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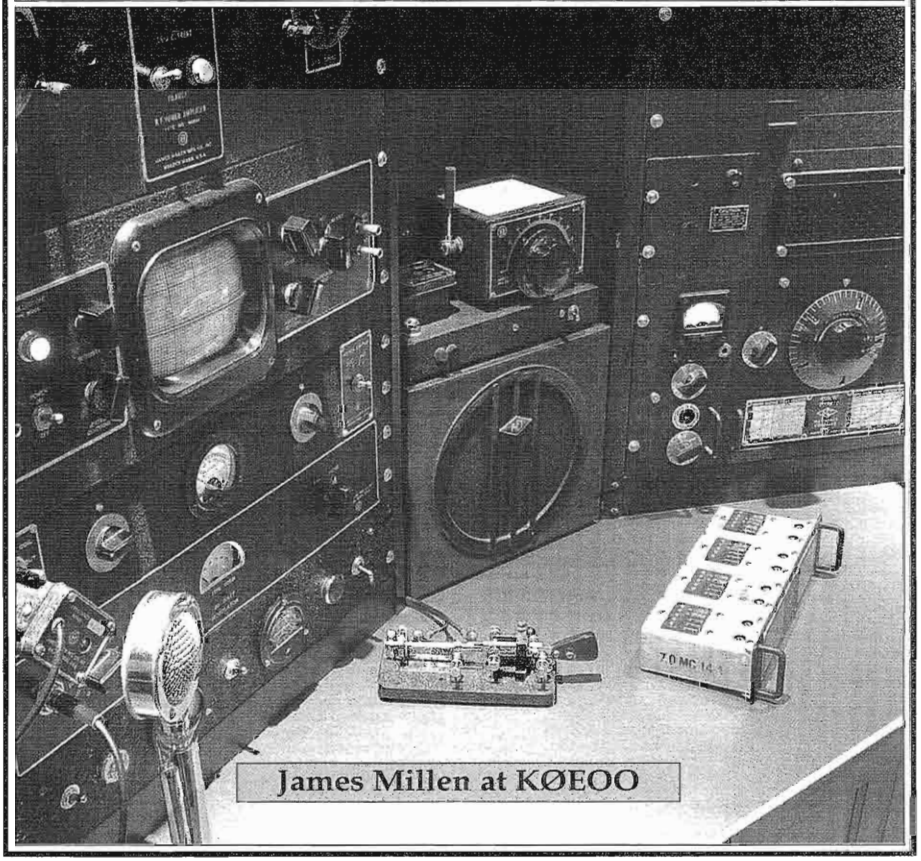
ELECTRIC RADIO

celebrating a bygone era

Number 206 July 2006



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.

Editor's Comments

AWA AM QSO Party 2006

Gary Carter (WA4IAM) sent me the results of the American Wireless Association's AM QSO Party that was hosted by AWA last winter. Here is Gary's report:

"The 2nd annual AWA AM QSO Party held last February was a great success! Once again AM stations from all over the country, AWA members and nonmembers alike had lots of fun contacting each other on the 75, 40 and 20 meter ham bands. The 24 hour event brought out stations using vintage amateur, military, broadcast, homebrew and modern solid state gear. Many an old timer remarked that they hadn't heard that many AM ham stations on the air since the 1950s!

One unique aspect that made the event so much fun were the two flagship stations that were on the air to give the other participants a special contact to strive for. We tip our hats to Ed Gable K2MP, Dave Payne KA2J and the rest of the crew at the AWA Museum for putting W2AN on the air as the eastern flagship station. They fired up James Millen's personal transmitter on 75 meters, used a beautiful BC-610 on 40 meters and a Johnson transmitter on 20 meters. We also salute Jim Hanlon W8KGI and Doc Khalsa K7SO for manning the western flagship station using James Millen's old callsign W1HRX. I don't have the final QSO Party tally for W2AN, but the boys at W1HRX managed 18 contacts on 75 meters, 9 on 40 meters and 35 on 20 meters, for a grand total of 311 points. Of course being flagship stations they aren't included in the scores with the other participants.

[Continued on page 4]

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Cover: For several years now, Dennis Petrich (KØEOO) has been collecting Millen modules and he now has enough to complete his reconstruction of a classic 1940s-era Millen station. The story about this station begins on page 10.

The Heathkit Movie Star

By Chuck Teeters W4MEW
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At our radio club spring swapfest and picnic, Frank, KS4OC, brought a neighbor who had his deceased father's Heathkit HW-101. He wanted to sell it, so Frank said come to our shindig and see if someone wants it. It had been in the father's storage shed for an unknown number of years. The son found it when he was cleaning out after his father's demise. The HW-101 was a 100-watt HF SSB and CW transceiver kit that Heath sold from 1970 to 1982. It looked a bit forlorn, covered with dirt and mildew and the green Heathkit paint was flaking off. Additionally it had been partially repainted when a can of white paint had spilled on it. There was considerable rust on the bottom of the matching HP-23 power supply, so it must have been the low man in the shed. A Heath HS-24 speaker, a few cables, and a Drake 7075 EV desk mike were included in the sale. Most club members ignored the Heathkit. The few who looked asked what was it, and then moved on. Only Henry, KN4AV, looked and said "I had one of those 25 years ago."

The food was about ready, and the swap meet was slowing to a stop. Frank said to me, "make an offer, you like old radio stuff and the owner doesn't want to take it home." I walked over and the Heathkit looked at me, with tears running down its dial, and cried out for help. I couldn't ignore that desperate plea so I made a two six-pack offer. It was immediately accepted, and like a flash the owner was loading it into my van, leaving a trail of green and white paint flakes and rust marks on the carpet. When I got home, I put the stuff in a cardboard box and vacuumed out the van.

The Saturday night movie on a cable channel was "Frequency." I had seen it, but decided to watch again. The plot, if you haven't seen or don't remember the movie, is where the fireman's son pulls out his dead, for 30 years, father's Ham radio (unnamed but obviously a Heathkit), and gets it operating. Then by some strange auroral propagation (known only to Hollywood) talks to his dead father who is using the same radio 30 years before. The son tells his fireman father how to avoid getting killed in a fire 30 years ago, and the father tells the son where to find evidence that will save the son's life and career in the present, and they live happily ever after (If the Heathkit survived it was not mentioned). Suddenly, I had a goal for my HW-101. I would try to fix it up with what tools and stuff I had in the kitchen drawers, which is what the son did twice in the movie (the second time because it fell off the desk) without test gear, spare parts, or instruction book. While the movie Heathkit appeared to be an SB-101, my HW-101 was identical except for the VFO and dial.

In the garage, I took the HW-101 out of the box, put it on the floor, brushed off the loose paint, and took off the top and bottom covers. It didn't look too bad: dust, dirt, and bug remains. I did the same with the HP-23 power supply. It was a mess inside, rust, corrosion, and bug remains, but as I had done with the transceiver, I cleaned it out with a clean paint brush. I figured a can of WD-40® would be within the realm of common household tools, so I sprayed down the HP-23 power switch, circuit breaker, and connector. Then I used the WD-40® on the HW-101 switches. Next I removed the tubes, used a bit of WD-40® on the tube sockets, and used sandpaper to clean the tube pins. I reinstalled the tubes, and

used some light oil on the control-shaft bearings. I used the sand paper to clean the pins on the 11-pin, octal-type power connectors.

Now was the time for the rubber to meet the road. I connected the power cable between the power supply and transceiver, and plugged it into a garage outlet and turned the power switch on. Dial lamps and tube filaments lit, and most important, no smoke, fire, or sparks from the transceiver or power supply. I grabbed the HS-24 speaker and cord to connect it up. The cord was rotted and the RCA connectors were rusted out. I had a hi-fi jumper with RCA connectors, so I used it to connect the speaker. There was noise using a long wire plugged into the antenna jack. I tuned around and could hear the internal 100-kHz calibrator and some weak 40-meter signals when I peaked up the preselector tuning. The tune position of the mode switch gave me some plate current.

Now, I moved the set from the garage floor to the workbench where I had access to antennas. I attempted to connect the Drake desk mike. The Heath uses an Amphenol 80-C2 connector. The male connector on the mike had a crushed locking ring. I had some spares, but that was against my self-imposed, get-it-working rules. It took about an hour with pliers and screwdrivers to get the thing close enough to round so it would screw on. The push-to-talk was intermittent, and the receiver didn't always come back to life. I found two small 4PDT relays that were operated by the mike PTT switch. I cut a strip of very fine sandpaper and used it to burnish up the contacts. The relay on the chassis was easy, but the one in the PA cage was a dog. After the cleaning the transmit-receive, PTT was good to go.

With a 40-meter antenna, the 101 tuned

My Heath HW-101 "Movie Star" transciever.

up like I thought it should. I calibrated the dial at 7200 kHz, and tuned up to 7251 kHz. When the Southcars NCS called for check-ins, I pushed the button and called in. I made it on the first try with a 5-9 report and "sounds great from North Carolina." Up to 20 next, and worked a DX PZ station. Then, that evening on our local 3920 kHz net I also got good reports. A try on CW was not good until I played around with the VOX delay pot on the side. An adjustment fixed the keying and I got 5-8-9 type reports on 80, 40 and 20 meters.

The front panel was a disgrace so I put operation aside for a bit. I removed the knobs and tried everything to clean the panel without removing the silkscreening. Nothing worked until my wife suggested "Tilex." It cleaned the front panel to new, and took the white paint off the cabinet and mike cord smooth as a whistle. All that remained was to repaint the cabinet (and hide the rusty power supply in a flame proof area under the desk).

So now, I have the first Heathkit SSB transceiver I've ever owned, a few years after everyone else, but much cheaper than most paid. I've owned some Heath test gear, but never thought much of their radios. But now the HW-101 has a permanent place on the shelf in my shack, and every so often I get the feeling it smiles at me. I think I will go rent "Frequency" and watch it in the company of my "movie star" radio.

ER

[Comments, from Page 1]

Unfortunately only 23 stations managed to send in their final summary sheets. This year Bob Raide (W2ZM) tops the list with a very impressive score. Bob not only worked a ton of U.S. stations, but he was also the only participant to work a few Europeans on 75 meters during the fray! His total indicates that there were quite a few participants who didn't send in any logs, so please do your best to get those summary sheets in next year.

As usual there were many fine AM stations to be heard during the AM QSO Party. One station in particular made for a very special QSO, that of Donald Benecchi K1DC. He was using a vintage Collins 30FX transmitter circa 1934 that sounds as good on the air as it looks. Nice job Don!

Next year, by popular demand, we'll be adding 160 meters to our AM QSO Party lineup. So you guys and gals better start getting those old AM broadcast transmitters in shape!

73, Gary Carter – WA4IAM

Electric Radio Vintage Field Day

Radio conditions were not very good again this year. I started out on 75 meter phone, but the band was full of thunderstorm noise. By the time it died down the band had shortened and because of no participation that I could hear in the Mountains states, I went to 40 meters. 40 was in even worse condition, with weak signals and lots of fading. I could hear occasional voices rising out of the background around 7293 kc, but my 27-watt Elmac was just too weak to be heard. My email indicates that a lot of operators on the West coast had fun on the 3rd of June, so at least conditions were better out there than in the Mountain states. Perhaps what we need for next year is some team participation, high power, and good antennas. Photos next month!

W5CZ Heavy Metal Museum

I would like to mention that Rod Perala (W5CZ) is hosting an opening of his museum that is located southwest of Denver, Colorado in the community of Indian Hills. Please see Rod's announcement on page 40, and I would like to encourage everyone who is interested in meeting Rod and seeing his excellent equipment to send him an email and request directions to the afternoon's event.

73, Keep Those Filaments Lit! NØDMS

Using a Bead Blaster to Prepare Steel for Replating or Painting

By Larry H. Will, P.E., W3LW
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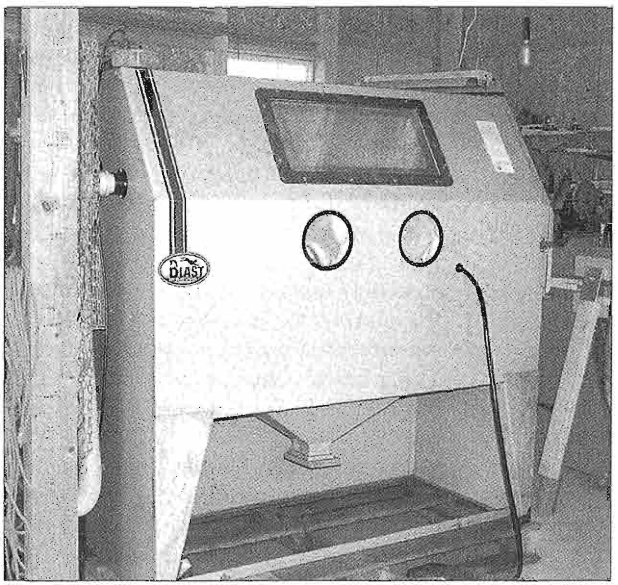
Glen Mills, PA 19342-9504

Introduction

In my recent article in ER[1] regarding the restoration of the Hammarlund SP-200LX, I mentioned that successful replating of steel chassis parts is best done by doing the prep with a silicon-bead "sand blaster" to make the process of replating develop smoothly. This article reports on my initial success utilizing such a blaster with radio parts prepared for both replating and repainting.

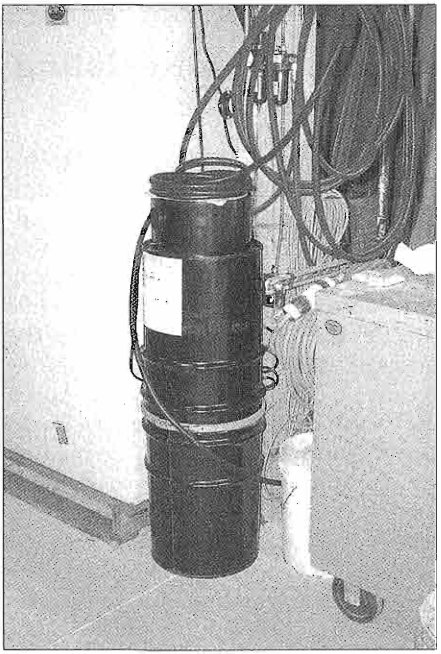
Thanks to a neighbor, I have received, on a long-term loan, a commercial silicon bead blaster[2], typical of what might be found in an automotive paint shop. This is a large unit that has a chamber approximately 28" x 56" by 28" including a supplied vacuum-recovery system. The unit requires a high volume 60-80 psi air source capable of 10-15 CFM[3]. The unit included about 50 pounds of sodium-aluminum silicate base, which are very fine glass blasting beads[4], and an air pistol with various size replaceable ceramic nozzle inserts. When cleaning the materials, an external foot switch controls the user-supplied *clean and dry* air. I used the medium 1/4" insert for all the initial cleaning described herein. The manual for the unit recommends two separate water separators in the air line, one at the compressor outlet and another near the flex hose that goes to the foot switch. The reason for making the air as dry as possible is the sodium-aluminum silicate cakes up easily when exposed to moisture and the venturi-type air nozzle will clog up. So far, I have had no trouble with the beads caking. No lubricators should be in the airline. The Skat web site[2] has excellent technical information on blast cleaning, installation, and required maintenance.



The installed bead blaster in my garage.

After picking up the new unit and assembling it in my garage, it was time to try it out on both of the power supply cover, various chassis metal covers from the SP-200LX, and some old tube shields from a 1930s table radio.

First, I'll discuss a project that did not involve any plating, just repainting. From the Hammarlund SP-200 desktop power supply, the chassis cover was the initial candidate. The unit has a few dings on the



Here is the vacuum recovery system alongside the blaster cabinet.

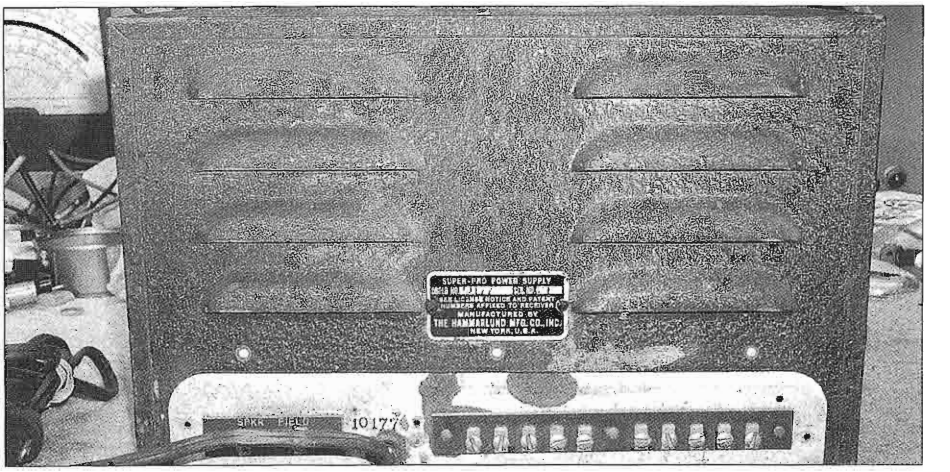
louvers and around the bottom edges, which I straightened out on my trusty old anvil. The initial prep results on the now 60+ years old SP-200LX power supply were outstanding. The blaster easily cleaned off the wrinkle paint and brought the underlying steel down to a clean finish. The fine beads deliver a finish to the steel that has a distinctive fine surface texture that allows paint and plating to adhere well. The resultant cleaned pattern is not as shiny and smooth a surface as you might expect. The more you work with the pistol, the more distinct the pattern becomes. The fine pattern insures a lot of surface area for the paint to adhere to.

After a complete bead blasting of all the paint off the outside of the power supply cabinet, I cleaned the cabinet thoroughly with the same heated degreaser discussed in the SP-200 article mentioned earlier. This cleaning removed any greasy fingerprints as well as fine dust left from the blasting so that the cover was ready for repainting. No other abrasive material such as Scotch-Brite® or Emery cloth were used in the process.

