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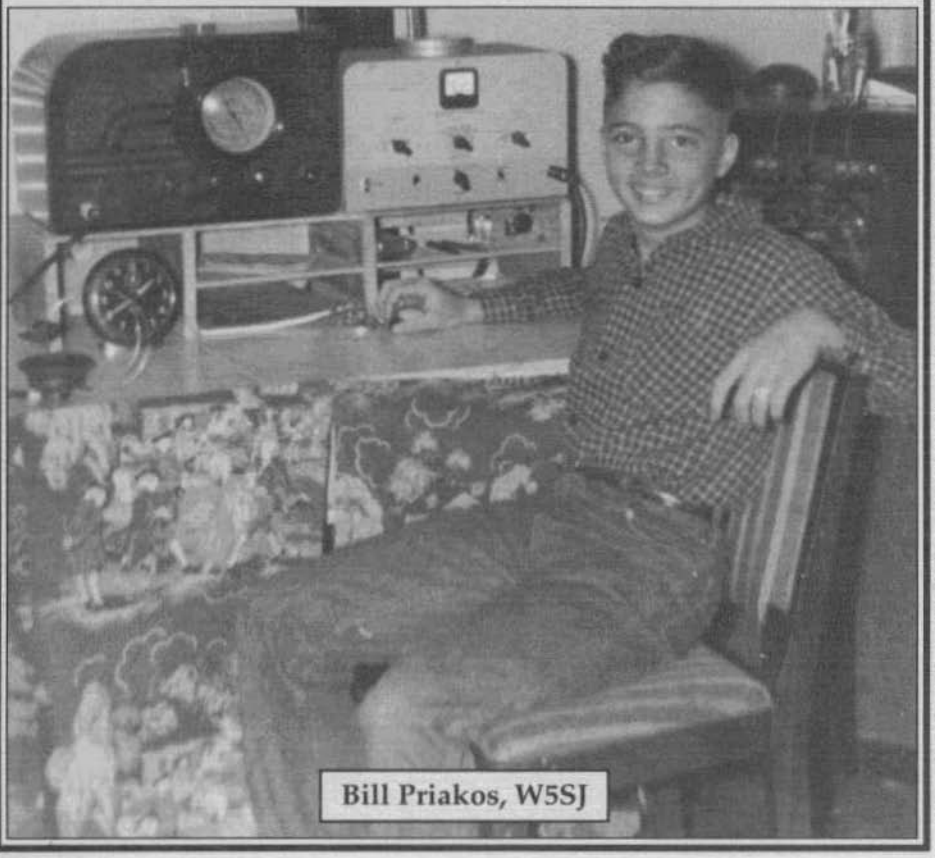
ELECTRIC RADIO

celebrating a bygone era

Number 131 March 2000



Bill Priakos, W5SJ

ELECTRIC RADIO

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Editor - Barry R. Wiseman, N6CSW
Office Manager - Shirley A. Wiseman

Electric Radio is published primarily for those who appreciate vintage gear and those who are interested in the history of radio. It is hoped that the magazine will provide inspiration and encouragement to collectors, restorers and builders.

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

Regular contributors include:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; Dave Ishmael, WA6VVL; Jim Hanlon, W8KGI; Chuck Penson, WA7ZZE; Dennis Petrich, KØEOO; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Rob Brownstein, K6RB; Don Meadows, N6DM; Lew McCoy, W1ICP; Kurt Miska, N8WGW; Warren Bruene, W5OLY; Brian Harris, WA5UEK; Thomas Bonomo, K6AD and others.

Editor's Comments

ER/High Tech

Recently I came across a quote that I found interesting *"I think there is a world market for maybe five computers,"* Thomas Watson, chairman IBM, 1943. How wrong he was and how wrong we all are when we try to predict the future. Today we all have computers, they're almost as ubiquitous as the telephone.

Eleven years ago when I started ER I had just bought my first real computer and I knew very little about the Internet. It wasn't until 1992 that I got on-line and then I wasn't very impressed. The Internet was very awkward and cumbersome then. My impression was that it was strictly for the academic types, the military and hams interested in the high-tech part of our hobby. I had no interest in it at all. I never thought it would have anything to do with my life or ER. I was dead wrong.

Each year since the beginning of the magazine we've been using more and more hi-tech equipment and the Internet has become an indispensable tool. Today 90% of our ads and almost 100% of the articles get here via e-mail. Although I've resisted the idea for some time (I always thought I had enough work already) we're working on a webpage and should have it up and running in a month or so.

In this issue for the first time we're using digital photos that I received via the Internet. Jack Shutt, W9GT, took these photos (see his article starting on page 20) with a 1.2 megapixel digital camera and sent them to me in a compressed JPEG file. Looking at the prints I think they're absolutely great. I hope they reproduce well in the magazine.

Starting next issue or the one following that (our 11th anniversary issue) we'll be producing the entire magazine in a digital form. I'll no longer be taking hard copies of the magazine page and photos to my printer I'll be just taking a Zip drive with everything in a digital form. I'll talk more about this next issue.

The next 15M AM Jamboree will be on the weekend of April 29/30. Mark your calendars now. N6CSW

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Cover: Bill Priakos, W5SJ, back in 1955 when he was a novice. See page 3 more on Bill and his novice days.

Looking Back

by Lew McCoy, W1ICP
8865 E. Baseline Rd., Space 1607
Mesa, AZ 85208
lewmccoy@uswest.net

I wrote last month about working in the lab at ARRL and how we did things. Actually, except when I traveled, I spent most of my time in the lab in my early years at the ARRL. It wasn't long after I started that I got a chance to review "Recent Equipment." That was what we called the new arrivals in equipment. One thing about the League in those days, we told it like it was—if a receiver didn't perform up to par, we said so.

The modern ham has no idea of the state of the art in those days. In receivers, we looked for the amount of drift and we carefully scrutinized the mixer's abilities to handle strong signals. I think it's taken for granted today that all receivers are stable and they're all capable of handling strong signals.

I recall the day that the representative from Hammarlund came in with a new receiver. Keep in mind that in those days, it was common to make a general coverage receiver, and one set the band with the main tuning dial and then used a bandspread tuning knob to get a slower tuning rate. As I recall, to get a really accurate frequency readout from a communications receiver we had to wait for Collins to come out with their PTO. PTO stands for "permeability tuned oscillator" and it was extremely stable and accurate but even so good frequency standards such as 100 kilocycle oscillators were still a must.

I think the National HRO series of receivers were very good. I managed to acquire one early on but it had its problems. I recall that I never turned the tube heaters off. If one did, it took several hours to get the receiver to stop drifting. Actually, drift was a way of life with all receivers except the Collins latter day gear.

So frequency stability, accuracy of the readout, were just a few of the things that got a good checkout for a review of the equipment in QST. And we did not pull any punches!

It was a pleasure to tell it like it was. One thing we did do though, at least when I had charge of recent equipment reviews, was to tell the reviewer if he found a bad problem to call the manufacturer and inform him so a fix could be installed.

I recall one instant when Atlas made a cheap single sideband unit. The FCC had put requirements in place that stated that the transmitting gear had to reach certain distortion product limits. The unit we test failed badly in this case. We actually tested several and they all were bad. We called the manufacturer and informed him of his problem but as I recall he did not bother to fix it!

Talking about distortion I recall the sales manager of Hammarlund showed up with a brand new Hammarlund. He came into our lab and we turned on the receiver and it was really hot—I mean it HEARD signals. But our lab unfortunately was surrounded by a very large rhombic antenna. When W1AW came on the air we had loads of RF around the place. The Hammarlund went crazy and completely knocked out on 20 meters. Needless to say, the sales manager packed up his receiver and promised to come back when the unit played right. (He never did). I will continue this next month. W1ICP

W5SJ and his Novice Days

by Bill Priakos, W5SJ
6408 Risinghill Drive
Dallas, Texas 75248
bpriakos@worldnet.att.net

Bobby Hardie was my older neighbor across the street and I was always there underfoot. I finally got the code by listening to CW on the old Silvertone (next to AT-1 in the photo) without any oscillation! So, now I smile at the whining about 5 wpm, especially from my son, KC5PFG. CW remains my preferred mode.

I remember working a ZL and many WH6's in 1955 on the 40 meter novice band using my Adventurer (I upgraded from the AT-1 which was a rig I had borrowed from my Elmer) and the Silvertone "beat" with the Zenith (when the Zenith was tuned to approximately the same frequency as the receiver, the Silvertone, an oscillation would occur and after a few hours on, was quite stable). What a thrill! DX with that "lash up"!

In the Spring of 1957 (when I was 16) a tornado hit Gans, Oklahoma, some 45 miles west of Ft. Smith, Arkansas where I lived. Bob and I lugged his Viking II and NC-183D down to the Red Cross and set up to handle emergency traffic with "Chief", W5EJK (SK), for supplies and then later, health and welfare traffic. Later that year, I was nominated to participate in an International Junior Red Cross study visit and go to Japan.

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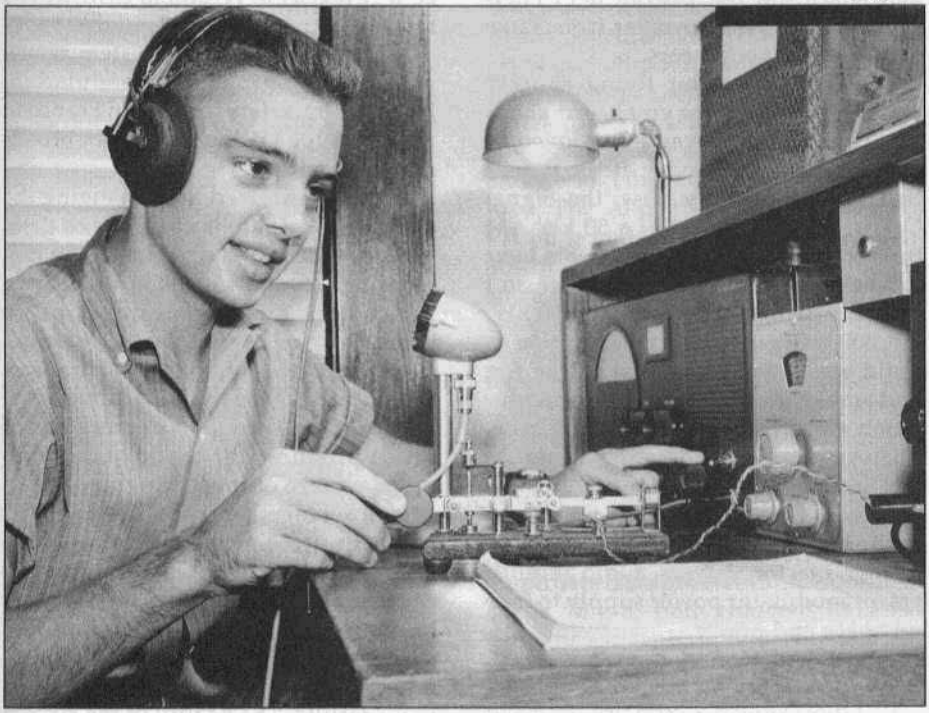


This photo appeared in a newspaper article that described Bill's trip to Japan.

RCA 50 KW Ampliphase Less 49.7 KW

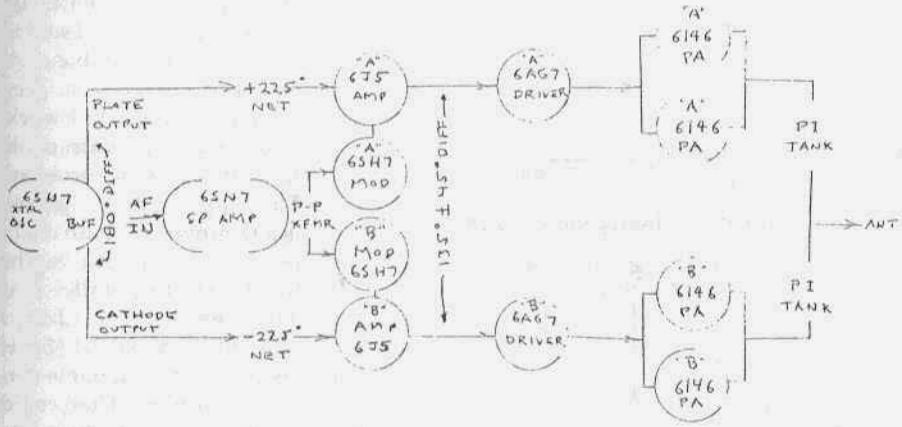
by Chuck Teeters, W4MEW
841 Wimbledon Drive
Augusta, GA 30909

One AM broadcast transmitter that stood alone was the 50 kW RCA Ampliphase. It was a breed apart from all the others, using two 25 kW FM transmitters in one cabinet to produce a 50 kW amplitude modulated signal. The two FM transmitters used phase modulation, hence the name, phase to amplitude turned around to sound and sell better in the advertising. And sell it did, costing a third less, half the size, and consuming half the AC power of its plate modulated competition, it was no contest. RCA had a winner, if you could keep it adjusted right. Twenty-nine station owners thought their engineers could and bought them. Saving money and space did not prevail over engineering questions however from some cautious chief engineers.

