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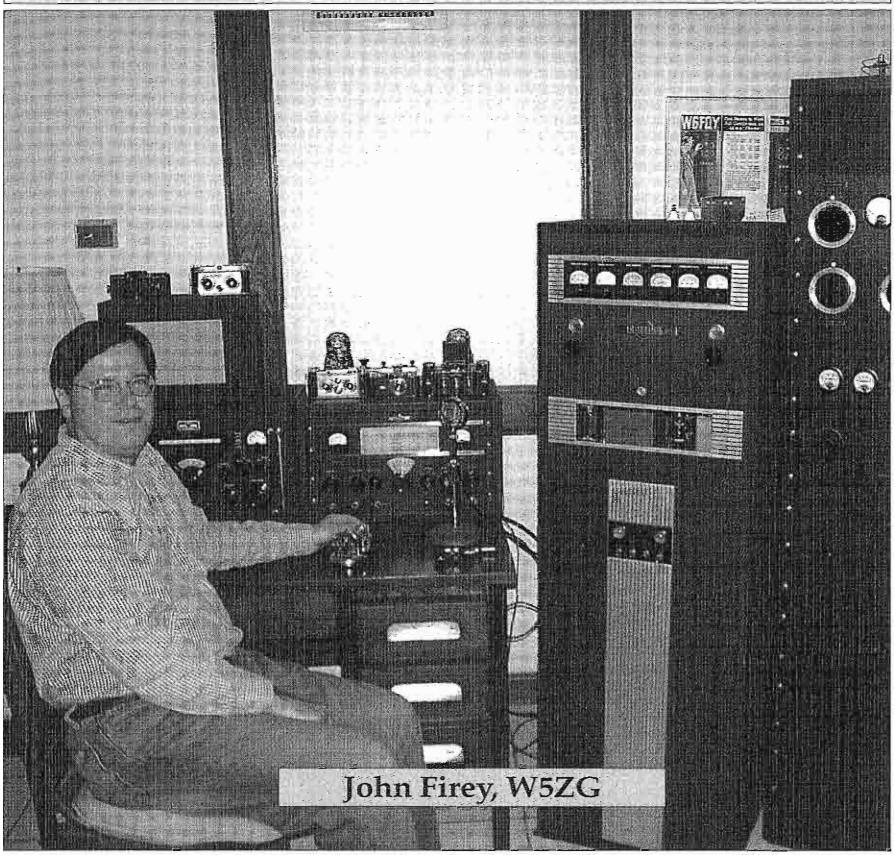
ELECTRIC RADIO

celebrating a bygone era

Number 209 October 2006



John Firey, W5ZG

ELECTRIC RADIO

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

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

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

Editor's Comments

2007 Postal Rate Increase

The US Post Office will likely increase rates again in 2007. At this time, the actual amount has not been announced, but could be at least 7%.

Fall and Early Winter Operating Events

Dale Gagnon (KW1I) has sent me information about the annual AM Jamboree that will be taking place this year during the Thanksgiving weekend, November 24-26, 2006. The Jamboree normally runs from sundown Friday evening, the 24th, until Sunday evening, November 26. This is always a fun event, and the purpose of it is to introduce AM to the amateur radio community in general, and to let everyone know that the mode is alive and well on the bands. Any AM transmitter is welcome. The rules have been simplified this year. Participants who submit logs with 25 contacts or more will receive a nice certificate from AMI. Please log AMI membership numbers if they are available. Questions may be sent by email to aminternational@earthlink.net. Completed logs should be sent to AMI, Box 1500, Merrimack, NH 03054.

2006 Electric Radio Heavy Metal Rally

I am announcing the event a little early this year so everyone can make plans to include the rally during the busy holiday season. The annual Electric Radio Heavy Metal Rally will start on Saturday, December 30, 2006, at 5:00 PM EST. As in years past, this is not a traditional Ham radio call sign echo. Although the Heavy Metal Rally was originally intended to include only big tube-type equipment, now it is a night for friendly AM QSOs, and is open to anyone using restored broadcast,

(Continued on page 21)

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Cover: John Firey (W5ZG) is the third known owner of a Collins 30J transmitter. John's is completely original except for "TVI proofing damage" probably done in the 1950s. He hand wound coils for 80 and 40 meters, and it regularly runs on 40 CW, 7004 kc. It has been run on AM on occasion, the most memorable contact being the first night WØCXX was put back on the air by the Collins ARC in Cedar Rapids, IA. On the far right is a Collins pre-war 150C, built in 1935. It is also restored and operates on 3520 and 3880 kc, running a single 203 final, 120 watts output.

A Breting 12 Receiver Restoration

By Charles W. Cassidy, AC7GZ
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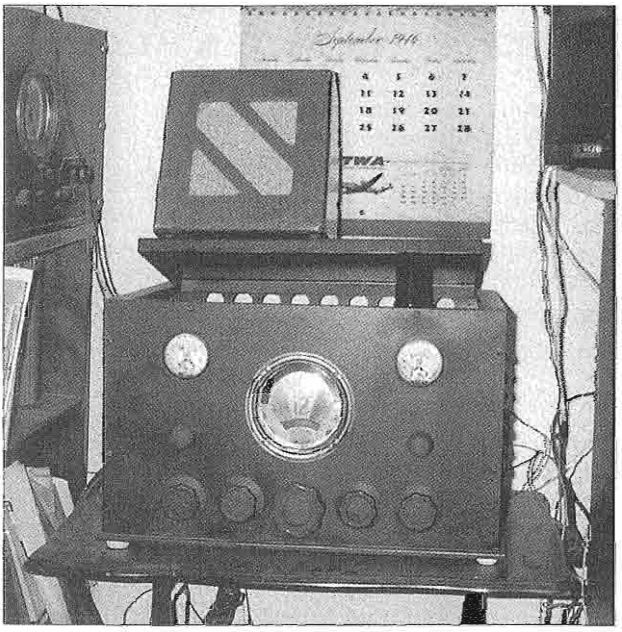
Chandler, AZ 85224

As my wife and I walked the aisles of an antique mall in southern California, a radio caught my eye. It looked very much out of place; very dusty, but apparently restorable as the photos show. I consider myself a "reasonably knowledgeable individual" concerning communications receivers, but this one was completely new to me. With no markings other than "Breting 12" on the dial and the two meters, I freely admit that I was stumped by what I saw sitting on that shelf. Pulling a few tubes revealed 6C6s and 6D6s. That, combined with the overall appearance, a fifty-cent piece-sized crystal holder in a crystal filter section, and the art-deco design of the dial led me to believe that this was a prewar receiver—most likely mid-1930s to late 1930s vintage. I was a bit baffled by the lack of dial function labels. At the time, I chalked it up to some previous owner's poor repainting job.

The $120 price tag looked reasonable enough; so after the usual "Where is that going to sit?" on the part of my wife, it ended up in the trunk of my car. Upon lugging it to the patio for a thorough dusting with the air hose, I discovered that the chassis, transformers, and chokes were chrome plated. Obviously, this was a high-end receiver, and it had been stored in a dusty, but relatively dry place.

The case bottom was next to come off. As are most of us who enjoy restoring receivers of this vintage, I was eager to see what would be found underneath the shiny chrome chassis. I was pleasantly surprised to see neatly laid out, well-shielded wiring (by 1930's standards). As the "before" picture of the below-chassis shows [page 5], it was in need of recapping, as are many (nearly all?) receivers of this vintage.



The author's restored Breting 12 receiver.

While I have restored receivers with no schematic, this one obviously was a little too complicated for that. The next step was the "Great Quest," as my wife calls my frenetic searches for information. A check of the index for Rider's Perpetual Troubleshooter's Manual turned up a listing for the receiver. I have a partial collection of Rider's manuals, but this schematic was in a volume I do not own. A quick Internet search located a copy of the Rider schematic. Internet

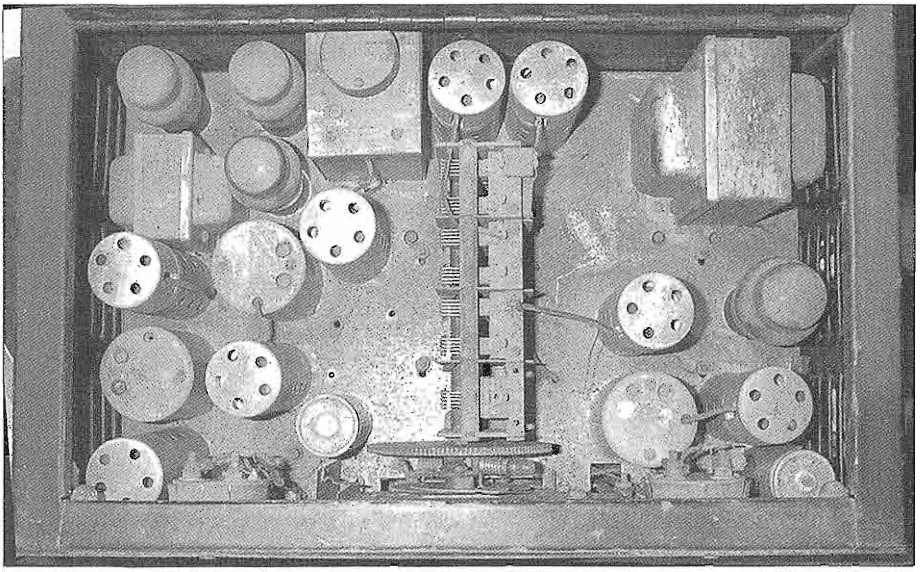
One of the few known advertisments for the Breting 12 was found in the October 1935, QST, page 95. One of the meters was calibrated in "Percent of Modulation" and there were terminals on the rear panel for feeding a transmitter's modulator.

resources are an excellent source of schematics, but the busy schematic of the Breting 12 would have been a real challenge to read on 8-1/2" x 11" paper printed from a web site. A trip to the Phoenix public library yielded a full-size schematic. They own a complete collection of Rider's manuals, and I pray they never decide it is surplus to their needs.

Other Internet searches revealed a couple of good articles. In particular, N7RK's article proved to be very helpful.[1] It revealed that it originally sold for $93.00, but what I didn't notice in my haste was the lack of any knob functions on the photos in the web sites. As I discovered later, others have made changes to the front panel to remember what knob does what.[2] Someone has added labels to the Breting 12 in this photograph.

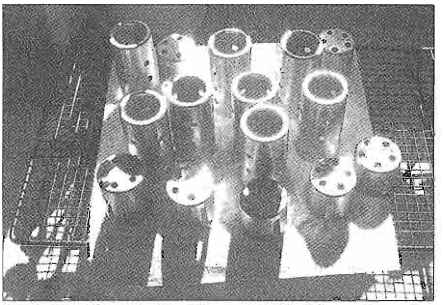
Since QST is the most extensive amateur radio periodical collection owned by the Phoenix Public Library, the XYL and I proceeded to sift through the years of 1934 through 1937 thinking those would be good starting and ending dates. Looking at the Index of Advertisers yielded no Breting ads, so we looked through the ad section of every month for the years mentioned. Only two references to the Breting 12 were found. The July 1935 issue featured a one-line mention from the Delaware Radio Sales Company that said they were making "immediate delivery on the following receivers: '...'" The October 1935[3], QST, had a 1/2 page ad from Delaware Radio Sales that featured the Breting 12.

Additional information regarding Breting equipment has proven rather difficult to locate. Further Internet searching did turn up the Radioblvd.com[4] web page which has some very interesting information. It reports that Paul Breting began selling communication receivers



Here is the receiver in its as-found condition, with much dust, dirt, and corrosion on the top of the chassis, which had originally been chrome plated.

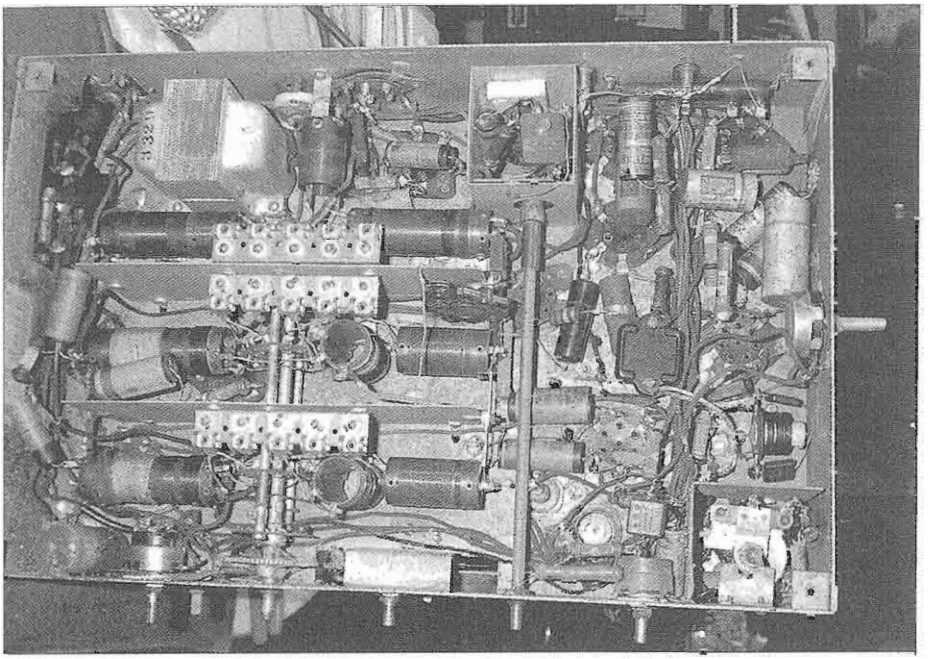
in 1935 and that the engineer who designed the Patterson PR-10 receiver, Paul Gudie, was the designer of the Breting 12. It also confirms that the receiver was brought out in 1935, and due to RCA patent protections, Breting contracted with Gilfillan Brothers to build the radios under its license from RCA. One other bit of information would prove prophetic: "The published Breting schematics are fraught with errors and rarely agree with the receivers produced."[5] (This is, in my opinion, a very nicely done web site).



The shield cans responded beautifully to gentle scrubbing and polishing as this photo shows.

The first order of business was to clean as much of the chassis as possible. My small two-gallon air compressor did a good job of blowing dust out of nearly inaccessible places. I've had success in the past using Simple Green™and a toothbrush. The shield cans were soaked in scalding-hot water with Simple Green™. A gentle scrubbing with the toothbrush restored them to near-new appearance, as the photo illustrates. Likewise, the variable tuning capacitor cleaned up very nicely. Over the years, I have learned to use an old Bell System contact burnishing tool on air-variable caps to remove oxidation from the wiper contacts. I also use liberal amounts of LPS™contact cleaner on air variables. Fortunately, the capacitor plates did not short across the range of rotation; so I was spared the tedium of combing plates.

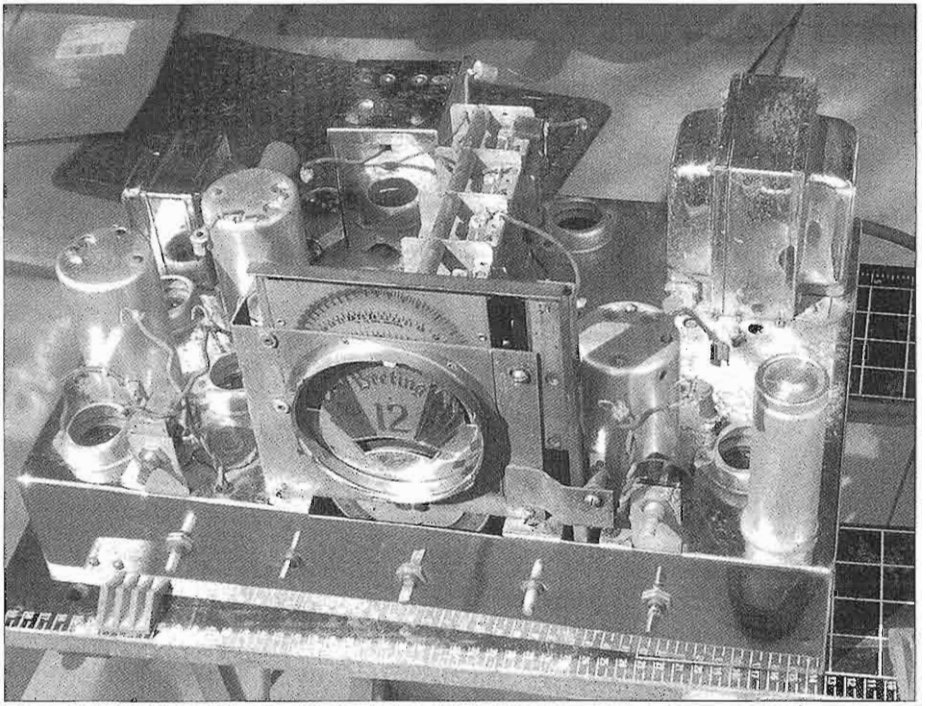
The air variable in the crystal phasing circuit has proven to be a much more nettlesome problem. The design seems to have been a poor one from the beginning. Unfortunately, there appears to be little that can be done to improve the operation and keep the receiver in



The "before" view underneath the Breting 12 chassis shows electronic components typical of the mid-1930s are plentiful, such as the Sprague 600-Line condensers in the upper right. Breting receivers are known for poor documentation.

original condition. A single moving plate makes contact with the crystal bypass wiper. This is an aluminum-copper contact and no amount of burnishing or contact cleaner prevents it from becoming noisy. I have considered attaching a non-permanent toggle switch which would operate when the control is rotated as was originally designed.

I am not a purist concerning under-chassis capacitors, and while I will admit that leaving the original wax caps in place looks best, I have found that very often, wax caps which test good prior to regular operation of the equipment, often break down under the stress of operation after a few days or weeks. As we have all experienced, the failures are sometimes rather messy; so I decided to install appropriate values of Mylar capacitors. 5Z3 rectifiers are becoming expensive, and Breting 12 power transformers may as well be gold, which meant new electrolytics had to be installed. Of course, the original electrolytic cans dried up decades ago, but they were left in place for appearance sake. Since the receiver was designed to operate with a dynamic speaker with a 1500-ohm DC resistance, some means of filtering the B+ as well as dropping the voltages to the correct values was needed. The local Radio Shack had two 3k-ohm, 10-watt, wire-wound resistors. In parallel between 30-µfd, 450-volt electrolytics from the junk box, this will have to serve as the B+ filter until an appropriate dynamic speaker turns up. The two resistors fit neatly in the space just to the right of the 4-pin speaker connector, which is visible in the under-chassis photom on page 6. I have given some thought to installing an appropriately sized filter choke in an old speaker enclosure I own, but searching for a choke of the right DC resistance and of the right voltage rating has turned up



The main chassis and tuning dial have been restored and are waiting for the tubes and shields to be replaced.

nothing so far.