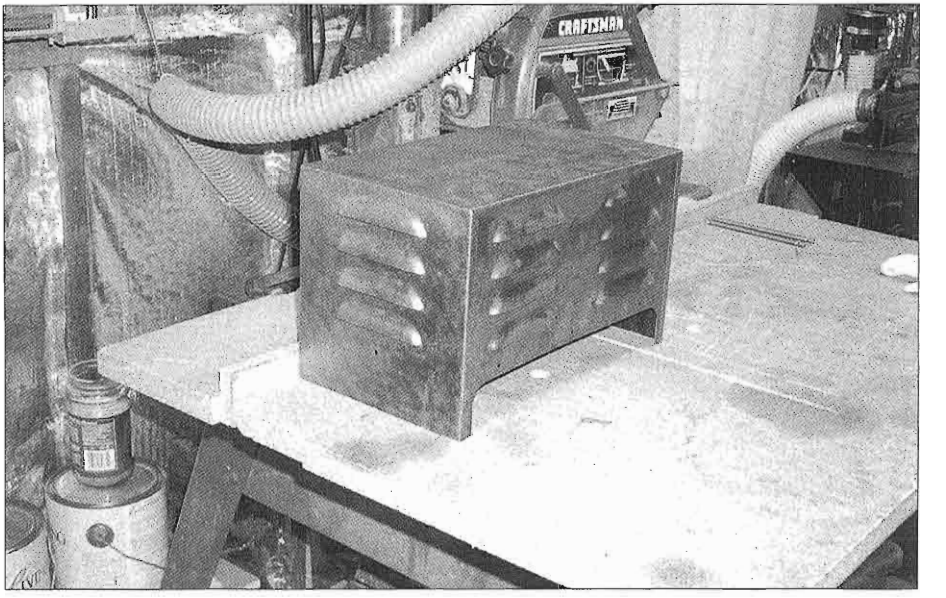
Bill, K3JPB, at his shop, completed the repainting. Bill has a large oven suitable for drying the applied paint. Bill used three heavy coats of the paint before placing the unit in the oven. Since the SP-200 Power Supply cover was originally a black wrinkle, the repaint was completed the same way. The spray can black wrinkle paint came from the local automotive supply company. The results were very good. The wrinkle texture is even except for a few small areas. On inspection, we think the areas not perfect came from some not-noticed runs, probably caused by some sputtering from the spray can nozzle. I have noticed this problem with some spray cans before, and sometimes the can is unusable because of the sputtering. I decided not to redo the cover as it otherwise came out just fine.

Next, I'll discuss the replating trial. As I stated in the SP-200 article regarding the unsatisfactory plating of each half of a large piece in turn, some of the covers replated on the main chassis of the SP-200LX, were again cleaned with the blaster and replated with the CopyCad® kit from that article. As shown in the attached figures, the results from the replating confirmed that bead blasting indeed is the correct and only way to prep steel materials for replating. Not only is the plating more uniform but also the amount of material deposited is increased. The plating time again was about 3 minutes at 25 milliamperes per square inch.

As a sidebar, as I work with the plating kit, I have found more 'tricks" to improve the process. First, inspect the work carefully to be sure that the blasting has really cleaned the material to be plated or

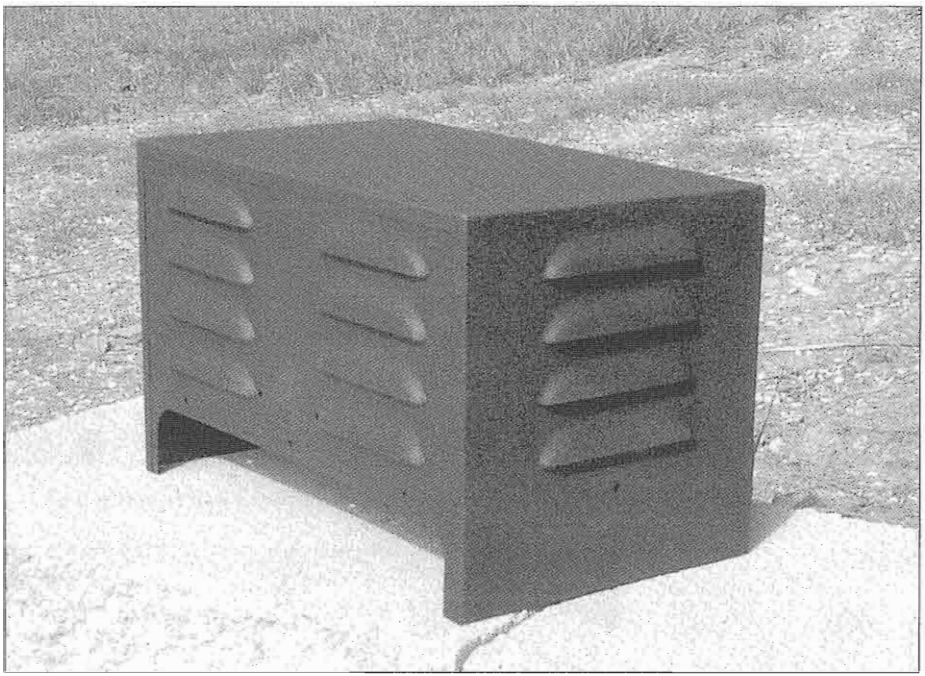


This is the rusty SP-200LX power supply cover before bead blastng and repainting.

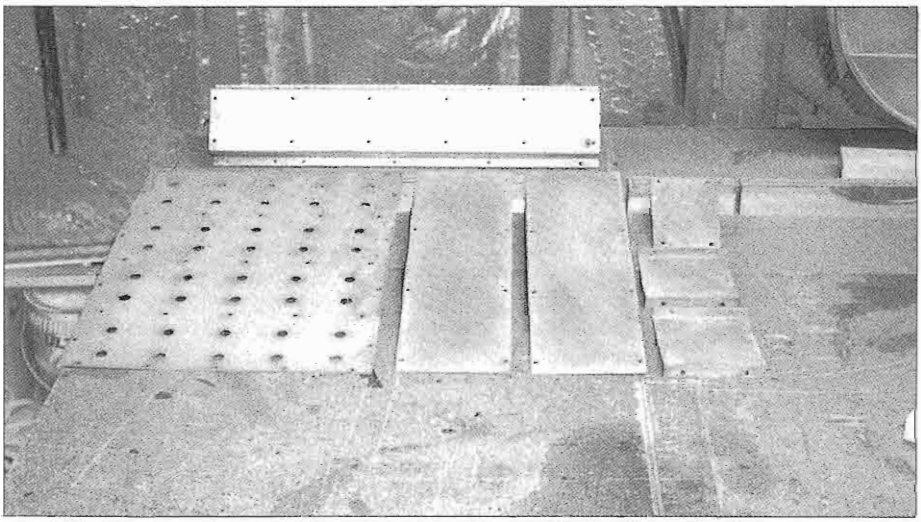


The SP-200 Power Supply Cabinet after cleaning with the bead blaster.

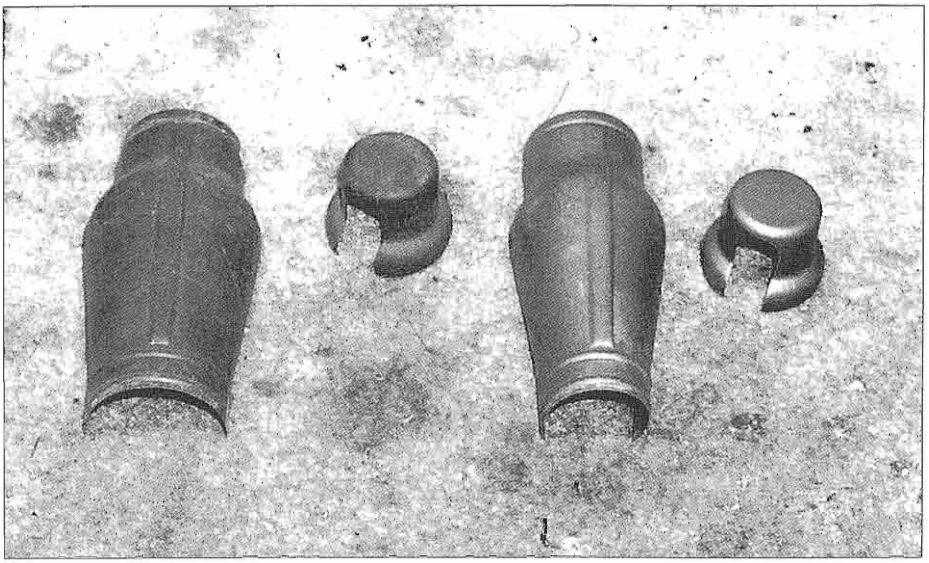
painted and that all loose materials are removed. Second, the kit instructions call for air agitation of the plating solution, and this is important. All my plating was done with air agitation and it doesn't hurt to manually shake the work within the solution while plating, or to providing additional stirring of the solution with a wooden paddle. Third, after plating per the kit instructions, remove the target material and *quickly* immerse into a container of distilled water. This will help to insure no streaking of the plating as liquid runs down the piece in question as



The SP-200 power supply cabinet after repainting, but before installation of the nameplate. It looks like a new piece.



The SP-200 covers after blasting and re-plating.



Here is a before (left side) and after (right side) example of how the 1930 radio tube shields came out looking like new.

it is being removed. I also disconnect the power source prior to removing the work from the solution.

All in all, the commercial bead blaster really speeds up and improves the preparation process for restoring metal parts for the old boatanchors. If you can latch onto one, I highly recommend its use. Smaller ones are available on the Internet, so just find one large enough to handle the pieces you are likely to want to prep and have fun. In the short time I have had the unit up and running, I have done several projects with it including cleaning of some of those old three-piece tube shields for the older series tubes found in 1930s vintage sets.

Footnotes

1. See "Restoring a Hammarlund SP-200LX", by W3LW, Electric Radio #202, Page 8; March 2006.

2. Skat Model 970. BLAST Dry Blast Cabinet manufactured by Skat Blast, Inc., 7075 Route 446, Canfield, OH 44406-0649; www.skatblast.com. Equipment sales are through authorized distributors.

3. My single stage compressor with a 33 gallon tank delivers about 7.5 CFM at 60 psi, just barely enough for the ¼" nozzle. I stop after a few minutes and let the pressure build back up and the compressor shut off. Observe your units duty cycle; mine is no more than 50% or 30 minutes maximum per hour. My use so far has not approached that percentage.

4. Double insulated respirator and sealed eye protection recommended. Spilled beads are almost invisible and very slippery, vacuum area around unit thoroughly. Other blast materials are available.

ER

A 1940s Vintage James Millen Transmitter

By Dennis Petrich, KØEOO
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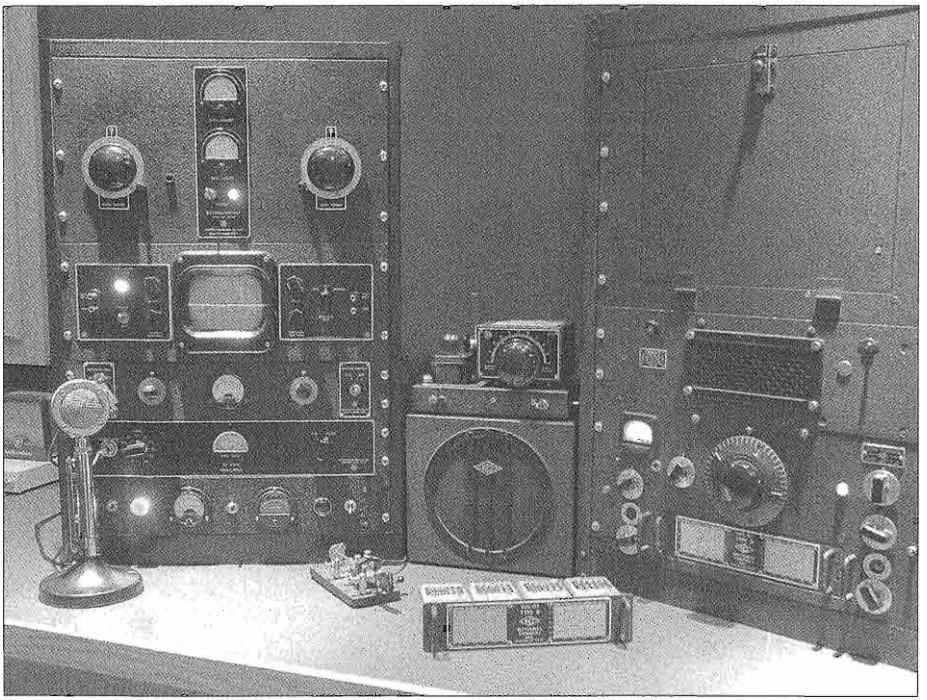
I think it's been over 8 years since I did my last article for ER and I'm feeling a bit rusty at the keyboard. What ever happened to voice recognition? I thought technology was supposed to save us from all those tedious tasks. That being said, I suppose your wondering why I decided to pursue building a '40s vintage James Millen station? And, how long it has taken me to gather the modules and so on? Well, now that I'm done and have the system on the air it seems like time flew and the year or so it took me to gather the modules and parts has been totally forgotten.

Well, it started this way; I wanted a '40s vintage AM transmitter in the 250-watt class like the Collins 30K-1, and was capable of about 350 watts on CW as well. I didn't feel like I wanted to do a



This photo shows the completed James Millen 500w transmitter in my shack connected up with a 1946-vintage HRO-5RA1 receiver. The 90700 Vari-arm VFO is sitting on top of the HRO-5 speaker. In the photo, you can see the two meters and the green and red lights on the bottom panel of the transmitter; that is the front panel of the power supply for the tabletop portion of the transmitter. The Millen modules, from top to bottom are: 90881-500w RF deck, 90905 5" scope to monitor the RF envelope or a trapezoid modulation pattern, 90800-50w exciter, and the 90831-speech amp with 6146s in its output driving the grids of the 811As in Class B in the power modulator.

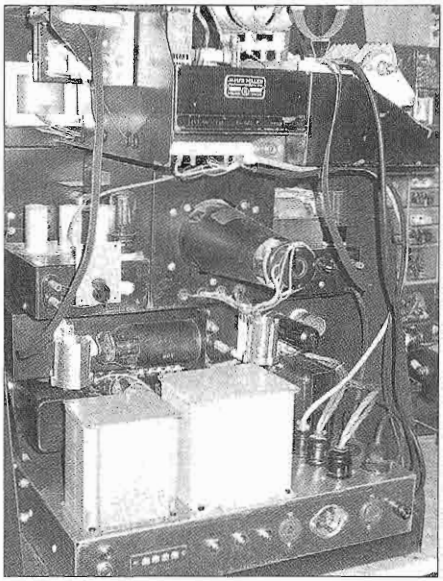
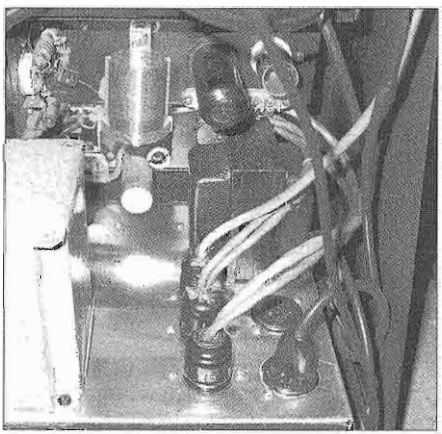


Figure 1: Here you can see the back of the transmitter. The bottom chassis is the homebrew supplies for the exciter, speech amp, VFO, and AC power for the RF deck's bias supply. You can see the adjustment pots for the bias supplies that are located on the back of this chassis.



ground-up homebrew station but instead wanted to put something on the air that would be somewhat rare; a conversation piece, something interesting. After all, you don't like meeting someone wearing your same tie, do you? Well, maybe I should rethink that remark, Hams have Multi-Elmac and DX-60 nets; I guess Hams might be different!

Anyway, after a little research, what came to mind was the 500-watt RF deck by James Millen. I already had a couple of Millen modules that were collected over the years, but I had never heard one on the air. I started talking around to some of my friends and none of them had ever heard a Millen station on the air, let alone the 500-watt RF deck. I soon discovered the reason; to my knowledge, Millen never made the companion 1500-volt HV supply or power modulator for the 90881 500-w RF deck. To put one on the air meant you would have to roll your own. Consequently, I thought that might make a fun project, mixing a little restoration and a little homebrewing. Now, if only I could find a 90881 RF deck in good shape?

Well, with a little bit of eBay surfing I was able to find the 90881 RF deck, a pristine 90800 RF exciter with 80-meters to 10-meters worth of plug-in coils and the rather rare 90831 speech amplifier/modulator from Dale Braun (WD9GWH). I already had the 90905 5" scope and 90700 Vari-arm VFO from my stay in California.

Next, I found the documentation with the earlier James Millen modules to be a bit lacking in completeness. It took a while to figure out just how to use the exciter, for example, and even though the documentation for the RF deck was better, they didn't address plate modulation or

Figure 2: Notice the multi-pin plugs; each one is for a different Millen module. This way I can easily remove one of the modules for repair. The two 120-volt outlets in the foreground are switched from the filament ON/OFF switch. One is for the 90905 scope and the other has an isolation transformer for the 90700 VFO. The 90700 VFO is an AC/DC design that doesn't like being connected to a circuit with a ground fault detector.

how to change the link for the different bands.

The best information I found was on the "James Millen Society" web site. There, I found valuable information on Millen module variations, how to get schematics and a very nice write-up by Don Buska, N9OO. His write-up is on putting a complete 50-watt AM/CW Millen transmitter on the air. See the Millen web site for details, http://www.isquare.com/millen/millen-page.htm.