Only stories about flying saucers could outdo the ones you heard about the Ampliphase, it was either loved or hated. Only a bystander at the time, I had no opinion. My boss, the Signal Corps, wasn't in need of a 50 kW AM broadcast transmitter. Fifty years later it was time to find out for myself, so I built my own Ampliphase. Not 50 kW, but 300 watts worth. My inspiration to build was aided somewhat by the fire and smoke that came out of my modulation transformer a few weeks back. The Ampliphase didn't need one, in fact its audio needs were only a few volts which was its big selling point, no modulator tubes, modulation transformer, reactor, drivers, audio amplifiers, or modulator power supply to take up space and power.

First I had to find how it worked. Books are scarce on the Ampliphase. I called Bob Dennison, W2HBE, a retired broadcast engineer from RCA. No luck, Bob had gotten rid of all his manuals. Larry, W3VU, a broadcast consultant, sent me two articles but they had few technical details, mostly advertising. Using WA4KCY's East coast AM swap net I got a lead that Armstrong Transmitter Company in Marcellus, NY had converted the RCA Ampliphase for short wave broadcasting. A phone call got me connected with Jeff Bourqe. He confirmed that they had bought several Ampliphase units, but only used the cabinets, control ladders and power supplies and built new RF sections with high-level plate modulation. I found a 1962 McGraw-Hill Radio Electronics college text by R. Whitfield Griffith. His text, heavy on math, covered the theory of the phase to amplitude system, which was called outphasing modulation. Henri Chireix developed it in France in 1933 for a 100 kW low frequency broadcast transmitter.

Griffith described how changing the phase of two signals could make them add or cancel when combined. The vector diagram shows that running two FM carriers 135 degrees out of phase produces the carrier level. Running them 90 degrees out of phase produces the modulation peak, twice carrier level and running them 180 degrees out of phase produces the modulation minimum, or zero output. Bringing the signals closer together than 90 degrees will result in non-linear operation, as the output vector will not increase in a linear manner. Each FM transmitter must be phase modulated plus or minus 22.5 degrees and the modulating signals must be 180 degrees out of phase to get these results. The beauty of the system



300 Watt Ampliphase Transmitter

is that the phase modulation is low level and only class C amplifiers are used to increase the power level. Combining the signals at the antenna feed means all the stages including the PA can run at CW ratings.

A common oscillator is used to feed both branches of the transmitter. Since any phase change should be produced only by the modulating signal, other phase changes have to be avoided. This rules out any kind of a tuning range so the transmitter has to be built for one frequency. Certainly no VFO operation is possible. It limits its ham applications but since we mostly stay on fixed frequencies when operating AM I thought it should be usable nowadays.

With an idea of how the Ampliphase should work I started building, designing as I went. I started with half a 6SN7 as a 3885 kHz crystal oscillator with the other half as a buffer with both plate and cathode output to get a pair of 180 degree phase difference signals. I then used RL and RC nets to advance and retard the phase 22.5 degrees and had my 135-degree difference. 6J5s phase modulated by 6SH7 reactance tubes follow the phase shifting nets. I feed the audio from a two stage 6SN7 amplifier into a push-pull interstage transformer to get the 180 degree difference in the two audio signals for the phase modulators. I use a carbon mic input. Seems appropriate for something originally designed in 1933, although a broadcast condenser box mic from the thirties would be appropriate.

A 6AG7 buffer driving parallel 6146s follows each phase modulator. I have plenty of grid drive so I swamp the 6146 grids and eliminate any need for neutralization. Pi sections are used in the plates of the two PAs. They provide a 90-degree phase shift in each channel and tie together to a common 50-ohm load. The 90-degree shift between the PA plate and load is to keep a reasonable load on the 6146s in each channel since they feed a common load. If they were directly connected, they would see a short circuit when the two channels were 180 degrees out of phase, and a very high impedance when they approached the in phase condition. The 90-degree shift levels off the impedance change throughout the modulation cycle. Makes for longer lasting PA tubes.

The 90 degrees shift in the pi net final amplifiers is no problem and is not critical as long as both channels have exactly the same phase shift. There is less capacitance than you would expect in a 90-degree pi, so there is very little harmonic suppression. I use an antenna

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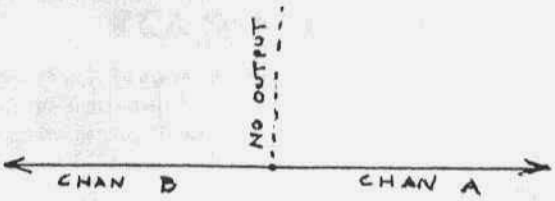
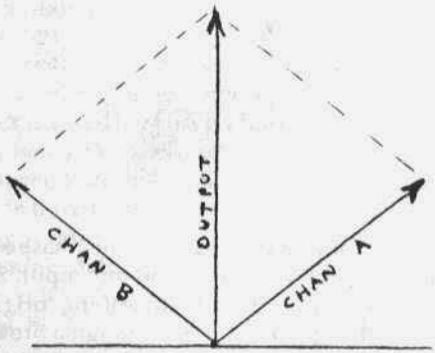
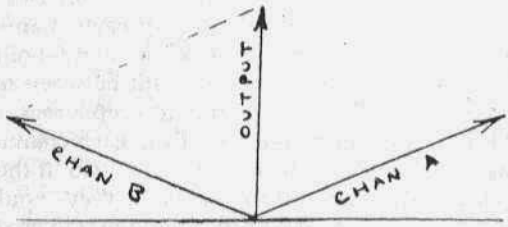


180 DEGREE PHASE DIFF – NO OUTPUT



90 DEGREE PHASE DIFF - PEAK OUTPUT



135 DEGREE PHASE DIFF – CARRIER LEVEL

Vertical representation of modulation

tuner to get a hi Q tuned circuit between the transmitter and antenna to avoid any harmonic radiation.

Building anything with vacuum tubes requires lots of parts scrounging these days, but is even more difficult when you have to find two identical fratastats. Anything that can cause a phase shift must be identical in both channels, or you will have troubles. The final tanks were difficult to match up out of my junk box. I settled on a pair of variable caps out of command sets. They were a bit small but work. The tank coils were made from air-dux so no problem. The output side of the tank is a common for both channel so no problem there. The RFCs for the parallel feed were hard to match; I tried two old National 2-1/2 mH chokes of questionable current capability. They could not handle the 6146s plate current so I wound my own. Pill bottles and number 22 wire took care of the chokes.

Finding a filament transformer in my junk box that could light up 4 6146s and eight other tubes was a problem. I found an 8 amp. 6.3 volt transformer at Radio Shack.com that could light the tubes, incidentally the only new part in the whole rig. The low voltage plate transformer was an old Hallicrafters unit that could provide 350 volts at 90 mA. The high voltage transformer came from a DX-100. I put the high voltage on a separate chassis as I was running out of room and it divided up the weight. I could get 750 volts DC with a 400-mA load using silicon diodes; a capacitor input filter, and lots of output capacitance, which works the 6146s just fine.

The first attempt at tuning up was a disaster. I had RF everywhere but where I wanted it. I pulled the finals and worked with the stages up to the 6AG7s. Trying to adjust the phase shift to the modulators was frustrating. I was about ready to trash the project. In a discus-

sion with Larry, W3VU, he pointed out plate voltage changes would change the phase shift. I added VR tube regulators to the modulators and reactance tubes and the adjustments started to act better. Listening to the eighth harmonic of the phase modulated signal on 31.080 MHz I got the phase modulators adjusted for decent sounding audio.

Jumping the 6AG7 buffer plates together into the scope and feeding an audio tone in I saw my first sign of AM. The two phase adjustments, two tuning caps, and two audio gain controls could produce some of the most interesting patterns you ever saw, but it was amplitude modulation of a sort. If the exciter of the RCA BTA 50G was as touchy as mine no wonder transmitter engineers hated to work on it. The audio I was producing wouldn't pass a broadcast proof of performance for a spark gap. I gave up on using the plus and minus 22.5 degrees shift in each channel and changed the feed to one modulator to a 45-degree shift and no shift in the other modulator feed to get the 135-degree difference. I balanced up the drive to the modulators by using adjustable pots in the modulator drive of each channel. This added two more adjustments but eliminated one very critical phase adjustment.

I finally figured out that adjusting the exciter with the audio gain down was the route to better audio waveform. The most critical adjustment is the plate tuning of the phase modulators. I tune them for maximum recovered audio on the eight harmonic, and then set the carrier level with the phase and modulator drive adjustment with no audio. Then I advance the audio gain to get maximum negative modulation, and then readjust the carrier level and check the positive modulation level. I could not get 100% positive and negative to occur simultaneously so I had to settle for 70% modulation.

I thought getting the finals working after the exciter would be nothing. Boy was that wrong, the final tuning seemed normal until you looked at the scope. The modulation envelope was affected by any tuning adjustment. The route to success was the same as the exciter, tune up without the audio, add an audio tone and adjust for maximum negative modulation, and then set the carrier level. This provided better than a 200 watt carrier with over 70% modulation that sounded good.

My first attempt at using the ampliphase on the air was frustrating. I had made no provisions for transmit/receive switching. I had not even put in a plate power switch. A bit of jury-rigging and I could switch from transmit to receive with 4 switches in 3 seconds. My first on the air contact was really surprising. A South Carolina station that shall remain nameless ignored the description of my rig. A report of audio distortion and that was it, and he quickly ended the QSO. He was running AM with a Japanese rig so I guess strange home brews didn't interest him. My second contact commented that slope detection of my FM made my signal sound better.

Reports on my modulation ran from 'sounds OK' to 'very distorted'. No one questioned that I was getting AM from two FM transmitters, either it was accepted as normal or ignored. So much for something different. In all fairness, with the time it took me to switch from transmit to receive, combined with the stability of my phasing adjustments and poor audio quality at times, I can see why I was considered an AM outcast. I was accused by one North Carolina AM-powerhouse of running a poorly adjusted sideband rig in the AM window frequency.

After a few weeks off for a trip overseas, I lost interest in cleaning up the ampliphase. It was a challenge, but the few weeks on the air led me to believe the ampliphase is more work than it is worth. I guess the broadcast industry

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PTO Design Recollections

by David M. Hodgin
4423 Northwood Drive NE
Cedar Rapids, IA 52402

Editor: The author was employed at the Collins Radio Company from 1947 until 1972. He retired as Assistant Director of Research. During the period he writes about he was head of the PTO group at Collins. The PTO group specialized in the research and development of all PTOs for Collins communication gear.

Background

The T-195 VFO (70-H3) design challenged the permeability tuning state-of-the-art (Electric Radio #30/31) as did the T-195 exciter/transmitter for both required a technology exceeding that of prior equipments. See ER #104, 113, 114 and 115.

Prior Collins PTO's provided linear frequency increments with dial rotation. These utilized molded powdered iron cores moving in a variable-pitch wound inductor. Lead screw rotation, usually ten turns, moved the permeable core through the linearized section of the inductor. Typically, one inch of core motion comprised the linear frequency range. Prior design evolution had led to use a Belleville washer to provide constant mechanical loading of the leadscrew between two precise radial ball bearings mounted in a circular head piece. This headpiece provided O-ring seals both at the leadscrew and at the cannister cover. The cover provided electrical shielding of the inductor, capacitors and wiring and an air-tight seal. A stack of multiple U-sleeves provided a track which guided the core follower. These sleeves were shaped by test operators to provide a differential rotation which corrected minor tuning errors and upon tightening would retain the required shape for permanent tuning correction.

Temperature effects within the combined system of leadscrew expansion, coil expansion, temperature coefficients of the permeable-iron core, tuning capacitors and circuit loading were critically dependent on the mechanical design and required careful selection of compatible materials and components. The inductor mounting and leadscrew loading into the head piece proved a preferred method to minimize the effect of thermal expansion effective through the tuning range and the operating temperature range. These components provided a positive frequency change with increasing temperature. Added negative temperature coefficient capacitance was required to minimize overall frequency change and was achieved through use of a main capacitor having nominal negative TC with test selection of small negative TC fixed capacitors in final test (typically -50 to +65° C). In this manner only the non-linearity of component and structural components remained to cause frequency change.