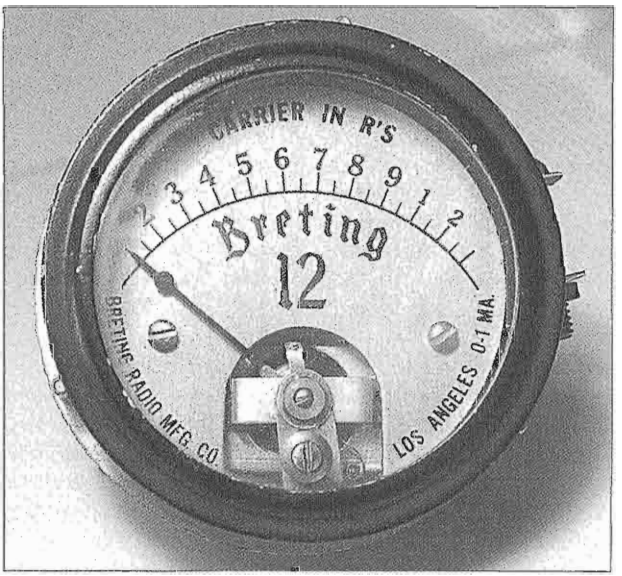
The usual smoke test with an autotransformer did not produce any fireworks or smoke, and at 110 VAC the DC voltages were within approximately 10% of voltages shown on the Riders schematic. It was time to connect an antenna.

While the front panel had indeed been repainted, I learned from the Internet that the Breting 12 had no dial markings as was the case with some other receivers manufactured at this time (RME comes to mind). The lack of dial markings made figuring out the front panel controls interesting. Unfortunately, most of the photographs in web pages are not of sufficient quality to be able to read the labeling that was put on Breting 12s by other owners. Obviously, a manual would be of immense help, but my search for an operating manual for the Breting 12 has been fruitless. Most of the controls are obvious, but the standby switch had enough oxidation on the contacts to prevent the application of B+ to the receiver. Liberal application of LPS™contact cleaner cleared up that problem.

I was pleasantly surprised to hear signals on the AM broadcast band. The local Radio Disney 50-kW blowtorch was booming in at 1580 kHz, but the AM talker, KFYI, at 550 was off the dial. Switching bands produced an ear-splitting racket, and the shortwave bands were not working. Obviously, a thorough cleaning of the band switch wafers, as well as a complete alignment, was in order. This meant that the front panel and all of its associated controls had to be removed. I had planned this anyway, as it would permit a more thorough cleaning of the chassis.

The chassis photo [on this page] is a view of the shadow dial and the now-

One of the best features of the Breting 12 is its beautiful "art-deco" dial.



A closeup view of a Breting 12 carrier meter, calibrated in Breting "R" units (photo courtesy of Gary Halverson, K6GLH).

gleaming chassis metal.

I discovered that part of the ear-splitting racket when changing bands was due to in part to what seemed to be a galvanic voltage between the rail which guides the shadow mechanism and the channel in which it rides. The rail was thoroughly cleaned with crocus cloth and LPS™, which solved that problem. Since that mechanism is buried behind the front panel and future oxidation might lead to noise, I applied a coating of NAPA's Permatex™copper-based, anti-seize compound. I stumbled across this product a couple of years ago at

the local NAPA store, and I have found it to be an excellent material for sliding electrical contacts, such as these two rails. It is not suitable for wafer switches because it tracks very efficiently across insulators, but for this particular situation there should never be a need to get at this mechanism again.

With the receiver torn down to the extent I had planned, I dosed every potentiometer and switch contact with a liberal squirt of LPS™ All of the tube pins were cleaned with a bronze brush, and the tube sockets were cleaned with contact cleaner and a somewhat worn .22 caliber rifle bore brush.

A close look at the bare front panel revealed that someone had done a very poor job of trying to paint over even more poorly applied control functions on the panel. He (or a later owner) had painted over it with black wrinkle paint. Stripping the old paint off was going to be necessary. At that point, I was happy that there were no front panel markings to preserve. (Had there been silk-screened markings, it is unlikely that any of this would have been necessary in the first place, but that was not the case). While the rest of the cabinet looked acceptable, new wrinkle paint on the front panel would make the rest of the cabinet look shabby. The corollary to Murphy's Law held true: "Work expands to fill available time."

Because my experience with wrinkle finish paint has been uneven at best, I decided to start the repainting job and work on the electronics at the same time, figuring I'd have to repaint at least once to get it right. Luck (certainly not my skill as a painter) was on my side. I did not strip the rest of the enclosure. A thorough cleaning and air drying made it ready for a new coat of wrinkle finish.

It was mid-summer in Arizona, so there was no need to bake the front panel in my wife's kitchen oven to enhance wrinkling. (The rest of the cabinet would have been a very tight fit in the oven anyway).

Incidentally, I used Krylon™ brand spray-on wrinkle finish. After a few hours in the Arizona sun, the desired black wrinkled finish appeared. The cabinet wrinkled as hoped, with the exception of the lid, which required three coats to wrinkle properly.

The dial escutcheon appeared to be pewter or perhaps tin. A very light cleaning with #0000 steel wool cleaned it up nicely.

The meter glasses and the dial glass were removed and cleaned. I carefully cleaned the dial with a damp paper towel. The dial lights are very difficult to reach, but they were removed; the contacts brightened, and replaced in their sockets.

As with most old receivers, the dial calibration was off by a substantial amount. Age and perhaps "screwdriver mechanics" were probably the culprits. Fortunately, Rider's schematic contained all of the information necessary to align the radio. I was concerned when I read N7RK's comments on his web page of his inability to pull his receiver into alignment. Luck was on my side. After about an hour's tinkering, the receiver was performing rather well with a ten foot hank of wire lying on the floor of the shack. As is typical of early commercial receivers, the IF was an oddball frequency: 432 kc. The IF cans were pretty far out, which was about what I expected. The trimmers and padders were much closer, though.

Stability and sensitivity are about what should be expected with a receiver of this vintage. The old trick of propping open the enclosure lid a few inches helps stability. It settles down after about one-half hour to something on the order of a few hundred cycles per hour—certainly incapable of SSB reception, but acceptable for short-term CW listening. Shortwave broadcasters do not present any listening problems. Since owning this receiver, we have been approaching, or are at, the bottom of the current sunspot cycle, which makes hearing anything above 17 meters difficult, at best.

I mentioned the allusion in one of the websites regarding the accuracy of the schematics. Turning the BFO on produced no beat note. Using the tube tester to check the 6D6 and and installing a new one in the BFO socket did not produce the desired result. I was about to take the bottom plate off of the chassis (an unpleasant chore at best) when my good friend of some 30 years, KN8DMK, Bill, noticed that the schematic shows "no connection" between the B+ buss and the BFO plate and screen terminals. Apparently, it left the factory that way because I could see no evidence whatsoever that any soldering or wire removal had ever been done! A short wire was connected to the proper points and the BFO worked as it should have. Interestingly, Breting brought the BFO air-variable adjustment out of the bottom of the chassis. Considering the nearly 60 pound weight of this receiver, one hopes that adjustment of this control is rarely necessary.

Readers may notice tape over the meter studs. In fiddling with one of the dial lights while the receiver was on, I accidentally brushed one of these studs. Unlike more modern receivers where one may reasonably expect everything above the chassis in a tube-type receiver to be at ground potential (or screened off if not), early commercial receivers such as this weren't quite so safe. There is 350 VDC to chassis across these studs—a life-threatening voltage to say the least.

I have noticed that knobs on Breting 12s seem to vary greatly. The knobs on W3IU's receiver appear to have been made of wood. Perhaps they did not hold up well and were changed to bakelite by owners? I am sure I do not know. I do know that the torque required to turn the band switch knob would have made the small knob on W3IU's set rather difficult to turn.

Due to the dearth of published information concerning this receiver, I hope that the Internet links to the Breting 12 will be active for a long time to come. As the link which so beautifully illustrates W3IU's station shows, this was a classy piece of equipment.[6] At $93.00, it would have rivaled the HRO receivers in price and would have been beyond the reach of the average ham in the midst of the Depression, when $93.00 was more than a month's pay to many.

Anyone who is interested in restoring early commercial communication receivers would be pleased, in my opinion, to own a Breting 12. With a 42 driving a pair of 42s in push-pull, the audio is superb and there is a lot of it. In this particular receiver, the crystal phasing circuit is its greatest weakness. I continue to consider this a work-in-progress where this circuit is concerned. Mechanically, it is extremely difficult to get at, and it is a so-so performer at best, but it is by no means a reason to send the radio to the attic. The chassis looks very good in my opinion. Yes, the chrome plating has flaked off in places, (digital photos make it look worse than it really is), but overall, I believe it to be a fine example of what is an uncommon early commercial receiver. It seems to be completely "stock" with no modifications other than a poor repainting job by a previous owner. I am pleased to have it sitting next to my Drake twins.

Footnotes:

1. The Breting receiver at N7RK, http://members.cox.net/n7rk/breting2.htm
2. http://www.antiqueradio.com/Feb04_Chase_Estes.html
3. [Not all October 1935 QSTs contain the Breting ad! In working with the author and other regular ER contributors, the editor has discovered 3 different versions of the upper ad on the same page 95. This leads to speculation about separate regional versions of QST during those years.]
4. Radioblvd.com/hamgear.htm
5. Radioblvd.com, Ibid
6. http://www.uv201.com/Photo%20Pages/ham_4.htm

Rebuilding the E.F. Johnson Viking Adventurer

50-Watt CW Transmitter, Part 2

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On the Air with the Viking Adventurer

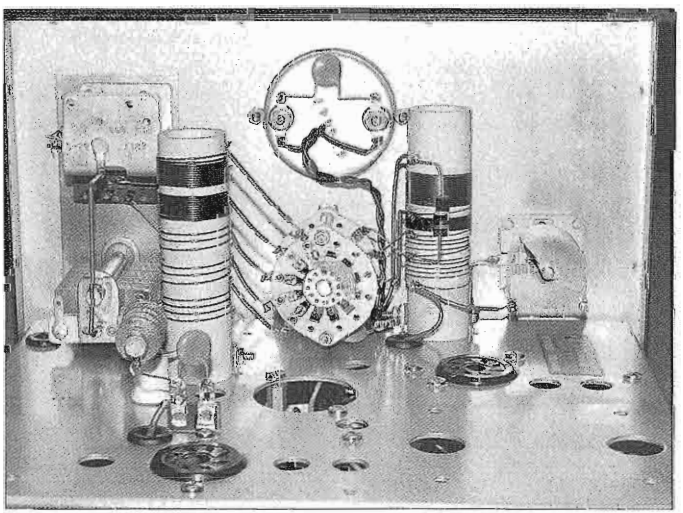
After my Adventurer was reassembled, the next step was the real "smoke test." I installed the shorting plug (pins 5 & 6) into the accessory socket, connected a 50-ohm dummy load, plugged in a key and a 3746 kHz 80-meter crystal, set the Adventurer's controls as recommended in the manual, and closed the key. Nothing happened! There was no grid drive. The 6AG7 oscillator was clearly not oscillating! The 807, however, was drawing 130 mA in an off-resonance condition! I then spent the next two-plus hours double-and triple-checking the wiring, verifying continuity, staring at the schematic, scratching my head, measuring component values, staring at the schematic, you're all familiar with the drill. I finally turned everything off and went downstairs to watch TV with my wife. Sitting on the couch watching TV, the "light came on" and I knew what the problem was. The 6AG7 is configured as a pierce oscillator and its screen is connected through a .001-µfd capacitor to one side of the crystal socket. The screen is also bypassed to ground with a 10-µµf silver mica. The screen is then connected to the 20k/25k (R7/R8) divider and "sees" an equivalent series resistance of 11.1k, the parallel equivalent of the two divider resistors. When I added the power supply filter PCBA, I used these divider resistors to "equalize" the voltage across the series-connected composite filter capacitor C16. As a result, the connection to the 6AG7's screen is now at AC ground, not the expected 11.1k! I installed a 11-k, 1-watt resistor in series with the 6AG7's screen lead and I now had grid drive, the 807 tuned and loaded in a normal manner, and the Adventurer's keyed signal sounded OK when monitored with my Kenwood TS-830S, as was the frequency. The 6AG7's calculated screen current of 5 mA through the additional 11k reduces the 6AG7's screen voltage but doesn't appear to affect the drive to the 807. I experimented with several values of series resistance, down to 4.3k, with no measurable difference, so I then permanently installed an 11-k, 1-watt resistor on an added terminal strip.

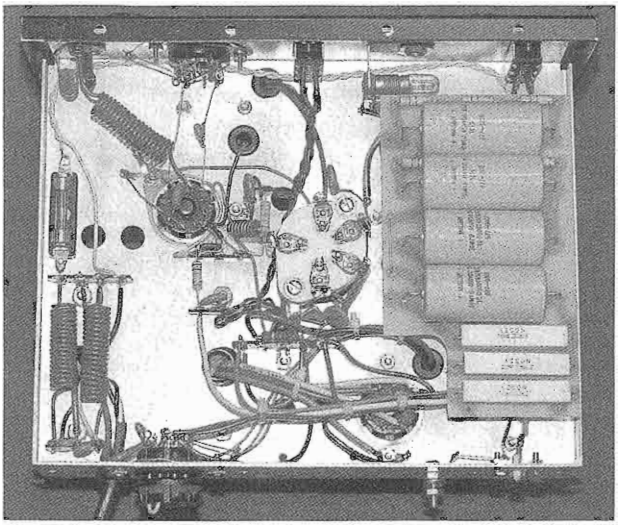
At a nominal line of 115 VAC, the 807's key-up plate voltage of 640 VDC falls to 445 VDC key-down when loaded to an indicated 110-mA plate current. The actual plate current was 97.1 mA for a calculated input power of 43.2 watts. The output power was 25 watts, measured with an in-line Daiwa Model CN-801 SWR & power meter. I replaced the NIB 807 with the original 807 and the input power stayed the same, but the output dropped to 21 watts. The measured output power is consistent with the Adventurer I tested in 1993.

The Adventurer's cabinet was "straight" with no major dents or dings but it certainly had its share of "battle-scars." The cabinet was rubbed-out several times with Meguiar's Cleaner/Wax and new nickel-plated 6-32 x 1/4" binder-head screws were used to install the Adventurer into its cabinet.

Rebuilding the Adventurer represents my most ambitious rebuild project to date. My biggest "problem" was finding replacement parts. I'm relatively lucky in that I have four electronic outlets in my area. Yet, none of them stock the higher

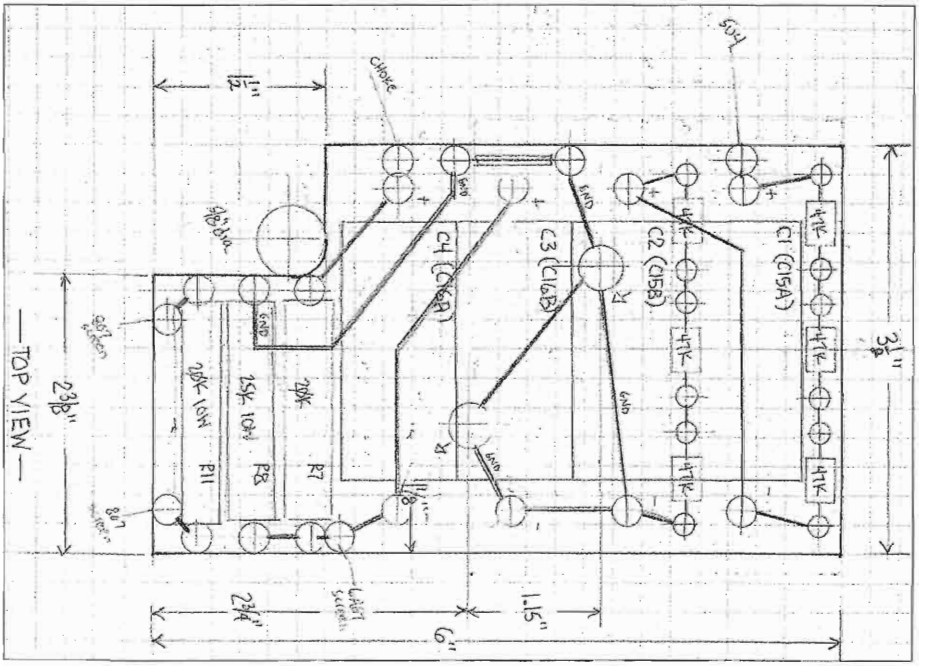
Above is the top view of the completed Adventurer. The tubes, left-to-right, are the 5U4G, 807, and 6AG7. The photo to the the lower left is a rear view of the Adventurer after I completed the top of the chassis wiring, but before the installation of the filter choke, shield, and power transformer was completed. To the front of the 5U4G socket is a terminal strip I added during reassembly to eliminate the original "skyhook" connection. The 807's multi-section output inductor L4 is on the left. Note that my restoration methods perserved the original E.F. Johnson decal, visible to the lower right center.





To the left is the bottom view of the completed Adventurer. Locations of the terminal strips were changed to "clean-up" the wiring and reduce "clutter." As I pointed out in Part I, the new filter PCBA is secured to the chassis using two 1-inch standoffs. I used the original hole locations so that no new holes were added. The added 11-k, 1-watt resistor and an added terminal strip can be seen below the 6AG7's socket.

Below is the layout of the filter printed circuit board. The PCB was fabricated using single-sided, 0.062-inch, epoxy-glass FR4 material. Bishop-Graphics artwork aids, pads and tape, were used as etch resist, and the PCB was etched in ferric chloride. The original 700-VDC filter electrolytics, C15 and C16, were replaced by two sets of two 50-µfd, 450-VDC Mallory electrolytics in series. The composite C15 uses two 141-k, 3-watt equalizing resistors (three 47-k, 1-watt resistors in series).



value 20k and 25-k, 10-watt "cement block" resistors anymore. I finally ordered them from AES. The same is true for silver mica capacitors. The only filter caps available locally are the smaller-sized electrolytics that I didn't want to use. Nickel-plated 6-32 binder head screws are only available at one place and their inventory is shrinking with every purchase! With the rising cost of gas, it's making more and more sense just to use mail-order. In the future, I would really like to find and totally rebuild a Johnson Navigator, but that's an even more problematic project with its VFO components and even bigger "laundry list" of discreet components. As a result, I think a project like the Adventurer is as far as I want to go.

A very nice copy of the operator manual was obtained from W7FG Vintage Manuals (www.w7fg.com), which included several generations of schematics plus the addendum for the "new type of meter with better damping features" (standard in serial numbers over 83091), plus a copy of the original data sheet. The manual is dated 6/57. Other versions of the manual are also available on eBay in CD-R or hard copy format.

Send me an email, and I will send you a schematic, data sheet, or partial manual. I can also send higher-resolution photos, but these are almost 1MB each, in JPEG format. As always, I will answer all questions.

Selected References:

QST, Recent Equipment, August 1955, "The Viking Adventurer", pages 39-40

David W. Ishmael, WA6VVL, October 1995, "The E.F. Johnson Viking Adventurer," Electric Radio, issue #78, pages 30-31.

ER

Milestones in the History of Amateur Radio

de Forest's Audion—A Centennial Commemoration

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Lee de Forest is the most polarizing personage in the history of American electronics. On the one hand, during the winter of 1906-07, he discovered that an electric current in a vacuum tube could be controlled by inserting a piece of wire, bent back and forth in the form of a grid, between the filament and plate of a conventional diode. A Nobel Prize scholar in physics, L. I. Rabi, described de Forest's discovery as "so outstanding in its consequences that it almost ranks with the greatest inventions of all time" (MacLaurin, 1949, p. 70). Hugo Gernsback (1947a), a prominent editor of several radio magazines, regarded it as a priceless gift to humanity. He designated the January 29, 1947, issue of Radio-Craft as the "de Forest Anniversary Number—40 years of the vacuum tube." He honored de Forest reverently, paraphrasing Winston Churchill: "never in the history of the world has so much been owed, by so many, to one man."