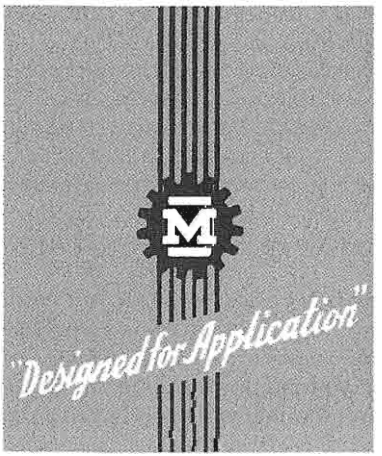
The modules I collected for my Millen station are:

- 90881 500W RF deck w/812As, Class C
- 90905 5" rack mount monitor scope
- 90800 160m-10m, 50w 807 exciter to drive RF deck
- 90831 40-w speech amp to drive Taylor TZ-40s or 811As in Class B
- 90700 Vari-arm VFO

Once I had the modules I needed, I started developing a list of features I thought would be nice in the finished product.

The Design Objectives

- A tabletop transmitter vs. floor-standing transmitter.
- CW and Phone operation from 160m to 10m.
- Because the rig would use link-coupled coils, I wanted to use a rack cabinet with open back and sides for easy access.

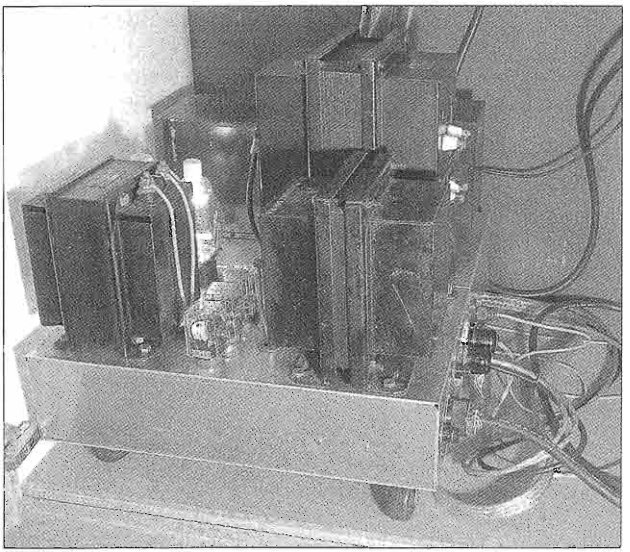


- Each of the Millen modules was to be easily removable from the rack by having their electrical connections on separate multi-pin plugs.
- The 1500-V supply and modulator to set on the floor on wheels.
- I wanted to be able to run the tabletop transmitter with the HV/modulator chassis disconnected.
- Use shunt choke plate modulation to remove DC current flow from the modulation transformers secondary.
- Use negative cycle loading to protect the mod iron.
- Include all of the exciter, speech amp, bias, and filament supplies as a part of the tabletop transmitter.
- "Tune/Operate" switching from the front panel to reduce the PA's high voltage in tune.
- "CW/Phone" switch on the 90831-speech amp to control the CW & Phone operation for the entire transmitter.
- Push-to-talk (PTT) to control the rig on phone and have a "plate" switch to use for CW.
- Add an "Exciter grid current" meter to the front panel.
- Add power modulator plate current meter to the front panel.
- Add relay contacts to control an external antenna relay and receiver muting.
- I wanted the 5" scope to display either an RF envelope pattern or trapezoid pattern.

Did I have to modify the Millen modules to meet my design objectives?

90881-500W RF Deck

Other than doing a basic restoration on the RF deck, the deck I got didn't have the 6.3-VAC filament transformer mounted on the chassis, so I acquired one from eBay. The good news was the Millen RF deck was designed to accept the transformer, so no holes had to be drilled. I understand you could buy the RF deck with or without the filament transformer. That was because the RF deck was designed to accept 6.3-VAC or 7.5-VAC tubes. I also replaced the Millen



swinging link with one I could easily change the number of turns on to accommodate the band requirements. For example, on 160m, 80m and 40m I would need at least 6 to 10 turns on the link. On 20m, 15m and 10m I would need only 3 turns. To accomplish my goal of operation on 160-10 meters, I would need the ability to interchange swinging links easily. The Millen link system was anything but easy to change. For one thing, you

Fiigure 3: The completed high voltage power supply and the power modulator. The choke to the left is in series with the HV to the RF deck. The modulation iron is in the back at the left on the other side of the 811A tubes. The mod iron is capacitively coupled across the choke to take the DC off the mod iron secondary; a trick used in many broadcast transmitters. You can see the interconnect cables at the right of the chassis and the two chokes and the HV transformer on the right side of the chassis. The three relays near the center are for Tune/operate, CW/ Phone and Plate ON/OFF control.

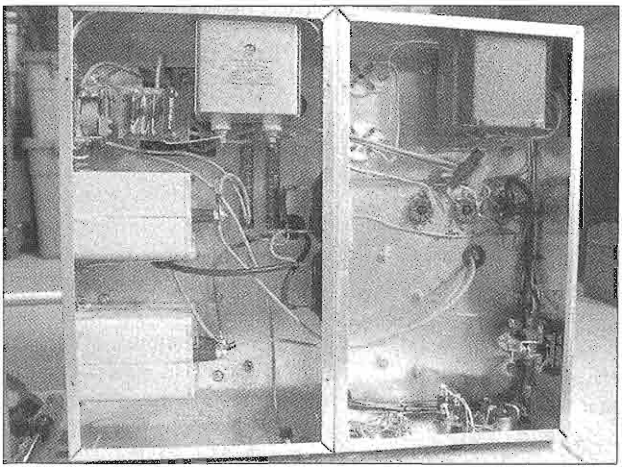


Figure 4, left: The bottom side of the HV supply and power modulator. I chose to connect two smaller chassis vs. one larger chassis due to the weight of all the transformers. The trick worked well, but a steel chassis would have been even sturdier. The power supply filters are on the left and the coupling cap for the modulation is at the top with one of the CW/Phone relays at top left. The small circuit board between the relay and the capacitor is the negative cycle loading circuit. In the lower right of the chassis is the plate relay and at the top right is the filament transformer for the 811As or the TZ-40s. I'm using 811As because, with 1450 volts, the zero-signal plate current is about 60 mA. The zero-signal plate current with the TZ-40's is about 90 mA, so I would need to add about –9 volts of bias to get those tubes down to 40-50 mA where they should be idling.

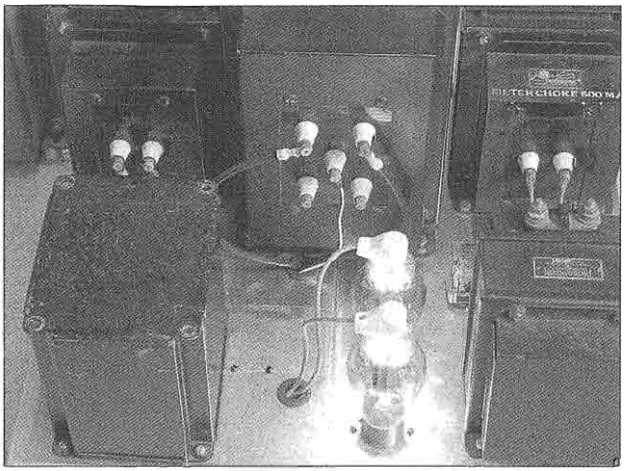


Figure 5: This is the top view of the high voltage power supply and power modulator. To the left of the 811As is the mod iron and to the right of the tubes is the 25H modulation choke. The plate transformer is center back, the swinging choke is back left, and the smoothing choke is back right.

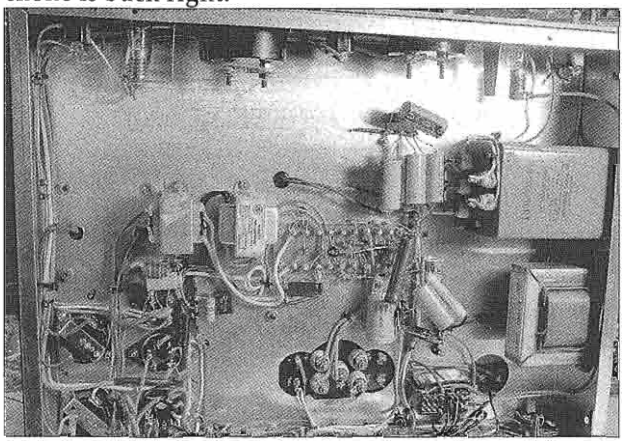


Figure 6: This is the bottom view of the low-voltage supplies for the modules in the tabletop transmitter, including 500 volts for the exciter and speech amp, 240 volts for the speech amp, three –45 volt bias supplies for the RF deck, speech amp and the exciter. The filament supply for The speech amp and exciter filament supplies and the switching circuits for the entire transmitter are here; plate switch, filament switch, tune/operate switch, exciter grid current meter and modulation cathode current meter. The CW/Phone switch is located on the 90831-speech amp and controls two relays on the HV supply to switch the transmitter from Phone to CW.

had to unsolder the twin lead from the link to the terminal strip on the RF deck, and the link coil itself was not removable from the swinging arm. Keeping in the amateur spirit, I replaced the Millen link with a B&W link that was an exact fit and the B&W swinging link had plug-in link coils for easy change. I also chose to use RG8/X 50-ohm coax up to the swinging link instead of balanced line, that way I could drive my 50-ohm antenna system without a balun. I used the two-pin terminal strip where the power output connection is to support a 8-turn, 3-inch diameter coil that acts as a RF pickup for the vertical plates of the 90905 scope.

90831 Speech Amp

Again, after doing a basic restoration on the module itself, the only change I made was to change the microphone termination resistor to 10 Meg for the D-104; this change would improve its bass response. I also changed the microphone connector to a two-pin Amphenol and added PTT between the "spare" contact on TB2 and ground. In addition, the speech amp transformer secondary would be terminated through two 2.4-k, 10-watt, wire-wound resistors to properly load the speech amp and provide a bias return for the grids of the 811As or TZ-40s. I needed

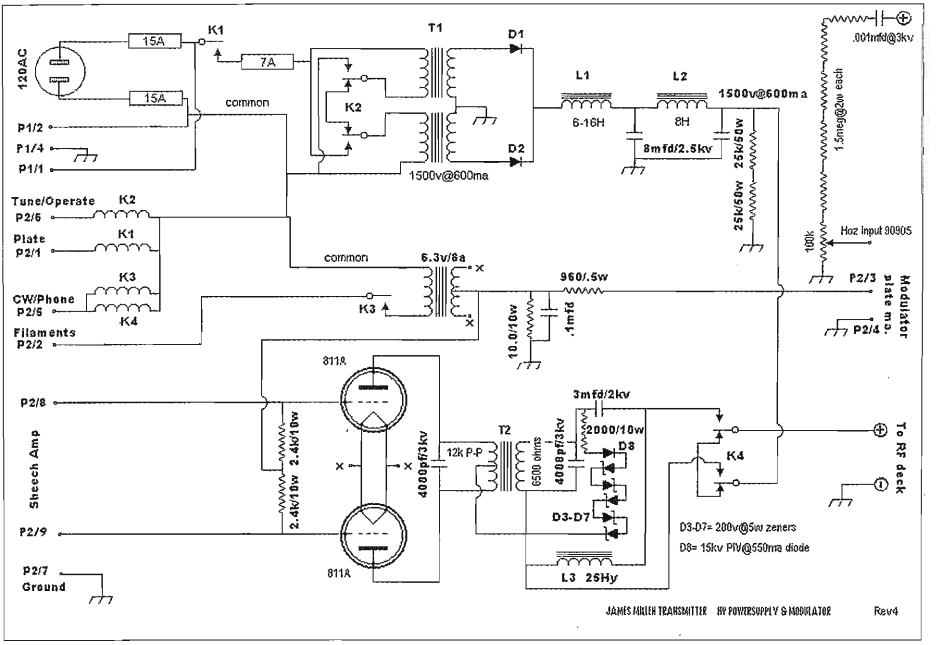


Figure 7: James Millen transmitter high-voltage power supply and modulator schematic.

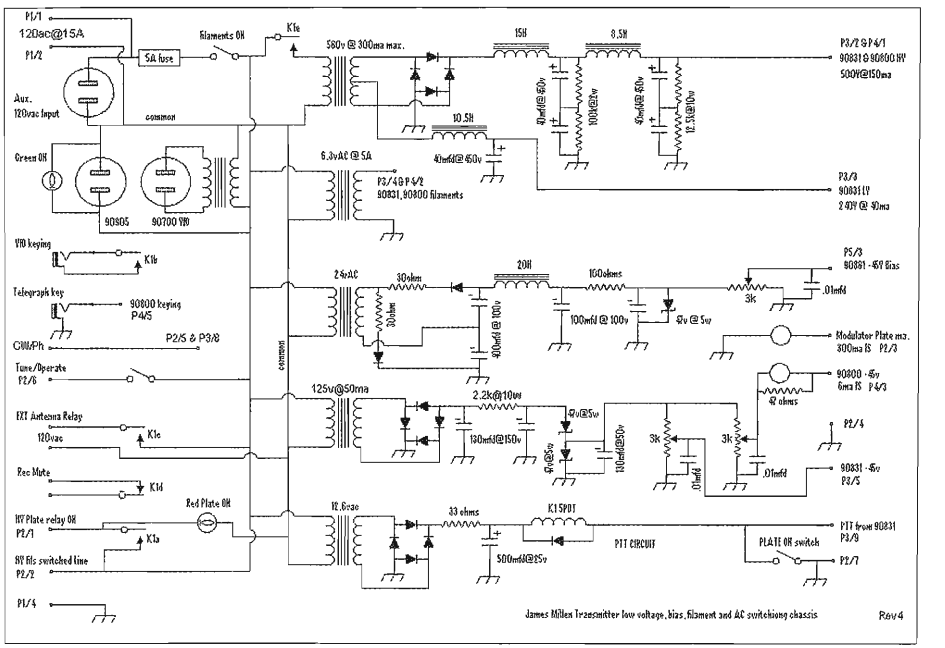


Figure 8: Corresponding schematic for the low voltage, bias, filament, and AC switching circuitry.

90831 P3/pin	90831 module	90800 P4/pin	90800 module	90881 P5/pin	90881 module
1	+HV (Mod Sec HV)	1	+HV 500v	1	120vac (hot)
2	+HV 500v	2	6.3vac	2	120vac (com)
3	+LV 250v	3	-45v	3	-45v
4	6.3vac	4	Ground	4	Ground
5	-C (-45v)	5	"K" (key)		
6	Ground				
7	CW/PH (3)(hot)				
8	CW/PH (4)(sw)				
9	PTT (spare)				
10	Mod Sec (J2)				
11	------				
P2	LV to HV cable	P1	LV to HV cable		
1	Plate relay ON	1	120vac (hot)		
2	Fil. Sw (hot)	2	120vac (com)		
3	Mod meter 300ma	3	--------		
4	Ground	4	Ground		
5	CW/PH 90831(sw)				
6	Tune/Op Sw (sw)				
7	Ground				
8	Mod sec HV				
9	Mod sec J2				

Table 1: James Millen transmitter cable interconnect key.

the two resistors because the speech amp's secondary was not center tapped; I used the connection between the two resistors as the grid ground return.

90800-50W Exciter

Again, after doing a basic restoration on the module, I added the cable plug assembly to provide power from the power supply chassis at the bottom of the desktop transmitter; see **Figures 1 and 2**. The power supply chassis would provide power and control to all of the modules. I coupled the link of the output coil to the input link of the grid coil on the RF deck using 300-ohm twin lead. This was the easiest module of the bunch to hookup. I plan to use the exciter either crystal controlled or with the 90700 VFO. For CW operation, I plan to key the exciter as it was designed. Consequently, I will not need to key the VFO or RF deck. When I flip the plate switch ON in CW mode, the VFO is keyed up by one of the relay contacts, the receiver mutes and the RF deck is powered up, but no plate current is flowing because of the protective bias. When I key the exciter with my Vibroplex, I get clean RF out with no chirps or clicks.

90905 5" Scope

I had to do the most restoration to this module. Almost every capacitor was leaky so I had to replace them all. Also, about 3 weeks into the project the power transformer shorted out, necessitating finding a replacement. A good friend, Herm (WØSCU), came to my rescue with an almost direct replacement transformer from an EICO 5" scope; thanks Herm. To the scope's horizontal inputs I added a small board with the circuitry to tap some audio from the HV connection to the RF deck. I also added 300-ohm twin lead to couple the vertical inputs to an 8-turn, 3-inch diameter coil I mounted up on the RF deck to couple a bit of RF for the scope.

90700 Vari-Arm VFO

I collected and restored the VFO many years ago and had used it with my HT-9 transmitter when I lived in California. As you might expect, I was especially excited to use this module in the Millen station because of its age; it's early 1941. The only problem with the VFO is it's an AC/DC design so it has no power transformer

to isolate it from the 120-volt line. Consequently, to keep from getting shocks and bothering ground fault detectors, I added an isolation transformer to the power supply chassis to isolate the VFO and make things easier to ground. So far, that has worked very well. The VFO has plenty of drive for the exciter on 80m and above. So far, I've had the rig on 80, 40 and 20 meters with no problems. On 160m I'll be using crystal control as soon as I get the exciter coils done.

The next question to ponder was, "What would I need to homebrew to get the Millen modules to work together?"

Don't hit me now, but I decided to use solid-state rectifiers and voltage regulation to keep things simple and cool; and it did. The only time high or low voltage is on is when I hit the "plate" switch or the PTT on the D-104; otherwise, all that's on are the filaments and the bias supplies.

I wanted NO hum on the RF CW note or modulation so I decided to use double choke filtering on most of the supplies. Ripple is less than .03%.

First, I had to design and build the low-voltage chassis for all of the modules mounted in the tabletop transmitter:

- 500V high voltage for the 807 and 6146s.
- 250V for the 90831-speech amp.
- 6.3 VAC for the exciter and speech amp.
- Isolation transformer and keying circuit for the 90700 VFO.
- A stiff regulated bias supply for the 812As
- Another regulated bias supply for the exciter and speech amp.
- A 6-ma (FS, full scale) meter to monitor the 807s grid current.
- A 300-ma FS meter to monitor the modulator's cathode current.
- Filament ON-OFF switch and green light
- Plate ON-OFF switch and red light
- Tune-Operate switch
- All of the connecting plugs for the Millen modules.
- All of the connecting plugs to go to the HV chassis and modulator.
- All of the grounds and miscellaneous keying, and so on.