Tuning cores formed by molding powered iron were used in all the former PTO'S, however the intrinsic permeability was limited by this process and limited the prior linear tuning range to 1:1.5. Prior research had proved that an increased length/diameter ratio of the coil and core travel would increase the tuning range, however, would severely affect the temperature/frequency changes between the in-out tuning positions between the high to low temperature extremes.

Thus, the prior technology had pre-

pared the way for changes but the requirements for the T-195 were more demanding than simple changes could provide!

The 70-H3 Design Process

The specifications for the design demanded a 2:1 tuning range (1.5 to 3.0 MHz) using ten turns of shaft rotation. The intrinsic temperature stability of prior designs was expected as was the tuning linearity. Collins engineers lived with a precedent to admit they "don't know how to do this now, but we will try!" Success was generally achieved.

The tuning range expansion was the first necessary achievement to provide. Ferrite materials were known to provide a greater permeability than molded powdered-iron core. The temperature coefficient was well known to be quite high and not readily controlled. Not much was known about the linearity of temperature coefficient, the manufacturing control and the electrical loss characteristics. An early design concession by the T-195 design team enabled placement of a VFO oven to reduce the low temperature excursion, just in case there was an inadequate core solution.

Collins component engineers contacted ferrite suppliers. A New Jersey company first made a few samples. Test methods were created to determine the permeability and temperature characteristics. Translation of these data to the 70H-3 core and coil configuration was not an analytical process and required many laboratory experiments.

The initial quantity of core samples proved to have a requisite permeability but very low unit-to-unit consistency. The temperature coefficient was too large as well. This information was relayed to the manufacturer who agreed to better control the variations and reduce the temperature coefficient. Meanwhile, a prototype VFO was constructed for tuning range coil and core design. That a 2:1 tuning range could be achieved was proved for the ferrite materials through use of a 1.25 inch core travel. This required use of a triple-start thread design (non-standard shop tooling). Thread grinding and lead-nut design specifications were drawn and tool orders placed.

Laboratory testing proved an excess electrical loss when using the sample cores and the usual stainless steel leadscrew. A search for a higher conductivity (lower loss) leadscrew material finally found that a chrome-copper (Anaconda 999) material could be used and had a suitable wear factor. Extensive mechanical testing of various nut/leadscrew/lubricants was conducted simultaneously with electrical design.

Additional sample batches of ferrite were received with some improved consistency. One group showed a lower temperature coefficient, although too high to be usable. However, variability between the batches appeared to require extensive inspection test screening by either the manufacturer or the Collins inspection department. The use of this manufacturer was found to be risky.

Component engineering had continued in their search for other suppliers. Some submitted samples for tests. In mid-1953 Stackpole Carbon Company provided a batch of core samples. Test showed a much improved temperature coefficient, a suitable permeability control and a lower electrical loss. At last a sample group met our requirements!! A larger engineering sample batch was ordered. On arrival tests proved the temperature coefficient was outside the usable range. It was then determined that a Collins engineer and test equipment must be taken to Stackpole Carbon Company for the production quantity build. Two weeks of day and night control of materials, firing temperature/time and testing by the team continued until the order quantity was produced.

The main production of 70H-3 VFO's utilized these cores. When it became

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dB or not dB

by Art Hogrefe, N3FEB
3140 Sheffield Dr
State College, PA 16801
ahogrefe@statecollege.com

The attenuator section of my KG-686 Knightkit HF signal generator had become seriously inaccurate after 40 years of intermittent use. Also there were two Heathkit 75 ohm attenuators lying on the bench, wouldn't it be nice to make one a 50-ohm unit. Figure 3 shows the generator and Figure 4 the Heath attenuator and its modification.

An accurate step attenuator is useful wherever small signals are required. Most inexpensive signal generators have a single step attenuator and a pot to control output level. Used commercial attenuators are fairly expensive. Heathkit's 75-ohm boxes (for use with their TV test sets) have a nice mechanical design, are cheap and easily modified.

Half-watt, 1% accuracy metal film resistors are individually available for about 12 cents each or in one hundred pack lots at about 6 cents. These XICON parts from Mouser are more accurate and handle more power than the originals. The Knightkit resistors were 5% carbon film, one quarter watt rating, some had shifted 20% in value. The table Figure 1 shows the improvement in initial accuracy. The metal film resistors are also more stable with time.

It's a good idea to check the switches prior to replacing the resistors. Switches become contaminated with time, signal output becomes noisy, unreliable or varies when wiggling the switch. Caig DeoxII D5 is a good connector and contact cleaner and protector. If you are really serious an additional application of Caig PreservIT P5 should prolong operating life. However plain old TV tuner cleaner/lubricant (Radio Shack etc.) also works. Once cleaned up the attenuator should give repeatable measurements. Then errors due to resistor drift noted. Load the output with 50 ohms during level checks.

The KG-686 attenuator is mounted on the front of the generator chassis and has a metal cover which is soldered to provide a reliable shield. A big iron (100W) is needed to remove the cover. Do not change any ground connection of the shielded cable, it is arranged to minimize low level coupling to the output.

Each attenuator section is a symmetrical three resistor pi section. When driven and loaded by 50 ohms the section provides accurate attenuation and 50 ohms at both its input and output ports. In all cases the resistors R1 and R3 are identical and in parallel with the input and output nodes while R2 is in series between the input and output.

The nominal attenuation is the calculated value for zero resistor error. It

Comparison of Original and Upgraded Attenuator

	Original	Upgraded
Resistor accuracy	5%	1%
Tolerance error per stage (worse case)	0.9 dB	0.18 dB
Nominal attenuation of -20 dB stage	20.3 dB	20.09 dB
Nominal attenuation of -10 dB stage	9.65 dB	9.87 dB
Nominal attenuation of -6 dB stage	6.19 dB	6.01 dB
Maximum input drive: Vrms	3.5 Vrms	5.0 Vrms
Vp/p.	10 Vp/p	14 Vp/p

Figure 1

Design Parameters

Design Attenuation	Vout/Vin	R1&R3	R2	Nominal Attenuation	Port Impedance
20dB	0.100	60.4 ohms	249 ohms	20.09 dB	50.3 ohms
10dB	0.316	97.6	69.8	9.87	50.08
6dB	0.500	150	37.4	6.009	49.96
3dB	0.708	300	17.8	3.02	49.6
1dB	0.891	820	5.75	1.00	49.7

Note, if you decide to use the 1dB stage its R2 is two 11.5 ohm resistors in parallel.

Figure 2.

Figure 3. Knight-Kit HF signal generator

results from the requirement to use available resistor values. I would expect commercial attenuators to have near zero nominal error and resistors with minimum parallel capacitance and series inductance as well as a machined box for low signal leakage. We can get away with a lot less expensive parts at HF.

The rework of the Knightkit produced good results and, along with a modification to reduce the harmonic content, allows the generator to be used as the second generator when measuring cross modulation. The KG-686 is an especially nice generator because of its attenuator, frequency calibrator, reference level set and overall good mechanical design. It uses discrete transistors and leaded components with an oscillator design that is similar to the local oscillator in a superhet.

The attenuator is a simple device whose performance depends upon its mechanical packaging as well as component specifications. Figure 4 shows a

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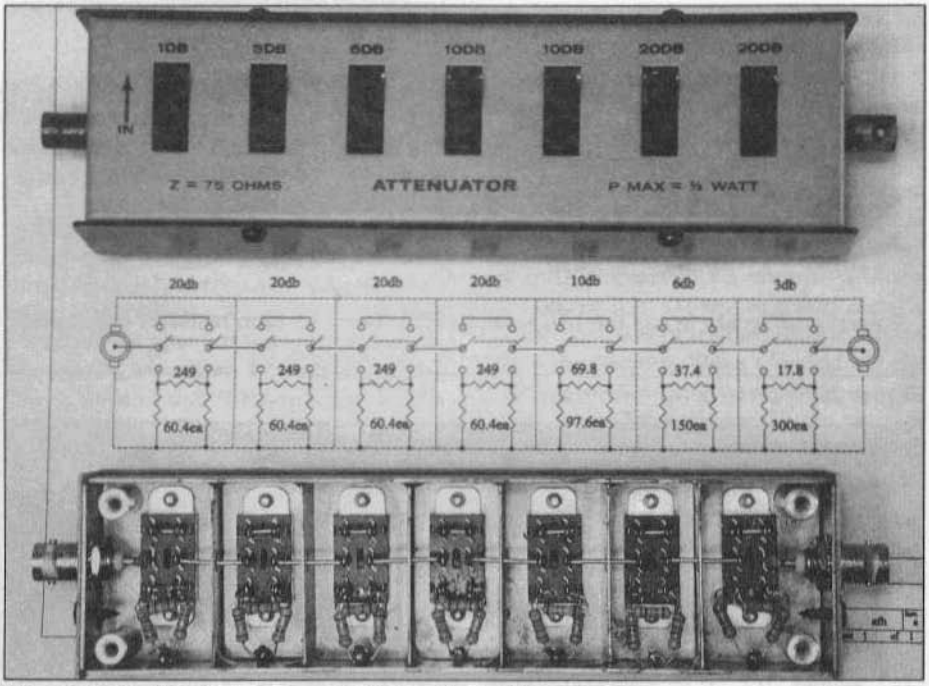

Figure 4. Heath attenuator and its modification

standard Heath 75 ohm attenuator with 70 dB range, an internal view of a second unit that has been converted to 50 ohms and 99 dB, and the schematic for the converted unit. 99 dB is about the maximum practical attenuation for the physical layout provided. The egg crate enclosure is large enough for easy rework and isolates each stage. The layout is classic and may be used as a pattern to build from scratch if so inclined, use brass, drill pass-through and mounting holes prior to assembly and use a husky soldering iron for the metal work.

The resistors are mounted with short leads that have a slight bend to relieve thermal expansion. The interior layout of the reworked attenuator assembly is shown in the bottom of the photo. The attenuator is symmetrical, either end can be input or output as desired.

When soldering is completed clean the assembly with flux remover or alcohol, then squirt contact cleaner into the switches and operate them a few times to get rid of contamination from soldering.

Once proper operation is confirmed the labeling should be changed to reflect the 50 ohm impedance and new attenuation values. The attenuator can be used from DC to more than 50 MHz.

Make sure to use 50 ohm coax for the associated cables. There are a lot of surplus cables at flea markets that look good but are not 50 ohms and ruin the attenuator characteristics. Also, when changing the attenuation observe the result and wiggle the switch a few times if any instability is apparent. You should have a stable accurate attenuator good for many years use.

If you use the attenuator with an inexpensive generator it may prove useful to incorporate a 50 ohm isolation transformer between its output and the driven load. This breaks the return loop circuit which is the source of much noise at low levels. ER

The Old and the New
Ranger II and Titan-2

by Hank Clark, W2IQ
635 Chestnut Grove Rd
Dandridge, TN 37725

Ranger II and Titan-2 tuned up on 3885 kc. The Bird shows 18 watts drive for a 400 watt carrier, peaking 1250/ 1500 watts into the antenna. The rig on the bottom is a Ten Tec Omni 6 xcvr.