On the other hand, Abraham White, a venture capitalist, and de Forest incorporated with some fanfare the "American de Forest Wireless Telegraph Company" in February, 1902. They intended, first, to compete with Western Union by establishing wireless stations throughout the United States, and second, to market receiving and transmitting equipment to military services and commercial agencies. White provided the financial backing and de Forest, the technological talent. The corporation prospered until the courts ruled in 1906 that de Forest's receiving apparatus infringed flagrantly upon Reginald Fessenden's electrolytic-receiver patents. American de Forest was forced to change all the receivers that had it installed and had been sold. Fortunately, Henry H. C. Dunwoody, corporation vice-president, obtained a patent in mid-December, 1906, for a crystal detector, which helped the corporation navigate the multiple problems caused by de Forest's transgression.

Nevertheless, White held De Forest responsible for his costly ethical lapse, and on November 28, 1906, forced him to resign from the company and surrender his stock. de Forest obtained only $1,000 in severance pay, but he was permitted to retain the patents that he had been issued while working for the corporation. de Forest was out the door with only $500 and his patents because the lawyer who prepared the papers for his termination charged him $500. He was virtually penniless (Mayes, 1987).

Whatever White and others, who were familiar with his propensity to cut corners, thought of him, Lee de Forest was a prolific inventor. He acquired 37 patents on many phases of wireless telegraphy, such as spark production, de-icing wire antennas, and oscillation responsiveness, between 1902 and 1906 (Gernsback, 1947b, p. 50). He has been described as "perhaps the most imaginative inventor in the history of the radio industry" (MacLaurin, 1949, p. 87). However, like other creative individuals, tormented by their restless minds, de Forest generated far more ideas than he had either time or opportunity to address. His visions and ambitions all too frequently beclouded his business prudence. Sometimes he associated with entrepreneurs who sought to exploit his inventions. And

regularly, he oversold investors, including those with the best of intentions, on the promising prospects of his inventions before they were thoroughly examined. His modus operandi seemed centered on the belief that ends justify means; perhaps, because of his ceaseless impatience for results, he seldom resisted the temptation to not only replicate but to even patent aspects of another inventor's products.

Although de Forest was bereft of financial resources after White fired him, his inventive spirit never wavered. He rented an inexpensive room in New York City, and he pawned his watch, clothing, and keepsakes in order to purchase supplies (Butler, 1947). He possessed three loyal assistants, C. D. Babock, Frank Butler, and John V. L. Hogan, a high-school student. Babock and Butler probably continued to work for White and helped de Forest after hours. Hogan likely was paid a modest hourly wage.

With the support of his three colleagues, de Forest, only a few weeks after he was put on the street, but following years of research, managed to create his "grid type" detector. On December 31, 1906, Hogan systematically analyzed its characteristics. Given its striking potential, de Forest applied for its patent on January 29, 1907. The patent, #879,532, was granted February 18, 1908. The timing–only one month from being fired from a job to inventing a three-electrode vacuum tube of momentous significance–enabled de Forest to derive benefit from one of the more bizarre reversals of fortune ever experienced in the annals of science.

Patent #879,532 is among the more famous of patents issued in the realm of electronics. de Forest, in turn, has been acclaimed widely as the "father of radio." However, perhaps of a consequence of de Forest's inclination often to skirt along the edges of dishonesty, historians have pursued unsuccessfully an acceptable understanding of how de Forest advanced his research. He started from gas flame technology. How did he manage conceptually to make the transition to vacuum tube technology (Espenschied, 1990)?

To address this intriguing question, the discussion below is divided into three parts: (1) the antecedents—chief characteristics of the "Edison effect" and the "Fleming valve"; (2) the description that de Forest has provided of his research agenda; and (3) the ensuing controversy.

Antecedents

Thomas Alva Edison startled the scientific community when he discovered circumstances by which incandescent bulbs may produce unilateral or one-way conductivity of current. As he investigated, in 1883, the properties of an ordinary carbon filament in a bulb from which oxygen had been evacuated, he noted that the filament became thinner as it burned while the glass bulb attained a blue glow as it grew darker and darker. Edison surmised that the heated filament was throwing off particles as it disintegrated, and therefore, that electricity was flowing in the space between the filament and the glass. To study the phenomenon, he inserted another wire or plate in the bulb to collect the particles. His found that when he connected a battery in series with a galvanometer, with the positive terminal attached to the "cold" wire and the negative to the "hot," incandescent filament, current flowed across the vacuum from the filament to the plate. When he reversed the connections so that the plate was negative relative to the filament, the current flow ceased.

Edison had no explanation for the unilateral effect. He reported it four years before Hertz demonstrated empirically that electric current could be propagated through space, and ten years before Oliver Lodge succeeded in detecting Hertizian waves from several hundred feet with a coherer detector. The discovery also occurred about thirteen years before the

English scientist, J. J. Thompson, postulated in 1897 his theory of the electron. Thompson suggested that the atoms of a metal are made of up negative charges imbedded in a sphere of positive charges. When a metallic electrode is heated to a high temperature, as in an incandescent bulb, the negative charges, or electrons, boil out of the metal and are drawn across to the plate. This flow, he believed, manifested itself in the blue glow of the Edison Effect (MacLaurin, 1949, pp. 46-47). Since the scientific world, at the time, was unprepared for his discovery, Edison simply believed that he had created a device that might be useful in indicating voltage and current variations in lighting circuits. On November 15, 1883, he applied for a patent for an "Electrical Indicator" (Tyne, 1977, p. 32).

The Edison Electric Light Company opened a branch of the company in England around 1882, and shortly afterwards it appointed Professor James A. Fleming, University College, London, to be electrical advisor to the company. The mantle of "foremost electrical scientist in England" had passed, by then, from Michael Faraday to Fleming. Fleming was thoroughly familiar with the phenomenon of "thermionic emission"–a process by which electrons evaporate from heated metal–and when he learned of the "Edison effect" he was sufficiently intrigued to initiate, in 1888, studies of its peculiar circumstances. He reported that he chose to investigate "the physical phenomena" of incandescent lamps "with all the scientific means at my disposal" (Yates, 1927, vol. 1, p. 173).

Fleming was distracted for a time by other responsibilities, including being enticed, December 1901, to become one of Marconi's consultants. Marconi asked him to design a 20,000 volt spark transmitter, which would be installed at Poldu point for making wireless transmissions across the Atlantic. Fleming created the transmitter, but he questioned whether Marconi's receiving apparatus—the coherer—was sufficiently sensitive to copy the Poldu signal in North America. Fleming held the coherer in such low regard that he once dammed it with faint praise: "the arrangements of Marconi," he said, "though admirable, require some dexterity to manage them" (Fleming, 1919, p. 377).

Fleming completed the design of the transmitter on schedule and resumed with renewed vigor his study of the "Edison effect." In it, he recognized the rudiments of a vacuum tube detector, which might become a successor to the relatively insensitive mechanical detectors. Fleming thus confirmed via systematic research the parameters of the "Edison effect." In his words: "By surrounding the negative filament with a metal cylinder and bringing the filament to a high state of incandescence, a current of negative electricity was induced to flow from the filament to the plate, but it could not be induced to flow in the opposite direction from plate to filament" (Yates, 1927, pp. 175-176).

Eventually, Fleming inserted his two-element tube in the aerial circuit of a detector and introduced a high-frequency current. The alternating characteristics of the incoming high-frequency signal made it successively positive and negative. During the negative half of the signal cycle, the plate repelled electrons given off from the filament, and no current flowed; during the positive half, the plate was positively charged and drew electrons from the filament to the plate.

Fleming had thereby employed the emission of electrons from a heated carbon filament to rectify or to augment the detection of radio frequency oscillations. He named his invention an "oscillation valve" or simply "valve" because of the nature of its unilateral activity, which is allowing the flow of electrons in one direction but not the other. He patented the results of his research in 1904. The British Marconi

Company, however, held the rights to it under the terms of his consulting contract (McLaurin, 1949).

de Forest's Invention of the audion

de Forest (1919, p. 1) stated that "the first conception of a detector of Hertzian waves" came to me in the summer of 1900. He was experimenting then with "a new type of electrolytic detector", hoping thereby to supplant the coherer. When he noted that light from a gas burner dimmed when he closed the key of a little spark transmitter across the room, he reasoned that the conductivity of incandescent gases were affected by high-frequency electrical waves.

de Forest was preoccupied until the Fall of 1903 launching American Wireless de Forest and perfecting his replication of Fessenden's electrolytic detector. Once time became available, he set out to "prove that my original conception had a basis in the physics of gases" (de Forest, 1947, p. 19). He set up a small independent laboratory in lower Manhattan, where he could carry on his experiments.

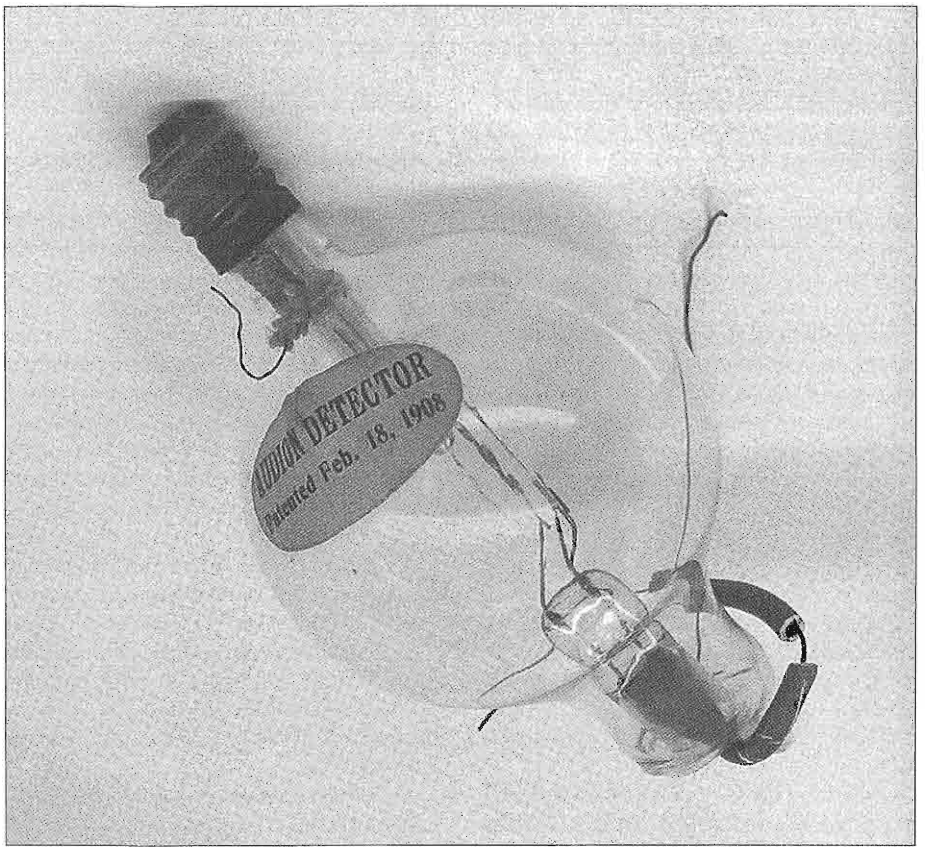
de Forest (1919, p. 1) noticed initially that "an appreciable current did pass between the two electrodes, making a soft fluttering sound in the telephone receiver" when the telephone receiver and a dry battery were connected in series between two platinum electrodes, which, in turn, were placed in the envelope of a Bunsen Burner flame. The discovery led to patent #824,638, which was issued June 26, 1906. Next, with one of the flame electrodes attached to an antenna and the other to ground, de Forest heard wireless signals from ships in New York harbor. He was elated. "Here at last," he said, "was actually demonstrated my earnest belief in the existence of this new detector principle" (de Forest, 1919, p. 1).

After de Forest's exuberance subsided, he realized that "a gas-flame detector would be wholly unsuited for practical wireless work." At first he was prompted to try a small electric arc, which proved to be too noisy. "The next plan which suggested itself to me [de Forest] was to use incandescent filaments in an enclosed chamber" (de Forest, 1919, p. 1).

During 1904 and 1905, de Forest's duties kept him "almost continually away from my laboratory, in traveling about the country directing the installation of numerous radio stations" (de Forest, 1919, p. 2). When he returned to his developmental work, he asked Henry McCandless, a manufacturer of miniature incandescent lamps, to construct for him "a tube containing a platinum plate and carbon filament." de Forest connected the plate (or anode) to the positive side of the dry battery; the negative terminal, in series with a telephone receiver, was attached to the filament. At this stage in his research, de Forest began employing two dry batteries. The first battery, for lighting the incandescent filament, he designated as the "A-battery"; he identified the second dry battery in the plate circuit as the "booster" or "B-battery."

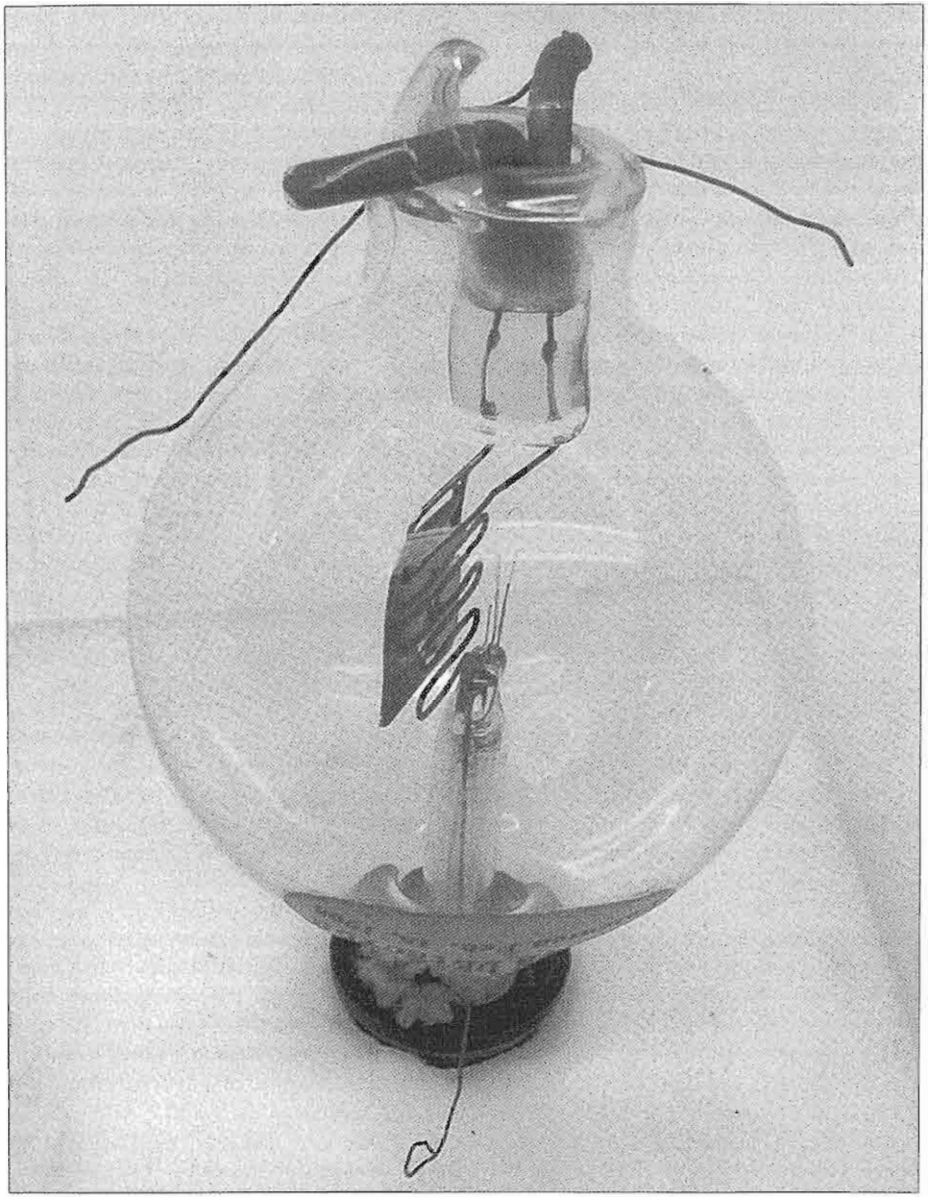
de Forest claimed that his "device was a genuine relay, in which the local energy of the plate battery supplying the current through the remaining gas in the tube was controlled by pulsations of the incoming high-frequency waves, which were picked up on an antenna connected to the plate electrode, the filament being connected to the ground" (de Forest, 1947, p. 19). de Forest thus insisted that his diode detector was more than a simple rectifier because, with the addition of the plate battery, it worked as an amplifier–he had employed "high frequency energy, not to actuate my telephone diaphragm, as Fleming had done, but to control very much larger quantities of energy from the local battery" (de Forest, 1947, p. 19).

However, de Forest recognized that his diode arrangement was imperfect because it permitted part of the high-frequency energy to pass to ground through the telephone receiver and B-



Two views of a spherical de Forest audion are shown above and on the facing page. The H. W. McCandless Company, a manufacturer of incandescent lamps, developed this early tube for de Forest. This particular audion was produced in 1908. The bulb is two inches in diameter and 2 7/8 inches in length from the tip of its candelabra to its top. The left-view reveals wires for two filaments—one is attached to the candelabra tip; the other protrudes from the top of the candelabra. The screw-base of the candalabra serves as a common ground. de Forest incorporated two separate filaments in the audion as insurance, because the fragile tantalum filaments tended to burn out capriciously. The left-view also shows a paper label affixed to the audion that reads "AUDION DETECTOR" and "Patented Feb. 1908." The right-view shows two "flying" wires extending from the stem seal. A red wire is attached to the grid and a green wire, to the "single-wing" plate, a term used to distinguish it from de Forest's "double-wing" audion, a two-plate/two-grid version which supplanted the former in 1909 (see Stokes, J. W., 1982, 70 Years of Radio Tubes and Valves. N. Y.: Vestal Press). This exceedingly rare audion is in the private collection of AI2Q, Alex Mendelsohn.

battery circuit. It failed to concentrate "the ions between the plate and filament" (de Forest, 1947, p. 19). To remedy the problem and improve the sensitivity of the detector, he "wrapped a piece of tin foil around the outside of the cylindrical-shaped gas envelope, and connected this third electrode to the antenna" (de Forest,



1947, p. 20) "The arrangement of the external tinfoil belt may therefore be called the parent of the third electrode" (de Forest, 1919, p. 3). On August 6, 1906, he filed for a patent on the design, #841,386, which was issued on January 14, 1907.

Since the external electrode provided considerable increase in sensitivity, he reckoned that even greater sensitivity would result if the third electrode were placed inside the bulb. Thus, he immediately instructed McCandless "to construct another 'audion' as I then called it" (de Forest, 1947, p. 20). The new version consisted of two plates with a filament located between them. Another

patent application was filed, October, 1906, and #841,387 was issued January 15, 1907.

de Forest took his creation a step farther, however, when he anticipated that sensitivity would be improved if the third electrode was located between the plate and filament. Since a solid plate would not pass any current, he supplied McCandless with a small plate of platinum perforated with a great number of small holes. Performance did improve. Now, to reduce production costs, de Forest formed the third electrode "as a grid [abbreviated from gridiron], using a piece of wire bent back and forth" (de Forest, 1947, p. 20). Marked improvement occurred again, and after John V. L. Hogan, a high-school student who emerged in the 1920s as a prominent radio engineer, systematically detailed in late-1906 its operating characteristics, de Forest applied on January 29, 1907, for patent #879,532, which was issued on February 18, 1908.