Second, I had to make the 1500-V, 500-ma supply with power modulator:

- 1500-V, 500-ma CCS with dual choke design and solid-state rectifiers.
- TZ-40 or 811A push-pull modulator with shunt-choke feed to the RF deck that keeps DC current from flowing in the modulation transformers secondary by capacitively coupling to the RF deck.
- Negative cycle loading of the modulation transformers secondary by using K6AD's circuit from ER [ER #154, March 2002]. This protects the mod iron.

Problems Encountered

I have to say I encountered no real tough problems in building the Millen station. Other than the usual, finding parts, wrangling the heavy transformers on the HV chassis, punching all the holes and punching those 2.5" holes for the meters; it wasn't too bad. Over the years I have done quite a bit of homebrewing, but in the past every bias supply I had ever designed was for Class-AB1 amplifiers and not Class C with 30 mA of grid current. It took me a couple of tries to figure out I had to separate the RF deck bias supply from the speech amp and exciter bias supplies and that I would need some pretty stiff voltage regulation to keep things stable (what's that saying about old dogs?).

The mica .002-µfd, 2500-V RF bypass cap on the 500-W RF deck caused the only fuse-blowing episode on this whole project. As I recall I did check it with my mica leakage tester and it was good. I have had problems in the past with those large transmitting mica capacitors. I had several go in my Collins 32V-2 and 32V-3, so I learned to be conscious whenever I see one. Well, I was fooled in this case. It checked good, but after a couple of days of 1500 volts and modulation, it finally shorted out to ground, 0.3 ohms. As much as I hated to, I replaced it with

a new .001-µfd cap at 3kV from Mouser. All of the vintage transmitting micas in my junk box, in that capacitance/voltage range, were leaky.

Having homebrewed stuff over many years I learned to build my projects in modules so I could power up items separately, making the debug job a bit easier. So, no sparks or blown fuses; I was able to get everything up to the RF deck running and working in a few weeks after assembly. Other than my fight with the bias supplies, everything went pretty smooth. Even the 1500-V supply and power modulator went off without a hitch. It would have worked perfectly the first time if I hadn't cross-wired the CW/Phone relay, but even with the cross-wiring error I didn't cause any serious problems, just couldn't hit 100% modulation and my audio sounded rough.

How Are Things Working on the Air?

Oh, I almost forgot to mention neutralization. The 812As were very easy to neutralize. All you do is disconnect the HV from the RF deck, connect the RF output to the vertical inputs of the 90905 scope and key up the exciter to apply some RF to the grids. At this point, you should have grid current as you peak the grid tuning on the RF deck. Now tune the plate tuning on the RF deck until you get a peak on the scope, then, take an insulated screwdriver and adjust the two neutralizing capacitors until the scope display goes to minimum signal. It took me all of about 2 minutes to complete the neutralization, which you should do on the highest band you plan to operate but I did mine on 80 meters, and even so, the rig was rock stable on 20 meters.

Once all of the wiring issues were resolved, I was on the air with 250 watts of clean RF and great audio reports. With about 1500 volts on the plates, I loaded the RF deck to about 225 mA with 30 mA of grid current. With 811As, the modulator is capable of over modulating the 812As quite easily. So, I tend to watch the trapezoid pattern as I talk making sure I don't push it too hard. Remember, I added K6AD's negative-cycle loading circuit. Well, I added it after I noticed how easy it was to over-modulate the 812As. Even though the negative-cycle loading circuit isn't designed to do more than protect the mod iron, I find it keeps me from over-modulating when that periodic loud sound hits. Reports on the air indicate smooth crisp audio with no hints of distortion; looks like Millen did a good job, a testimony to the quality built into each module.

Well, I have to say, being one of the first on the air with the James Millen 500-W RF deck, plate modulated, is turning out to be more fun than I anticipated. Many of the "good fellows" belonging to the James Millen Society are now very interested in getting their Millen transmitters operational and on the air. Now, the next thing we need is a James Millen net on 75 meters to flush out more of those fine rigs.

If you have any questions please do not hesitate to email me at k0eoo@arrl.net.

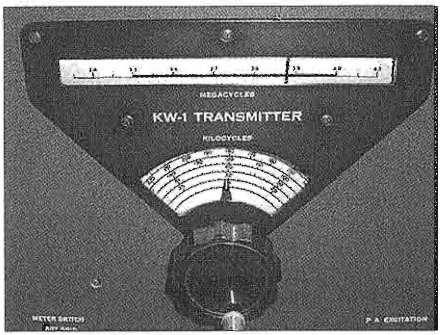
ER

Restoration of a Collins KW-1

By Bob Sullivan, WØYVA
PO Box 579
Great Falls, VA 22066

The Collins KW-1 is arguably the most sought after piece of Collins equipment. With only 150 manufactured in the early '50s, they have become very rare and quite expensive. The KW-1 sold for $3850, and was a monster nearly 6-ft high and weighing in at 600 pounds. The KW-1 covered all bands 160 through 10 and can easily generate 600 watts of AM carrier (into a dummy load of course!). Finals were a pair of 4-250As modulated by a pair of 810As. One nice feature of the KW-1 was the "window" showing the final tubes—a nice sight in a darkened room. Now selling in excess of $20,000, only a lucky few will end up with one of these beauties in the shack.

This article will chronicle the restoration



of one of these fine half-century old AM transmitters. You may never have the opportunity to restore a KW-1, but many of the restoration details and hints herein will be applicable to many other, more common rigs. For those who want to view numerous detailed photos of the restoration process I invite you to view my web site at http://www.isquare.com/personal_pages/kw1-34restoration.htm.

Everything about the KW-1 is big and heavy so it is a good idea to have help with disassembling and assembling the major components. Basically, the KW-1 consists of the following major pieces and modules:

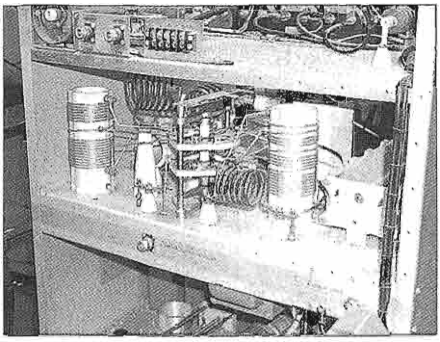
1. The cabinet
2. HV Transformer (a monster!)
3. Modulation Transformer
4. RF Deck
5. Audio Deck
6. Modulator and Rectifier tube assembly
7. Transformer/Capacitor assembly
8. Wiring harness

Disassembly and Some General Comments

Before removing anything take *plenty* of close-up photos. If you don't have a digital camera, get one! Believe me you *will* forget what goes where. In addition to the photos, keep careful notes. Use small plastic baggies for storing hardware—mark the bags carefully. Make drawings of any mechanical assemblies you must remove. For example, removing the kHz dial involves a half dozen pieces; clips, spring washers, etc. A drawing is a must.

Speaking of hardware, you have two restoration choices: Buy all new stainless steel hardware (my favorite place is Hi-Tech Fasteners at 800-466-1940; they have everything and you can purchase small quantities) or clean the existing hardware with a tumbler.

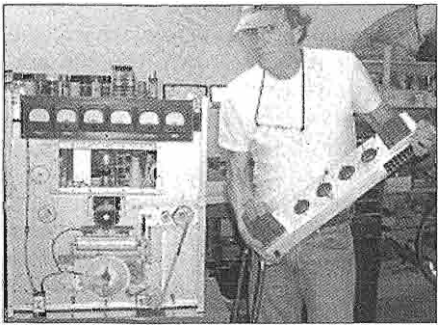
You will need a lot of work space. The various parts take up a lot of room. Remove all the tubes, rear cabinet door, meter panel, front door, and all knobs from the RF deck. Clean everything before setting it aside. Decide now if you are going to repaint any of the panels. If you do, I suggest bead blasting and powder coating. (I have a silk screen available for the RF deck panel should anyone be interested). My cleaning solution for just about everything is a 50/50 mixture of Formula 409® and household ammonia



Rear of RF deck before disassembly and cleaning was done.

followed by a water rinse, blow drying with compressed air and, if possible, further drying in the sun. Clean and polish all the knobs using a slow speed buffing wheel. If required, renew the white line pointer with a paint stick.

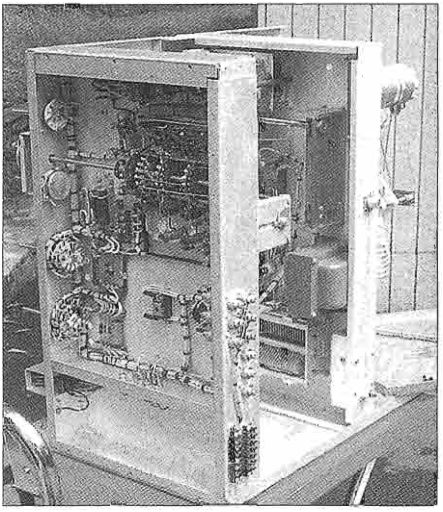
Remove the modulation and HV transformers from the bottom of the cabinet. With the HV transformer weighing in at around 100 pounds, it's a good idea to have a small dolly to set it on allowing you to easily wheel it around. The modulation transformer is easily moved about. Both of these transformers should be hi-potted to ensure good insulation, then cleaned and painted. Remove the ID plate from the HV transformer before cleaning. I power washed both transformers after spraying them down with a 50/50 solution of Formula 409® and ammonia and scrubbing with a brush. After drying, tape



Here's Roy, K1LKY, arranging the "KW-1K" kit at my QTH.

the terminals over and spray with a medium gray paint. Trying to match the original is an exercise in futility – no two transformers are ever the same color anyway! Replace the ID plate. Set the transformers aside. You won't need them for quite a while.

With a partner (the Ham down the



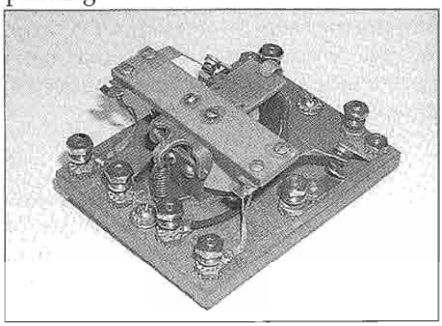
Cleaning the RF deck. Note the use of a hydraulic lift table, very handy!

street who owes you a favor) remove the major modules from the cabinet. A *very* handy tool is a hydraulic table that can be raised and lowered to various heights. Some of the modules, especially the transformer/capacitor assembly is heavy and awkward to handle. If you are not going to refinish the cabinet it is imperative you protect the edges. Use duct tape—it's heavy enough to protect and removes easily. There are numerous interconnections so once again, keep careful notes. Use additional wire markers if necessary. They can be removed when reassembly is complete.

With everything removed from the cabinet you can now remove the wiring harness and interlocks. Clean the harness as noted above and replace any terminals that look suspect. Remove and clean the aluminum angle pieces that are used to

Fill the bottom of a milk carton with Tarn-X® for dipping silver plated pieces; then polish with Nevr-Dull®.

support the various modules. Make notes to ensure these angle pieces get reinstalled correctly—each pair is slightly different. The cabinet can now be set aside or sent away for blasting and painting.



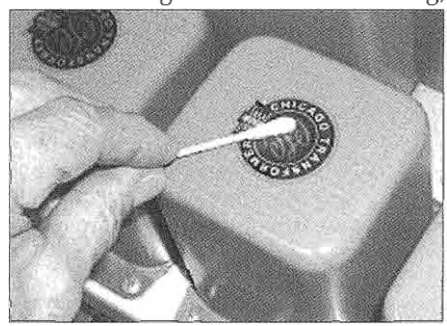
Here is an example of the attention to detail in this restoration. The hardware on this HV relay was removed and polished!

RF Module

Again, use of a hydraulic table is very handy. You can set the height of the big RF module to a convenient level for working. Remove all the panels from top, bottom, rear and sides. Remove the front panel. This panel is held in place with six brass screws so be careful not to mess up the heads. Set the panel aside or send it away for blasting, painting and silk screening.

There are a million screws. (Remember those 27-MHz IF television sets? TVI was a big deal in the '50s). As you remove aluminum pieces clean them (any time I say "clean," that means scrub with 50/50 solution of Formula 409® and ammonia, rinse with water, blow and air dry).

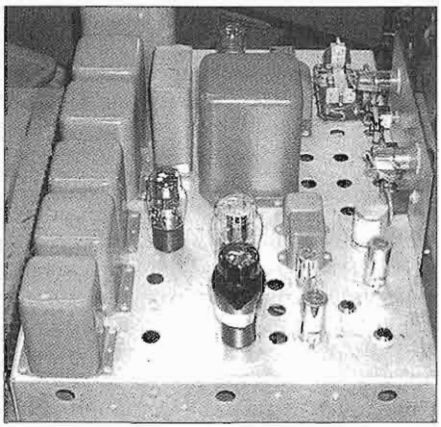
With the panels removed clean the *entire* assembly. Rinse down with a hose; dry carefully. Now remove all the coils and silver-plated strapping. Soak these in Tarn-X® (or something similar) and rinse with water. Then polish with NevrDull® (this stuff is fantastic—you will love it). Reinstall with new or cleaned hardware. Check all connections for tightness; lubricate all moving parts with lithium grease; clean all contacts and controls with your favorite cleaner (I like DeoxIT™); burnish antenna relay contacts; remove and polish the meter cases. If the meter glass has a film on the inside, carefully disassemble the meter and clean the glass. It's time consuming,



After trimming the custom decals, soak them in water and carefully slide into position. With a Q-tip, smooth from center outward.

but do it! A good restoration is in the details. Check all the large feed-through capacitors at the rear of the chassis for leakage—replace if necessary.

If desired, aluminum can be polished with NevrDull® or Wenol® Polish. This is a time-consuming process but the results are worth it. Any hardware I don't replace I polish with NevrDull® or 0000



A view of the completed audio deck.

steel wool. Brass gears are polished with a Dremel® using a fine wire brush. (Wear eye guards—*Safety First!!*).

You may elect to replace the kHz dial and/or the MHz drum. If so, both are available from Howard Mills (W3HM), or contact me. Finally, replace the front panel and knobs.

Audio Module

This is a bit easier to handle than the RF deck but still quite heavy, thanks to 8 transformers. Again, as with the RF deck, remove all tubes and the wash everything—top and bottom. The water won't harm anything. If the transformers are badly nicked and scratched (they usually are) they should be repainted. I elected not to completely remove the transformers but only loosen the hardware enough to slip painter's tape underneath. The transformers are then lightly sanded and spray painted with gloss medium gray paint. The spray nozzle will allow you to apply paint between the transformers. Naturally, everything else is masked off while spraying. A nice detail is to replace the original decals with newly minted versions. There are three sizes on the various transformers. If you have a friend in the model train or plane hobby ask them about making decals—those guys do it all the time. I won't detail it here but the process is straightforward. If you do this, remember to photograph or otherwise scan the originals before they

This is the complete RF deck, top view, without the cover.

are removed by sanding.

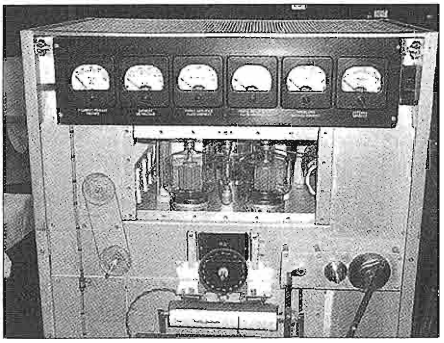
I decided not to make any major changes to the audio circuitry. I think the KW-1 audio sounds great without modifications! Some owners increase the size of the coupling capacitors for better low-frequency response. While we're on the subject of audio, I should also mention that some owners also remove the splatter filter at the output of the modulation transformer which consists of a large inductor and a couple of HV capacitors. I have tried it both ways and notice no difference.

Modulator and Rectifier Tube Assembly

This is the easy one—a small chassis with four tube sockets and a couple of transformers. Clean as discussed above. Disassemble the transformers in place (remove the end bells); sand and paint as with the audio deck transformers. Mask and paint the edges of the laminations while in place on the chassis. Redo the decals if desired. Polish the chassis. That's it for this module.

Transformer and Capacitor Assembly

This is the most unwieldy of the assemblies—it is heavy and hard to move around without damage, so be careful. Remove the HV relay to avoid damage and make it easier to clean; polish hardware; and burnish the contacts. Clean thoroughly as above. The large transformers and chokes may be painted



Final assembly of the modules into the cabinet has been completed. Thanks to Howard Mills (W3HM) for trucking the newly-painted cabinet to my QTH!

in place or removed. They are heavy and whatever you do don't drop one and break one of the ceramic terminals.

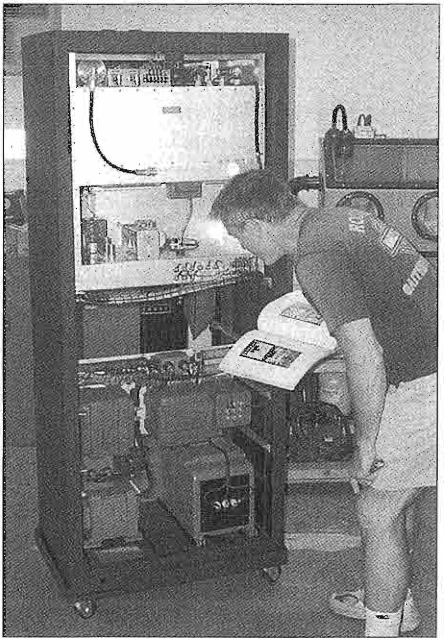
Reassembly

Reassembly is pretty much the reverse of the disassembly. During this process you will thank me for reminding you to take photos and make drawings! Reassembly requires a helper so don't try it yourself.

I am assuming the cabinet has been thoroughly cleaned or you have it back from the blaster/painter. Place the cabinet on a dolly so it can be moved around easily. First step is to reinstall the eight aluminum support angles. Make sure they go where they belong. During this installation you will also reinstall the wiring harness and a couple of the interlocks. Use your drawings/photos as a guide. Install the power and modulation transformers at the bottom of the cabinet.