Several months ago I had a phone call from Mr. Tom Salvetti, VP of Ten Tec, Inc. After exchanging pleasantries, he asked if I would like to proof run the new Titan-2 amplifier. This amp was one of three prototypes that were ready for extensive ham radio testing. I was delighted to say the least. Tom said that they would send two men to set it up in my shack. This was a real boat anchor weighing in at 85 pounds. No wonder they sent two men. When being shipped to a customer the plate transformer is sent separately as it weighs 42 pounds and is rated at 3 KVA for SSB operation. Anyway, the men arrived to set up the equipment connecting the Titan-2 to the Omni 6+ and then tuned the rigs up in the 40 meter SSB band. After zeroing out the SWR a few contacts were made under their supervision. The men left me with a few tuning points and no instruction manual. Knowing me, I would have only read it if I was in trouble with the Titan. Typical ham, that's me! Many QSOs on all bands 10 through 160 were made, mostly on SSB and some on CW. I talked to a few AMers on SSB and promised not to tell if they didn't. Excellent reports were received, both in the SSB and CW modes. I wanted to try this new Titan-2 on AM phone but just didn't get around to it. Scott, W4PA, Amateur Radio sales manager, received an inquiry as to the Titan-2 capabilities in the AM mode. Scott called me and asked of my findings. I told him that I hadn't had the amp on AM but would try it in that mode and let him know of my findings. A Johnson Ranger-II with the W4LQE power reduction modification was pressed into service as the exciter for the Titan-2 amplifier. The Titan was then turned on and while in the warm up stage to bring the Svetlana 4CX1600B up to operating temperature, the Ranger was tuned up on

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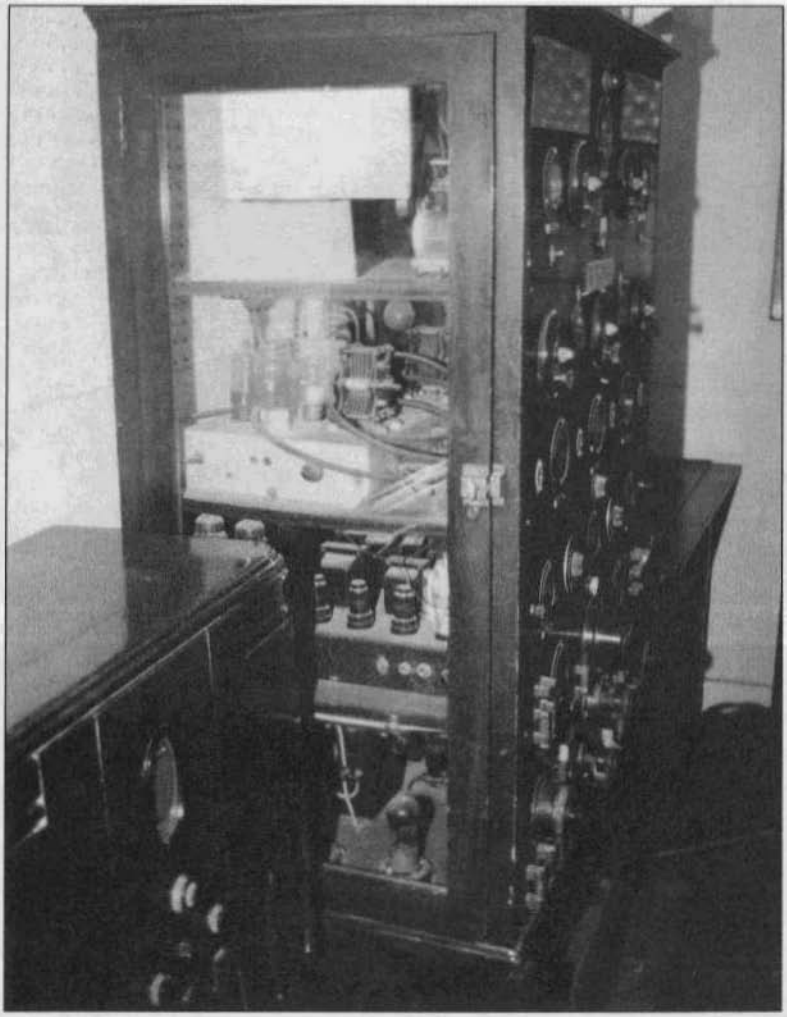
One of a Kind Transmitter

by Barry Wiseman, N6CSW

While visiting his brother who is a neighbor of ours, Claude Lee (not a ham) became aware of our magazine. When he came across this transmitter in a museum in Deming, New Mexico (Deming-Luna Mimbres Museum) he knew it would be something I would be interested in. He hired a photographer to come to the museum to take these pictures.

The first photo I looked at was the front panel view and I thought that this was a display of knobs and meters; it couldn't be a transmitter. Then looking at the next photo, the side view, I could see the chassis and components—it was indeed a transmitter!



I called the museum for more information and the person that answered the phone was a ham, Andy Anderson, W5UBU, a volunteer custodian. He said that he would get some more info for me. A few days later I received a letter from him with the photo of the final tube which he thinks is a UV-204A rated at 250 watts. I asked him if he could supply further information but he told me that at present he just does not have the time.

I'm sure most ER readers, myself included, would like to know more about this unique looking transmitter—what are all those vernier dials, knobs and meters for. I've checked our subscription list and we do not have any subscribers in Deming but we do have several in towns close-by. I wonder if one of those hams will take it upon himself to visit the museum and get us some more information.

A plaque by the display of the transmitter supplies more leads for the investigators. It reads:

"Antique Amateur (ham) transmitter was homemade (homebrewed in radio termi-

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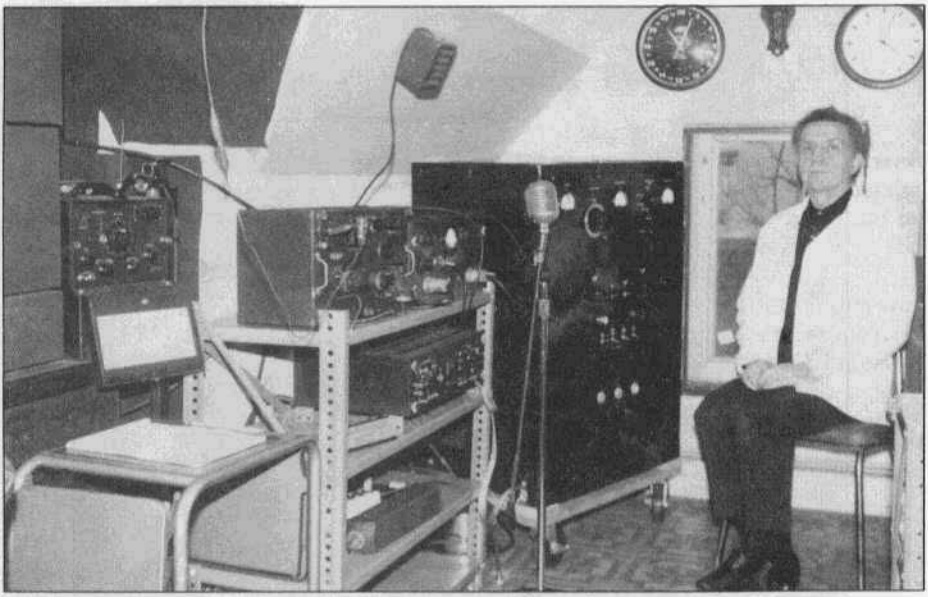
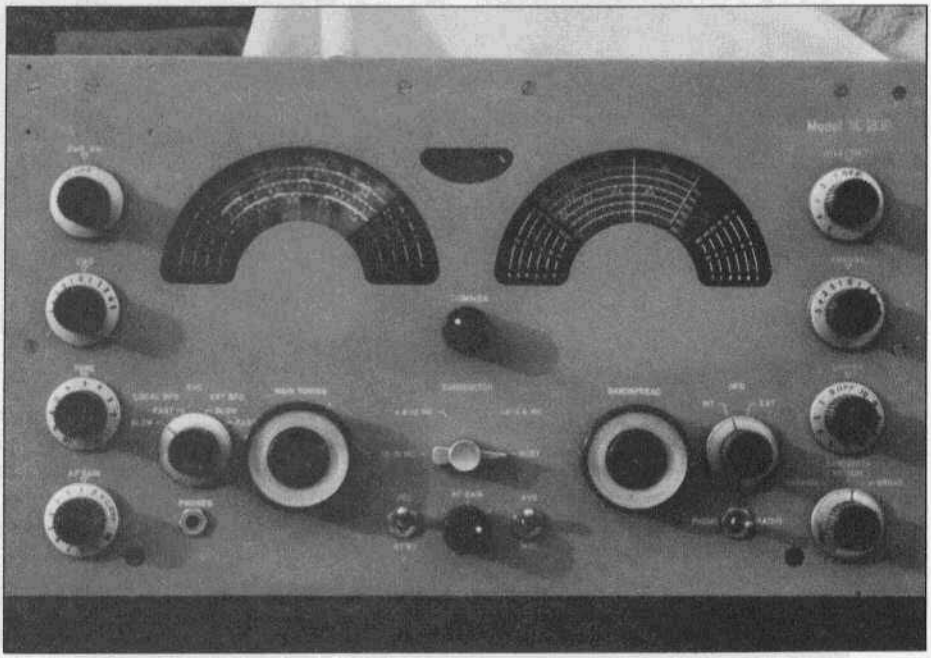


Phil Epstein, KØXI, in his vintage hamshack. The BC-610 is an I model.



Does anyone know anything about this rack mount NC-183D receiver? Was it built for the military? In the upper left hand corner there are 4 screw holes. I wonder if these were for a nomenclature tag. If this is a piece of military gear I think it would be incredibly rare. If anyone has any info please pass it along to the owner Hal Potter, KF6FHL, 617 Sancado Terr., Fallbrook, CA 92028.

Al Cormier, VE4WG, in his Winnipeg, Manitoba hamshack. His main AM station consists of the Hammarlund HQ-180/Johnson Valiant II. He also operates mobile with a Gonset G-76.

Harry Weber, well-known Squires & Sanders collector with some of his gear. On the left are two SS1V spectrum analyzers. The top receiver to the right is a SSIBS and the bottom one is a SS1R.

Another Viking Ranger PTT Modification

by Richard Brunner, AA1P
10 Brookside Drive
Foxboro, MA 02035
rbrunner@gis.net

After bringing my Viking Ranger back to 1st class operating condition, I dutifully made the PTT modification that was enclosed in the instruction manual, and quickly found that it was badly thought out, and forever precluded CW operation; an intolerable condition! The problem is that the modification connects the 6146 screen to the negative keying line, intending to cut off the 6146 plate current, but also blocks CW operation. As modified, the 6146 plate current was 8 mils and screen voltage was -2.8 volts, not quite cut off!

For the record, unmodified conditions are shown in Figure 1.

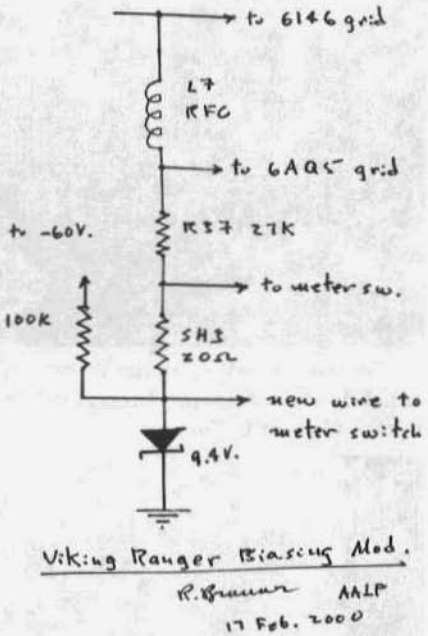
PTT modifications are as follows

1. Add a small relay. I used a small 12 volt 4pdt (R.S. 275-214) relay powered from a voltage doubler from the 6.3 volt filament line. Operate the relay through the microphone PTT contact.

2. Connect (NO) relay contacts to SW4A contacts 3 and 5, with the present jumper removed. This picks up the antenna relay.

2. Connect (NO) relay contacts to the black wires formerly on SW4 contact 8. This grounds the multiplier cathode and key line.

4. Modification #3 from the instruction book is not done. The intent was to pull the 6146 screen voltage negative on standby.



Viking Ranger Biasing Mod.
R. Brunner AA1P
17 Feb. 2000

It is desirable to greatly reduce the 6146 plate current on standby because if you are using a TR switch you will have lots of thermal noise from the transmitter. But, note also that "cut-off" does not usually mean zero plate current! As a tube grid voltage goes more negative and approaches cut-off, the amplification factor greatly decreases, and you have a small but finite residual plate

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Switch Position	Plate Current, Ma.	Screen Voltage
CW, key up	23	10.1
Standby	8	Screen grounded through SW4A
Phone, off	20	9.40

Figure 1.