The Controversy

de Forest advanced from a Bunsen burner flame to an electric arc, and then, to a vacuum tube in his evolution of the three-element audion. To what extent did he adapt features of Fleming's valve as he progressed? Herein is the basis of the controversy. Did he make the transition from flame to bulb with merely a fleeting awareness of the valve or did he, in fact, ask McCandless to clone several of them for him? If de Forest was unfamiliar with the Fleming valve, how did he devise independently such a comparable two-electrode tube?

de Forest (1919, p. 2) admits that "I was familiar in 1905 with Prof. Fleming's work on the subject of the '"Edison Effect"' as utilized for the rectification of high frequency oscillations.... This was interesting to me only as an evidence of growing activity along lines similar to those of my new detector." Subsequently, de Forest (1947. p. 19) stated defensively that "it has always been quite impossible for me to understand the confused idea, in the minds of some otherwise keen thinkers, that the audion differed from the Fleming valve merely by the insertion of a third electrode therein. . . . This device was not the Fleming valve. . . . I was employing the high-frequency energy, not to actuate my telephone diaphragm, as Fleming had done, but to control very much large quantities of energy from the local battery." To bolster his premise, de Forest reiterated emphatically: "At the time I was working on the two-element audion with B-battery, I had never heard of the Fleming valve. My approach to this perfected device was by an entirely different series of events, and began with the gas-flame detector" (Butler, 1947; de Forest, 1947, p. 19). To isolate himself from further reproach, de Forest maintained steadfastly through the years that he knew nothing of the Fleming valve prior to his invention of the audion (Espenschied, 1990; Tyne, 1977).

A fire in 1908 destroyed de Forest's laboratory. All the historical material from 1905-1906 pertaining to the development of the audion, including tube samples, records, note books, and logs, was destroyed (Mayes, 1987). Accordingly, as Espenschied (1990, p. 10) has suggested, "we can only surmise the groping process by which de Forest arrived at the magical grid form of electron tube." However, John V. L. Hogan, before his death, told Espenschied that de Forest was experimenting with a Fleming valve, "trying all manner of ways of influencing it with radio signals. Starting with outside electrodes, he gradually felt his way to the intervening 'hairpin'" (Espenschied, 1990, p. 9). Tyne (1977, p. 53) reports that McCandless' records show that Babcock, toward the latter part of 1905, brought to him a tube, which he said was a Fleming valve and asked him to make duplicates of it.

The conceptual pathway that de Forest chose to follow in developing the three-electrode audion may never be adequately

clarified. He seems destined forever to remain a polarizing figure in the history of the electronic sciences. Whether members of the cohort of radio aficionados believe his critics' allegations or de Forest's explanation of events depends on whether they decide to view him as an overly-ambitious charlatan or as standing tall among electronic pioneers as "the father of radio."

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(Comments, from page 1)

military, homebrew, any commercial ham gear meeting the requirements, i.e. Johnson Invader 2000, Viking Desk KW, Globe King 500, Collins KW-1, etc. and big solid state Class-E equipment. This includes using a solid-state exciter as long as the PA is Heavy Metal, such as a 300 pound Henry 8K! I want as much participation in the rally as possible. Obviously, we would all like to work as much tube-type Heavy Metal as possible, and a point advantage is given to tube equipment.

All AM transmitters can participate, but the winner needs to be running a rig weighing 250 pounds or running at least 250 watts. This includes big homebrew, military, and vintage commercial Ham gear, and Class E solid state rigs as long as they meet the qualifications. For example, some vintage Navy rigs weighed in at over 300 pounds, but only produced 100 watts of carrier—that's still Heavy Metal! (The "or" statement is intended as an illustration, and should not be misread as an intent to keep someone out.)

Suggested Frequencies: 1885 kc east of Mississippi, 1915 kc west; 3830 kc, 3870-3890 kc, and nationwide on 7290 kc.

The rules for this year's Heavy Metal Rally are nearly same as in years past.

Scoring: You get 1 point per contact on each different band. If you work the same station on both 80 and 160 it counts for two points. You get 1 additional point per contact if you are using all tube-type heavy metal. 1 point for each different state worked. 1 point for each letter or email received from Hams or SWLs with positive comments about a station's signal or sound quality. So, if someone works 20 stations in 10 different states with a tube rig, the score is: 20 contacts + 10 states + 20 tube points = 40.

If two emails are received complaining that "KØXYZ" broke their S-meters but sounded darn good doing it, that's 32

(Continued on page 26)

The American VHF-AM Equipment Gallery

Part 8, The Lafayetter HA-260 2-Meter Linear Amplifier

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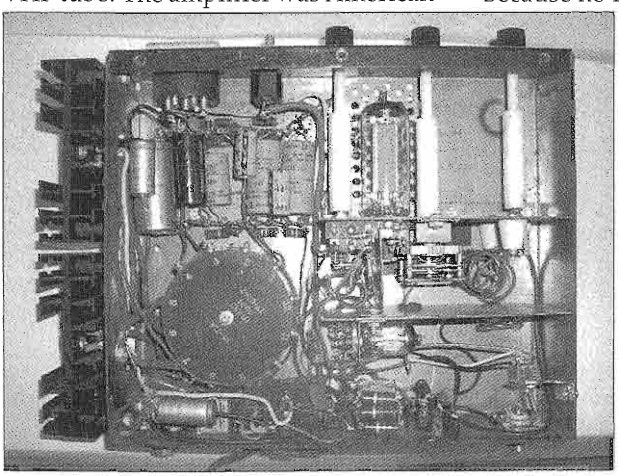
Before the days of the solid state VHF "brick" amplifiers, a few companies offered high power linear amplifiers for the AM and FM users. Gonset and Lafayette were among the first companies to get into the market, albeit at a point when their usefulness was declining. Newer FM mobile transceivers were capable of 25 to 50-watt outputs matching the power of these linear amplifiers. Lafayette contracted a New York consulting company to design a low cost VHF mobile linear amplifier for their new transistorized 2-meter portable transceivers. At that time, high power VHF transistors were very expensive, if available at all. Amperex had available, at that time, a high-power, high-gain dual-tetrode tube intended for mobile high-band applications. The 8637 tube is a low cost 120-watt, radiation-cooled, 12-volt VHF tube. The amplifier was American made in Long Island, NY by K&E Manufacturing, a contract assembly house that also fabricated the Lafayette HA-250, their matching HF linear. As the advertisment on the facing page shows, a selling price of $139.95 was almost a bargain in 1967.

In Lafayette's model HA-260, this 2-tube (plus a solid state switching power supply) design made an ideal compact mobile linear amplifier. First offered in 1967, the linear was an ideal match for their hand held handy-talkies, enabling them to be used in the mobile at higher power. At that time there were few, if any, solid-state, high-power mobile transceivers available. Operation was simple; automatic RF sensing via a 12AL5 provided the necessary drive to the TR relay for automatic changeover switching. No preamp was provided, as in modern bricks, and PTT was a snap. The push-pull output circuit is capable of AM or FM operation, and a small jumper was used to select the correct bias. The output circuit was capable of developing 60 watts. Because no fan or heatsink on the 8637 final amplifier was used, Amperex specifications stipulated a duty cycle of 1-minute transmit and 4-minutes off.



Underneath the HA-260 mobile amplifier.

Operation of the unit is straightforward. All that was needed was to connect a transceiver to the input, the antenna to the output, and connect a 12-volt power source. Tune up was equally simple; peak the three controls for maximum power output on the panel meter and

The HA-260 has a simple, clean front panel and easy to use tuning controls.

start talking! The compact size and easy hook up make this an almost modern linear.

- **Pros:** Compact, easy to connect, easy to tune, handles both AM and FM with internal adjustment, lightweight, and American made.
- **Cons:** Draws 14 amps in transmit, uses a delicate and hard to find 8637 RF output tube. HA-260 is somewhat difficult to find on the used market.
- **Specifications:** 120 watts PEP input power, 50 to 60 watts output, 12 volt operation, 1 amp standby, 14 amps transmit, 11" X 6" X 2.5" high, 3.5 pounds, 8637 push pull RF power amplifier and 12AL5 controller, two transistors.
- **Conclusion:** It is a neat, interesting historical item that matches the size of today's modern transceiver, but has a delicate RF tube. It works well with low power transmitters. The amp is somewhat expensive and not too common. *ER*

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A completely self contained VHF linear amplifier designed specifically for mobile use. Efficient RF amplification stage utilizes a special purpose mobile application Amperex DX296/8637 twin tetrode. RF sampling relay automatically switches linear in the instant the exciter is energized. No external switching, wiring, or muting circuits are necessary. Antenna is automatically connected directly to input socket in off or standby modes. Front panel controls permit full flexibility of tuning and power level selection. Illuminated relative RF power output meter simplifies linear and exciter tuning. Built in power supply features high efficiency transistor and toroid transformer circuitry. Oversized heat sinks assure cool operation. Supplied with manual, fused DC power cable, and mounting bracket. 12 Volt DC Negative Ground Only. Made in U.S.A. Shpg. wt., 3½ lbs.
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SPECIFICATIONS: Minimum RF Drive: 1 Watt. **Input Impedance:** 50 Ohms. **Output Impedance:** 50 Ohms. **Amplification Mode:** AM. **Controls:** Grid Tuning, Plate Tuning, Antenna Loading, Passive Grid Input. **Power Requirements:** 12 Volts DC (Negative Ground Only). **Power Consumption:** 12 Watts idling (1 Ampere at 12 Volts), 168 Watts at Full Input (14 Amperes at 12 Volts). **Size:** 11⅝"W x 8 7/16"D x 2⅝"H.

The HA-260 was featured in the 1967 Lafayette catalog.

A Wire Antenna Classic Revisited

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Background

In the early 1970s, when I was W2EGH in New Jersey, a single delta loop antenna was erected that was a full wavelength on 80 meters. Most delta loops at that time were equilateral triangles with the flat top high in the air and the apex at the bottom where it was fed with coax. My delta loop had the apex at the top where it was fed with 1/2-wavelength of 50-ohm coax. The flat-top was at the bottom, about 8 to 10 feet off the ground, and broken in the middle where a DPDT knife switch was inserted to allow either a series inductor, series variable capacitor, or nothing to be inserted. That innovation allowed the loop to be fine tuned from the ground. The loop also had parallel dipole legs cut for 80 meters to lower the impedance. The loop worked great on 4 bands: 160 meters (knife switch open), 80 meters (knife switch with series capacitor), 40 meters (knife switch with series inductor), and 20 meters (knife switch with inductor).

The loop antenna was written up for QST and appeared in the January 1973 issue. It was later included in Volume 1 of Wire Antenna Classics, published by the ARRL.

A Colorado Loop

During the winter and spring of 2006, the poor propagation conditions on 40 meters were frustrating. Based on the success achieved with the 1970's loop, I decided to utilize a tall cottonwood tree in the backyard to erect a smaller version of that loop. It was anticipated that a full-wave, 40-meter loop, following the convention in the preceding paragraph, would work just fine on 40 and 20 meters. Using the formula for a full wave loop (1005 / frequency in Megahertz), enough wire, RG-58A/U coaxial cable, connectors, insulators, and a 1:1 current (choke) balun were ordered from MFJ. The loop was erected in the time-honored method of using fishing line, a lead sinker and a slingshot with the help of a friend. **Figure 1** illustrates the dimensions of the loop.

A delta loop can have a feed-point impedance of anywhere from 100 to 200 ohms. Generally speaking, depending upon the geometry of the loop, we can assume it has 150 ohms.

A loop that collapses on itself becomes a folded dipole with a feed-point impedance of 300 ohms.

A quarter-wave series matching section composed of RG-59 cable was used on the presumption that the feed-point impedance would be about 150 ohms. This was born out when measurements were taken without the matching section that resulted in a SWR of 3:1 at resonance on 40 meters. With the matching section, the SWR at resonance on 40 was 1.5:1.

The formula for the impedance (Z) of the 1/4 wave section is:

Z = (square root of the impedance into the line) x (load impedance)
= square root of (50 x 150)
= square root of 7500
= 86.6 ohms.

The closest match to that value is 70-ohm cable or RG-59.

A 1/4-wavelength of RG-59 at 7.150 MHz is:

¼ wavelength = 246 x (velocity factor / frequency in MHz)
= 246 x (.66/7.15)
= 22.7 Ft.

Results

The cottonwood tree was not quite as tall as I had hoped it was. It was possible to get the apex up about 40 feet; however, the ends of the base wires had to be pulled out in order to keep the base wire about 6 feet off the ground. So, it was not a true equilateral triangle. No problem there. A standard 100-foot RG-58A/U cable with pre-installed connectors was used as the transmission line; however, a

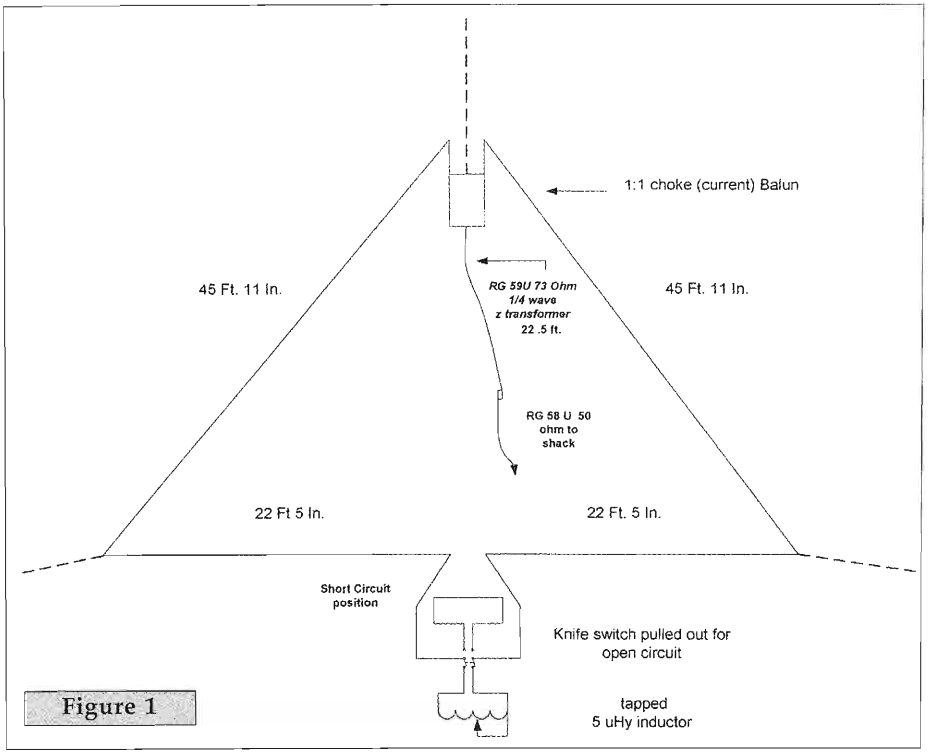


Figure 1

1/4 wave section of RG-59U (73 ohm) transmission line was inserted in series with the RG-58 at the choke balun to transform the high impedance of the triangle down to near 50 ohms. Measurements were taken at the end of the transmission line in the shack, using an Autek Model RF1 antenna analyzer.

Table 1 shows the results for 40 through 10 meters. The results were quite pleasing. It is to be noted that a T-tuner is used at the transmitter end to provide a pure 50-ohm load to parallel 813s, running about 800-watts PEP output.

It is important to use the series 1/4 wave matching section; otherwise the

TABLE 1

BAND	DPDT SWITCH	RESONANCE	Z (Xmtr end)	SWR
40	SHORT	7.190	57 Ohms	1.6:1
	INDUCTOR	7.150	49 "	1.5:1
20	SHORT	14.600	32	1.9:1
	INDUCTOR	14.300	32	1.8:1
15	SHORT	21.3	68	1.8:1
	INDUCTOR	21.2	85	1.9:1
10	SHORT	28.6	69	2:1
	INDUCTOR	28.24	40	2.6:1

mismatch to 50-ohm cable will result in a SWR in the 3:1 (or more) region on 40 meters (the main band of interest). The matching section becomes approximately a 1/2 wave section on 20 meters, which merely repeats the antenna feed-point impedance from one end to the other at the resonant frequency, see Table 1. The inductor is used to fine tune the antenna, and one setting of the inductor was used on all of the bands in Table 1.

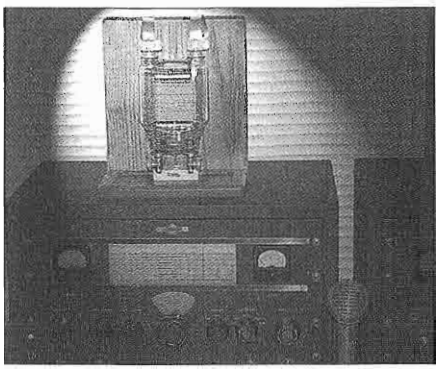
Operation

As expected, the antenna has about 2-dB gain and a fairly low angle of radiation. It is bidirectional and is oriented broadside NE-SW in central Colorado. During daylight hours on forty, with the current poor propagation, it provides optimum results for Minnesota, Illinois and Michigan to the east and northeast and Phoenix and Southern California to the southwest. During nighttime conditions, it favors the East Coast New England and Atlantic seaboard states and European DX.

When propagation conditions are short skip (a rarity so far during the spring and summer of 2006) the antenna works remarkably well, even at distances of 60 to 80 miles. One might consider adding 40-meter inverted-V elements in parallel with the top connector to add even better cloud warming short range capability.

ER

(Comments from page 21)



The 2006 Heavy Metal Rally Trophy (Collins transmitter not included!)

points total.

You can't win unless you're running a Heavy Metal rig—NO exceptions! This is Heavy Metal night! Everyone is welcome to participate with smaller rigs, but the winner needs to be using Heavy Metal.

Completed logs should be sent by email to Ray@ERmag.com or by US mail to the Electric Radio address printed inside the rear cover. Please have your point totals calculated when you send in your log, and be sure to mention the equipment used during the rally.

The winning top scorer this year will receive the Heavy Metal trophy, a donation from Gary Halverson (K6GLH). The Electric Radio 2006 Heavy Metal Rally trophy is a handsome oak plaque with a cosmetically perfect RCA 833A mounted with a porcelain E.F. Johnson 833 filament mount, while matching heat-dissipating plate terminal leads secure the top. This exquisite piece was custom made by the late Vern Dawson, K6RRC. An engraved plate with name and call sign will be affixed to plaque to complete this beautiful addition to the lucky winner's ham shack.

Photos

Everyone mentions how much they like the ER Photo column. Please continue sending me your photos of your shacks and ham activities so that I can keep the column running on a regular basis! Right now I am very low on photos.

Department of Corrections

The N6PY R-390A product detector circuit in ER 208, last month, had a minor error. The correct relay P/N is Mouser 653-G6A-274P-DC48. This is a 5-mA relay. The article's 8-mA relay can be used, but R2C should then be 22k, 1 watt. Also, R2C can be a 2-watt resistor and R2B can be 1 watt. Bill had 5-watt resistors in stock and used them.