Install the Transformer/Capacitor assembly. Two people are required here! Before installation, be sure to place duct tape along the edges of the cabinet to avoid damage. This module is a tight fit going through the cabinet. Bolt it into place.

Next, slide the audio deck in and bolt into place followed by the modulator and rectifier tube assembly. Finally, slide the big RF deck into place. Now you are ready to connect up the harness and HV



I was *SURE* I remembered how that HV wire was routed! (Restoration hint: Take a lot of photos during disassembly - you *WILL* forget!)

cabling.

Final steps are testing and alignment as may be required. I have not addressed any possible functional problems in this article. The KW-1 is actually quite simple, and standard troubleshooting techniques can be followed. But please remember that this is a **big** transmitter with large, lethal power supplies. Only one mistake is required to put you in the hospital—or worse. So be careful and energize this beast only if you have a partner and are wide awake!

Obviously, the actual process is much more complex and time consuming than what you might think from this article. My objective was to present a number of restoration techniques and ideas that you can use with your own project—whether it be a KW-1 or that little 5-tube superhet receiver you used as a novice.

73 and happy restoring!

ER

The National SW-5 "Thrill Box"

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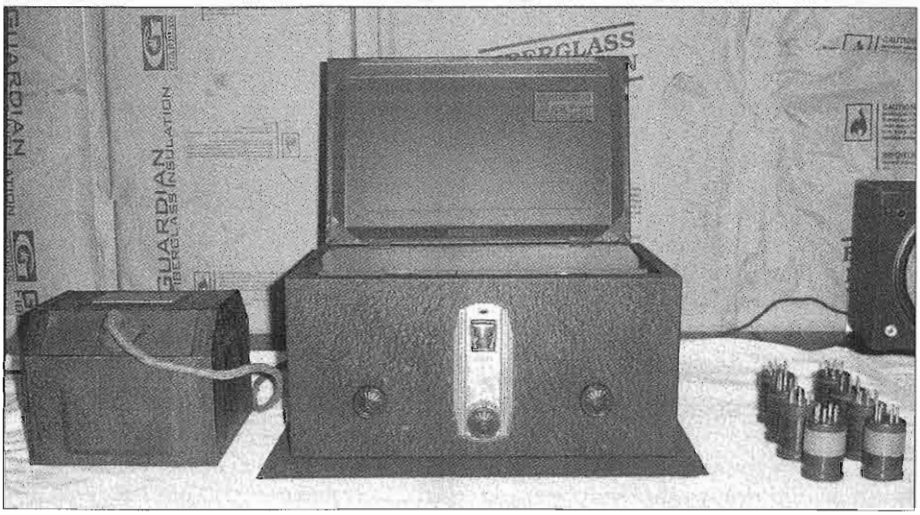
One of the more unique and sought after early National receivers is the National SW-5, labeled by National in their marketing as the "Thrill Box." The National SW-5 regenerative receiver was first announced to the world in the June 1930 issue of Radio News written by James Millen and Robert S. Kruse. Millen also authored an excellent description of the SW-5 and its underlying principles for the 1930 Manual of Shortwave Radio. This article can be downloaded and viewed in Adobe PDF format by clicking on www.w1ujr.net/sw-5_reference.htm.

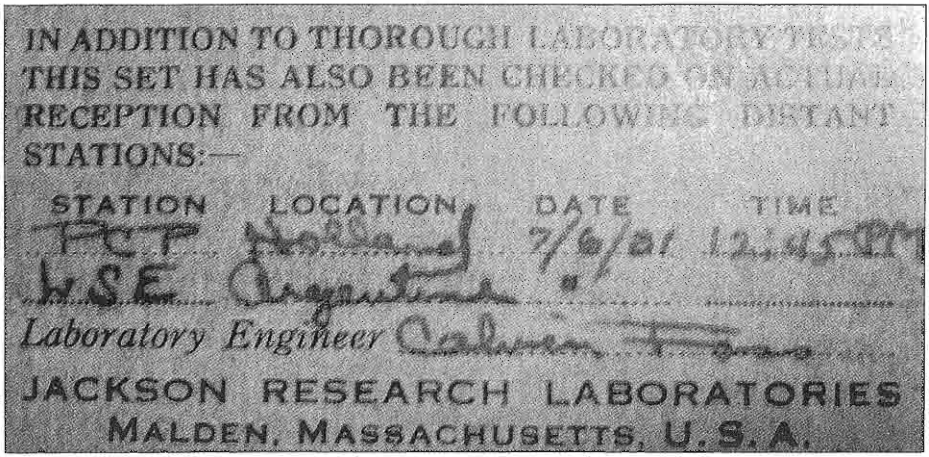
The SW-5 is not an exceptionally attractive radio like the later HRO series. Rather than sporting the HRO and SW-3 black crackle paint, the National SW-5 lives inside of a rather plain rectangular metal cabinet finished in a dull textured brown paint color. Indeed, the SW-5 bares a closer resemblance to metal breadbox than to a radio receiver. I'm not certain why National chose this color, but I suspect that the color's lack of visual appeal may have something to do with the scarce number of SW-5s around today, for the performance of the receiver is exceptional but the aesthetics are quite plain, other than the National "diamond" painted on the top and sides of the cabinet.

Background and Design

My receiver was first tested and put into service on July 6, 1931 by Jackson Research Labs laboratory engineer Calvin Foss. It appears that each SW-5 was tested as it came off the line and the results noted on a small chart on the right upper side of the top inside cover. The first stations logged on my unit were "PCP" in Holland and "WSE" in Argentina at 12:45PM July 6, 1931. The use of "Jackson Research Laboratories" on the testing tag struck me as curious, but upon further research I understand that National "subcontracted" the



The National SW-5 receiving equipment with the doghouse power supply on the left, the SW-5 in its cabinet, the coil sets on the right, and a National speaker in the right background.



Test tag on my SW-5 from the Jackson Research Laboratories, July 6, 1931.

building of some of their earlier receivers to Jackson. It would seem that Jackson Laboratories was really just a "shell company" located around the corner from National, on Jackson Street in Malden, MA. The reason for this scheme was apparently to avoid paying RCA patent royalties! Under the RCA agreement, royalties had to be paid based on gross sales, regardless if all units sold used the patent or not. This was a clever tactic on RCA's part, matched by an equally clever National response. Sadly it would seem that the SW-5 enjoyed only a short life, production given variously as ending in 1932 or 1934.

The New NATIONAL
A. C. THRILL-BOX

New Product of NATIONAL Company, designed in collaboration with Robert S. Kruse. Brings foreign S. W. Broadcast Reception within the reach of all. Easily assembled by anyone, with genuine NATIONAL Radio Products.

New type SE-100 S. W. Condensers. Insulated bearings, constant impedance pigtail, straight frequency line plates.

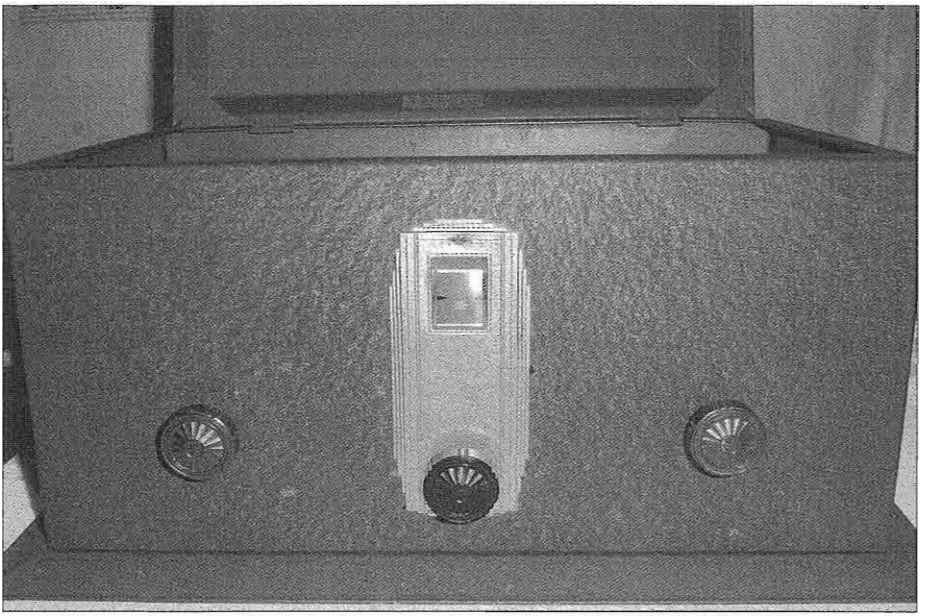
The coil-forms used in the new THRILL-BOX are made of R-39, the low-loss coil-form material recently developed by Radio Frequency Laboratories.

FULL A.C. OPERATION, but no A.C. hum, even on phones. DOUBLE SCREEN-GRID. Push-Pull Audio loud speaker reception of S. W. Broadcasts all over the world. Single Dial Operation. Accurate logging. Easily adjusted for wide spread of Amateur Bands. Special Construction eliminates "clicking" on higher frequencies.

ALSO AVAILABLE IN BATTERY MODELS for use with new UX 230, 231 and 232 Tubes. Send Today for full information. USE COUPON.

SW-5 ad from Radio News, June 1930

In the September 1930 issue of QST, Leeds Radio offered the SW-5 as a battery kit for $75.00, an A.C. kit for $79.50 (wired $10.00 extra) and the power supply (less tube) for the A.C. model for $34.50. Aside from the kit form, there are at least three variants of the SW-5 design. The first was the battery set, then an A.C. set using a pair of 27



The front panel of my SW-5, showing the National Type H dial.

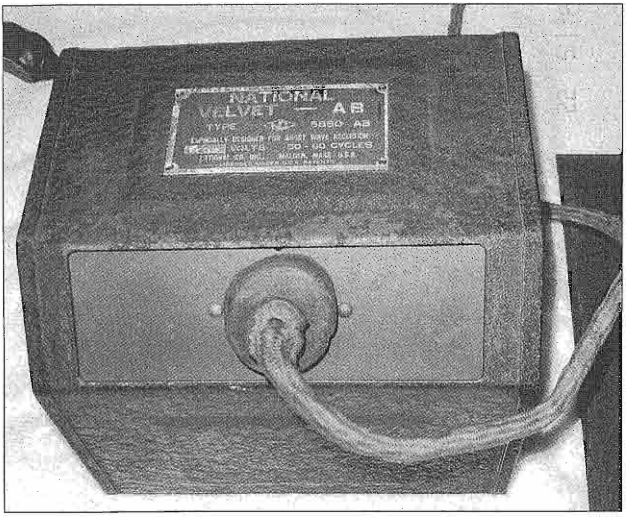
vacuum tubes in the audio output, and finally another A.C. set with a pair of 45 tubes for the audio. The rest of the tube compliment is the same between the set variations, consisting of an R.F. amplifier, a regen detector, and an audio voltage amplifier. A similar set, the National SW-58, was later offered, but the front panel tuning dial had changed from the early vertical style known at National as the type "H" that is shown on my unit. The SW-58 used a slide rule layout, quite similar to the National FB-7 series.

My receiver seems to be the model marketed to the amateur radio community as it uses a pair of 27s in push-pull arrangement for audio. It came with five sets of plug-in coils covering the upper end of the commercial broadcast band to 25 meters. The general coverage coils, identical in construction, are used in the detector and oscillator stages, just like the later National SW-3 series. The bandspread coils utilized a small trimmer cap inside one of the coils. During the past 75 years, this unit had somehow managed stay quite intact and even included the original external "dog house" shaped power supply.

Millen and the early set designers at National felt that an outboard power supply was the only acceptable method to keep the receiver free of hum and drifting from heat. These concerns, hum and drifting from component heating, are why the very early National gear, SW-3, FB-7s, the 1-10 and HRO all require an external power supply. In Millen's 1930 Radio News article, he listed the design criteria of the SW-5 to be "1-Absolutely hum-less a.c. operation, 2-Single dial control, 3- Loud speaker reception from broadcast stations, 4-Good tone quality, 5- Noncritical tuning, 6- Neat appearance." Based on my use of the SW-5, Millen seems to have hit it right on the mark as the set works remarkably well for a radio over 75 years old!

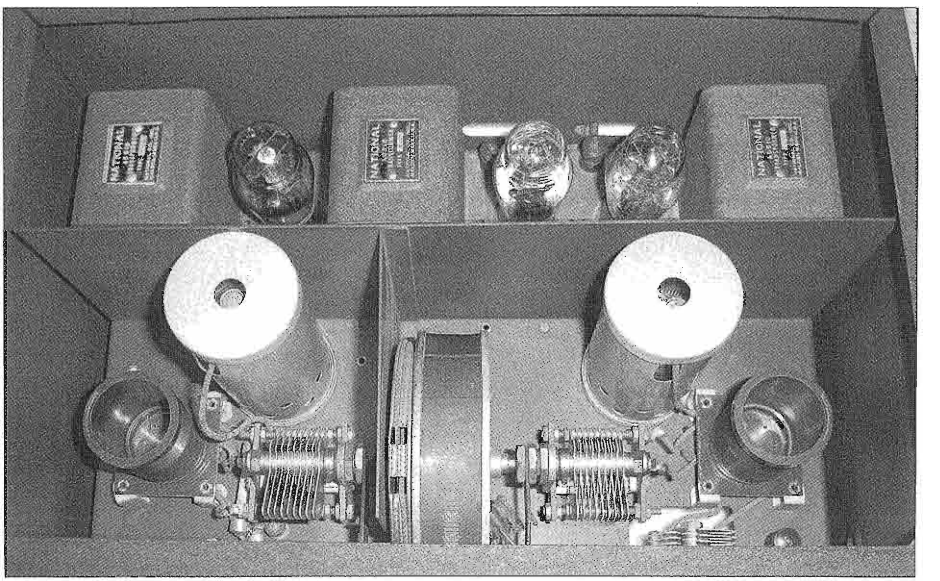
Use of the SW-5

The SW-5 is a fun receiver to use in today's vintage Ham shack. The unit is simple to tune, forgiving, and has plenty of audio output. A standard 1/4-inch

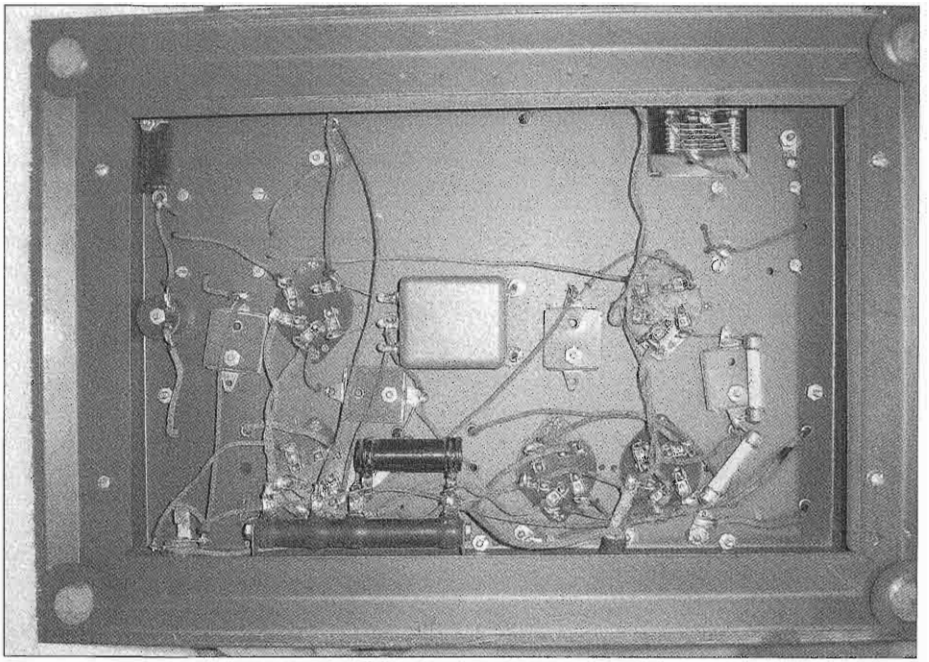


The matching outboard "doghouse" power supply unit for the SW-5 receiver.

headphone jack is located on the rear panel but the unit really shines when played through a vintage speaker. One note of caution, like many of the early National receivers, full B+ plate voltage, in this case close to 200 volts, appears across the speaker leads *and the headphone jack*. So, exercise caution and be sure to use a good set of insulated headphones. As for that other connection, the antenna, keep in mind that the SW-5 is designed for, and seems to work best with, a high-impedance antenna feed. My unit seems somewhat deaf with coax. If you do need to use coax, try one of the inexpensive 75-to-300 ohm TV antenna transformers sold by Radio Shack. Perhaps the only "quirky" item on the set is the antenna trimmer capacitor. Adjustment of this can cause the receiver to "pull" and skew the tuning of the logging scale, so it is best to peak the trimmer on the signals of the band in use and leave it alone. One shortcoming, when using the SW-5 with a transmitter, is the lack of provision for muting. No external connection is provided, though it would



A view under the lid of the SW-5. The tuning dial is in the front center portion.