VINTAGE NETS

Arizona 40M AM Group: Meets on 7293 kHz at 10:00 AM MST (1700 UTC) on Sat. and Sun.
West Coast AM Net **meets Wednesdays 9PM Pacific on or about 3870kc. Summer conditions have moved the net control to California with John, W6MIT and Tom, K6AD as net controls. In the winter months Randy, KK7TV usually runs the net.**
California Early Bird Net: Saturday mornings at 8 AM PST on 3870.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3835
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net controls are Andy, WA4KCY and Sam, KF4TXQ. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours.
Arizona AM Net: Sundays at 3 PM MT on 3855. On 6 meters (50.4) at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AM'ers get together on 3876 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.
DX-60 Net: This net meets on 3880 at 0800 AM, ET, Sundays. Net control is Jim, N8LUV, with alternates. This net is all about entry-level AM rigs like the Heath DX-60.
Eastcoast Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is Ted, W3PWW. Saturday mornings at 0500 ET on 3885 + or - QRM.
Westcoast Military Radio Collectors Net: Meets Saturday evenings at 2130 (PT) on 3980 + or - QRM. Net control is Dennis, W7QHO.
Gray Hair Net: The oldest (or one of the oldest - 44+ years) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:00 PM EST & 8:30 EDT. http://www.crompton.com/grayhair
Vintage SSB Net: Net control is Andy, WBØSNF. The Net meets on 14.293 at 1900Z Sunday and is followed by the New Heathkit Net at about 2030Z on the same freq. Net control is Don, WB6LRG.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet on Tuesday nights on 3805 at 2100 Eastern and on Thursday nights on 3875. West Coast 75M net that takes place on 3895 at 2000 Pacific Time.
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Drake Users Net: This group gets together on 3865 Tuesday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, W8NS; Rob, KE3EE and Huey, KD3UI.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. NC is Will, AA6DD.
Old Buzzards Net: Meets daily at 10 AM Local time on 3945. This is an informal net in the New England area . Net hosts are George, W1GAC and Paul, W1ECO.
Canadian Boatanchor Net: Meets Saturday afternoons, 3:00 PM EST on 3745.
Midwest Classic Radio Net: Sat. mornings on 3885 at 8AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics. NC is Rob, WA9ZTY.
Boatanchors CW Group: Meets nightly at 0200Z on 3579.5 Mhz (7050 alternate). Listen for stations calling "CQ BA" or signing "BA" after their callsigns.
Wireless Set No. 19 Net: Meets the first Sunday of every month on 7.175 +/- 5 kHz at 2000Z (3760 +/- 5 kHz alternate). Net control is Dave, VA3ORP.
Hallicrafters Collectors Assoc. Net: Sundays, 1730-1845 UTC on 14.293. Net control varies. Midwest net on Sat. on 7280 at 1700 UTC. Net control Jim, WB8DML. Pacific Northwest net on Sundays at 22.00 UTC on 7220. Net control is Dennis, VE7DH.

Nets that are underlined are new or have changed times or frequency since the last issue.

A 30K-4 Revived

by Jack C. Shutt, W9GT
1820 Dawn Ave
Fort Wayne, IN 46815
w9gt@fortwayne.infi.net

This is the story of my efforts to restore and revitalize a classic piece of Collins gear that I have been fortunate enough to locate and add to my collection. I have been able not only to repair this wonderful old rig, but also to get it on the air on AM for many enjoyable QSOs. Perhaps this account of my experiences will aid others who have similar transmitters and/or are interested in finding and restoring one of these classic relics of history.

The 30K-4 is a commercial version of the famous 30K and 30K-1 amateur transmitters that have been previously reviewed in ER. (Ref. 1,2) The "K-4" was one of the series (K-2 through K-5) built for government and commercial duty. These transmitters were built in the late 40's and early 50's and were utilized for point-to-point HF communications by government and police agencies. They were in service at airports, state police departments, and other government agencies. Although they appear to be somewhat scarce these days, I have been told that quite a few of them were built and they were fairly well known as reliable workhorses. A few of them have found their way into ham shacks.

The 30K-4 "ground station transmitter" is conservatively rated at 250 watts output on AM radiotelephone and 300 watts output on CW from 2 MHz to 15 MHz. It is rated at 200 watts output AM and 250 watts CW from 15 MHz to 30 MHz. It was designed to operate with crystal control, but is very easily adapted to external VFO control.

The 30K-4 utilizes a total of 13 tubes, including a 6V6 oscillator, an 807 frequency multiplier/driver, and a single 4-125A in the final amplifier. The speech amplifier utilizes a 6SJ7 - 6SN7 - 6B4 lineup to drive the modulators. A 6H6 clipper circuit is also provided to eliminate splatter from overmodulation. The modulator stage uses a pair of 75THs in PP class B service to provide high level plate and screen modulation.

The tube complement is rounded out with a pair of 866's in the HV B+ supply and two 5R4's in the LV B+ supplies.

The power supplies are husky and conservatively rated although normal operation is from 115-120 VAC, which can result in a bit of "light-dimming." The high voltage plate transformer does have provisions for operation from 230-240 VAC, however.

These transmitters were built with the typical Collins attention to quality and reliability and have many unique and versatile features. Unlike the 30K-1, the 30K-4 has a Pi-Net output circuit and is set up to match modern coaxial cable-fed antenna systems. (It may be a good idea, however, to replace the old porcelain antenna output terminals with coax connectors. This can be accomplished without drilling any extra holes by utilizing single hole mounting connectors.) The 30K-4 also has a built-in exciter, while the 30K/30K-1 utilizes the external 310A exciter in a separate cabinet.

This rig is quite interesting in that it has two complete and separate RF tank circuits which may be set up (with plug-in coils) and tuned for two frequency bands. Two channels may then be instantaneously selected and switching

The author's Collins 30K-4 with homebrewed 310C exciter on top.

between two bands becomes quite easy. Plug-in coils and dual crystal sockets are provided for the oscillator and multiplier stages and these are also relay-switched, putting the appropriate coil and crystal in place when the band is changed.

This whole wonderful "super boatanchor" is housed in a full-sized 66-1/2" rack cabinet with a window in the front for viewing the 4-125A and full metering via four panel meters across the top, behind their own little window. It weighs in at a mere 420 lbs. My transmitter also came with an optional factory-installed cabinet fan mounted in the top of the rack which serves to keep things nice and cool. Top all of this off with some classy-looking stainless steel trim strips on the front panel along with the coveted Collins winged emblem and what we have is pure BOATANCHOR HEAVEN.

The 30K-4 was designed to be either operated locally or remotely controlled via telephone lines. The remote control chassis includes a matching transformer and relays for controlling and keying the transmitter.

I learned about the possible availability of the 30K-4 from a fellow amateur at work. While discussing my interest in old transmitters, he stated that he knew where I could probably purchase a "big" Collins HF transmitter for a very reasonable price, but that I would have to pick it up myself and haul it away. Since I have a mini van, I said NO PROBLEM! Just point me in the right direction! I then made contact with the owner and the following weekend I enlisted assistance of one of my sons-in-law and we headed off to a nearby small town to pick up the treasure. While driving along, visions of KW-1s and other delights were dancing through my head, but I really had no idea what the mystery Collins transmitter was or even if it would be complete.

Upon arrival, we were escorted to an old building which, I believe, had once

continued next page

been an old grocery store. It was now just used for storage of various old junk items including the transmitter. When we entered the building, I came face to face with a large and very impressive rack cabinet with a large COLLINS emblem on the front. Wow! It was a 30K!!! I was delighted. It certainly wasn't perfect and it wasn't a KW-1, but it was the next best thing. A 30K!!! It was beginning to rain, so I hurriedly reached an agreement with the owner and we loaded the transmitter into my van. Fortunately, it had casters on the bottom and we were able to roll it up to the rear hatch and then tip it on the side of the cabinet and push it into the van.

I was also very happy to obtain a box of parts along with the transmitter, which included a set of plug-in coils and a few spare tubes. I also obtained the original instruction manual. I could hardly wait to get my prize home and check it out; however, waves of concern began to fly through my mind. What will my wife say when she sees this monster? Where am I going to put it? Will it work or will I have to put a lot of time and money into fixing it up?

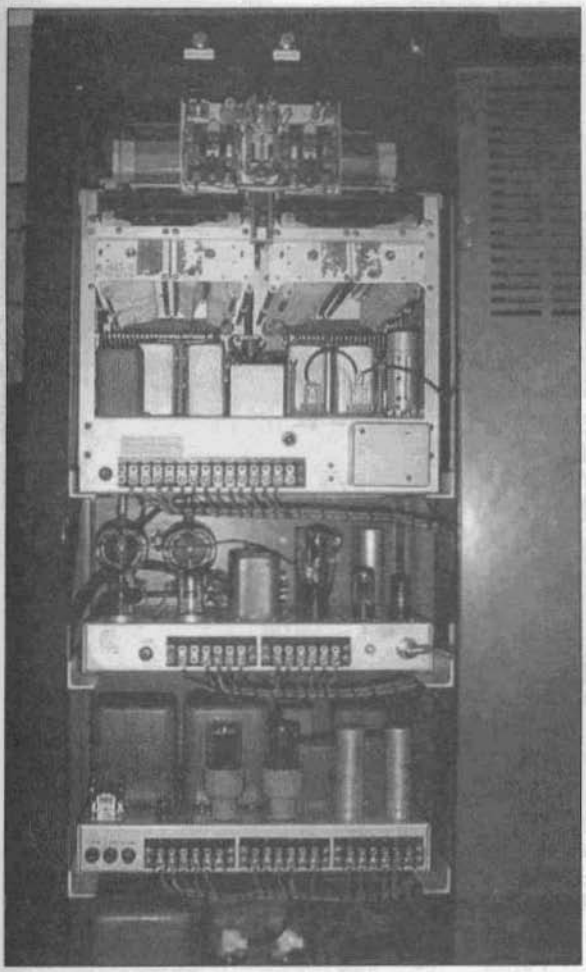
Upon arrival back at the N9GT (now W9GT) QTH, we unloaded the 30K-4 and rolled it up to the garage door. The first step in introducing my acquisition to the household was to give it a thorough cleaning. Years of neglect and storage in a semi-hostile environment had taken a toll. The 30K-4 was, in a word, filthy! It had the usual layers of dirt, insect and mouse stuff, and spider webs, which required immediate removal, before it would be allowed into the house. Good 'ole soap and water and elbow grease did wonders and soon the transmitter was looking as though it at least might be accepted inside. Needless to say, my XYL was not thrilled to see this thing coming into the shack! She recognized my "hamfest look" which she describes as an expression of delight mixed with guilt over a recent radio purchase. She failed to see how she should be as honored and delighted as I was to be welcoming this fine piece of vintage equipment into our home.

The next step was to look over my acquisition completely, read the manual to become familiar with it, and to assess the condition of the transmitter and discover any obvious problems. Actually, the inside was not too bad. It was not nearly as dirty and disgusting as the outside had been. The only real obvious problem was purely cosmetic. The transformers on some of the chassis decks had lost some of their paint and were a little rusty. A little cleaning and repainting would solve this problem.

As for the electrical condition of the transmitter, caution and patience were the word of the day in the approach toward firing up and testing the old rig. First, I tested the various filter capacitors in the power supplies and looked for shorts on the B+ lines. I looked for any obvious damage, i.e. scorched components, evidence of burned-up transformers, etc. I also looked for bad wiring, shorts, and poor connections. Initial examination and tests revealed no major problems. Not too bad for a transmitter built in 1950.

The next step was to fire up the filaments. Hmm. One 75TH was kaput. The other tubes were fine. I ordered a new pair of 75THs (ouch, those were a bit scarce and a bit expensive!) and took care of that problem. I'm glad that I purchased a pair, because I ended up breaking one later. I learned the hard way that the 75TH's should be removed before removing the RF or modulation decks from the cabinet. I determined also that the filament panel meter was inoperative and would require repair or replacement.

After I was comfortable with my initial testing, I held my breath, turned on the PLATE switch and fired up the B+. Well, so far so good. No smoke, no sparks and arcs, everything appeared to be operating OK.



Rear view with back door open. The lower two chassis contain the power supply circuitry. The next deck up is the modulator deck—note the two 75THs on the left. The upper chassis contains the driver and the two final output circuits.

I initially plugged in the appropriate coils to set up the two RF channels for 75/80 meters and 40 meters. I discovered a minor modification had been made to the exciter that allowed the use of a VFO. This consisted of a terminal strip and a couple of disc capacitors. I connected my old faithful Globe 755 VFO to one of the crystal sockets and tuned it to 3885 kHz. I also added a small relay to key the VFO, and connected it to operate off of the receiver muting relay terminals.

I connected a dummy load and attempted to key the transmitter in the LV position (exciter only on). Well, I expected something to click or clank or to make some indication that it was being activated, NOTHING. I immediately scanned the schematic and located the keying "plate" relay K-401. It is located on the LV power supply deck and is powered by the bias supply. Some quick measurements indicated that it was not getting any voltage applied to it. Further investigation led me to a wire-wound resistor in series with the relay which had opened up. This was somewhat of an oddball value (only because there wasn't one in my junkbox). I managed, however, to find one within acceptable tolerance and quickly replaced the open one. I put the power supply deck back together and reinstalled it into the cabinet. Well, some measure of success... now when I keyed... K-401 clicked and clanked away... Hooray!

My next try at tuning up revealed another problem, the driver grid meter (0-10 ma DC) which is mounted atop the RF chassis and viewed through the final amplifier window, was apparently inoperative. Upon closer examination, I discovered that the pointer was gone! It had apparently corroded from the presence of moisture and fell off. I located a temporary replacement meter in the junk box and quickly installed it. I then reassembled everything and tried to tune up again, still nothing.