73, Ray, NØDMS

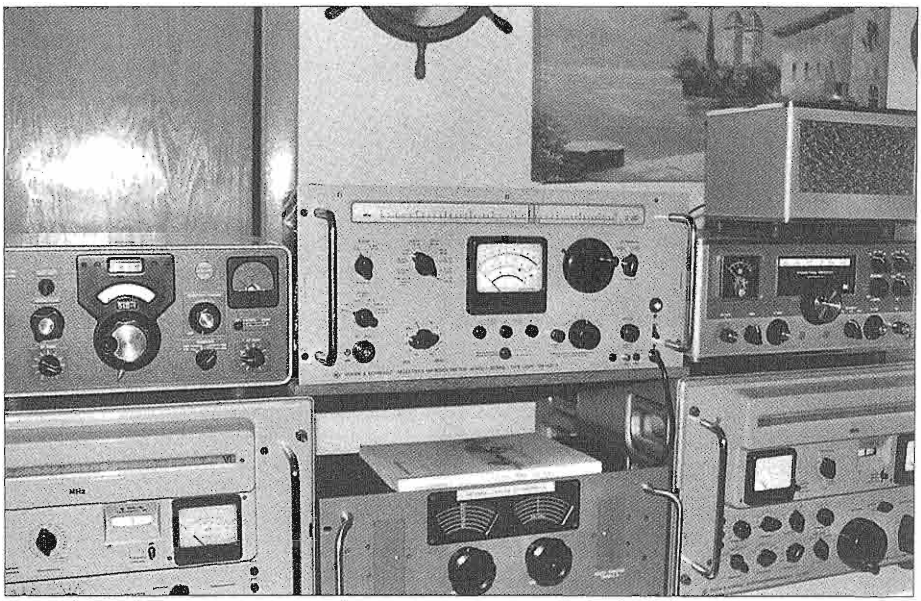
Rohde & Schwarz USVH Receiver

By Harry A. Weber
4845 West 107th. St.
Oak Lawn, Il 60453

For some time now I have been contemplating the fact of what to do with my old Rohde & Schwarz USVH frequency-selective microvoltmeter. This product of West German engineering was primarily manufactured for the telco-telcom industry for servicing wireline or microwave telecommunications networks, in areas of multi-carrier channel analysis or as a spectrum analyzer, looking for those elusive baseband carriers. Similar sets like the USVH have also been manufactured stateside by such notables as good old Hewlett Packard, Sierra, Rycom, or Cushman; only to be replaced by more "siliconized" versions, and finally to be run down on the digital highway.

Considering my attachment to Rohde & Schwarz equipment, I just could not part with this lovely piece of test equipment. That precision tuning dial, those velvety smooth knobs, chrome handles, that bilingual DIN rack. Nostalgia aside, lets look inside the RSVH and see what makes this set a keeper.

Basic operation starts with the six-band frequency selector switch allowing it to go from 10 kHz to 30 MHz. Frequency selective tuning is then accomplished with a very smooth 22-turn dial mechanism coupled directly to the set's only variable capacitor for the VFO. The receive frequency is displayed on a 15-inch wide slide rule dial that has an anti-parallax cursor. Input impedance options are selectable at 50, 60, 75, 600 and 100k ohms; with an input sensitivity of less than 1 microvolt at –120 dB to –40 dB, selected via a decade switch calibrated in



The author's receiving station showing the Rohde & Schwarz USVH frequency selective microvoltmeter in the top center, now in use as a sensitive receiver.

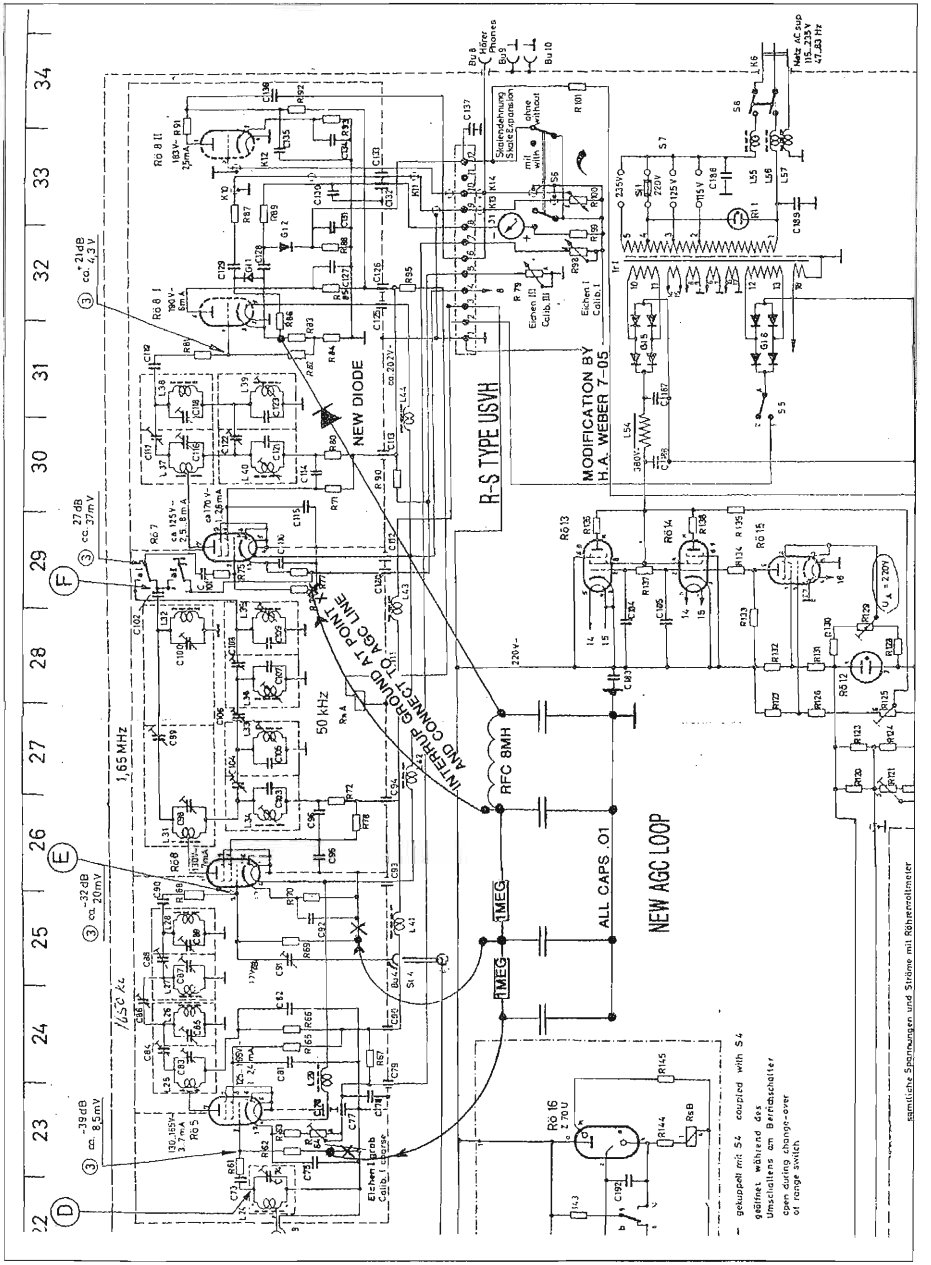


Figure 1: Schematic for the Rohde & Schwarz USVH frequency selective microvoltmeter that shows the additional components for the newly incorporated AGC loop. See the text for additional information.

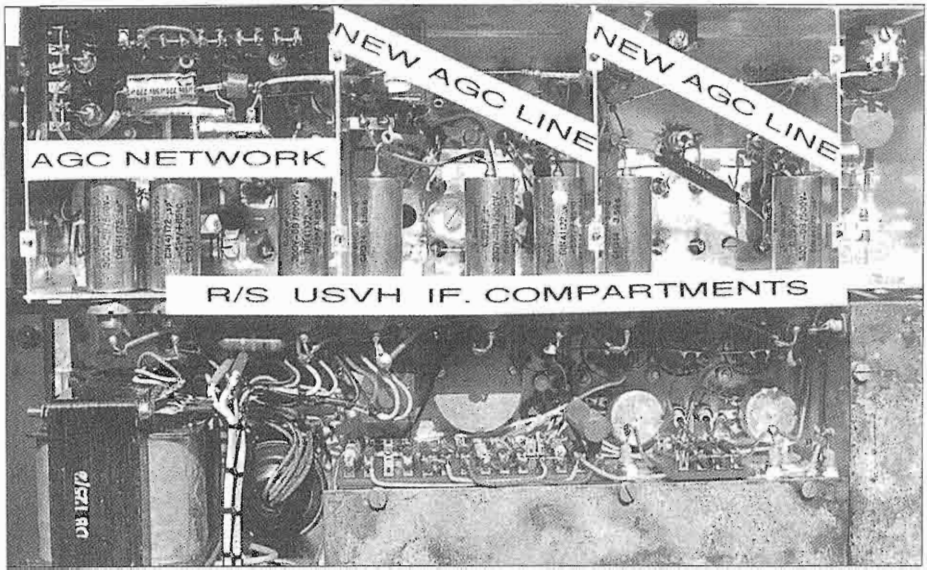


Figure 2: The 1.65 MHz IF compartment of the Rohde & Schwarz instrument and locations of the added components.

a step ratio of 10 dB. Based upon a superheterodyne platform, the set's selectivity is defined by a triple-conversion circuit, having intermediate frequencies of 40 MHz, 1650 kHz, and 50 kHz, with IF passband options of 5 kHz or 500 Hz. Once a signal of interest has been acquired, its amplitude can be accurately measured on a rather large meter, calibrated in microvolts, while at the same time monitored with headphones from the AM detector portion of the meter circuit, see **Figure 1**.

In conclusion, what we have here is an AM receiver with excellent sensitivity, and two IF bandwidths. There is only one slight drawback, no AGC (AVC) circuit. As a frequency-selective voltmeter, this feature would have never been incorporated anyway for fear of distorting the precise readings that are required. In order for us to turn this set into a contemporary receiver, all that was needed was to add an AGC control network, thus going from a mere voltmeter to a world-class, all-band receiver.

By paying close attention to the schematic in Figure 1 and its drawn-in modifications, it should be readily apparent that by incorporating another signal diode to generate negative bias-control voltage, an RF choke with several bypass capacitors and some resistors, the modification will complete our simple AGC (AVC) control loop; thus allowing for full-gain reception without the usual pesky fluctuations as experienced in the past. At this time, no point was made in complicating the process by adding such luxuries as multiple AGC time constants or CW and SSB capabilities.

The overall response of this conversion has been most gratifying, considering the investment of less than five dollars in parts, has turned this "Boot Anker" in to a full fledged AM and shortwave receiver; it may not compete with my two EK-07Ds but their lineages are still the same. Now complete, this USVH selektives mikrovoltmeter has entered a new chapter in the world of Electric Radio; providing this listener with many more decades of listening pleasure to come!

ER

Radios Anonymous and the PRC-1

By James JeRB Buchanan, K8WPI
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oldbugger@earthlinknet

"Hello, my name is JeRB, and I am a radio junkie. I was first introduced to radio at the age of five when, my own father gave me a crystal set, then an electric motor kit which included stiff wire and pointed nails, then a space helmet radio. I was hooked. Fifty-four years later, I still need a regular "fix."

By now, I am an old-bugger, not to mention an old bugger radio junkie. The mystery of radio has never faded, and the more I learn, the more appreciation I have. Today's kids just don't get it. They have no imagination, they see no mystery, and they think everything but the latest X Box is blasé. I, on the other hand, am continually impressed with the ability of radio, and its inabilities. I am not just talking about the nuts and bolts of radio, the resistors and inductors; no, radio has changed our lives. Before radio, but still in the 20Th century, the other side of the world was a month away. Presidents and Monarchs died and were buried before the rest of the world knew they were ill, or unpopular. Cries for help couldn't be heard.

As a kid of the 1950s and '60s, *American Graffiti* was not a movie, but a way of life. Cruising the local drive-in with a Bandspanner on the back of my Poncho and a HF rig under the dash, I met the redhead who forty-something years later is still my wife. We would listen to WABC, WBZ, KYW, WOWO, and of course, Wolfman Jack on the border blasters. I not only spent time listening to radios, working on them, building them, but also enjoying the history of radio and its implications upon civilization, past, present and no doubt, future.

There are too many milestones in the archives of radio to even think of compiling a list of the most significant. I just take whatever comes along. I still listen to Prairie Home Companion, but have given up attending live performances; the mental images I see are so much better than the actors on stage reading scripts. I've enjoyed movies and television documentaries, which try to explain radio and its importance. Developments in code breaking as depicted in *A Beautiful Mind*, and in numerous PBS specials have caused me to wonder. A book titled *Listening In*[1], which details radio's place in society, reinforces some of my thoughts. *Border Radio*[2], detailing the history of early broadcasting in the U.S. and the exiled profiteers who began camping on the other side of the border, speaks volumes to business practices and ethics, not to mention bold imaginations. My friend, Eli Segal, passes audio tapes to me made from original transcriptions from the 1930s to the 1950s. I am not so fond of the "entertainment programs" as I am the state of the art, the longevity and history of some stations, the business practices and the norms of society at various points in time. *Two O'clock Eastern Wartime* is a compelling murder-mystery and anguishing love story with set in the environment of a large radio station, which in reality could be nothing other than WLW. Last year, my friend David Watt (WA8TT/1) sent me *The Secret Wireless War: The Story Of MI-6 Communications, 1939-1945*. Having always considered myself a bright, fairly well-educated and well-read boy, I was blown away by how little I knew of the

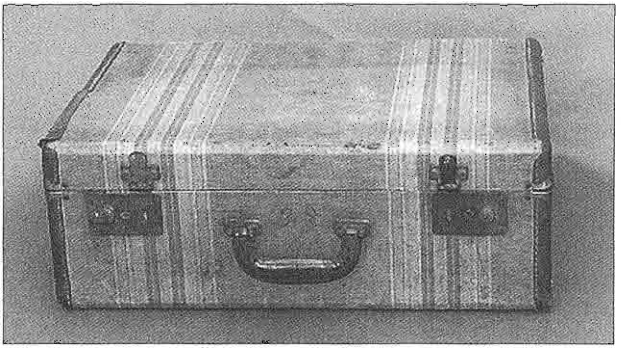
truth of spying. Learning of the despicable living conditions which the handpicked communications officers had to endure, was a real shocker. On the other hand, the cloak and dagger aspects in such locales as Morocco and Cairo did bring images of something from a movie to my mind. The selected British hams who were allowed to keep and use their receivers as "Volunteer Listeners," copying code groups in Morse code and advancing their copy sheets to a drop box for official agency use, also conjured up idyllic images. Just knowing that if you were a ham, your knowledge of Morse code would automatically place you in an elite group for picking over by the intelligence division, can't help but inspire the legends of radio. I don't mean to glorify even the concept of war which, along with religion, I believe is best addressed by Mark Twain in his *War Prayer*, but if one has to be dragged into such a situation....

I shared this, as I do other books, with my "home boys" including Chuck Agosti, WD8AXA. After reading, Chuck said it was very interesting, and mentioned he owned the U.S. version of the legendary Mark III British suitcase spy-set, and asked if I'd take a look at his first issue suitcase U.S. spy radio, which eventually became known as the PRC-1. Would I? Would I?

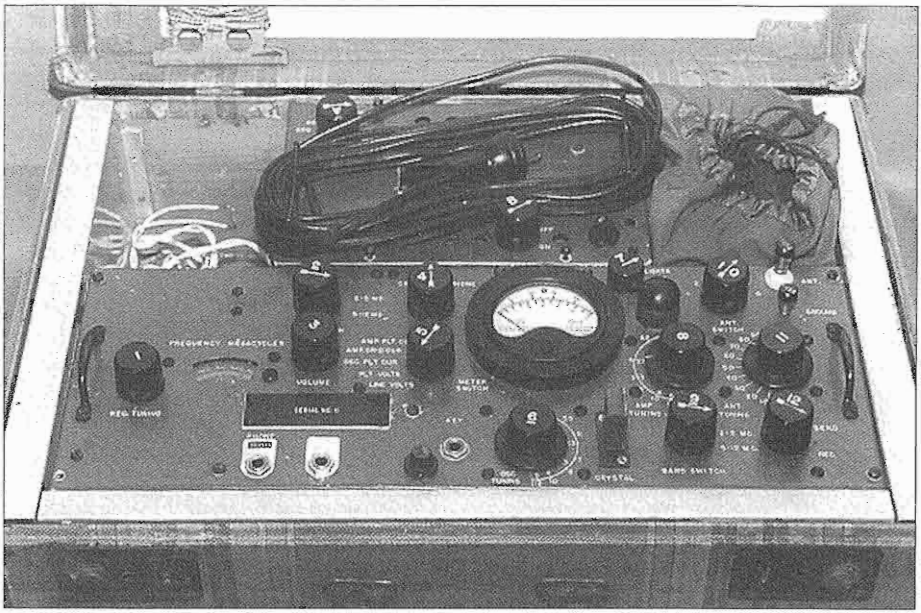
Chuck's specimen PRC-1 is serial number 38 for the case and power supply, accompanied with RF chassis serial number 8. From the outside, it is a classic suitcase of the 1940s. Absolutely nothing offers a hint it is anything else. Upon close examination of the interior construction, it was only with great effort, expense, and complication that the radio set was accommodated by a case bearing no clues from the outside. In addition to the RF chassis, a power supply is included, and there are two storage compartments with very nice drawstring bags, which hold a windup antenna, key, and spare parts. The power supply connects to the RF deck via a Jones 12-pin connector on a very short cord. Although it is as long as will fit inside the radio, an extension cable is required for any sort of active servicing.

The little rig, which must be AC powered, is switch-selectable between 115 and 250 volts. Frequency range of the tunable receiver is 2 to 12 MHz. The transmitter is crystal controlled with one crystal socket on the face of the radio. A "radio for dummies," each knob is engraved with a number indicating the order in which it should be tweaked to get the set to perk. The rig operates CW with an output of about 50 watts and is made to connect to an end-fed wire antenna.

Removing the two chassis from the case offers the first clues to the radio's purpose. The mechanical construction, in general, is robust. To complement this, only the finest components available at the time were used; all resistors are sealed ceramic, and all RF capacitors are mica, typically bolted in place. The radio was constructed from the inside out; servicing was not intended. For sure, the life expectancy of such radios was short. All tubes are anchored with keepers and captive hardware is used in abundance. All wiring is



This nondescript suitcase would never draw attention, or give a clue of what is inside.