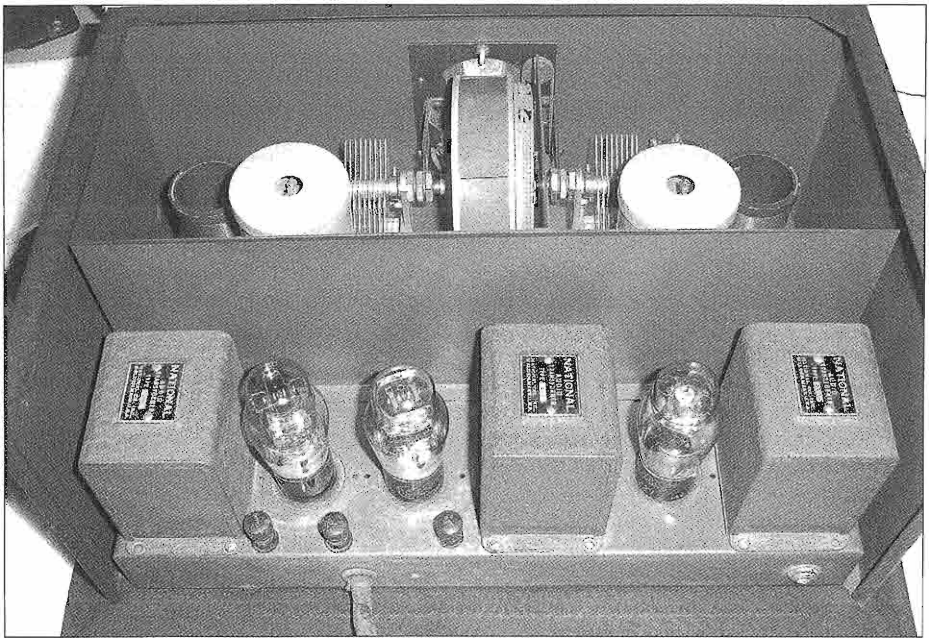


Looking underneath the SW-5, the relatively uncluttered component layout is visable.

be a simple matter to implement such a scheme by utilizing the headphone jack hole, or by snaking a cable out under the chassis.

The SW-5, like most regens, is a very "hot" receiver, capable of exceptional sensitivity. It is however, again, like most regens, not capable of great selectivity. In fact, on the crowded AM broadcast band it is very easy to tune in two stations at the same time. Still, given this shortcoming, the receiver is really quite

Rear view of the SW-5 with the covers removed.



Another SW-5 top view that shows the audio stages.

simple to operate and capable of some surprisingly good audio. As the dial is simply calibrated as a logging scale, it helps to make up a "cheat sheet" of the tuning settings for quick return to desired frequencies. On this receiver's maiden voyage in the W1UJR shack, I quickly developed just such a sheet and found that I was able to return to each frequency with good repeatability, a must for a serious monitoring receiver.

Once you find a SW-5, the next challenge is to locate the coil sets. While you can still find coil forms from time to time at Hamfests, the higher bands, like 160 and the AM broadcast bands, require some rather complex winding to make the coil sets. So by all means, if you do come across a SW-5 or its little cousin the SW-3, try to get the coil sets at the time of acquisition. National offered surprising coverage with the SW-5 and SW-3 sets, with coils spanning from 90 kc to 35 Mc. The bandspread coils, noted by the trimmer capacitor installed in the top of one of the coils, are very helpful if the set is be used on the Ham bands.

The photos are of my set in the "as found" condition, prior to any cleaning or prep work, actually very little was needed. Interestingly enough the unit played out right of the box, pulling in domestic AM broadcast stations on the upper end of the band using only a 12 inch length of wire on the test bench. Perhaps it's the novelty of the unit, or its ungainly appearance, but the SW-5 has become one of my favorite receivers of the National line.

I'll write more about the SW-3 in an upcoming column, but for now, with Hamfest season on the horizon, keep your eyes peeled for that ugly brown box hiding under someone's table, you might just be in for a treat! *ER*

NATIONAL COMPANY

The American VHF-AM Equipment Gallery

Part 5, The Clegg 22er 2-Meter Transceiver

By Jim Riff, K7SC
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Scottsdale, AZ 85255
k7sc@arrl.net

This part of my series on VHF AM equipment is intended to compliment the Part 3 article in the May 2005 edition of Electric Radio that was about the Clegg 22'er, Mk II. Some material will be repeated for the benefit of readers who may have not seen that previous issue.

When the well-known and common Gonset came on the market in the 1950s, it established the standard for compact VHF transceivers. The combination of receiver, transmitter, and power supply in one package was a new and exciting concept. Many companies offered 2-meter components, but Faust Gonsett (W6VR, SK) combined them into one system, and made mobile and base operation possible with one compact package. His popular Gonset Communicators have been written about extensively, so we will focus on the other companies who challenged this technology with their own designs.

Today, with the growing interest in 2-meter AM activity in the US, these old tubed boatanchors have become increasingly popular. The operation, maintenance, repairs, and just collecting of these boatanchors has become easy and fun.

The continued use of 2M AM may indeed help preserve our operating privileges on all VHF bands!

Squires Sanders, a Millington, NJ security manufacturer, introduced the original 22'er as the first competitor to the Gonset Communicator. Designed by the renowned VHF engineer, Ed Clegg (W8LOY, SK), to take market share from the lower cost Gonsets; this was Clegg's first attempt to package his accumulated experiences into a single box. Their 2M AM transceiver copied the Gonset in

The original Clegg 22'er

Squires Sanders 1967

SQUIRES-SANDERS 2 and 6-METER VHF TRANSCEIVERS

CLEGG 22'ER
2 Meter Transceiver
249.50
Less Mike
No Money Down

CLEGG 66'ER
6 Meter Transceiver
249.50
Less Mike
No Money Down

• Both the 22'er and 66'er Have Built In 115VAC/12VDC Solid State Power Supplies

CLEGG 22'ER—Complete 2 meter AM package with dual conversion receiver and 18w input transmitter. Meter functions as "S-meter" in receive and Output meter for tune-up. Covers 143.8-148.2MC with fine tuning control. Features NUVISTOR RF stage for .2 μV sensitivity. Audio output: 3 watts. Transmitter features broadband exciter; push-to-talk; frequency spotting switch. Internal solid state power supply for 115 volts AC and 12 volts DC. Size: 12⅛"x6½"x10¾". Less mike and crystals. Shpg. wt., 19 lbs.
40 H 4402WX $12.50 monthly Net 249.50

CLEGG 66'ER — Successor to the famous 99'ER. Compact and flexible, for fixed or mobile use. Internal 115VAC/12VDC power supply. Sensitive dual conversion receiver covers 49.9-52.1MC with 60db rejection of spurious signals. Features AGC, squelch, switchable ANL, built in speaker. 22 watt input transmitter incorporates high talk power with speech clipping and 50db harmonic suppression. Multituned and broadband exciter stages for quick QSY. Crystal frequency control. Size: 12¼x12x7¼". Less mike and crystals. Shpg. wt., 19 lbs.
40 H 4418WX $12.50 monthly ... Net 249.50

Equip Your Ham Shack Now — Use Your Lafayette Easy Pay Plan

The Clegg 22'er was advertised in the 1967 Lafayette Catalog in either 6 or 2-meter versions. This would be about $3,370 in today's dollar!

many respects, but took advantage of more modern circuit designs. Image rejection, selectivity, and RF gain were much improved over the Gonset. Although a similar 2E26 final was used, transmit audio was Heising modulated using parallel 6AQ5's. This unique design used a single 6AQ5 for receive audio, and a second 6AQ5 was biased "on" during transmit to increase talk power. Most 22er's can usually be identified on the air with their unusually strong, punchy modulation. On the receive side, the introduction of the lower-noise, higher-gain nuvistor 6CW4 triode provided a much better RF stage than the older pentodes in Gonset products. Image rejection, a major Gonset problem, was cured with the addition of tunable traps in the 22'er front end. Lacking a VFO and having only a single crystal socket seemed to be the 22'er downfall. A long slide rule dial provides adequate band spread for AM operation. The chassis is a straightforward, hand-wired, easy-to-service design. It was sold through all of the major catalog houses such as Allied Radio and Lafayette during the late 1960s. Although capable of 12-volt mobile operation, these big square boxes would be unacceptable in most any modern vehicle. Ed Clegg went on to produce a continuing series of "22'er" models after this design: 22'er Mk11 (previously covered), then a 22'er FM, and some prototypes of a 22'er AM / FM, then finally a SSB model called "Comet" that was never put into production. The 22'er was a better all-around performer than the common Gonset Communicators (1, 11, 111), and can usually be found today at Hamfests for about the same price as the poorer performing Gonset.

Pros: Simple, very reliable, with strong modulation. Utilizing common and easily obtained tubes, and other standard components.

Cons: No VFO, slight receiver drift, delicate S meter.

Specifications: 117V and 12V operation, PTT, 7W (2E26) RF output, .35μv sensitivity, selectivity 10 kc, weight 19 lbs., size 12 X 6.5 X 10.75 inches, cost $249.50 in 1967.

Conclusions: A great and inexpensive performer, loud strong modulation, good receiver characteristics, plentiful and easy to find at most Hamfests. Best all-around, low-cost method to get into the fast-growing 2M AM nets on 144.450MHz found in most large cities.

The AM Broadcast Transmitter Log

Part 12: The RCA BTA-1R1, All-Band RCA, and Revisited Gates BC-1

By David Kuraner, K2DK
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Haymarket, VA 20169
k2dk@comcast.net

With this issue, we present two conversion approaches for comparison of the RCA BTA-1R1 and its variants. One approach has been presented in the September 2003, ER #172, by Larry Will (W3LW). The other is a multiband conversion for 160, 80 and 40 meters. As with the Gates BC-1 series, there are several ways to make the conversion. And with regard to the Gates series, we could not have included all the variations for conversion in the first Gates presentation. The Gates methodology to be described is for 160 meters only, as was Larry's RCA conversion. This one for the Gates is much simpler than those previously described. It keeps the original output circuit intact.

It should be mentioned that the Gates is not a good candidate for conversion above 80 meters. The lead lengths of those 833As will tend to make it difficult to stabilize. Also, remember that the 833A triode needs to be neutralized. In general, a broadcast box using the 4-400 tetrodes has a far better chance of being stable at 40 meters. There have been suggestions that the "4 by 4" boxes will work on 20 meters. Like with Big-Foot and Nessy, I have been rather skeptical.

By now, you will conclude that different manufactures use the same circuits in different combinations. The various 833A and 4-400 transmitters will now reveal a pattern and have a limited number of permutations. These will definitely cover the vast majority of the 1-kW broadcast rigs most likely to be made available for amateur conversions.

The RCA BTA-1R1 and Siblings

The BTA-1R is a late-1950s design. The designation changed from 1R1 through 1R3 and the run ended after 1970. The transmitter uses 4-400s and fixed capacitors in the output network with adjustable tuning coils. As the series developed, the first rigs used 8008 rectifiers, changing to solid state with the 1R1 variant. Also, power change was initially performed with power-reduction resistors in the RF DC line, as was the usual practice with 1950s and earlier designs. The BTA-1R1 and later versions used separate taps on the HV primary for power reduction. Surely, this is a much more efficient method. Like the Collins 20V series evolving into the 820D, the RCA series became the BTA-1S. And like the Collins 1-kW boxes, the 1S was much lighter because solid-state circuitry was introduced. The Collins 20V-2 is 1150 pounds, compared to the BTA-1R1 at about 1500 pounds.

The RF chain starts with a 6AK5 oscillator, into a 5763 buffer. The driver stage is a 6146. The output network of the 4-400s final is the standard PI-L with a second-harmonic trap. The audio lineup is a bit of a surprise. The typical push-pull input stage of most of these transmitters use 6SJ7s. This one uses 2E26s, the baby brother of the 6146.

Larry's transmitter is tuned to 1945 kc. His original partial output network schematic with circuit values is shown in **Figure 1**. The plate coil (L301) was tapped 59 turns from the bottom end. The harmonic coil (L304) was tapped 25 turns away from the chassis. And, the output coil (L302) was set at 8 turns from the chassis. Larry reported the greatest drive

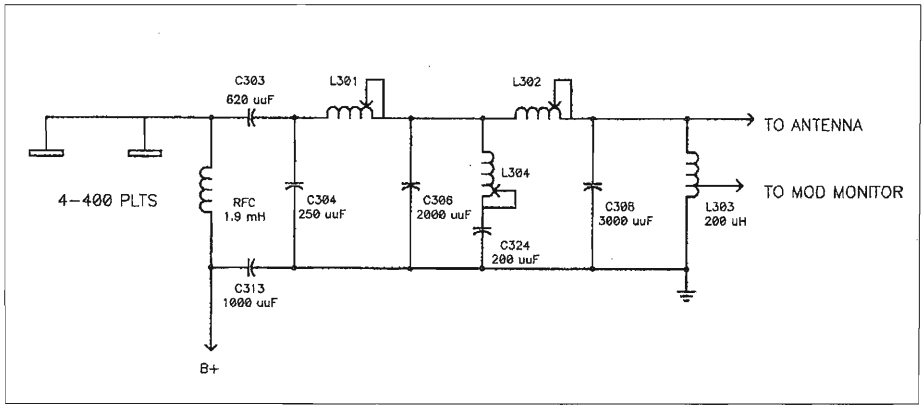


Figure 1: Above is the original illustration from ER #172, page 33.

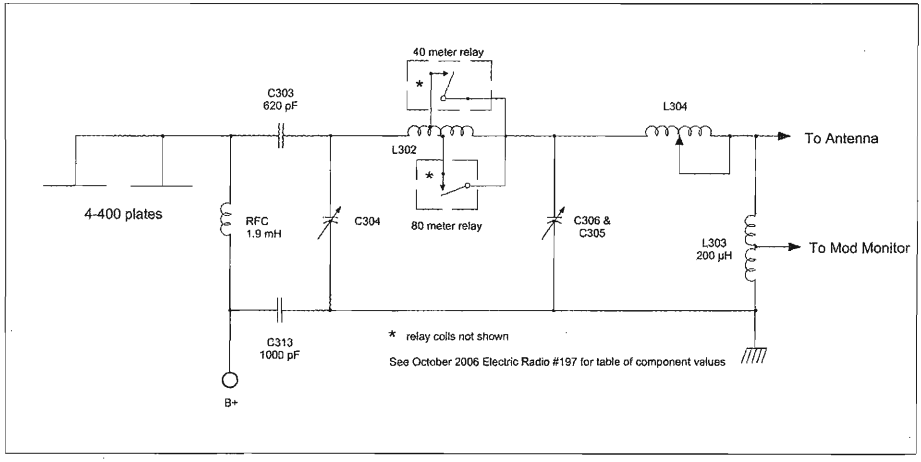


Figure 2: Schematic of a multiband output network for the RCA BTA-1R1 as described by Bill Coleman, N2BC.

from the 6146 at tap #5 on the driver output coil. So, here we have a rote starting point for the conversion to 160 meters if you do not wish to change the output network design. Larry uses an external antenna tuning network for fine loading adjustments. He continues with much more detailed useful information. I strongly encourage anyone doing this RCA conversion to refer to his original article.

The second iteration for conversion, by the necessity of multi-banding, requires reworking. The design was changed to a standard PI-L without the harmonic trap. The fixed tuning capacitor (C304) and the loading capacitors (C306 & C308) were changed to vacuum variables. The two loading capacitors, of course, became one. In this conversion, the L coil (L302) was remounted and used as the PI coil, replacing L301. The coil from the second harmonic trap (L304) became the L coil, replacing L302. Band changing switches the taps on the coils with healthy DPDT relays.

The original driver coil is replaced with an air wound coil, and a variable capacitor

The completely rebuilt RCA transmitter at N2BC. It's now in a standard rack cabinet and modified to make it fully bandswitched from 160M through 10M. Notice the Ranger II driver and R-390A receiver. A good example of a quality transmitter that might be found for very little cost.

is mounted as part of this tuned circuit. The control shaft appears at the front of the transmitter. Relays select the correct taps for band switching. Similarly, the buffer is tuned but with fixed capacitors and slug tuned coils, again, selected by relays. The oscillator is not used, and a VFO is fed into the buffer in its place.

This multiband conversion takes some serious work and planning. The strategy here could be applied to most 4-400 boxes. If a multiband conversion is being considered, using an external exciter to drive the final grids will make it much less complicated. Those newer designed transmitters such as the Bauer, McMartin and Collins 820D would be ideal candidates since, in most cases, the lower power stages may not be used for a single band conversion.

When I corresponded with Bill Coleman (N2BC), he informed me that he had completely torn the transmitter apart and rebuilt it in a six-foot cabinet. He "got tired of it living in the garage." He also informed me that because of the rebuild it now covered 160 through 10 meters. Now, does this confirm Big Foot or Nessy?

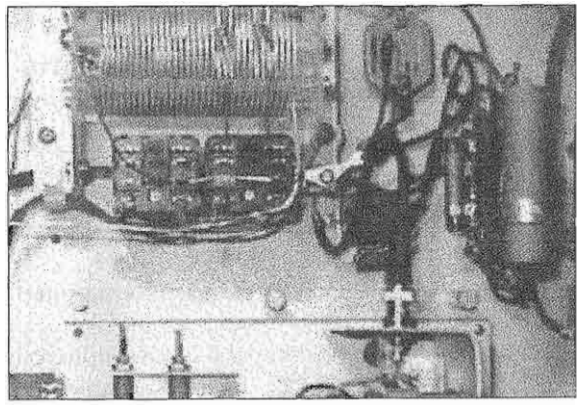
And, after the story of Bob Raide's Frankenstein rig was published in April 2005, ER #202, Bob informed me that it too covered 160 through 10 meters. So, I guess these mythical creatures have been confirmed—at least the electronic equivalents. Ironically, Bill had just sold the multiband RCA. At least we have the picture. We also have the picture of Frankenstein's output network. A 1/2-inch, silver-plated, copper-tube coil for the higher bands is placed ahead of the original tank coil. This technique is often found in multiband Ham transmitters.

My own preference is to dedicate one box for each band, but try to make them multiband capable via tap and capacitor changes. I am lazy and hate retuning. I also believe it's just a matter of time before I tune for the wrong band and "zorch" the relays in the output network.

The Gates BC-1 Series and DX-100 Revisited

The earliest model in the series, the BC-1F, is a one-ton, double-wide

monster. It is not very practical for the average Ham to bring into the house—both physically and matrimonially. As a result, sadly, many have just been abandoned and/or scrapped. It is surprising to learn that at least one broadcast station is still using a 50+ year-old rig as its main transmitter. The later single-bay transmitters are far more practical 1-kW and 1/2-kW models for conversion. The 1/2-kW, BC-500 series uses a single 833A in the RF stage and tunes just like its big brother. For either model, tune the lower power stages as described in Part 5 of this series, November 2005, ER #198. The final network settings to be described next presume that the transmitter is initially tuned for the top end of the broadcast band.



