 30 a/o $60. Hallicrafters S-53 recapped, sounds good. $100. Bernie Samek, 113 Old Palmer RD. Brimfield, MA. 01010 413-245-7174, bernies@samnet.net

FOR SALE: Viking Invader 2000, Good Condition, $1,400 OBO. You ship. Ken Sands, K8TFD, 734-453-7658, ken.sands@juno.com

FOR SALE: National speaker that matches NC-183D receiver; mint condition no scratches; view speaker in ER issue April 2005, page 28. $120. kd9gi@msn.com Bob 815-332-9520

FOR SALE: Collins S-Line Crystal filter 2.1 kc for 455 kc IF $90. 5 element 10-meter beam PU only, $180.5-foot rack cabinet, $45 Herb K9GTB 217-324-3233 Before 9:00PM CT

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

FOR SALE: Collins 32V-3 excellent. Approx. 200' 7/8 Prodelin coax w/ connectors. Kato-Lite 500W 110V 60 cy 1800 RPM generator perfect for field day. Rudy, W2ZIA, 3411 Home Rd., Alden NY, 14004 716-937-9279.

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

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

FOR SALE: Hammarlund XP-55 plug in coils. Four 6 prong. Four 4 prong. $ 30 for all. Free shipping in continental U.S. John, W2PRR, jandjm130@peoplepc.com 585-671-4228

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

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

FOR SALE/TRADE: Original manuals: Hammarlund, WRL, B&K, Gonset, National, Drake, Harvey-Wells, Hallicrafters, Knight, Lafayette. NI4Q, POB 690098, Orlando FL 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

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

Hallicrafters Service Manuals: Ham, SWL, CB, Consumer, Military. Need your model number. Write or email. Ardco Electronics, PO Box 24, Palos Park IL, 60464, WA9GOB@aol.com, 708-361-9012 www.Ardcoelectronics.com

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

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

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

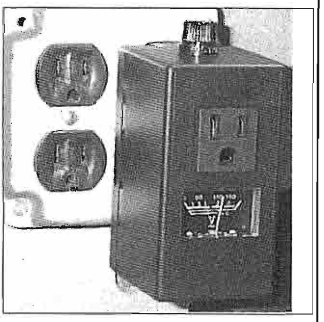
DRAKE SERVICE FOR SALE: R.L. Drake repair and reconditioning, most models including TR-7's, 35 years experience. Jeff Covelli, WA8SAJ, 440-951-6406 AFTER 4 PM, wa8saj@ncweb.com

ZIM ELECTRONICS INRUSH CURRENT LIMITERS

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

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

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



Model AB1-M

Electric Radio Store
720-924-0171

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

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

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

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

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

TUBES FOR SALE: Tested good globe 201A and 226 $14, 227 $10 and others. Slightly weak 226, 227, 245, 280 guaranteed to work in early radios ½ regular price. Write or e-mail: tubes@qwest.net for a new price list or see www.fathauer.com. George H. Fathauer & Assoc., 123 N. Centennial Way, Ste. 105, Mesa, AZ 85201. 480-968-7686 or toll free 877-307-1414

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

w4pnt@highspeedlink.net

WANTED: 2000 ohm headphones and 100-250 Mc coil for Heathkit grid dip meter GD-1B. E.F. Hayes, WØJFN, 3109 N. Douglas Ave, Loveland CO 80538

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

WANTED: National SW-3 Universal. Octal tube type, doghouse, coils if possible. George Rancourt, K1ANX, k1anx@charter.net, 82 White Loaf Rd, Southampton, MA 01073-9550

WANTED: Schematic and data on E.M. Sargent "10-20 Booster." 1930's nonregenerative preamp. R. Kuchera, K1TG, 270 Tawny Thrush Rd., Naugatuck, CT 06770, rwkuchera@snet.net

WANTED: Mint operational T-368 exciter. W4RML, Cliff Christlieb, 1928 Sycamore, Tavares, FL 32778 352-253-0112

WANTED: Lafayette HE-25 transmitter. Thomas Nickle, W8AI. hl9xx@yahoo.com or 713- 502-7799 weekends.