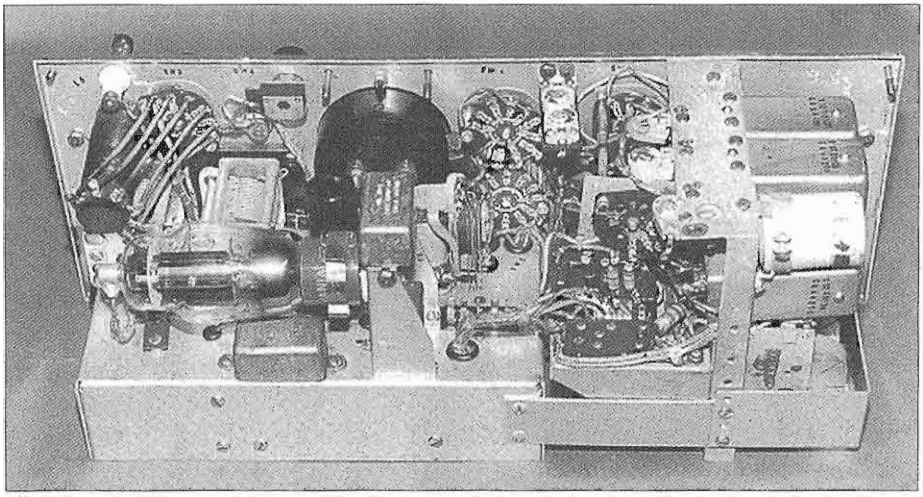


Looking inside the case shows the transmitter/receiver, with power supply centered above, to put the weight of the supply on the bottom of the case in normal carrying or storage position. The removed draw string bag area in upper left gives a hint of how the framework was secured from within the case, leaving no outside clues. I believe the engraving on the "A" knob, which is the voltage selector on the power supply shows the rig was expected to be powered by 220-250V, as only those positions offer the lettering to be right side up. The spare tube caddy, upper right, has a balsa wood framework padded with wool felt. All six spares fit in protected full-length cutouts. Less tubes, this caddy weighs less than 2 ounces! An errant hole was added to the front panel before acquisition. A second headphone jack has been added with the legend plate still not engraved to match the original on its left.

very short, and components are huddled together to defer impact shock.

The circuits are as simple and direct as possible, with every conceivable shortcut taken to reduce the number of parts, therefore reducing size, weight, and the opportunity for failure. Considering the primitive nature of this radio, it had some advanced engineering and components buried within. Knowing the rig would never see a good antenna, the output network on the transmitter is elegantly elaborate. On the other hand, the meter has an AC position, which merely places the meter across the AC line through a rectifier and multiplier, measures Ep from a high side multiplier, the oscillator tuning is indicated by a shunt with the meter in the plate lead, and if it could get any better, the Ip position places the entire meter at high B+, 800 volts, across a shunt in the plate circuit.

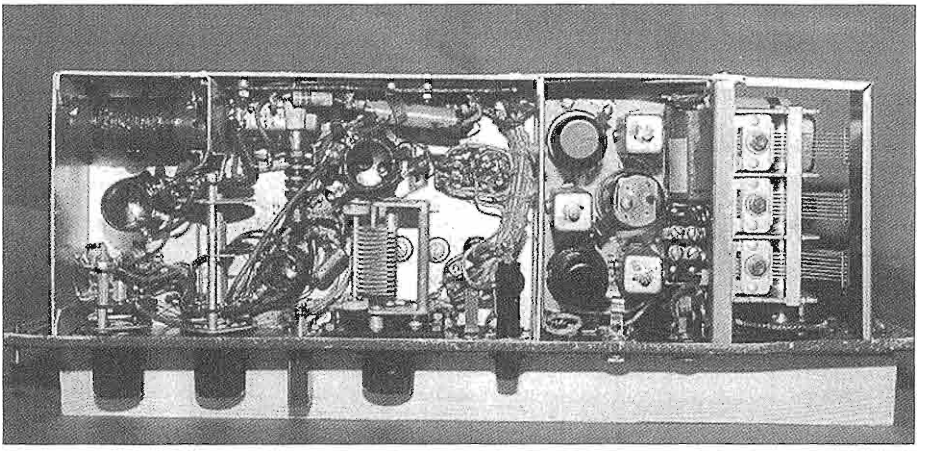
The simple transmitter uses two tubes, an oscillator feeding the PA, an 807. Tuning of the transmitter may make sense to a trained spy, who was instructed on this particular radio, but for a guy who's idea of spying is voyeurism but has 46 years of radios behind him, it was a bit odd. The oscillator tank is a parallel network, and metering is in the plate lead. For those of us who have peaked



In this top view, the transmitter is on the left, with the 807 a dead giveaway, and the oscillator tube just behind. The antenna coupling network is continued on the bottom side. The receiver occupies the right side, with the Langevin audio output transformer in the round can. Langevin was a very high-end audio manufacturer, and I personally have not seen their components in "military" gear before. The "makeshift" lower support around the receiver to the front panel partially suggests service repair to this rig. In total, and as seen in the next photo, it is a bit sophisticated for a "homebrew" repair, but certainly not proper for the rest of the radio.

oscillators for decades, tuning for a dip took a minute to figure out! Yes, this is much more simple. The receiver has its own two-range band switch, probably not for operating split, but for simplicity, and is a bit more complicated. Five tubes run the gamut from RF amplifier to audio amplifier, with internal jumper selectable low or high-impedance headphone output. Of course, there is an AF gain control, but in reality, it is an RF gain—think about it. Unfortunately, without a volume control the side tone is a bit loud. The side tone is generated by turning the audio stage into an oscillator which is keyed with the transmit relay. I can't help but think there were times when this caused a problem; you can't keep the headphones on while transmitting without going deaf. On the other hand, there is mechanical dial calibration so if you have an external signal of known frequency, you can adjust the dial. Once zeroed, it is exceptionally accurate over the entire tuning range. I find the receiver dial illumination inadequate even in total darkness, while the front panel illumination seems to be typical for the era, and purpose.

The receiver seems moderate in performance, even by my interpretation of the standards of WWII vintage gear. I assume this is because of the uniqueness of the purpose of the rig. With weak BFO injection, only a minute's looking at the schematic shows injection is by mutual coupling between two tube sections in the same envelope. A "gimmick" coupling capacitor was added across the tube socket and it performs much better. Although I was enamored with the spectacular performance of the HRO-M well before reading of its legacy, and have restored SX-28s to what I am sure was their original performance, this little rig is a bit primitive. Well, it is only five



Here is the bottom view. Transmitter output circuitry is on the left, oscillator tuning in the center, and the receiver again on the right. You've seen both top and bottom, and only three of the five receiver tubes! Look at the previously mentioned receiver-to-front panel bracket and the wave in the upper rear chassis wall. Ouch!

tubes. I would grant there is a possibility that the mechanical problems encountered in this receiver may be unique, as evidence suggests this rig took one heck of a fall or tumble at some time. I'd bet it was during its service life.

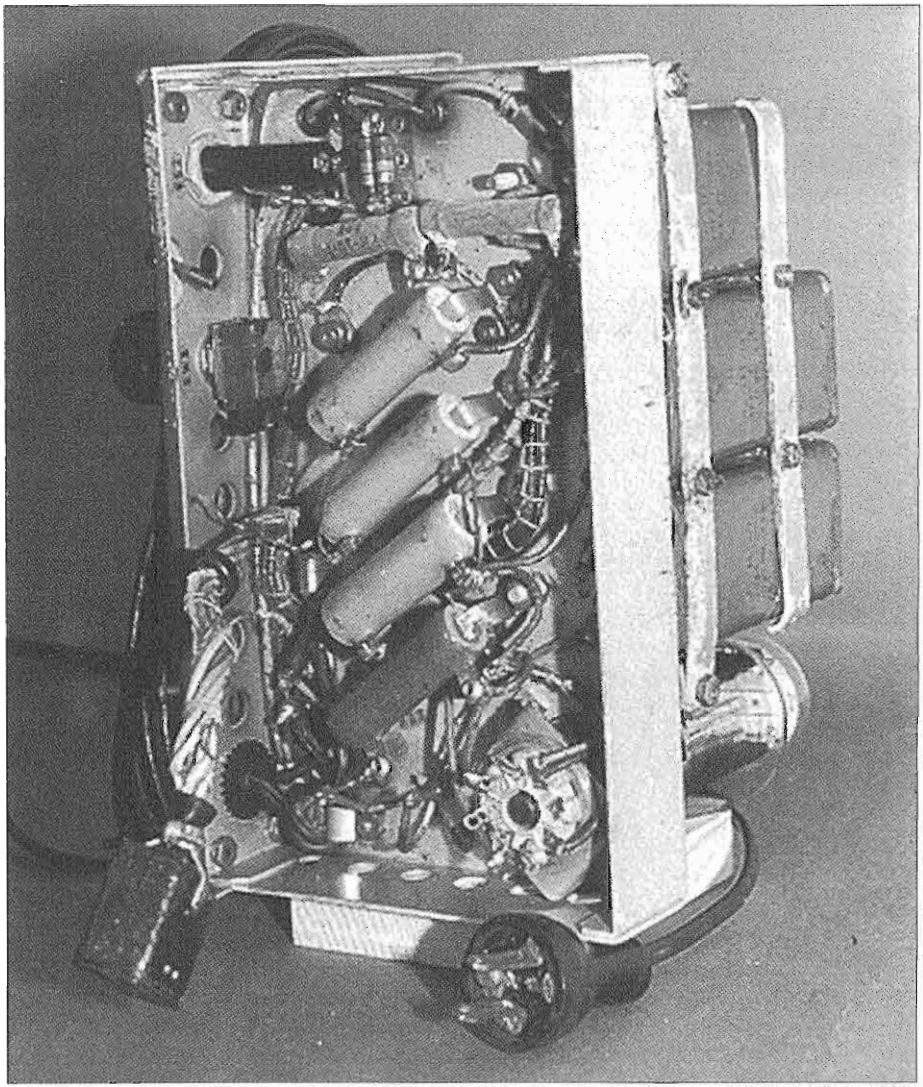
Although this rig did not work when it arrived, repair was quite simple, thanks to the absolutely delightful schematic on the inner case cover, which also includes very specific part identification information. It is interesting to note, the schematic is identified as "Schematic Drawing of Radio Set." The centering on the page would indicate something such as a model number were to follow "set," but perhaps at the last minute it was pulled from the printing press. Also, the draftsman box, upon close examination with a magnifying glass, is nothing but hen scratches; there are no real characters or numerals.

After replacing two meter shunts, one screen dropping resistor, and one trimmer capacitor, the rig was on the air. Fortunately, all failed components were nearly accessible. As mentioned, getting to RF parts requires completely dismantling various sections, and all parts between you and where you are headed would be destroyed and need replacement.

All-in-all, the PRC-1 is a very enjoyable little rig; however, without knowledge of the purpose of the rig, its significance in history and how it no doubt set the course of history, it can't be fully appreciated.

On-air operation is a hoot! With crystals I have available, the rig has been on 40 and 30 meters. The receiver is not very hot on 10 MHz, but performs better on lower frequencies. The transmitter keying is clean, and if the oscillator is properly tuned, there is no noticeable chirp. The relays in the rig accurately follow with a bug in the 30-WPM range. You know, I think adding two transistors would turn this rig into full QSK!

Any such radio is scarce, with the U.S. PRC-1 only behind the British MK-III, it seems. There appear to be at least three known PRC-1s in the hands of the general public, while remaining MK-IIIs seem to be in the possession of only museums.



The power supply has been removed form the suitcase. Yup, that's a 5R4 along side the three oil filled filters. One 800-volt supply divided down to each needed voltage. The new screen resistor shows its lack of service life.

Footnotes:

1. Susan J. Douglas, Listening In, Random House, ISBN 0-8129-2546-7

2. Gene Fowler & Bill Crawford. Border Radio, University of Texas Press, ISBN 0-292-72535-3

3. John Dunning "Two O'clock, Eastern War Time", Scribner, ISBN 0-7432-0195-7

4. Geoffrey Pidgeon, The Secret Wireless War, The Story of MI6 Communications 1939-1945, UPSO Limited (UK), ISBN 1-84675-252-2, ARRL, the current sole importer and seller.

ER

The AM Broadcast Transmitter Log

Part 15, Finale, The Western Electric 451-1A and 23A

By David Kuraner, K2DK
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Last month we discussed several of the 1/4-kW transmitters which have been converted to amateur use. This month we continue with two more Western Electric transmitters, which have been placed on the ham bands. As you will see, they are most unique.

We continue with an interesting but obsolete AM modulation method found in 1940s' equipment and some more tips regarding audio and conversions.

The Western Electric 451A-1

Here is the possible winner in the pre-WWII transmitter beauty contest. Its art-deco design is enhanced by the tube line up as viewed through the beautiful etched glass front door. I have been in contact with several hams owning this model transmitter with plans of converting them. John Staples (W6BM) and Sam Thompson (W6HDU) described a WE451A-1 in ER #64, August 1994, along with several others of that era. This model was manufactured between 1939 and 1948. It weighs one-half ton and is 76 inches tall.

Western Electric employed many proprietary tubes in their equipment designs. They were similar or identical to other manufacture's bottles. Perhaps they were avoiding licensing issues or forcing the owners to buy replacements only from Western Electric. The oscillator is a type 702A, working into an untuned 247A stage. The next stage is a tuned 350B. The 350B is purported to be a slightly heavier duty 6L6. The driver is a type 312A. None of these numbers can be found in amateur handbooks of this era.

The final employs six bottles, type 242Cs. The 242C has a plate dissipation of 100 watts. These six are configured three and three, in parallel-push-pull. The final RF stage is grid modulated by parallel 350As feeding the audio to the RF grids. Even with the inefficiency of grid modulation, the 600-watt combined plate dissipation is very conservative.

The audio section employs RF feedback which is something alien to most

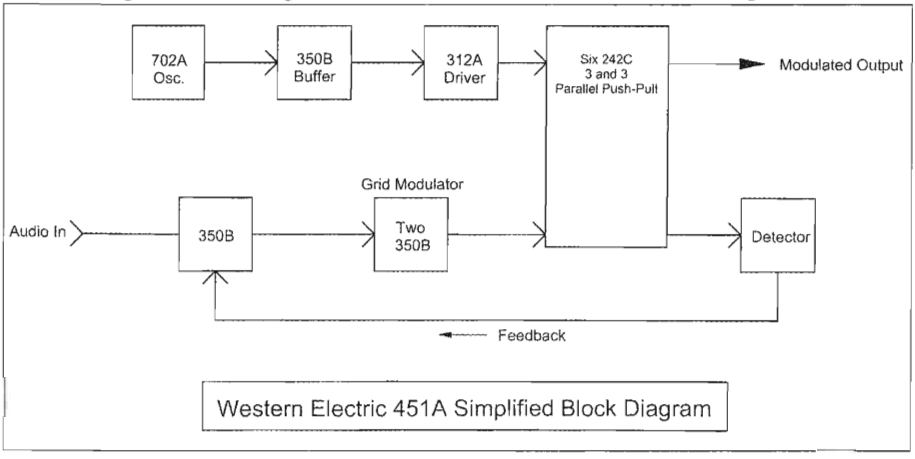
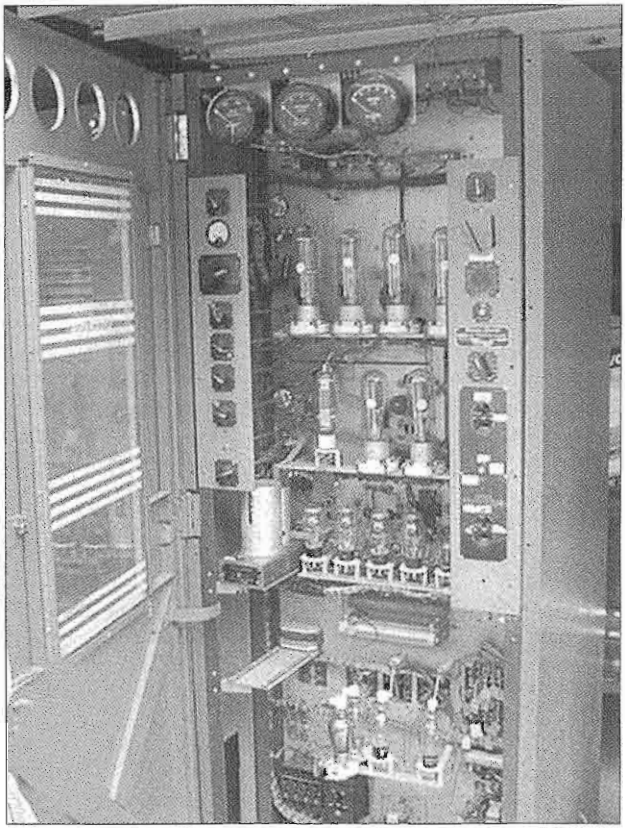


Figure 1: Rectified RF audio feedback was common practice in broadcast transmitting equipment during the 1930s and 1940s.

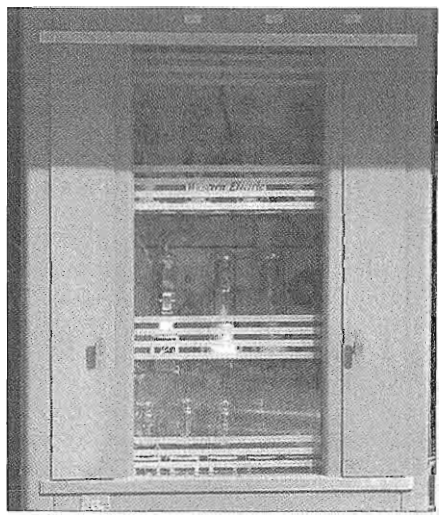


The classic Western Electric 451A-1 is shown above and below right. The lucky new owner of the transmitter is Joe, N3IBX.

amateurs and many experienced broadcast engineers. It was common in the 1930s and '40s. A portion of the modulated RF is rectified and then used for audio degenerative feedback. The amount of feedback is easily determined by simply removing the rectifier, noting the amount of audio power (in dBm) needed for 100% modulation. Then, replace the rectifier and again note the amount of audio power for 100% modulation. The difference is the negative feedback of the system. This method, of course, can be used with other degenerative feedback systems to determine feedback. But, this system makes disabling the feedback loop so much easier, see **Figure 1**.

Two models of this transmitter were available, the 450A-1 as a 100-watt unit and the 451A-1 at 250 watts. The transmitters had an optional power reduction kit. One of the reasons for the power reduction feature may have been the fact that both transmitters were also employed for services other than broadcasting. The fact that the normal frequency range was 540 through 2750 kHz makes these models a snap to convert to 160 meters. During its production, these frequencies were used for police dispatching (one way broadcasts to mobiles) and in the maritime service.

During tuning, the operator is cautioned to ensure that none of the tuned circuits are set to a harmonic frequency because of the extended tuning range. Preliminary settings for coils and capacitors are given in the manual for the entire frequency range.



The manual advises to disable the audio feedback during major tuning adjustments and then to check and adjust the tuning as needed for 100% modulation.

Typical parameters for the Western Electric units are 1250 volts for the plate and 230 or 570 mA for 100 and 250 watts output, respectively. If the 451A-1 is reduced to 100 watts, the plate voltage is reduced to 800 volts at 360 mA.

This is the one you want to see in an ER centerfold pin-up!

The Unique Modulation Scheme of the WE 23A

Another of the Western Electric transmitters originally described by John and Sam in ER #64 is the WE 23A. This model is the only broadcast rig I am aware of in amateur hands using low-level modulation and linear amplifier stages. There may well have been others produced as prototypes or even production runs. This is the only one I can document. It was manufactured between 1936 and 1939, having apparently been replaced by the WE451A-1. Perhaps there was a reason for its short run.

Tube type 837A, specifically designed for the purpose, is suppressor-grid modulated. Suppressor grid modulation is rarely ever used and results in 1/4 of the output carrier, compared to 50% CW efficiency. The modulated stage is fed to the 243C driver and then to the final. The final is the same 243C, parallel-push-pull configuration, employing RF feedback as do the other transmitters.

This scheme of low-level modulation followed with linear amplifier stages may be of some practical purpose should your 1 kW suffer the fate of fried mod iron. While previously we discussed PDM or series-cathode modulation as a "fix," turning the RF stage into a linear while grid or plate modulating the driver, or feeding the final from an external exciter are other options.