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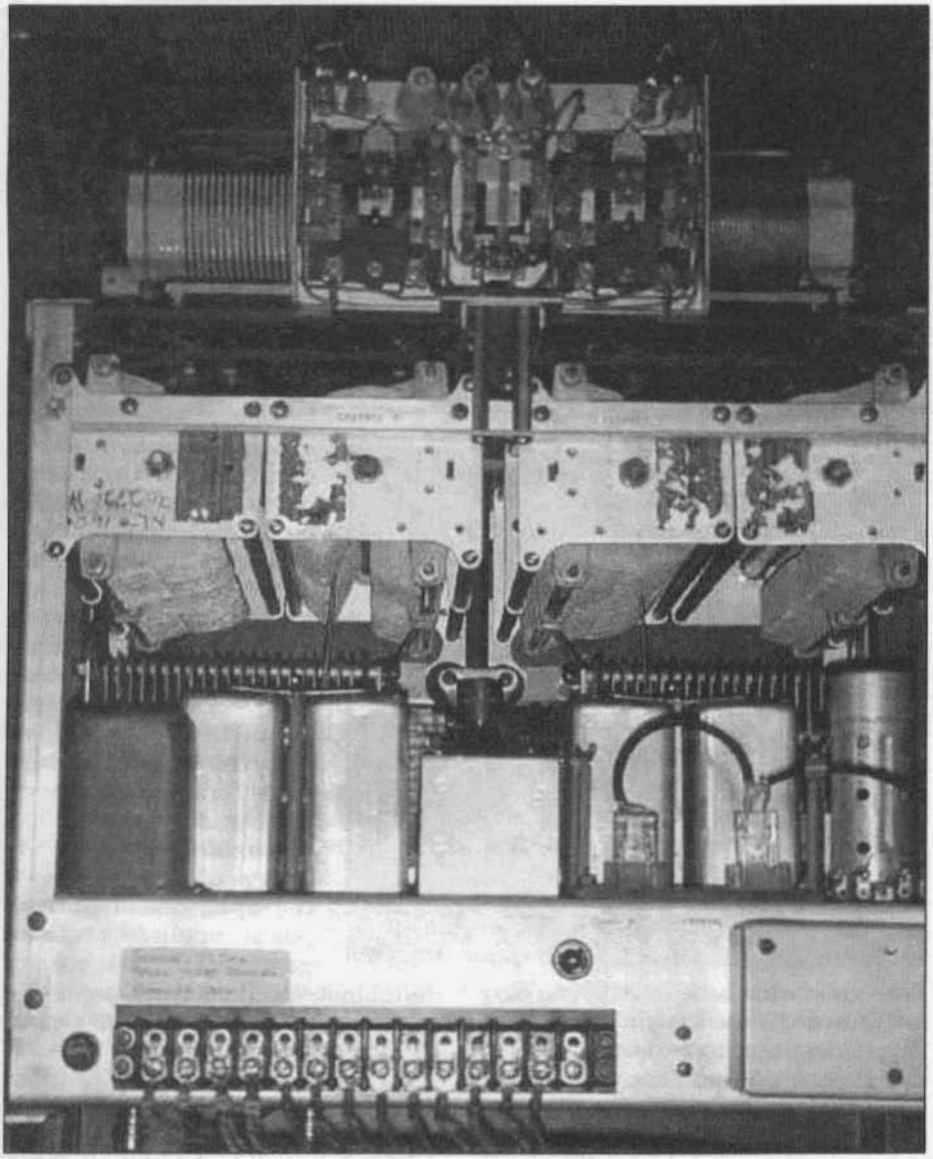


The center box is a shield over the 807 exciter/driver tube. The two cans on either side of the 807 are the plug-in coils for the two RF channels in the exciter. The RF amplifier tank circuits are located at the top with large variable capacitors for tuning and loading and plate coils above the capacitors. The 4-125A final amplifier tube is located in the center and toward the front of the chassis (behind the 807 shield box in the picture.) Note the dual antenna relays at the top of the RF deck and a control relay mounted between them.

I decided that it was time to remove the RF deck/exciter assembly and have a closer look. After looking around in the oscillator /buffer area, I discovered that two large wire-wound resistors were burned on the outside and open on the inside. I had missed these during my initial scan of the chassis. These resistors were part of a voltage divider circuit, which provided voltages for the low-level stages. I located some suitable replacements in the junk box and installed them. I then, once again, turned on the power, keyed the exciter and attempted a tune-up.

Aha..., success, this time. I was able to get an indication of grid drive to the 807 and the final amplifier grid meter began to indicate the presence of drive.

Next I moved the plate voltage control to the tune position and began to tune the final amplifier. I was able to tune, but couldn't get a good dip and resonance indication. I turned everything off and readjusted the roller tap on the final amplifier tank coil. I then tried again, this time I got a better indication, but still not quite right. After two or three more attempts, I reached what appeared to be an ideal setting. I was getting an indication of almost 100 watts output into the dummy load. I was able to repeat this procedure on the channel 2 position which I set up for 40 meters.

Now, for the real test, I moved the plate voltage control to the HV position and keyed the rig. Wow! Over 300 watts output at the rated plate current! It looked like the 4-125A was in good shape!

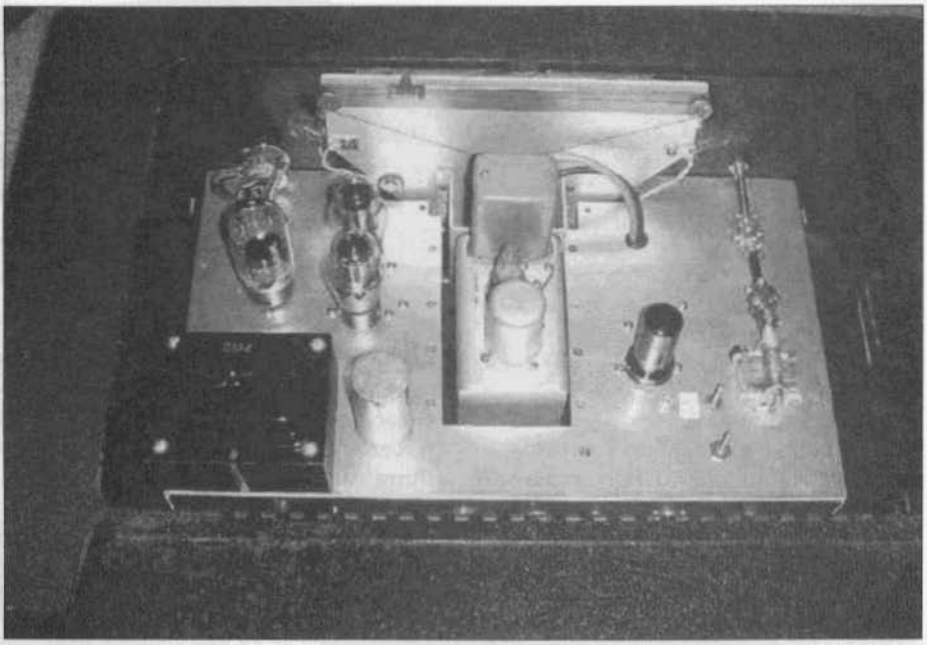
The next step was to check out the modulator and see if everything was operational. I switched to the phone position and observed the modulator idle current on the modulator plate meter. It was running a little high, about 75 mA. I readjusted the bias control which is located on the LV power supply chassis, and was able to obtain the rated 45 mA idling current quite easily. I then connected the trusty D-104 to the microphone input and turned on the receiver to listen to the audio. Uh, Oh! The audio seemed to be low and distorted, even with the gain turned all the way up. What now?

I remembered reading about the clipper circuit in the speech amplifier and how removing the 6H6 tube would disable it. (Ref. 3) Surely that was the problem. I removed the 6H6 and cranked up the gain and clipping controls, no change. I then decided to check out the speech amplifier by putting a signal tracer at the grids of the 75THs. Everything sounded good at that point. Oh no, I hope the modulation transformer is OK.....gulp!

I contacted another amateur via the Internet who owned a 30K-1 and also had a spare modulation transformer, which was actually for a 30K-4. We compared resistance measurements on the transformers and mine appeared to be just fine. I was painfully aware, however, that modulation transformers can fail and breakdown with HV applied even though they do not show shorts or problems with ohmmeter readings.

*NOTE: One way to check for this is by using a "Megger" or a HiPot tester. Unfortunately, I didn't have access to either at the time.

Well, since the signal was good up to the grids of the 75THs, it was a strong possibility that the modulation transformer might be bad. The mod transformer in the 30K-4 is a special unit that has windings for the plate as well as the screen. I decided, however, that I could test using a universal modulation transformer for the plate circuit and replace the screen winding temporarily with a filter choke. I temporarily installed a Stancor universal 300-watt mod transformer set at the highest P to P impedance of approx. 20K. This was significantly less than the 32K rating of the Collins unit, but I reasoned (perhaps



Inside the homebrewed 310-C exciter unit. The author referrs to this as his "310GT" exciter.

carelessly) that even with the mismatch, it should work better than a transformer that is breaking down under load. I also installed a hefty 10 H filter choke in the screen lead. I fired everything up again. NO CHANGE! Was my temporary lash-up at fault, or was there another problem?

At this point, I began to get really frustrated. The 30K-4 is not the easiest thing to work on, especially with power applied. It is difficult to get in there and measure voltages and troubleshoot due to the fact that wiring harnesses connect the various chassis decks together and there isn't much slack. I even considered building some extension cables so that I could work on chassis outside of the cabinet.

I decided to try and make arrangements to obtain another mod transformer with which to test and, hopefully, either eliminate that as the culprit or determine conclusively that mine was bad. Through the kind efforts of Brian, KN4R, my Internet contact, I was able to borrow a good transformer to test with and determine if mine was bad. I installed the new transformer and found that the problem was still there. NOW WHAT??? Maybe I should just give up and sell this thing and put an end to this frustration! I even put out some feelers to see if there was any interest, but I soon came to my senses and reconsidered.

Being the stubborn, determined, and generally persistent cuss that I am, I decided to keep trying. I decided that the only way I was going to fix this thing was to get the schematic out, study the problem, and try to reason it out. I proceeded to do just that and I theorized that something had to be wrong with the Phone/CW function switch or with K-301, the relay which shorts out the modulation transformer secondary in the CW position. Perhaps the relay was sticking? I removed the speech amp-modulator deck and inspected the relay. This was incredible!! The relay

was wired backwards! A wire had apparently been moved to the wrong terminal, which resulted in the modulation transformer secondary being shorted in the Phone position. I moved the wire and also found and removed a modification in the switch wiring, which apparently had been installed by some previous owner in a futile attempt to fix the problem caused by the relay wiring. (Or for some unknown other purpose).

I reassembled everything, fired up the rig, and viola!!! I had all kinds of beautiful modulation. Boy, did I feel dumb! Had I overlooked the obvious? Why didn't I think of that relay to start with? Well very simple, I assumed that the circuit was still wired the way it was supposed to be. I also didn't bother to take resistance measurements across the mod transformer secondary while it was still wired into the transmitter. All of my troubleshooting efforts had been aimed at the transformer itself, not the wiring.

I learned a valuable lesson after this experience, one that I should have learned when I was in college and my professors used to say "Don't assume anything". Some assumptions may infact save time and be acceptable, but when troubleshooting an old piece of gear which may have had many previous owners, DO NOT ASSUME ANYTHING! The rule should be go slowly, take one step at a time, and check everything very carefully. A little care at this stage may prevent many problems later, as well as prevent a condition of terminal frustration. I was certainly fortunate that I didn't do any further damage to the rig or replacement parts while testing.

Well, now I can report that the 30K-4 is working beautifully and it has provided many great AM QSOs. I have received numerous reports of excellent audio and that it sounds "loud and clear".

My next step will be to attend to some cosmetic details which will most likely include having the cabinet painted or powder-coated in St. James Gray and having the front panel re-silk screened. This will require a considerable investment, so it may be on the back burner for awhile. I did succeed in locating some replacements for the two panel meters that were damaged.

I am in the process of attempting to assemble a 310-series Collins exciter for use as a "matching" outboard VFO in place of the old Globe 755 that I have been using. The 310-C, which contained just the PTO and a buffer/multiplier, would be ideal, however, those things are rather scarce and expensive.

I did manage to pick up a 70E8-A PTO which is the heart of the 310 exciters, and I recently found a "basket case" 310B-1 chassis. So, perhaps soon I will be able to assemble something from these components resembling a Collins exciter/VFO. Another possibility that has been suggested to me for use as a VFO is a T-368 exciter unit.