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: Schematic and info on a USN loop ALR 25, 10kc to 30 Mc, made by Electro-Metrics, NY. KB6BKN@Juno.com

WANTED: The W3EWL "Cheap and Easy SSB" homebrew SSB transmitter in any condition. It is a BC-458 ARC-5 converted to a phasing type SSB 75 or 20 Mc transmitter. [Anthony Vitale QST March 1956] Ted Bracco, WØNZW. braccot@hotmail.com 217-857-6404 Ext 306

WANTED: Info on VLF loop coupler CU-352/BRR for SRR-11 RAK RBA VLF rcvr. Weber, 4845 W. 107th St., Oak Lawn, IL 60453

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

WANTED: Collins crystal unit 13C-1 with or w/o crystals, 399B-1 DX adapter for KWM-1. Louis Lytch, K2DET, 386-447-8186, 2 Waser Place, Palm Coast, FL 32164

WANTED: Working original panel meter for Viking Adventurer. Ron Schwab, 3582 Bell Road, Auburn, CA 95603 k6tty@foothill.net

WANTED: Basket case only—Triplett model 3444 tube analyzer. John Snow, W9MHS, 1910 Remington Ct., Andover, KS 67002 316-733-1856

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

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

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

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

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

WANTED: Manual/schematic for Pearce-Simpson Marine Radio "Catalina". JR Linden, K7PUR, PO Box 4927, Cave Creek, AZ 85327 480-502-6396, jrlinden@usa.net

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

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

WANTED: Top lid, manual for Hickok 580, manual for Hickok 121. **FOR SALE:** AK 20 $25, AK-44 $45. Carter, 434-979-383; celliott14@earthlink.net

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

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

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

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

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

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

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

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

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

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

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

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

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

WANTED: WW II German, Japanese, Italian, French equipment, tubes, manuals and parts. Bob Graham, 2105 NW 30th, Oklahoma City, OK 73112. 405-525-3376, bglcc@aol.com

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

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

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

The Hats Are Back!

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

$19.95, including priority shipping.

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Or on-line: www.ermag.com

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

WANTED: Hallicrafters HT-33 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: Commercial or kit-built 1930s and 40s transmitters. Doc, K7SO, 505-920-5528 or doc@cybermesa.com

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

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

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

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

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

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

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

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

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

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

WANTED: WWII Navy GP-7 transmitter in any condition, with or without tuning units or tubes, etc. Ted Bracco, WØNZW, braccot@hotmail.com A.C. 717-857-6404 X306

The Collins Video Library

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Produced by Floyd Soo, W8RO

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720-924-0171

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

WANTED: WW I era and 20' s hi-end sets, amps, detectors: SE 143/IP 500; SE 1420/IP 501; CN 112; RCA 106; SE 1000; SE 1071; Kennedy 110,220; Grebe CR 18; early supers: Norden Hauck Navy 10; Golden Leutz; others; WW I, WW II RDF gear; need DU 1 Loop set-up; others; WW II spy radios. Always buying vintage broadcast gear, tube pre's, compressors, mics, stands, mic flags, by Altec, RCA, Sony, WE. I've got lots of cool radios and stuff to trade or pay cash. Ward Kremer, KI4JHA, 1179 Petunia Rd., Newport, TN 37821, Ph/fax: 423/625-1994. Please note: new e-mail: witzend99@bellsouth.net

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

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

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

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

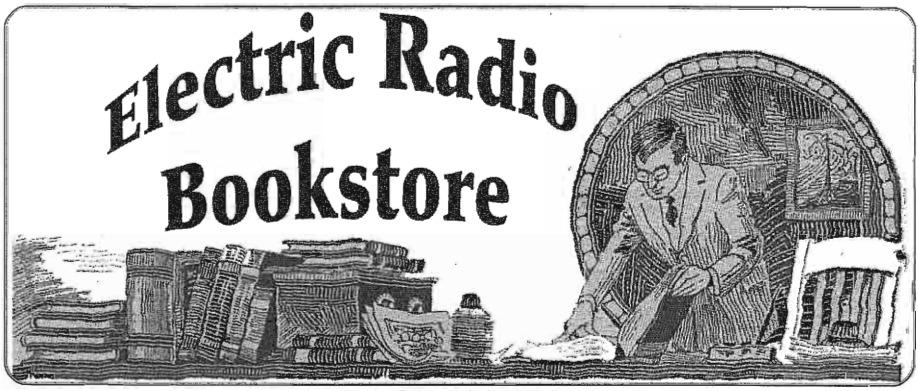
WANTED: PYE, Fairchild, Syncron, Langevin. Richard P. Robinson, PO Box 291666, LA CA 90029 323-839-7293 richmix@erols.com

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

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

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

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



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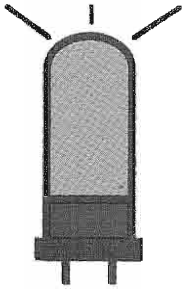

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