Rear view of the RCA BTA-1R1 that shows the new 6146 tank coil and two bandswitch relays just below.

For 160 meters, you will need to disconnect one of the fixed loading capacitors on the right as you face the rear of the transmitter. Again, facing the rear of the transmitter, the tapped coil should be 11 turns from the left. For PA tuning, the coil should be set so the roller is 15 turns from the front of the transmitter and at the top of the winding. The PA load coil should be set at the third turn from the front of the transmitter and at the bottom of the winding. Neutralize the final stage as described in the previous article by changing the tap on the driver coil and adjusting the neutralizing capacitor. Moving the final tuning circuit in and out of resonance, should not result in a change in grid current. A healthy amount of grid current to two 833As is about 150 mA. (For illustrations and photographs, refer to ER #198.)

Should you not be able to get sufficient grid drive, do not just assume that you have a problem in the driver or previous stages. As I cautioned before, you may not be able to trust these old meters. In the case of the multimeter incorporated in many of these old transmitters, the associated multiplier resistors can change value. Expect any possibility! And as mentioned last month, even the meter reading of a DX-100 can be erroneous.

The Maintenance Log

The Gates series, as well as many other manufacturers' models, often has a built-in dummy load. See the transmitter manual. The antenna line is easily switched out and the dummy load switched in. As with all practical Ham rigs, tuning into the dummy load and into the real antenna usually will be different.

There is a warning light associated with the dummy load of the Gates BC-1 series. Its purpose is to warn the operator that the transmitter is indeed switched to the dummy load and not on-line to the antenna. This warning light takes a 240-volt, 50-watt bulb. It may be obtained at Griffith Electric Supply Co., 5 Second, Trenton, NJ 08540, 609-695-6121 or 609-921-8482. My guess is that any good local electrical supply house should stock this, as well as many of the special bulbs needed by these vintage broadcast transmitters. Here is, at least, one known source if locally you draw a blank.

I will cover the 250 watters in an upcoming article. 73, Dave

ER

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May 2005 – June 2006
(Issues 192-205)

Compiled by Don Buska, N9OO

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District 6: WB6ACU, 194 / 41; WA6HCX, 194 / 40; W6IRD, 194 / 40; W6JRY, 204 / 7; W6XM 192 / 45 (ex W6BLZ, in 1933); KO6NM, 194 / 41; KO6NM, 200 / Cover; N6PY, 195 / 40; NI6Q, 194 / 41; W6SGJ, 204 / 45; KO6SM, 194 / 42; WJ6W, 194 / Cover; WJ6W,194 / 41
District 7: KE7ASK, 194 / 42; W7AVK, 194 / 44; KC7BGE, 194 / 42; K7CAX, 194 / 42; KD7EQ,194 / 42; W7IFJ (In 1936), 201 / 46; K7JEB, 194 / 42; N7JUG, 194 / 42; W7QHH (In 1951), 205 / 41; W7QHO, 195 / 45; W7RHV (In 1951), 205 / 41; N7RK, 194 / 42; K7SA, 194 / 42; NE7X, 194 / 42; K7YOO,205 / Cover
District 8: 8AB (In 1924), 201 / 19; W8AU, 197 / 5; W8AU, 197 / 6; W8GLW (In 1961), 196 / Cover; W8GLW (In 1940's), 196 / 49; W8GLW (In 1940's), 199 / 15; W8KGI, 205 / 40; WA8OIK, 192 / 45; W8QBG (In 1950's), 205 / 40
District 9: W9ADJ, 201 / 47; W9GDW, 201 / 47; WA9MZU, 196 / 19; WA9MZU, 196 / 24; KB9R, 201 / 47; WW9W, 201 / 43; K9XH, 201 / 47; WJ9Y, 201 / 47; 9ZT (In 1924), 197 / 36
Canada: VE3CUI, 201 / 42

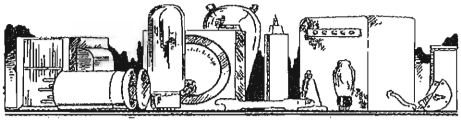
Photographs of Non-Hams

Bob Henry 201 / 12; Bob Ryan, 204 / 44; Jesse Bunnell, 197 / 18; Samuel Bauman, 195 / Cover; John Raymond 194 / 43; Krystyna Jennings 194 / cover; Kay Dorrough 194 / cover; S. Claus 199 / cover

[Editor's Note: Thanks to Don Buska's (N9OO) excellent work, ER readers not only have the yearly index, but also the on-line index. Be sure to thank Don for his hard work when you hear him on the bands! The on-line index is at: http://home.wi.rr.com/n9oo/ersearch.html]

The W5CZ Heavy Metal Museum is opening August 5, 2006!

All are invited at 3:00 PM, MDT for Ham radio fellowship, a barbecue, special guest speaker, door prizes, and a swap table.



Contact Rod Perala, W5CZ, by email for a map to the event:

rodperala@aol.com

DD-103 Digital Dial Product Review

By Steve Marquie, W8TOW
5946 N. Hagadorn Rd.
East Lansing, MI 48823

Many Ham radio operators typically are not too concerned about the frequency readout when using "boatanchor" gear. The operator may be satisfied if the desired station is found...if not, well, keep tuning! When the radio shack is all "BA" gear, I find having a digital readout is handy. Also, those occasions where the band is busy and getting right on the frequency is desired, a better means of frequency resolution becomes necessary for me. Over the years, several techniques to establish a frequency reference have been developed. One early method was to heterodyne the signal from a known source with the receiver in use. To achieve this reference signal you could 1) use a crystal-controlled transmitter, 2) a reference calibrator—such as the Hallicrafters or Telrad unit—, or 3) a frequency meter such as the BC-221.

In the 1950s, a more accurate means for frequency measurement came about in the form of crystal calibrators built into the receiver. Advanced receivers like the HRO50/60 had crystal calibrators with reference markers at 100 kc and 1000 kc. For a receiver with the National PW dial, this was a great advantage to the operator. Nonetheless, dial resolution was the drawback. Frequency calibration at best could be .5 kc; some creative Hams achieved 0.1 kc resolution, but not this Ham!

The earliest digital-readout receiver I am aware of is the R-390 followed by the HRO-600. Countless other manufacturer desired to achieve this goal. And, as single sideband voice operating techniques were honed, along with increased band population, the luxury of digital readout became highly desirable. For those of us using the older analog readout BA gear of the '30s, '40s and '50s, adding a new fangled digital readout might seem like a sacrilegious act, but if you are attempting to run CW or "getting on net frequency" with an older VFO (or ECO), a digital readout can become a necessity!

Now, I am willing to bet that shortly after the first Drake twins were produced some enterprising amateur began dreaming about adding digital readout to the pair. In the early 1970s, a company from Dayton, Ohio, introduced the Torrestronics TK-1 Digital Readout. I have had a couple of these units over the years. They work quite well, although by today's standards there are shortcomings. Programming this unit can be a challenge, but the old manual provided many established hints on how to interface the unit to virtually any receiver.

When I was asked to review the Electronic Specialty Products (ESP) DD-103, I was hoping to see a digital readout that was as much of a leap from the Torrestronics product as the former was from a BC-221. I was not disappointed. WOW! What a wonderful bit of engineering. ESP is owned by Ron Hankins, a long time Ham. Ron enjoys using older receivers and SWLing. Once you attempt to find a SW BC station on a SX-25 Hallicrafter receiver you will immediately want a better means of frequency reference!

The DD-103 is a 3rd generation digital readout for Ron. A similar unit is found with the High Serria QRP rigs. The DD-103 is pre-programmed for over 200 different receivers and transmitter. Standard band coverage included in the receiver is part of the program for each; auxiliary bands must be manually programmed. Fortunately, this procedure

is well covered in the instructions. In addition to performing as a digital readout for a rig, it also operates as a frequency counter. There is nothing like getting double duty from an accessory!

A Quick Tutorial

My unit for evaluation was the pre-assembled version. I poured a cold "807" and sat down on the patio with the manual. In about 30 minutes, I was ready to interface it with the first receiver, a Drake 2B. This process took exactly 15 minutes. I spent more time carefully removing the receiver from the cabinet to prevent scratching it than addressing the interface! According to the manual, "the VFO signal is to be routed to the input of the DD-103." This might be referred to as the local oscillator; *not the crystal oscillator!* Regardless of the technique used to generate this signal, I found on 6 different receivers the process was the same: sample the smallest amount of the VFO signal without loading the VFO circuit. On the Drake, I simply coupled a 100-pF silver mica cap to the VFO tube's cathode. For the Drake 2B, that is V3 (6BE6), the 2nd mixer & VFO tube. After adding a couple of RCA female connectors to the rear apron of the 2B, a short length of RG-174 coax was used to route this signal from the capacitor to an RCA connector. Power required for the DD-103 is 6.3 VAC provided by the filament supply. I was now ready to program the digital readout.

Controls & Programming

The programming and operation of the DD-103 is performed through the function of only 3 controls. A CALIBRATE button on the rear apron of the unit; a BAND switch; and a MODE/CAL switch located on the front. For all receivers, this procedure is the same. For my specific receiver, I began with the 80-meter band. With the readout's power OFF, press the CALIBRATE button IN on the rear apron, and turn the power ON. It is now in programming mode. The BAND switch needs to be in the CENTER position. Turn the MODE/CAL switch clockwise (CW). The radio model will be displayed. Rotating the BAND switch CW or CCW (counter-clockwise) changes the radio model. Rotate the BAND switch to the center once you locate your radio model. Press the CALIBRATE button "out" to auto-program the DD-103 for your specific model.

Some specifics about the DD-103: each band must be calibrated; when the receiver's band switch is changed, so must the DD-103 band switch be changed; if the receiver (like the 2B) tunes in one direction for a given band & the opposite direction for another band, the DD-103 must be "programmed" what to do for each *reverse* tuning band. The procedure addressing this follows: in the CALIBRATE position, the MODE/CAL switch can be rotated to display a ">" for forward tuning or a "<" for reverse tuning. Once the proper direction is selected, set the CALIBRATE button "OUT". Again, this must be done for each band. If desired, BFO offsets for LSB, USB, and CW can be programmed. These offset functions are stored in 3 separate memory locations accessed by rotating the MODE/CAL control. For all of my tests covered here, I chose to use the DD-103 only for AM mode, thus the MODE/CAL control is left in the CCW position. Further details' regarding the offset programming is covered quite well in the manual.

The Calibration

The equipment I used was a Phillips PM5123 lab standard frequency synthesizer to generate a stable signal (other options will work fine such as a crystal controlled transmitter, modern HF rig, or by zero beating WWV, etc). Two or three times per year I check the Phillips calibration to WWV at 2.5, 5.0,10.0 and 15.0 MHz. For this evaluation, I checked the top and the bottom end of each band of my rig comparing the crystal calibrator to the read-out confirming accuracy.

A comparison of the ESP DD-103 to the older Torrestronics TK-1: How did it do? As anticipated, the newer product provides some vast improvements. The ESP DD-103 provides some modern engineering improvements: Backlit LCD readout; full direct frequency readout; frequency resolution to 100 Hz or 10 Hz; and a pre-programmed frequency span and calibration for the many radios it directly interfaces. Adding to its flexibility, the DD-103 also offers programmed offsets for CW & SSB. By contrast, the TK-1 does not display the MHz place of the frequency; uses 7-segment LEDs and only resolution to 10 Hz.

I would grade the DD-103 an A+. If ordered in kit form, this unit should require only a couple of hours to build. The ability to quickly program it should greatly appeal to all and improved programming details are covered in a revised manual (plus a new QUICK START GUIDE). Determining how to interface the readout perhaps is a drawback for some, but the manual, along with these tips, might be helpful!

Post Script

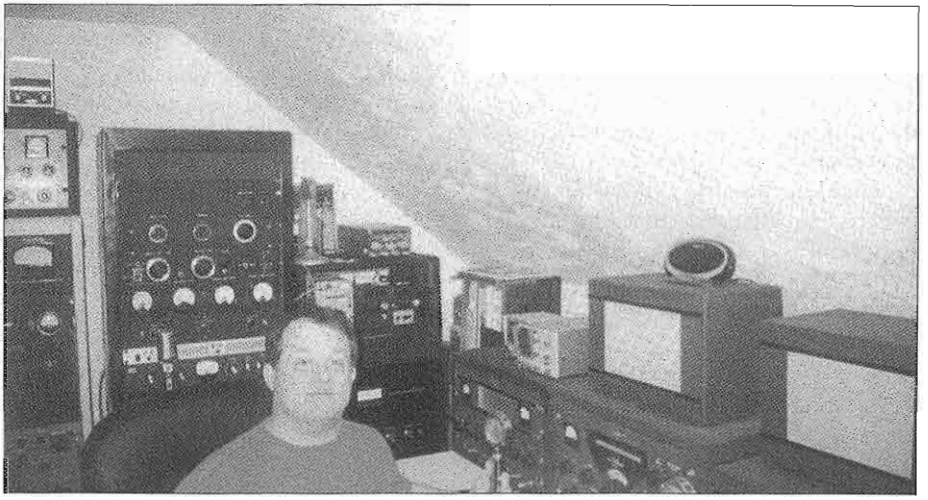
As of the submission of this review the following receivers were adapted to be used with the DD-103 in my shop: Collins 75A-3, 75A-4; Hallicrafters SX-100; National HRO-60; TMC GPR-90; & Drake 2B, R4A. I used the same approach for each to determine the appropriate circuit to obtain adequate signal for driving the DD-103. In each case, the readout performed exactly as with the trial receiver, the 2B!

[See page 58 for DD-103 contact information.--Ed]

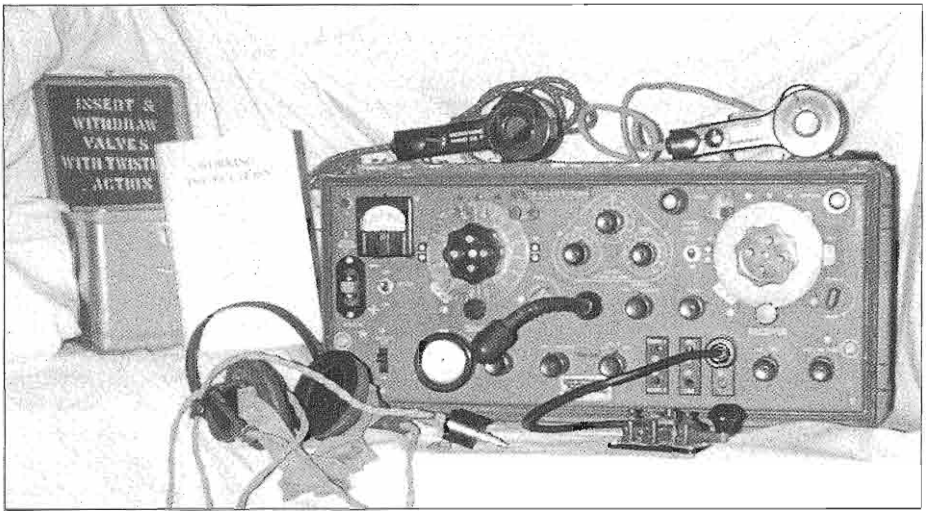
ER

At W8TOW, the DD-103 digital dial is indicating the receive frequency of a Drake 2B. Surely a classic station when paired with a Johnson 500!

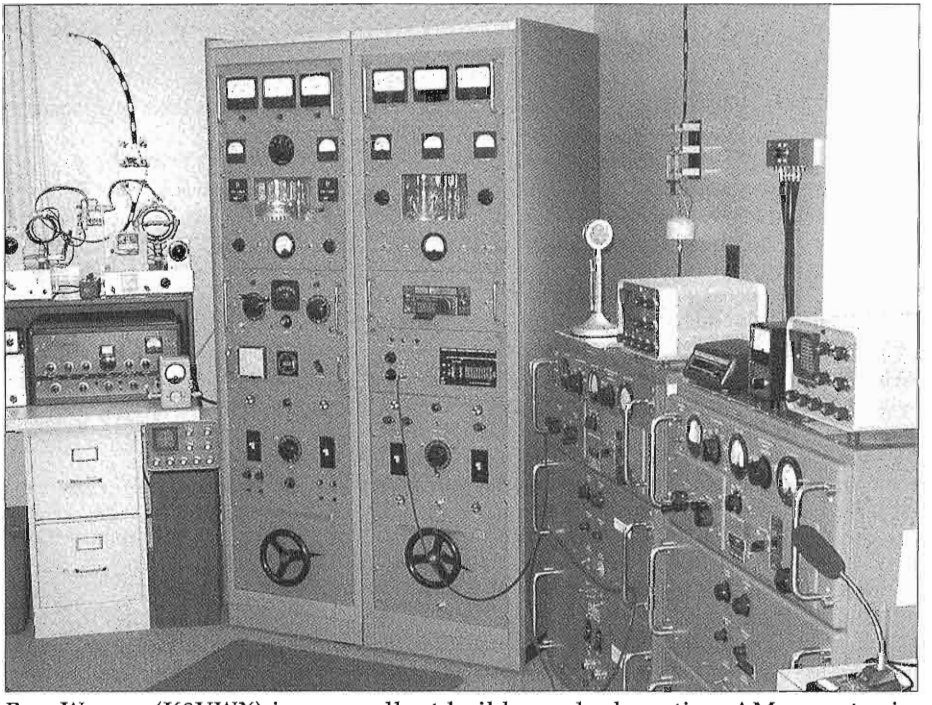
PHOTOS



Rich Sperling (WB3JLK) has four operating positions in his shack in Pittsburgh, PA and he is seated at one of them. The rack on the left holds a Viking 1, a modulation monitor based on Bob Dennison's (W2HBE) article in ER #10, an R-388 and a R-390A. In the center is Rich's homebrew AM rig running 300 watts out on all bands, but he mainly uses it on 40M. It has a set of parallel 813s modulated by p-p 810s. One the right is his ARC-5 station featuring a homebrew power supply/modulator from another ER article. The Gonset G-66B can be switched in when the band gets crowded. The units shown cover 40M; Rich has another set on 15M. On the desk are a 32V-2 and 75A-3 pair he uses mainly on 15M. The receiver on the right side is a 75A-4 which is paired with a 32S-1 and homebrew quad 811A linear, similar to the 30L-1 design. This is where you may hear Rich while he performs net control duties on the First Tuesday Collins Collectors net on 3805 kHz. Other operating positions include the Collins S-1 and S-3 lines with companion 30L-1 amps. The main position has a KWM-2/30L-1 pair and a KWM-2A driving a Dentron Clipperton L. There is also some modern equipment. HF antennas consist of a Cushcraft MA-5B minibeam for the higher bands, an Alpha-Delta 80/40M dipole and a soon-to-be-erected Carolina Windom 160 Special. Rich mentions that he splits his operating time 50-50 between AM & SSB, with favorite activities consisting of ragchewing, homebrewing and vintage gear restoration.