All in all, I am delighted with the 30K-4. It has provided me with a wonderful introduction to the joy of owning a real high quality piece of gear manufactured by Collins, the "Rolls Royce" of radio. ER

References:

(1) Vintage Product Review Collins 30K Series by Skip Green, K7YOO, Electric Radio #29, September 1991. PP 24-28.
(2) Designing the Collins 30K by Warren B. Bruene, W5OLY, Electric Radio #94, February 1997. PP 4-14, 39.
(3) 30K-4 Instruction Manual Collins Radio Company Cedar Rapids, Iowa November 1950.

Displaying Those Old Transmitting Tubes

by Ernie Franke WA2EWT
10484 138th St. N.
Largo, FL 33774

Editor: I think that we should all observe a couple of rules when displaying tubes. First of all, it seems to me that any good tube put into a display should be mounted in such a way that it can be put back into service if necessary. And I think there are enough 'dud' transmitting tubes around that only those should be on display. The good ones should be kept for their intended purpose.

Memories...do you have a family heirloom, childhood treasure or an article that brings back memories of a very special time? Visit most homes today and you will find shoe boxes filled with old photographs. Visit most amateur shacks and you'll usually find a collection of oddball antique electron tubes. Why not display them made into lamp stands, bookends or shadowboxes and place them in the hallway, study or living room? The beauty of these displays is that by actually using original sockets the tubes can be pressed by into service if needed. Many tubes are too small to be made into lamps, but too large for a tie clasp. But still, you want to dig out those boxes full of those nostalgic reminders of the good ole days and do something with them in a functional and attractive manner. One of the greatest joys of collecting is displaying your collection. This article suggests a few possibilities of displaying those gems of yesteryear, focusing on transmitter tubes rather than receiving tubes because they are more distinctive, expensive and generally "manly".

Collectors & Collectibles: There is a Difference

In everyone's psyche is something that wants to reminisce and preserve the past. We see it today in the popularity of creating family albums capturing memories. We gaze at memorabilia on restaurant walls, reminding us of days gone by. Surfing the Internet shows that folks are truly collecting everything from railroad memorabilia to cast-metal toys and banks, duck decoys and teddy bears....and yes, even airline barf bags. The dilemma is how to properly collect, store and display them in an interesting way, keeping the collection in the foreground and not in the closet.

Collectors usually start with just a few items. Once other folks discover this hidden interest, they start contributing more pieces as novelties or jokes, until after a while the collector is known as the "tube man or lady" or that "guy or gal with the funny glass collection". We also see that each collector slowly acquires more historical knowledge and maybe even a few comical anecdotes, developing pride in recognizing clever nuances and design evolutions. Finally, the true collector becomes obsessed with "adding to" or "completing" the collection.

The Collector's Dilemma: How to Display

We want to not only see our own collection but we want it to be seen by others. First we divide the collection into storage versus display. Storage items consist of duplicates, blemishes, partials, supporting parts, historical books and spares. Because the heyday for transmitting tubes has passed, it is becoming more difficult to capture them, especially the sockets. The number of tubes found at hamfests has steadily decreased - along with the folks that actually used them. Still there are

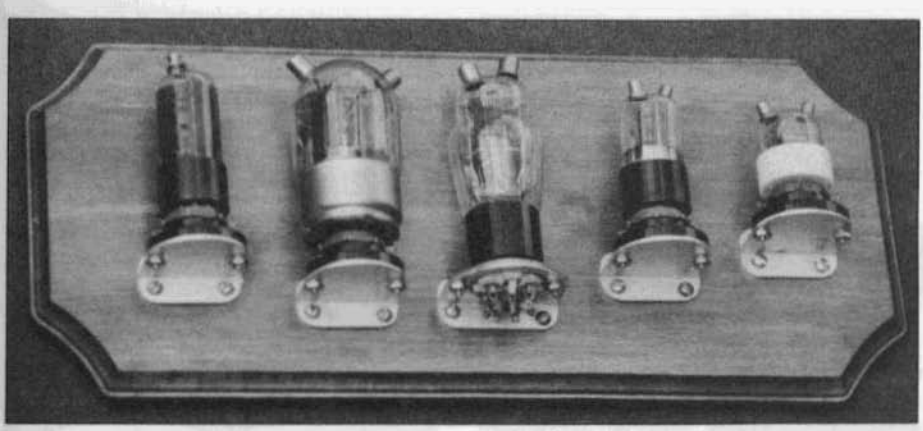


Figure 1: The "Goldilocks" family of double-cap tubes is a natural.

the local radio stations, basement clean-outs, and estate sales that must be periodically visited. Radio and TV stations are a source of duds. Fortunately transmitting tubes in the size needed by collectors are never rebuilt. Economically, only tubes with plate dissipations greater than 5 kW are suitable for rebuilding. Most collectors focus on glass tubes, because of their interesting global shapes and their immunity to tarnishing.

Natural Grouping of the Collectibles

What is a natural interest grouping for a display? Because we're looking to tell a story or rekindle a spirit, we want to focus on the grouping of the display items. We're looking for a thread of commonality within a collection of transmitting tubes. An example of this is a group of tubes with double plate caps in common. This naturally hints at a family of tubes, progressing in size from papa (833 or 815), mama (RK-34), older brother (2C26A) and sister (7193), and the baby (HY75 or HY114) as seen in Figure 1

A similar grouping might focus on the wire-element connection, double-anode variety, such as the 832/829B/6252/5894 group. Usually a grouping of three or four appears most pleasing. Then there are the tubes with side electrodes, such as the 808, 810, etc. One sees a natural progression in the size of the glass globe when going from the 25T to the 4E27, 100TH, and 250TH. Some tubes, such as the classic 4-400/4-1000 or the 803 / 813, are sufficiently large that they don't need a family gathering. Ambitious collectors try to complete the entire 800-series of transmitting tubes. Special-purpose tubes such as klystrons (2K25, 2K26, 417B, X-13), magnetrons (2J45, QK400), doorknobs (316A, 388A, 703A), acorns (950 series), lighthouses (2C39, 2C40, 2C43), magic-eyes (6E5, 6AL7), and medium-power transmitting tubes (4-125A, 1625, 807, 811, 6146, 24G) are all interesting because of their distinctive shapes.

Ceramic sockets for your tubes look rather smart because of their classic appearance, especially with the E.F. Johnson decal on the side. One word of caution when using ceramic sockets. Always install a fiber, rubber or plastic washer underneath each mounting screw to prevent micro-cracking of the ceramic. Sockets for coaxial tubes with concentric ring connections are usually prohibitively expensive. Lacking a socket, you may simply drill several clearance holes in the wooden base and glue the tube in place.

Choosing the Best Display Format

As you might guess, displays divide easily into at least seven areas; book-

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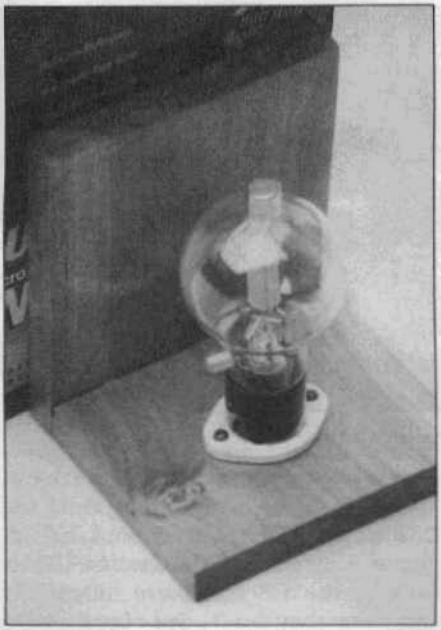

Figure 2: Bookends are a natural for displaying medium-size transmitter tubes.

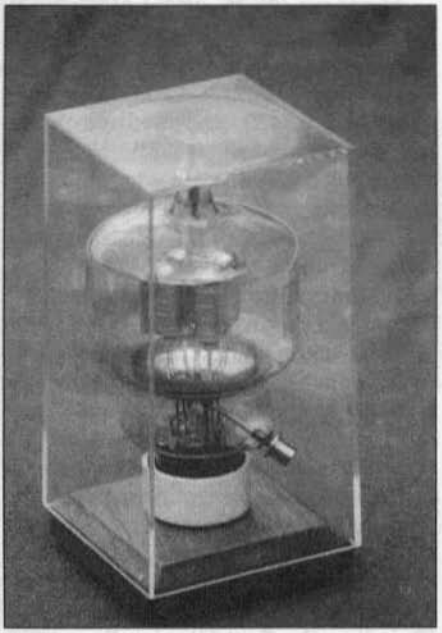

Figure 3: Figurine cases protect exotic tubes from dust and moisture.

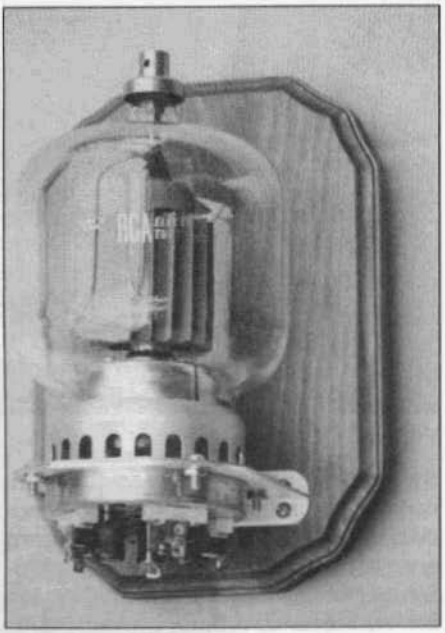

Figure 4: The T-bracket is used to mount tubes on wall plaques.

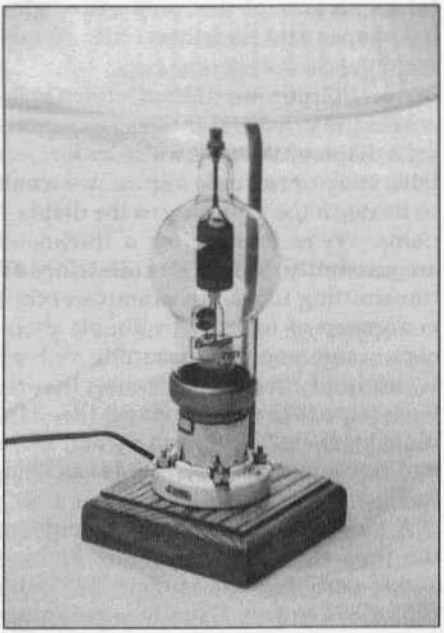

Figure 5: The 250TH makes an excellent centerpiece for a lampstand.

ends, wall plaques, lamp stands, paperweights, shadow boxes, pen and pencil sets, and centerpieces. Displays such as bookends are great because they serve a dual purpose, as they combine the beauty of nature's wood with the glass and metal of man's technology, to please even the most discerning XYL as shown in Figure 2.

One of the best sources of display material is the local craft shop, where one finds unfinished wooden wall plaques, shadow boxes and mounting bases. Art & Craft shops stock clear plastic and glass containers for displaying Barbie dolls and Beanie Babies. These figurine display cases can rest on either wooden or plastic bases. In fact, some display cases fit exactly on the square wooden unfinished bases stocked in the unfinished plaque section of the same craft shop, store, as shown in Figure 3.

A good way for mounting tubes on a wall plaque is to use the actual socket, preferably ceramic because they are more distinctive. A "T" or "L" bracket can be fashioned from extruded aluminum to hold the socket as shown in Figures 5 and 6.

Treasured keepsakes can be taken out of storage boxes and be placed on display in shadow boxes 3" to 5" deep. By putting someone's special transmitting tube in a shadowbox it creates a one-of-a-kind gift that no one else can ever duplicate and will thus be treasured forever. Beyond a certain size, the glass (4-1000) or external-anode (4CX1000) tube is too large or heavy to display on the wall. The lampstand is a better choice for accepting these heavier, larger tubes. Threaded brass tubing and harps are readily available from local lamp repair shops or on the Internet [2]. The tubing is available with bent offsets to allow for center-mounting of your transmitting tubes.

Because of their weight, some folks use external-anode tubes as paperweights. The magnetron has even been used to hold paperclips on the office desk as shown in Figure 6. Beware of its effect on your watch.