On the subject of linear amplifiers in AM broadcast service, there was another modulation scheme which also used them, but in a very different way. Continental models 317 (50 kW) and 315/316 (5 kW) are examples of broadcast transmitters which used the Doherty modulation system. Two RF tubes were used. One was for the carrier, running Class C, and one for the positive modulation, running as a linear and adding to the carrier power. For negative modulation, the RF carrier tube was biased up to cut-off for 100% negative peaks. The Doherty system claimed better overall efficiency. Like the RCA Ampliphase system mentioned in Part 10, Electric Radio #204, it never really caught on. Apparently, few were produced and faded from the scene, most likely for the same reason that the RCA system did. It had to be very difficult to keep the two RF stages adjusted for proper operation.

As a footnote to FCC licensing, I remember having to learn and describe the Doherty system for the First Class Radiotelephone License back in the sixties. It was just antiquated theory as few if any stations were using the Doherty system by then.

A Few Final Thoughts

Before signing off, I must discuss a few more items which may well save you time, trouble, and money. The first is about the Internet source of audio processing software which emulates the Optimod multi-band device. It's used with a computer and its sound card. It comes on a CD with 50 pre-settings and is available with shipping for seven dollars. That's 7 bucks! I did say that new processors are relatively inexpensive? Just do an eBay search. Here is another toy in that never ending quest for broadcast audio quality perfection.

An update to the N2BC 160-10 meter broadcast conversion: The new owner is Phil, N2BEE. He intends to repackage it again in another cabinet with his own modifications. It would seem, by the third iteration of this rig, it would have evolved into a new species.

I must remind everyone about those teething pains focusing on your antenna system. A wind storm forced me to com-

pletely redo the antenna system in mid January. As luck would have it, the 160 meter "L" inadvertently touched the inverted "V" element feed by the coax outer shield. It was at the apex and unseen. At the 100-watt level, there was no problem. At the higher power level, it arced over, shorting the "L" element. I chased that one for two days thinking the laws of physics had been repealed!

Going back again to the Bauer and more teething pains: Only this one confirms my design changes which would eliminate the detuning problems of the driver stage. If you recall, the driver is a 6CA7 audio output tube. It works for AM broadcast frequencies, but when moved up to the lower portion of HF, the tuning changes as the tube heats. I often thought that a more appropriate bottle would be the 6146 since it was specifically designed for RF service at HF and above.

Thanks to Paul Wende (VE7KHZ), I learned that Bauer produced a shortwave version of the Bauer 707. You get no prize for guessing what changes were made for the shortwave version. So, armed with this knowledge, you should investigate if there was an HF version of the transmitter you are converting. Then, make the changes as necessary. Or, consider your own changes. Surely, if the BC version of this Bauer is to employ the driver stage on 40 meters, the tube would have to be changed to the 6146.

As the 21st Century continues, more obsolete equipment will become available. Terrestrial broadcasting, as we know it from the last century, is radically changing and could even become extinct within the next twenty to thirty years. Many broadcasters are closing unprofitable stations and letting them go dark. And, many listeners are tuning out because of endless commercials and boring repetitive programming material. Subscription satellite aural broadcasting seems to be the wave of the future. So, more equipment will be there just for the taking and could even include today's modern solid-state devices.

Let us do our best to preserve this heritage for future generations to understand. We hams are the ones with the vintage equipment and are operating de facto museums. We are enjoying the equipment that would have been unimaginable to obtain in our youth while preserving these historic devices for posterity. Those of us who understand vacuum tube technology are in the unique position to become curators as we enjoy this aspect of ham radio. Keep those historic light houses burning and those filaments lit!

Like the Star Trek "Next Generation" series title of its last show, "All Good Things...," this series must come to an end. It has been my pleasure and privilege to collect and present this information. I give my sincere thanks to the many hams who contributed. It has been a rewarding, learning experience for all involved.

What sparked this series was a suggestion by our editor, Ray Osterwald. He mentioned that readers were continually asking about broadcast transmitter information. As readers know, I started the series with what immediate information I had at hand. As more people supplied information, it was presented as it was received. Also as topics and issues were raised, they were researched and presented. ER readers now have the information necessary to both, do the BC conversions, and bring many vintage Ham rigs up to broadcast audio quality.

Future plans call for an anthology that will put this information in one source rather than scattered throughout well over a year's worth of ER issues. We hope to present more detail, pictures, and information on both broadcast and ham equipment modifications. Space limitations in Electric Radio have prevented many great photos and illustrations from being included.

May the Force—of the AM Broadcast Transmitter—be with you!

73 Dave, K2DK

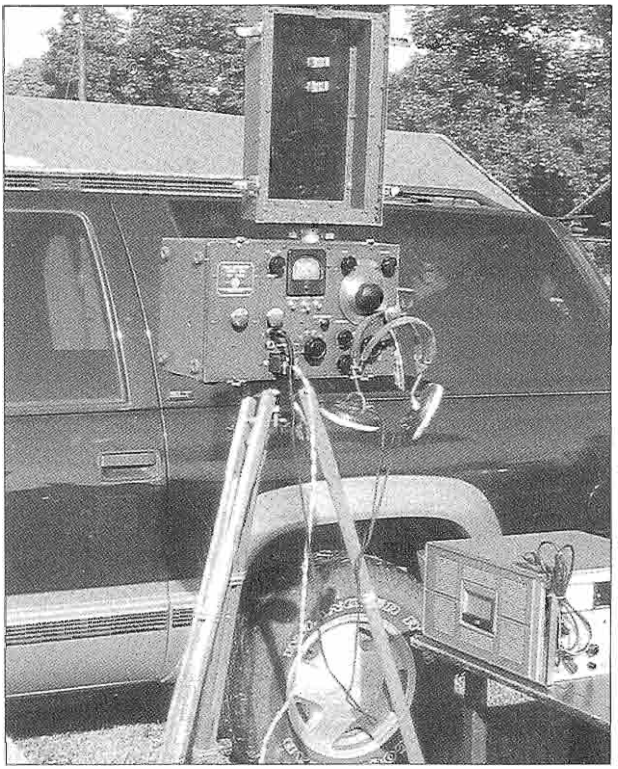
ER

PHOTOS

Stan Bryn (AC5TW) is shown here onboard the USS Alabama. Stan has finished the radio room restoration on his ship and attended the annual crewmembers meeting of the USS Alabama in April 2006. Stan says, "...I installed ten receivers, five RBBs and five RBCs, a couple of days before the annual reunion. All were fully functional and would meet original Navy specifications; needless to say I felt very good seeing most of Radio Central back in working order. I still need to install three more radios to make the current Radio Central fully functional, and will do that later in the summer [2006]. When I started this project I had just two of the RB series to work with and they were junkers at that. Mostly through the ad that ran in Electric Radio, I have been able to obtain all that is needed to finish the restoration of Radio Central aboard the Alabama. In addition, I now have enough extra equipment to trade off to other memorial ships, one fully functional unit for one of their non-functional unit. As a result, the battleship USS North Carolina now has six of the RB series receivers aboard that are fully functional. I am finishing off four more of the RB series for them that I will deliver later this year. Also, I will likely start doing the same for the battleship USS Massachusetts later this summer. Along with the battleships I will likely start some restoration on the USS Stewart, a Destroyer Escort, (Galveston, TX) of WWII era early next

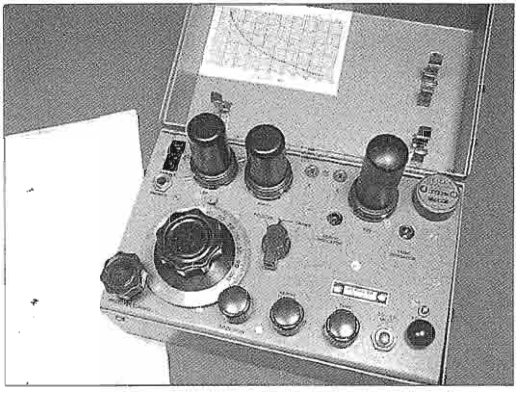
year. Seems there is no end of the Navy Memorial Ships that need this kind of service. I visited the USS Lexington, a carrier of WWII fame in Corpus Christi, TX, and found that they do not have one piece of WWII radio equipment aboard. They would like very much to set up a hanger deck display of typical equipment that was aboard during WWII...I can't ever thank you [ER] enough for your contributions to the effort. "

[I would personally like to thank everyone who helped Stan make this project a reality. It would not have been possible without your support!–NØDMS]

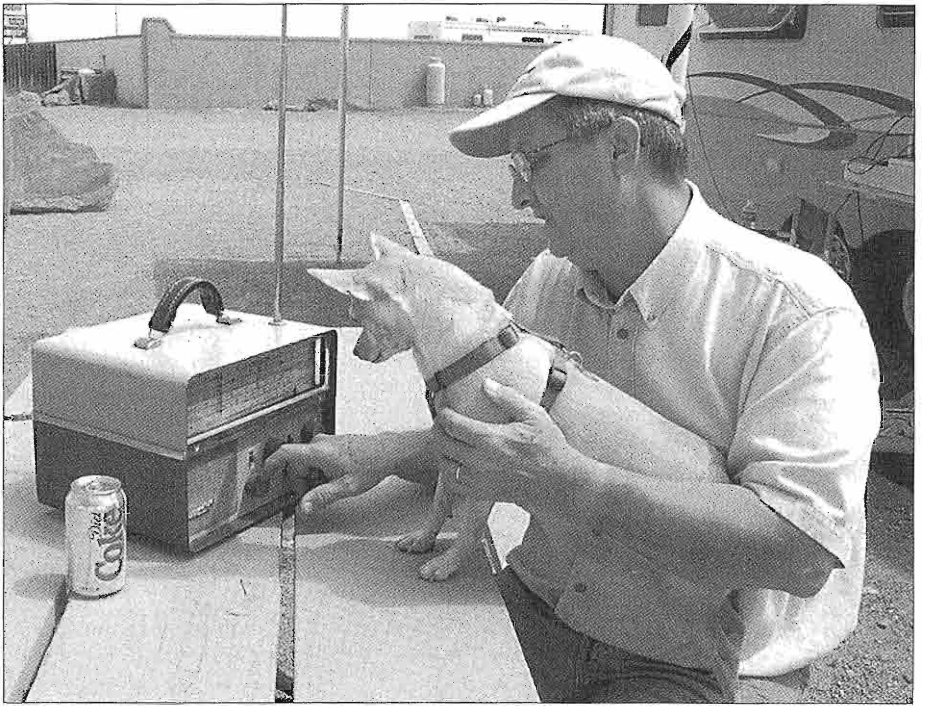


Center left: Name That Boatanchor! This photo was sent in by Mike Shaw (K2LRE), who found this interesting piece of equipment at the Sussex Hamfest in New Jersey this summer.

The answer is that it's a Federal 101-C Field Intensity Meter, made by the Federal Telegraph Company of Newark, NJ. Unusual pieces of test equipment such as this one are becoming more rare all the time.



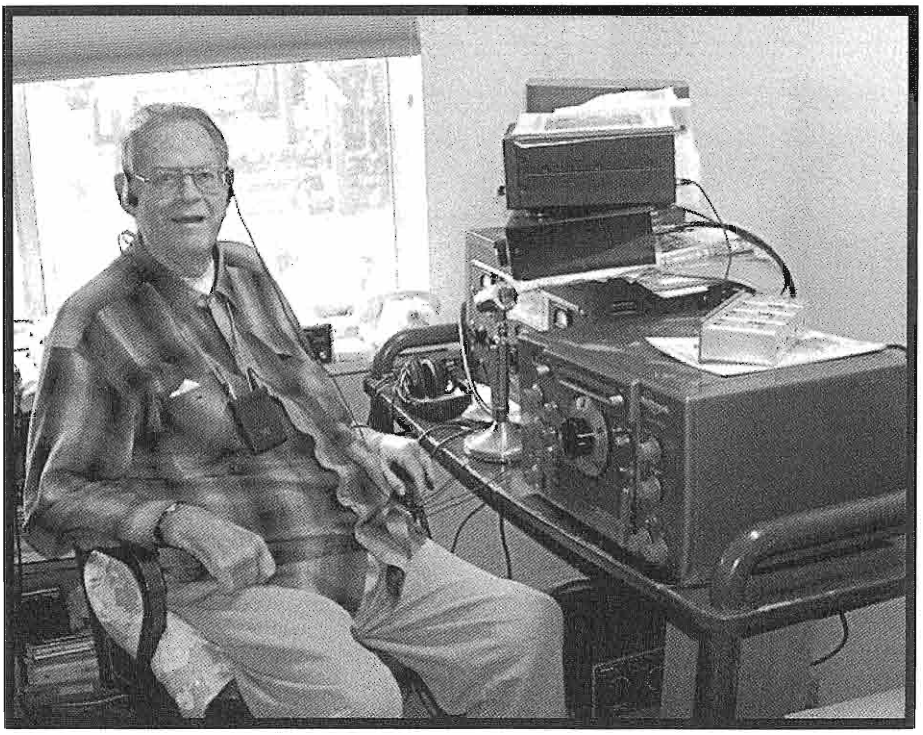
Lower left: Jerry Fuller (W6JRY) is a master radio builder who sent in photos of his version of the "Paraset" resistance radio that was featured in the April 2004 Electric Radio #179, an article by Michel Janis (KE3OQ). Many ER readers are builders, and the Paraset is a popular project. Quite a few copies of the set have been built in recent years. A common comment is how much fun these projects are to build and to use.



The author of this month's article on the Breting 12 receiver, Charles Cassidy (AC7GZ), is shown above with his best friend, Carlos, who is very interested in learning all about Charles' newest receiver, a National NC-66. The '66 was a 5-tube battery-powered portable, made from 1957 to 1961.

Here is Loyd Garvin Jr.'s (N4WPG) shack in Union, MS. Lloyd is known as the "Keeper of the Harvey Wells" and many fine examples of the brand can be seen in Lloyd's photo. Loyd is pictured in the inset at the lower right.

Robert Henriksen (KFØAM) has quite a nice collection of vintage equipment, and this photo shows his shop area. There was another photo of Bob's shack in the March 2005 issue #190, of Electric Radio.



I have some very sad news to report. Erle Scott (W6OAU) passed away in a veteran's hospital on June 28, 2006, after an illness. He was known as Scotty, and had many friends in California and on the ham bands. Scotty had been a great supporter and help to those of us who enjoy restoring and operating classic American-made radio equipment. Here is what a few fellows had to say about Scotty's ham career.

Bill Feldmann, (N6PY): "...He was always a great source of encouragement to me and was always willing to help find radio parts. I met Scotty in 1970 when he practically gave me a 32V-2 to use with a restored 75A-3 on CW. Drifting away from ham radio until 1997, a Collins S-line station was obtained and one of the first to welcome me into the CCA West Coast Net was Scotty. During this time, he really encouraged me to get back on AM and start collecting military gear. He will be greatly missed by all of us in the AM community."

Les Zwiebel (WB6ORZ): "...It is a really sad loss when a fine old timer goes SK. Scotty was one of those...a man with no pretense, no phoniness, always gentlemanly, and always patient on the air. His affection for the hobby and vintage gear was contagious. Scotty was like the men who always inspired me as a kid and set the example for the classy operating heard on vintage tube gear. I hope we can carry him within us."

(Photo courtesy of Dennis Duvall, W7QHO)

These are the times that try a man's soul! Gary Halverson (K6GLH) had some problems with his Collins 32F recently while trying to check into the Collins Collector's Wednesday AM net. Gary mentions that band conditions were impossible and the noise level was S-9 due to power line corona. He couldn't get his FT-243 crystal to oscillate in the 32F. Trying to make the best out of the situation, he tried to take advantage of another 3879 crystal to check in. His 25 watts was not heard over the course of 45 minutes of check-in attempts. Just short of smashing his 75S-3C, Gary regained control and turned the power switch off. Where is Jeeves when you need him?

To the left is Dave Sower's (K4SUE) station in Vinton, VA., that recreates the station he had in the the 1960s. It consisted of a Hallicrafters S-38E and that all too elusive Ameco AC1-T. Dave mentions that "...In those days I could never afford Drake gear, so the A and C lines are a treat for me...."

VINTAGE NETS

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

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

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

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

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

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

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

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

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

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

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

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

Eastcoast Military Net: Sat. mornings starting 0500, 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. Late checkins are welcome.

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

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

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

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

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

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

Lake Erie Boatanchor CW Net: Sat. mornings, 7143 kc, 10:00 Eastern time. QSX op Steve (WA3IJT) or Ron (W8KYD).

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

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

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

Mountain States CW Net: NTS CW traffic net meets 3715 kc 7:45 PM MT daily.

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

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

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

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

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

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

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

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

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

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

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

CLASSIFIEDS

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

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Deadline for the November 2006 issue: ☞Friday, October 27!

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

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

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

FOR SALE: Knight KN-4550 cardioid dynamic mic (similar EV-672, made by EV) Circ 1960, 60-13,000 HZ, 57 DB, scratch free, 150 ohm or HI-Z, $50. + u-ship, Bob, kd9gi@msn.com 815-332-9520

FOR SALE: Most excellent condition Drake T4XB transmitter, AC4 power supply and MS4 receiver speaker. No dents, no holes, no scratches, no modifications and chassis is absolutely free of corrosion. Extra crystals have been installed for 30, 17 and 12 meter operation. $200 plus shipping. Jeffrey Hopkins, WA2DPK, 8358 Jones Rd., Hornell, NY 14843, 607-281-1224.

FOR SALE: Hallicrafters S408, real nice, works, manual, $100. Drake SC-2 two meter converter, with manual, $35. Knight C-577 Compressor, manual, $25. HP 5300A Measuring System with 5304A timer/counter, $50. Triplett 310 VOM, case, probes, manual, like new, $45. Tram Diamond 40 CB, $50. Heath ET-3300 Lab Breadboard, $35. Norbert C. Wokasch, WAØKJE, 3312 W. Bijou, Colorado Springs, CO, 80904. 719-633-5661

FOR SALE: Absolutely beautiful Collins-designed/Hammarlund-manufactured (EAC, 1967) R-390A receiver and Technical Material Corp. CV-591A SSE converter, both beautifully rack mounted. Units have been "re-manufactured" electrically, mechanically and cosmetically by Rick Mish of Miltronix and look like new. Extras include 9 hours of R-390A Hi-Res VHS video tapes, spare audio chassis for R-390A and spare tubes for both units. $1,500 cash and pick up only. Jeffrey Hopkins, WA2DPK, 8358 Jones Rd., Hornell, NY 14843, 607-281-1224.

FOR SALE: RAREST OF THE RARE - Hammarlund SPC-10 SSB receiving converter designed for rack mounting and specifically for use with the SP-600. Will sell for best offer in excess of $2,000. Yes, I know you're thinking that I am a few french fries short of a happy meal but the last SPC-10 to change ownership (that I am aware of) sold several years ago for $2,500! Jeffrey Hopkins, WA2DPK, 8358 Jones Rd., Hornell, NY 148437 607-281-1224.