Walter Schivo (KB6BKN) had a rare New Zealand Coast Watcher's ZL1 MK11 set until recently, when he traded it for a more powerful Globe King 500B transmitter.



Roy Werner (K8VWX) is an excellent builder and a long-time AM operator in Columbiana, Ohio. In the center is Roy's beautiful homebrew transmitter that runs a pair of 4-1000s, modulated by a pair of 5868s. It is driven by the Johnson Viking 1 on the left, and above are balanced line tuners. On the right are a pair of military-surplus T-368 transmitters, known for rugged reliability.

VINTAGE NETS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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Deadline for the August 2006 issue: Thursday, July 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: Huge Vintage Estate Sale. SASE for complete list of rare Transmitters, Receivers, Accessories. David, PO Box 323, Metamora, Michigan 48455

FOR SALE: HRO-50, HQ-170, HQ-145XC, parts SX-101, Valiant I, 60-inch rack, 10 meter beam. Priced to sell, pickup only. Herb, K9GTB, 217-851-2585

FOR SALE: Desk Kilowatt: Completely restored Johnson Desk kW. Pickup only in Great Falls, VA. Contact me if you are interested. robert@isquare.com or 703-450-7049

FOR SALE: Hallicrafters S40B $125. BC457 Command xmtr $35. Heath IB1100 counter $35. T195 PTO $25. Jones Micro Match with coupler $25. Heath HP10 mobile PS $50. Johnson transceiver tester $35. Norbert Wokasch, WAØKJE, 3312 W. Bijou, Colorado Springs, CO 80904. 719-633-5661

FOR SALE: 500W VFO transmitter. See 1954 ARRL Handbook page 172. $250, delivery possible. Tom Berry, W5LTR, 1617 W. Highland, Chicago IL 60660, 773-262-5360.

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onto Garman Rd. and follow to the auction site.

Estes Auctions is pleased to offer the collection of Mr. William Turner of St. Charles, Missouri at our auction facility. Some of the items are a Zenith Type 3R, an Atwater Kent Model 9 breadboard, Atwater Kent Model 10 breadboard, Atwater Kent Model 12 breadboard, Atwater Kent Model 20, Atwater Kent Model 30, Atwater Kent Model 33, very nice Western Electric Type 7A amplifier, Crosley 50, Crosley 50A, Crosley 51, Crosley 52, Crosley Ace, Crosley XJ, Crosley VI, Crosley Super Trirdyn, Crosley regular Trirdyn, a nice original Crosley Pup. We will have lots of ca. 1920s battery sets to include a Grebe CR-9, Grebe MU-1, Radiola III, Radiola IIIA, Radiola balanced amp, Radiola 20, Radiola 25, Westinghouse RA-DA, Magnavox Model AC-2 amplifier. Into this collection we are adding a collection of Crosley radios from an estate in Cincinnati that will include a rare Crosley "Reado" the early Crosley version of a fax machine. It includes a roll of Reado Paper with original wrapper, Crosley Dashboard Type radios, Crosley Bullets and many more wood and Bakelite Models, a Crosley grandfather clock radio, and a Crosley sales lighted sign. This auction will include horn speakers, cone speakers, headphones, lots of radio magazines and books, lots of test equipment, many tubes with lots of early types including 201A-301A, WD-11, WD-12, UV-200, UX-99, UV-99, balloon Type 45, balloon Type 80 and 81, some Western Electric 216, VT-1, 217, also a selection of mixed tubes and some transmitting type. We are also offering a nice variety of crystal sets, some that were kits or homebrew type. Another good auction. We hope to see you there. Terms: cash, check, Visa, M/C. 5% gallery fee. Coming in September: a super collection of cathedral and tombstone radios from New Orleans, LA.

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http://www.radioattic.com/kremer.

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

FOR SALE: JFD Woven Fabric Dial belts catalog by manufacturer 34 pages $10 post free. John Snow, 1910 Remington Ct., Andover, KS 67002 316-733-1856

FOR SALE: Tektronix service note copy: AM Broadcast Measurements Using the Spectrum Analyzer, 20 pgs $15. Shipping and mailer extra. Ross Wollrab, 229 N. Oakcrest Ave, Decatur, IL 62527. 217-428-7385. REWollrab@aol.com

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FOR SALE: Tektronix 221 oscilloscope, good working order, with operator and service manual on CD. $125 plus shipping. Johnny Umphress, 1415 Moore Terrace, Arlington, TX 76010 817-915-4706 www.jgumphress@yahoo.com

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FOR SALE: BC454B, AC supply, others. Collins exciter plug-in coils, Crystal filter. Fluke digital counter, 1980A acting up. Bill Coolahan, 1450 Miami Dr NE, Cedar Rapids, IA 52402, 1-319-393-8075

FOR SALE: CRT tubes 3API & 5UPI guaranteed $10 each plus shipping John Snow, W9MHS, 1910 Remington Ct., Andover, KS 67002 316-733-1856

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FOR SALE: Globe Chief 90, $90, no shipping, will meet at approximately 50 miles max., Tom Root, 1508 Henry Court, Flushing, MI 48433, wb8uuj@arrl.net, 810-659-5404

FOR SALE: Hammarlund HQ-150 $200, prefer pick-up, Heathkit HW-12A w/power cable, mike and manual $50 plus shipping. Steve Davis, KD2NX, 71 Oak Street, Keansburg, NJ 07734, 732-495-8275, kd2nx66@yahoo.com

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FOR SALE: Modulation Transformer, new in original box with documentation, UTC S-22, multi-match 250 watt. $200. Two new 813 ceramic sockets $25, pair. New Thordarson swinging choke in original box, 5-20 Henry, 5 kV, 300 ma, 105 ohms resistance, $50. New Stancor #1414 choke, 7.5 Henry, 5 kV, 400 mA, 60 ohm resistance, $50. E.F. Johnson dual 100 variable capacitor, 3 kV insulation, $30. One NOS 813 tube $20. Filament transformer, UTC FT-8, 6.3 volt, 8 amp for pair 811 tubes, $30. One new in original box Eimac SK-410 black plastic socket with chimney clips, $35. One 5 volt, 30 amp filament transformer $35. Don Moth, W2MPK, P.O. Box # 73, Chittenango, NY 13037, w2mpk@dreamscape.com

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

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

FOR SALE: LS-3 Loudspeaker. Condition NOSB, tested/working. Black wrinkle finish US WWII dated $55. MFP'd and repacked in the early fifties. May have minor chips/scratches. Smooth black finish US Korean War dated $50. All plus shipping. Robert Downs, 2027 Mapleton Drive, Houston, TX 77043, wa5cab@cs.com www.wa5cab.com.

FOR SALE: B&K Model 960 Transistor Radio Analyst complete with manual in excellent condition. $75 plus shipping. John Snow, 1910 Remington Ct,. Andover, KS 67002 316-733-1856

FOR SALE: Tubes, transformers, receivers cabinets, more. LSASE w/2 stamps or email for list. WA7HDL, 167 Highway 93 south, Salmon, Idaho 83467 gbabits@salmoninternet.com

FOR SALE: Radiotron Designer's Handbooks: 3rd edition (352 pages) $19. 4th edition (1482 pages) $39. + shipping. Henry Mohr, 1005 W. Wyoming, Allentown, PA 18103-3131

FOR SALE: Icom R-75 with DSP, no filters w/ pwr supply and manual. Asking $400 plus UPS, Call Bill Hoisington at 850-621-3680 or email bill.hoisington@w-neweb.com

FOR SALE: Military whip antennas, Sears Silvertone batter set $45, Cathedral project radio $40. Bruce Beckeney, 5472 Timberway, Presque Isle, MI 49777, 989-595-6483

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

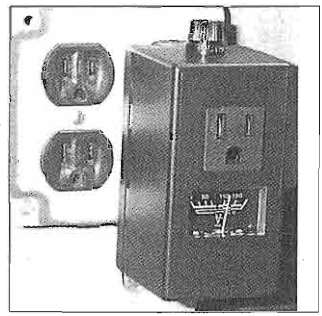
FOR SALE: Make offer: 1 radio tower 97 feet high base 12 feet, ladder all way to top with platform heavy duty. Need sell at once. Frank Bridges Maple Street Brevard, NC 828-885-2470

ZIM ELECTRONICS INRUSH CURRENT LIMITERS

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

Model AB-1M (With Voltmeter) $34.95
***NEW! Model AB-300M* 300 watts (2.5 amps x 120 VAC) with meter $39.95**
Model AB-1 (With Pilot Light) $29.95
Shipping, each limiter $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. Both models come with a full money-back guarantee.



Model AB1-M

Electric Radio Store
720-924-0171

FOR SALE: Hallicrafters 12S, stations just audible, some surface rust, all original, no damage $25. Manual for Tektronix oscilloscope type 545B blue cover, 5/8 thick folder, $8. Bernie Samek, 113 Old Palmer RD. Brimfield, MA. 01010, 413-245-7174, bernies@samnet.net

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

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.

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/TRADE: Manuals: NC300, NC303, NC183D, 32V2, 75A2, 51J3, DX40, DX100B, Apache, Valiant, GPR90, Conar. NI4Q, FOB 690098, Orlando, F1 32869 407-351-5536 ni4q@juno.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

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

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

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

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

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

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

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

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, PO Box 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

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

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

WANTED: Manual for GE lawn tractor E15. Motor for mower deck, drive board, parts. Hank 570-654-2347

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: 8873 tube for Heath SB-230 amp. Bill Smitherman, KD4AF, 9401 Hwy 67, E. Bend NC, 336-699-8699

WANTED: Heathkit 650 digital display and HM102 wattmeter. Shannon, W3SML, 540-867-9294 or W3SML@hotmail.com

WANTED: Info on National RCH "communication receiver", circa 1940, 5 bands, 200-400 kc, 1.3-30 megacycles. Case for National NC 101X receiver, also National RRA brackets for Rack mount. Barometer that is similar to my Chelsa Navy clock for my 40's/50's vintage hamshack. Johnson SSB unit 240-305 for Valiant/Viking II. Johnson transmitter switch 250-39. National HRO receiver. Always Looking For: Vintage broadcast mics; tube pre's; compressors; amps by RCA, Altec, Sony, WE, etc.. See Great Goodies in For Sale or Trade ad this issue! Ward Kremer, 1179 Petunia Rd., Newport, TN 37821, Ph/fax: 423/625-1994, E-mail: witzend99@bellsouth.net, http://www.radioattic.com/kremer.

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

WANTED: Black wrinkle cabinet for older HRO or junker for cabinet and parts. Jim, K7BTB, 928-635-2117 jeldgl@aol.com

WANTED: Manuals, copies or operating instructions for Farnell PSG-1000 RF Signal Generator.Kirk Ellis, KI4RK, 203 Edgebrook Drive, Pikeville NC 27863. 919-242-6000, e.kirkellis@netzero.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: Radio correspondence course lessons by National Radio Institute of Washington DC. Will pay cash and shipping. Also need a capacitor analyzer. George Reese, 380 9th St. Tracy MN 56175-1020. 507-629-4831

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

WANTED: Manual for Brown Electro-Measurement Corp. Model 815AF Impedance Bridge. Might be same as ESI 815. Norbert C. Wokasch, 3312 W. Bijou St., Colorado Springs, Colorado 80904, 719-633-5661

WANTED: 2-Crystal ovens and 1-relay #1K303 (110 VAC SPST) for BTR-1R2 Rick Brashear, K5IZ, rickbras@airmail.net or 214-742-1800

WANTED: CQ Magazine April, May, June 1945. Lynn Stolz N8AJ 614-885-5428 n8aj@yahoo.com

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: Hallicrafters R45/ARR7 receiver, even non working but complete and good cosmetics. Francesco Sartorello, francesco.sartorello@virgilio.it

WANTED: Entire metal case or back and bottom for BC125 or junker radio. Robert Hawworth, 112 Tilford Rd, Somerdale, NJ 08083, 856-783-4175

WANTED: SX115 knobs. Need audio gain knob and small ANL AVC knob. Also need an HT32B. Ward Rehkopf, K8FD, 1417 E. Bradley, Shawnee, OK 74804, 405-275-5677 or radiohound2@yahoo.com

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. Email: k5mlg@verizon.net

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

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

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

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

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

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

WANTED: Searching for RME CT-100 or 3R9 xmtrs and info about them. David

Edsall, W1TDD, 156 Sunset Ave., Amherst, MA 01002. 413-549-0349, dedsall@crocker.com

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

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

WANTED: 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: Commercial or kit-built 1930s and 40s transmitters. Doc, K7SO, 505-920-5528 or doc@cybermesa.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: Scott Special Communications rcvr. EA4JL, please call Kurt Keller, CT, 203-431-9740,

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. Work #913-577-8422.

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

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

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

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

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

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

WANTED: JB-49 Junction Box, BC-731 Control Box, DY-17 Dynamotor. Rick Brashear, K5IZ, rickbras@airmail.net or 214-742-1800

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: Schematic and meter for Hickok 209 VOM. Lee Elkins, 3016 Jasmine Rd NW, Carrollton, OH 44615 1-330-627-4922

WANTED: Info on Jerrold 704B calibrated field strength meter. Any info at all. Ed Kalow, 612-788-7976, 712 36TH Ave NE, Minneapolis, MN 55418

WANTED: 100 µµf silver mica capacitors or different values of this component for regenerative receiver. Louis L. D'Antuono, WA2CBZ, 8802-Ridge Blvd., Bklyn, NY 11209. 718-748-9612 AFTER 6 PM Eastern Time.

WANTED: A copy of "The Radio Handbook" by Frank C. Jones, 1937 issue preferred VG condition. Mike at: mike46@shaw.ca

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

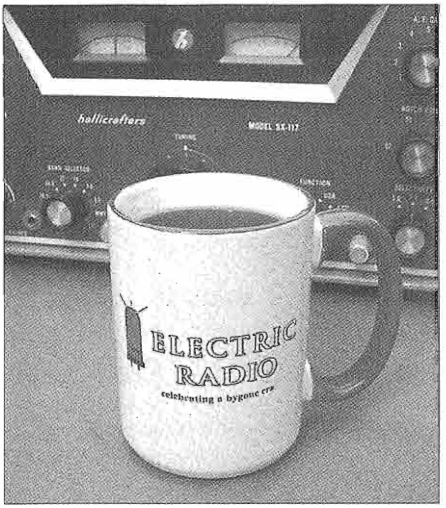
Don't forget to say you "Saw It In Electric Radio" when contacting advertisers! It helps Electric Radio and it helps the advertiser.

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 T-Shirts

The front displays the logo from the cover of ER (the tube logo, Electric Radio, and "celebrating a bygone era"). The back has "Real Radios Glow in the Dark" (used with the permission of Classic Radio). The T-shirts are 100% cotton and come in Small, Large, X-Large, XX-Large. The color is slightly lighter than the cover of ER. $15.50 delivered, $16.50 for XXL.

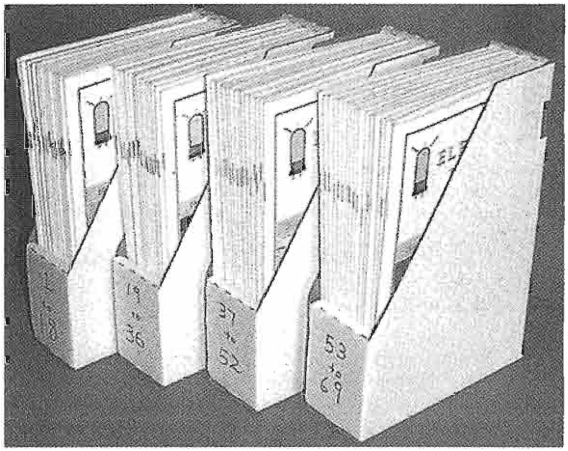


Electric Radio Coffee Mugs!

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



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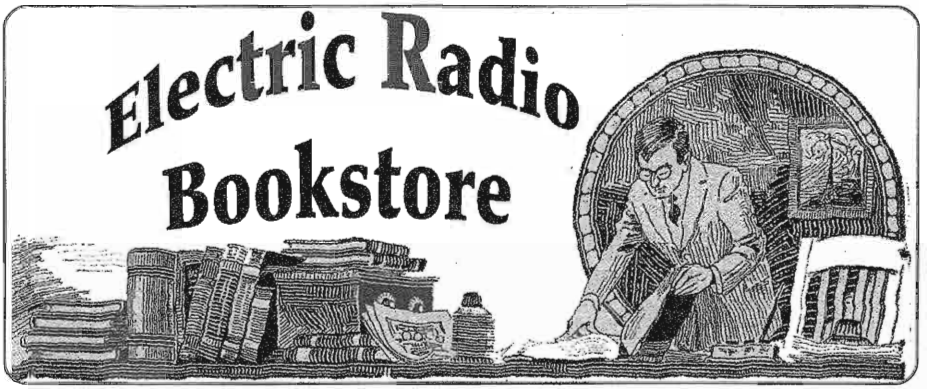

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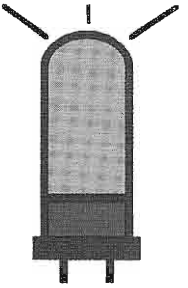

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