FOR SALE: Absolutely beautiful Central Electronics 200V transmitter, 600L linear amplifier and MM2 RF analyzer (transmitting/receiving monitor scope). All three units have been rehabilitated electrically, mechanically and cosmetically by Nick Tusa (K5EF) and the cabinets all have a new powder coat wrinkle finish so that they match perfectly. Will sell as a package for $3,500. Will not ship unless buyer is willing to incur additional cost of professional packing. Jeffrey Hopkins, WA2DPK, 8358 Jones Rd., Hornell, NY 14843, 607-281-1224.

FOR SALE: Heathkit manuals originals not photocopies. LSASE for list. John Snow 1910 Remington Ct., Andover KS 67002 316-733-1856

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

FOR SALE: National NCX-3 and NCX-A power supply both as new $300 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: New in box tubes 6MJ6/6LQ6/6JE6 50% off list also others. John Snow 1910 Remingtn Ct., Andover, KS 67002 316-733-1856

FOR SALE: Johnson Viking match box 250-23 exc cond $110 plus shipping.John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: Navy GO-9 transmitter, museum condition. Carter, W4FVZ, 434-589-1293

FOR SALE: I'm selling several WWI era military and hi-end sets, and some entire systems. All very good to excellent condition. All original and working. Pix, prices and data on request. IP 500 #558; Amrad SE 1420 #447; Paragon RA-10 tuner/DA-2 detector amp; Kennedy 220 radio, 525 amp, San Francisco models. SCR 109 system: DeForest BC 86 transmitter; Westinghouse BC 98 receiver; all tubes, mic, key, headsets. Heintz & Kaufmann modified system for Robert Dollar Steamship Lines: SE 1420 receiver; SE 1000 amp; H & K LW loading unit, very historic! SCR 132 wireless station!: BC 138 tuner; BC 118 RF/AF amp; BC 131 receiver; rare BC 104 heterodyne unit; all accessories, WE 509 headset, Arkay speaker, glass A & B batteries and a candlestick phone! All this equipment has been restored and operated for extended periods of time. We are moving to smaller space and reluctantly need to sell! Ward Kremer, 1179 Petunia Rd., Newport, TN 37821, Ph/fax: 423/625-1994, Email: witzend99@bellsouth.net

FOR SALE: Viking Invader 2000 transmitter in good shape, 80 thru 10 meters, 2kw filter type SSB/CW/AM. with supply,. you ship, $750. Heathkit HW-101 w/CW filter & pwr supply $225. Ken Sands, K8TFD, ken.sands@juno.com 505 Parkview Drive, Plymouth, MI 48170.

FOR TRADE: Teletype and radio for trade: Receiver: AN/FRR-36 single-channel FM Rcvr 150-174 Mc, complete (R-394, AC pwr sply, 12V vibrator pwr sply, manuals). Teletype: All 60WPM synchronous motors, Model 14 typing reperf. Western Union Model 103 printer/keyboard. AN/FGC-38 T-D (2 tape heads TT-167 on base with motor). Trade for WWII radio gear or tech manuals. Harry, WA1GXC, 401-789-4378

FOR SALE OR TRADE: E. F. Johnson Adventurer for restoration. $54.95 +UPS OBO by 11/30/06. Robert Baumann 1985 South Cape Way, Lakewood, CO 80227 303-988-2089 keysbugsradios@aol.com

FOR SALE: Hallicrafters S408, real nice, works, manual, $100. Drake SC-2 two meter converter, with manual, $35. Knight C-577 Compressor, manual, $25. HP 5300A Measuring System with 5304A timer/counter, $50. Triplett 310 VOM, case, probes, manual, like new, $45. Tram Diamond 40 CB, $50. Heath ET-3300 Lab Breadboard, $35. Norbert C. Wokasch, WAØKJE, 3312 W. Bijou, Colorado Springs, CO, 80904. 719-633-5661

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

FOR SALE: Unmodified big iron powerhouse for 2 mtr AM. 3-drawer FAA? Force air cooled 832 final & two 807s, plate modulation. 15+ tubes. Spare RF drawer for step to HF. Houston pickup, or? 281-996-5835 or tomN5ACA@juno.com

FOR SALE: Collins KWM-2, clean, working, $600. Zenith Tranoceanic Wave Magnet $35. Alinco DX70, $375. George Stevens, WØATA, POB 704, Longmont, CO 80502 303-776-9036, vintage1@prodigy.net

FOR SALE: BC-348 Rcvr, unmodified, $225. BC-611, nice shape, $225. WS-19 MK2, complete set, 950,00 Collins xmitter, $500. PRC-10, $150. 3 Simpson 260-2, $45. Steve Bartkowski, 1-708-430-5080

GIVE AWAY: Large L.F. AM xmitter, 2 meter AM xmitter. FOR SALE: National HRO-60, $325. Heavy duty 40 ft tower, $100. Pick up only. Ed, 847-566-9312

FOR SALE: Bug made for Collins Radio. Heathkit MR1, MT1. HRO60 coils. Homebrew exciter. Hallicrafters S38C. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402, 1-319-393-8075

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

FOR SALE: RAK power supply. Heathkit HN31. Sierra 164 Bi-directional power monitor. Hallicrafters S38C. Motorized neon Bud light. Heathkit Comanche MR1. Also **WANTED:** Sub assemblies for SP600 misc parts. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402, 1-319-393-8075

FOR SALE: Hickok Model 752 with all 7 special tube adapters, last chart update and obsolete tube data. Excellent to like new condition $475 plus shipping. John Snow 1910 Remington Ct., Andover, KS 67002 316-733-1856

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

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

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

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

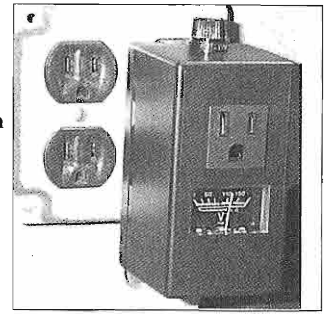
ZIM ELECTRONICS INRUSH CURRENT LIMITERS

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

Model AB-1M, (With Voltmeter) $34.95
Model AB-300M, 300 watts (2.5 amps x 120 VAC) with meter $39.95
Model AB-1 (With Pilot Light) $29.95
Shipping, each limiter $5.45

(4 or more limiters are shipped free for US orders. Overseas customers please ask for shipping quotes.)

The Inrush Limiter provides a gentle, slow startup for your valuable vintage radio equipment. They also reduce the line voltage closer to original design values due to the voltage drop across the limiter element. AB-1 and AB-1M are 150W. All models come with a full money-back guarantee.



Model AB1-M

Electric Radio Store
720-924-0171

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

FOR SALE: Thermistors, 100+ of various shapes and resistances, $10 post paid via priority mail. Len Gardner, 458 Two Mile Creek Rd, Tonawanda, NY 14150, radiolen@att.net

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

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

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

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

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

FOR SALE: DRAKE TR-7/TR-7A/R-7/R-7A Service kit. Includes 13 Extender Boards and Digital Jumper Card. $63.85 includes postage. See http://pweb.amerion.com/~w7avk, Bob,

W7AVK, 807 Westshore J28, Moses Lake, WA 98837, w7avk@arrl.net 509-766-7277.

FOR SALE/TRADE: Manuals: Ameco, Knight, EICO, Lafayette, Conar, Morrow, RME, Realistic, Harvey-Wells, Heathkit, Hallicrafters. NI4Q, POB 690098, Orlando, F1 32869 407-351-5536 ni4q@juno.com

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

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

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

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

FOR SALE: QRP transmitter kits. Step-by-step instructions. Wood model, up to 5 watts 40/80M $15. "Tunatin" one watt 40M $10. You furnish crystal and power. Robert Larson, 1325 Ridgeway, Medford, OR 97504 w7lng@arrl.net

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

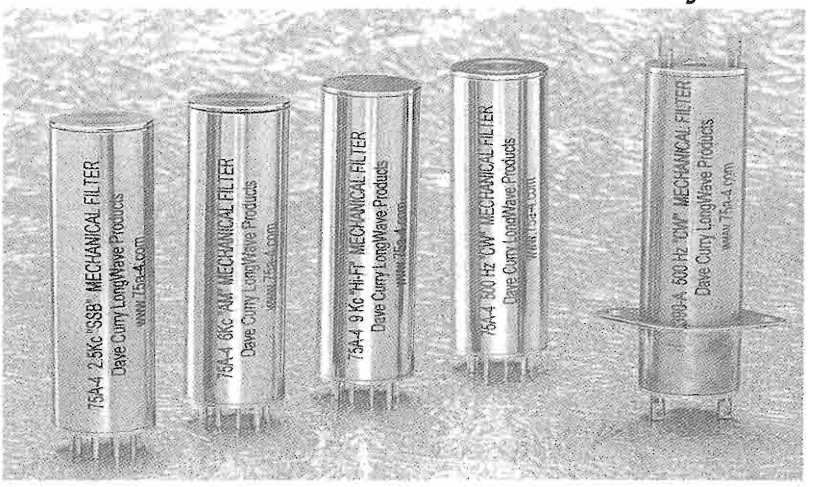
PARTS FOR SALE: Complete hardware set to connect Collins PM2 to KWM2 - $19.95 ppd. Warren Hall, KØZQD, POB 282, Ash Grove, MO 65604-0282.

FOR SALE: Obsolete Triplett parts. Send part number and description for possible quote. USA only. Also several tons of transformers, switches, other material that's Triplett surplus. 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

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

The Collins Filter Family



By Application, Left to Right:

75A-4 2.5Kc 75A-4 6Kc 75A-4 9Kc 75A-4 .5Kc R-390A

by Dave Curry Longwave Products

These are exact duplicates of the original filters using the latest, modern design Collins mechanical filters. The electrical specifications exceed the original Collins design.

Note: Less than six R-390A filters are available. This item has been discontinued.

* CW - 500 cycles
* SSB - 2.5 kc
* AM - 6 kc
* Hi-Fi AM - 9 kc Ceramic Filter

$199 each, $178 for 9 kc, plus $5.45 S&H within the U.S. each order

In stock for immediate shipment from the ER Store, or on-line at

WWW.ERMAG.COM

Money-back guarantee

FOR SALE: Tubes tested good globe 224 $6, 226 $8, 227 $9. Write or e-mail: tubes@qwestnet for price lists or see www.fathauer.com. Slightly weak tubes guaranteed to work in early radios 1/2 regular price. George H. Fathauer & Assoc., 123 N. Centennial Way, Ste. 105, Mesa, AZ 85201. 480-968-7686 or toll free 877-307-1414

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

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

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

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

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

FOR SALE: 160m FT243 CRYSTALS: 1885, 1900, 1915, 1925, 1930, 1945, 1970, 1977, 1985 kHz. See: http://www.af4k.com/crystals.htm or call Brian, AF4K, at 407-323-4178

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

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

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

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

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

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

ACCESSORY FOR SALE: RIT for Collins KWM-2/2A; No modifications needed. $79.95 SASE for details. John Webb, W1ETC, Box 747, Amherst NH 03031 w1etc@adelphia.net

PARTS FOR SALE: Aluminum heat dissipating plate and grid connectors for all 3, 4 and T series Eimac tubes including 3-500Z, 4-1000, 304T's and others. Alan Price, fixer7526@wmconnect.com

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

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

WANTED: Subminiature vacuum tubes or old equipment utilizing them, any condition, for personal collection. Johnny Umphress, 1415 Moore Terrace, Arlington, TX 76010, 817-915-4706, www.jgumphress@yahoo.com

WANTED: Hallicrafters SX-62 Cabinet. This is the same cabinet as used with the SX-42 and others. Tom Mackie, W2ILA, 14 Washington Street, Jamestown, RI 02835 401-423-0233 tom_mackie@trimble.com

WANTED: BC1066B US Army receiver by Philco. Need manual & schematic. Walt Schivo, 560 Eldridge, Novato, CA 94947 kb6bkn@juno.com

WANTED: Manual schematic General Radio GR-1003 signal generator. Harry Weber, 4845 W. 107th St., Oak Lawn, IL 60435

WANTED: Manuals w/schematics for HT-37, Valiant, Valiant II. Copies OK. Carl, W3BRX, 717-852-3223, w3brx@aol.com

WANTED: Looking for "J" coil set for early HRO's. I have dupes of most other coils for trade or cash. Also looking for original power supplies for same and an HRO case, also case for Collins 51J3/R388. Ward Kremer, 1179 Petunia Rd., Newport, TN 37821, Ph/fax: 423-625-1994, Email: witzend99@bellsouth.net

WANTED: Manual for Knight Kit Tube Tester, 83YX142/83YX143. Thanks, Tom Rayner, 386-961-8547, maryrayner@netzero.net

WANTED: IC for Sears two-way radio, Model No. 93438270 or 93438260, IC No. SM5104. These radios were converted for 10 meter QRP. Will purchase whole radio. Please call John at 850-944-6563.

WANTED: Cabinet for R-388 receiver, please contact Mike at: mike46@shaw.ca

WANTED: National 1-10A receiver to complete the replication of my early UHF-VHF amateur radio station. Must be cosmetically very good. No dings, gouges, rust, or extra holes. Must include the six sets of coils for this receiver. Will pay any reasonable price. Roger Zaun, W9UVV, 4902 W. Parkview Drive, Mequon, WI 53092-2027, w9uvv@att.net 262-242-4931

WANTED: Help: Need circuit diagram for model PAR marine radio, 1.6 to 5.0 Mc. Will pay, please contact C.R. Filer, 2808 Patterson Ave, Key West, FL 33040

WANTED: Dead or semi-dead T-195 for parts. Also the "Dogbone" to connect to R-392, and T-195 inverters Thanks Robert Boyd, VE3BE, rwboyd@gta.igs.net or 613-722-4098

WANTED: 51J-4 in good condition, please contact Mike at: mike46@shaw.ca

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

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

WANTED: Cabinet for Pierson-Delane PR15 receiver. Patterson PR15 cabinet will also fit. JC Jackson, kd7tue@aol.com or 406-642-3253

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

WANTED: Any or all low freq. coils for my Millen 90651 grid dip meter. Coils 46702 to 46705. George Reese, 380 9th St., Tracy, MN 56175, 507-629-4831

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

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

The Caps Are Back!

By popular request, we are offering another run of the popular Electric Radio baseball caps. These new caps 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.

ER Store
PO Box 242
Bailey, CO 80421
720-924-0171
Or on-line: www.ermag.com

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

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

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

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

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

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

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

WANTED: National NC-183DTS speaker, NFM-83-50 adaptor and SOJ-3 Selectojet. Contact Ric at c6ani@arrl.net

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

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

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

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

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

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

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

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

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

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

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

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

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

WANTED: 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: Hammarlund ED-4 transmitter. Any condition or information. Bob Mattson, W2AMI 16 Carly Drive Highland NY 12528. 895-691-6247

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: 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: 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: 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. 913-634-3863.

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

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

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

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

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

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

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

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

WANTED: 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 717-857-6404 X306

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

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

WANTED: Manual, titled "Operator's Wireless Telegraph & Telephone Hand-Book" by Laughter, circa 1907?. Louis L. D'Antuono, WA2CBZ, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

PARTING OUT: Collins 32V-2. Contact me for your needs. Cliff, N6ZU, 209-477-1235.

WANTED: HW-16 Knobs and HW-16 Dead or alive. Trimm Professional Phones. Tube TR Switch. Jeff, KEØMT, ke0mt@aol.com

WANTED: Veeder-Root counter assembly P/N 15148 from the T-368 exciter unit. My counter has a broken gear. Please call Ray, NØDMS, at ER, 720-924-0171 or Ray@ERmag.com

WANTED: SCR-300 back pack radio with handset and short antenna for donation to the 45th Division Museum. Willing to pay market price. Robert Hall, 229 Ave. B, Redondo Beach, CA 90277, hallxbab@aol.com

FOR SALE: Scott RCH- $225, Swan 350-$75, SP-200- $100, Carter, 434-979-7383

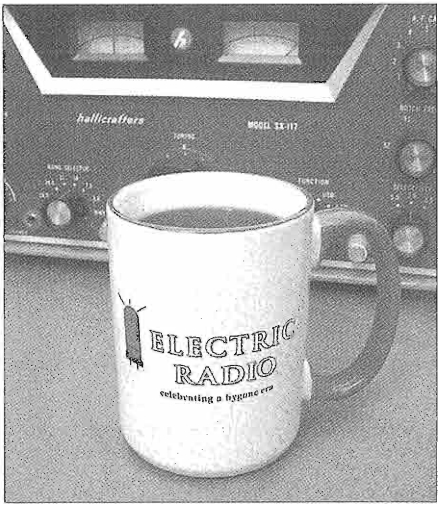
WANTED: GRC14 or R808 parts rcvr or IF strip. Tony, 313-882-2815

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

Don't forget to say you "Saw It In Electric Radio" when contacting advertisers! It helps Electric Radio and it helps the advertiser.

KDØZS optoisolator package per "New Valiant" article is $18.00 postpaid.

Fairchild 1N4938 switching diodes are still available in packs of 20 for $10.
See Ordering Info, page 63



Electric Radio Coffee Mugs!

A new item in the Electric Radio Store is this nice 15-oz white ceramic mug with the ER logo in 3 colors and a maroon-red handle and rim. This large mug is perfect for those long roundtable QSOs and holds a lot of coffee!

$13.99, including priority shipping within the US.

ER Store
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Bailey, CO 80421
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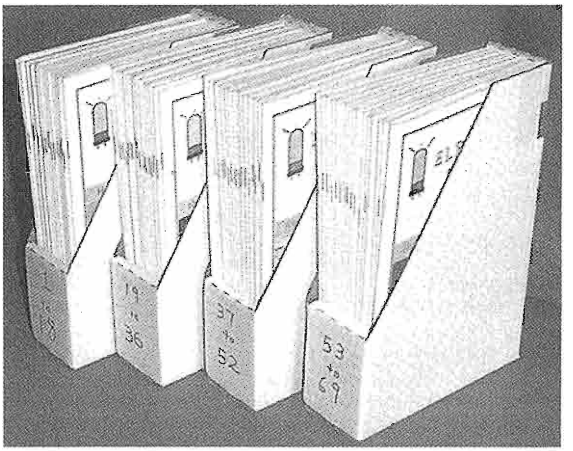

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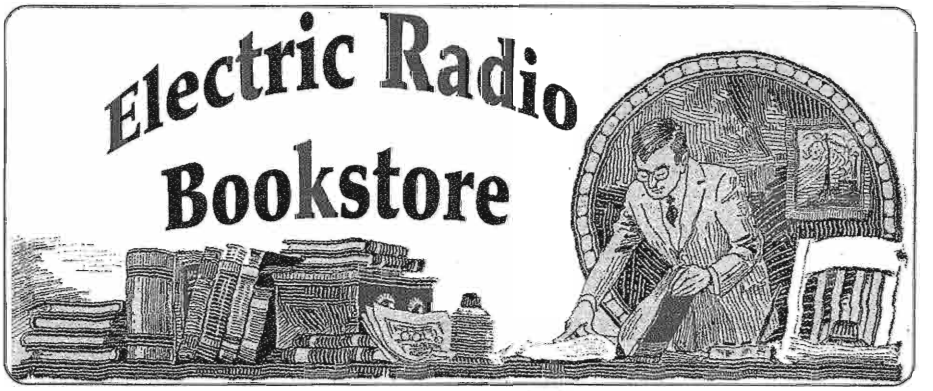

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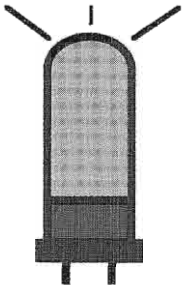

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