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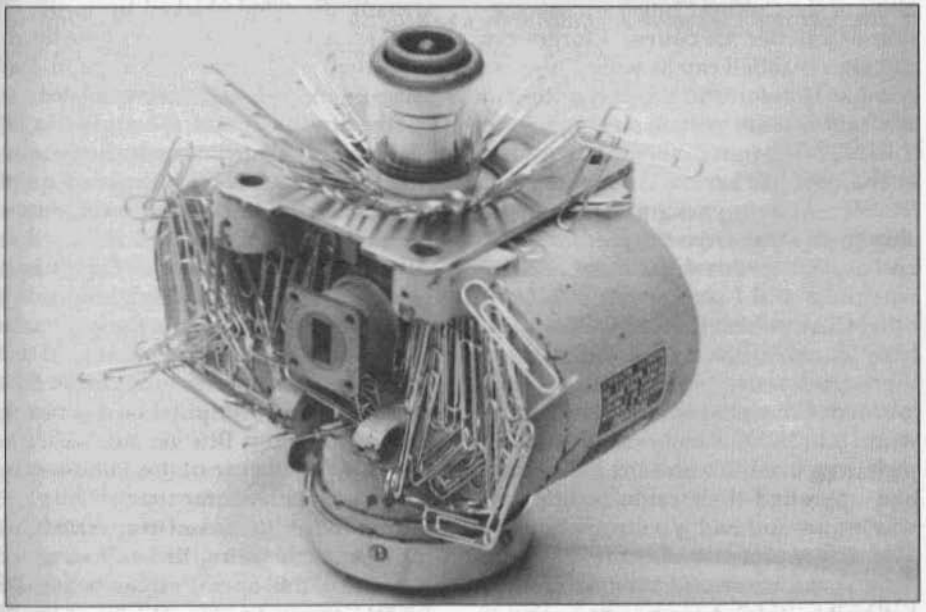


Figure 6: The magnetron makes an office combination paperweight / paper-clip holder.

Collins Collectors Association Cruise, November '99

by Mike Zonnefeld, WØLTL
3020 N. Amethyst Lane
Tucson, AZ 85749

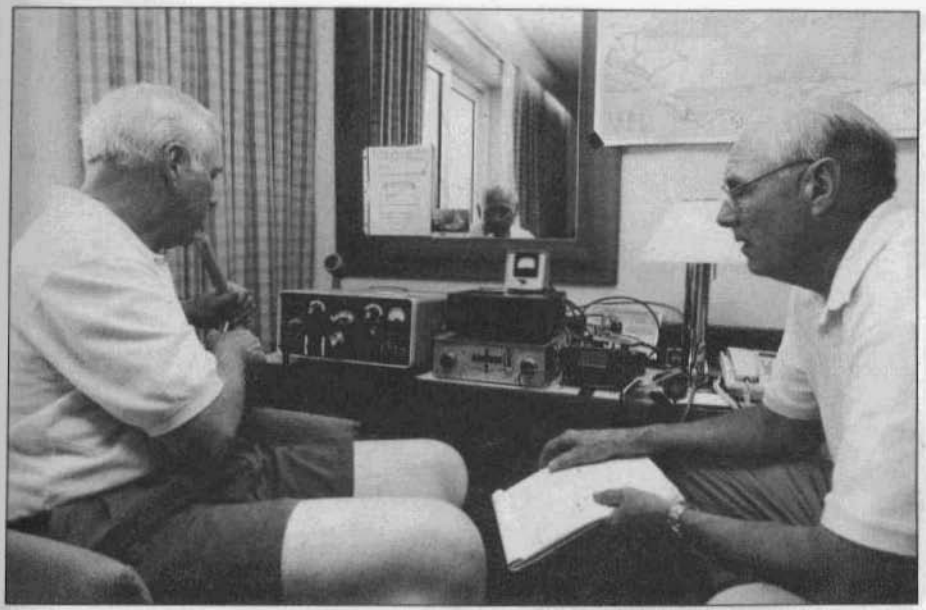
When the taxi took us to the side of the Celebrity V Cruise Liner, it was difficult to imagine the size of the ship! The excitement of flying over to Florida for the departure, waiting in line for hours to board all helped to heighten the excitement. The cruise line is very well organized, but it still takes a great deal of time to board this many passengers. Florida weather is always quite nice, and there was nothing to complain about the morning on this day either. Waiting was certainly no problem. The anticipated cruise throughout the eastern Caribbean helped to soothe any concern.

Looking around in the huge pier boarding lounge, I did not see one face that I could recognize from the magazines or the Collins Collectors Association newsletter. Of course, I forgot my call sign baseball cap as well! This was going to be interesting! Upon getting to the cabin, there was a message from Bill, N2YON, (now W2WIL), to gather at the outdoor bar on the top deck at 5:00 PM. After unpacking, watching the ship push away from the pier, my XYL and I went to this area. Butch, KØBS was there and I recognized him from other CCA publications as well as from his picture in ER. A few others were there, and soon the entire group adjourned to the cocktail lounge out of the wind. Bill, N2YON had everything very well organized. He and his XYL Diane had upgraded their cabin to one that was higher and had a balcony. Bill had also driven down to Florida from the New York City area just to take along a KWM-2A/PM-2 power supply and a long extendable fiberglass pole to support the antenna. After the brief meeting in the cocktail lounge, some of the group went to Bill's cabin to begin installation of the rig and antenna, and many others began serious exploration of the ship, which is truly magnificent.

Looking over the front of the ship and watching the pilot boat just slightly off our starboard bow, it became apparent that the seas were being driven quite high by the wind. Watching the pilot boat completely disappear in the waves was quite a sight. Unfortunately for some of the group this also spelled sea sickness troubles. Even the Century, displacing some 70,000 tons, pitched and rolled just enough to make some of the group uncomfortable for a few hours of the first day! The skies were overcast and occasionally the winds kicked up to the 50 mph level as a forewarning of the hurricane that was in the making and that attacked the area about a week later.

The first stop was scheduled to be San Juan Puerto Rico, which meant a full day at sea. This coincided quite nicely with having the station on the air for the Collins Collectors Association net on Sunday afternoon. Conditions were not particularly good, but during the net operation, many stations managed to work WØCXX, the onboard call sign from Collins Amateur Radio Station from Cedar Rapids, Ia. Thanks to Collins and Rod Blocksome, KØDAS, for allowing the use of this famous call, for one of its few maritime mobile applications. (Arthur used to operate from his own yacht using this call as well.) Pictures of this operation can be seen in KK5IM's recent excellent Collins book.

The first antenna was a dipole sus-



George Donavan, WB5WUX, makes a stateside contact with a Collins KWM-2A aboard the *MV Century* as Butch Schartau, KØBS keeps the log. Over 20 Collins enthusiasts and their XYLs sailed for a seven-day Caribbean cruise aboard the 70,000 ton ship in early November. Operating with special permission from the ship's Captain, the Liberian government and the Collins ARC in Cedar Rapids, the group signed the club's call WØCXX/MM. A 20-meter dipole and a 120-foot vertical long wire were rigged outside of a stateroom on deck 10. Over 300 QSOs were logged during the trip. *Photo by Jay Miller, KK5IM.*

pended from the side of the ship using Bill's fiberglass pole and anchoring the ends in adjoining rooms. Horizontal, this antenna may not have been the most efficient as it was suspended approximately 18 feet from the side of the steel ship. While some 60 feet high, it was working against the ship, and may have been quite directional. After the net, experimenting began in earnest! With that many hams on board, designs and efforts were limitless, the final installation consisted of an end fed wire, working against the ship as a "ground" using a KØBS homebrew antenna tuner. This setup resulted in some 350 or so contacts on all bands with most of them SSB and on 15 and 20 meters, some on 40 meters and even a few on 75 meters. Many DX stations were worked, although band conditions never did become excellent during the cruise. As a CW aficionado, the author even worked several CW contacts on CW. While the bulk of operating was with the KWM-2A and tuner, there were also many concessions to modern technology, using IC-706's.

Bill, W2WIL and Diane are to be congratulated on their hospitality, as hams were in and out of their cabin at all hours over the entire cruise. They were gracious beyond belief to the CCA group. This is one of the reasons that the Collins Collectors Association is so much fun. Not only fun, but the people involved all evoke the somewhat lost spirit of the past when amateurs were friendly and cooperative. Perhaps this spirit was instilled in the operators from

continued next page

On the bridge/radio tour. Left to right: George, WB5WUX; Rod, KØDAS; Butch, KØBS; Mike, WØLTL; Jay, KK5IM; ship's Second Officer; Bill, W2WIL.

All of the XYLs plus "Singing" George, WB5WUX.

Mike, WØLTL, at the key.

leaking electrons from those high power vacuum tubes!

Bill, W2WIL, had performed miracles in getting permission from the Liberian government and the ship master in obtaining permission for this operation. When the ships "radio officer" called just after the antenna was installed and the station was just operating to inquire about the interference that occurred when the ship rolled to starboard, the offer to immediately shut down as agreed to with the ship's management, was offered. The thinly disguised "ship's radio officer" agreed to permit the operation to continue much to the relief of the operating crew. When the "ship's radio officer" turned out to be WØLTL disguising his voice and calling from the beauty shop, many threats were considered. Later that evening, at the first formal dinner in the ships dining room, WØLTL received a menu that had no entries on it! Clever and richly deserved!

The ship food and entertainment were outstanding. The evening shows were outstanding. The Century spared no expense nor made any concessions to quality to make this cruise a class act. Even one of our group, George, WB5WUX, was drafted into singing "I left my heart in San Francisco" with one of the Four Lettermen. Needless to say, George became famous among our group, and is shown with his many female admirers in the photograph.

Jay, KK5IM, made arrangements to tour the ship on another of our days at sea. His efforts even resulted in a tour of the bridge, usually strictly off limits. With the visit to the radio room, and engine room, this was quite a treat!

Overall this CCA event was outstanding, over too soon, and thoroughly enjoyed by all. For those of us still working full time at high pressure jobs, this was a vacation made in heaven. One thing about a cruise, when the ship puts out to sea, you are on vacation, if you like it or not. You will enjoy; no cell phones, no memos, and no meetings etc.

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Rebuilding Caps In R-390s, R-388s and other Boatanchors

by John A. Poplawski Sr, WB2GFR
9 E 15th St.
Bayonne, NJ 07002

The power supply caps in the R-390s, 388 etc, are just getting old and leaking and should be replaced. After rebuilding a dozen or so 390s I came up with a fairly simple way to do them.

Figure 1. Cutting along base indicated in the picture, just cut through the metal, not too deep.
Figure 2. Heat outer cap with small propane torch just to the point of being able to pull it apart with pliers as shown. After it is apart, heat the empty can a little longer while inverting it to clean out any residue.
Figure 3. Use a new octal tube base (AES p/n P-SP8-476) and any good quality caps as necessary.

Around the tube base a few wrappings of electrical tape or heatshrink is necessary, until a snug fit happens. Along the bottom edge of the tubular metal cover I have used epoxy or silicon sealant to secure in place.

Special Tools
Hacksaw blade - metal cutting
Propane torch - you could do it over the kitchen stove but the XYL might strangle you.
Old newspapers - spread out where your working.

I would recommend wearing worn gloves & eye protection for safety. Also do not do this while sitting, the heated tar is worse than coffee. ER

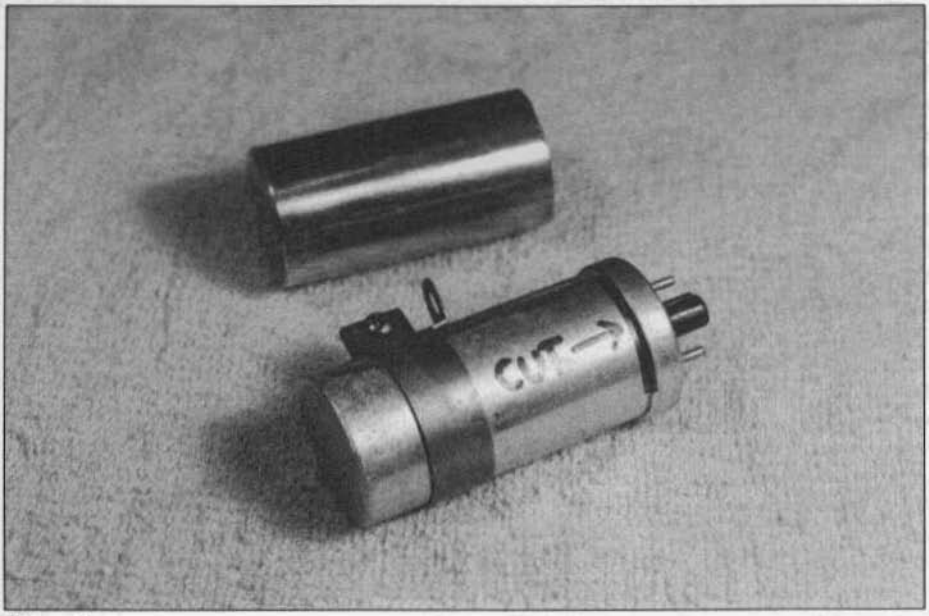

Figure 1

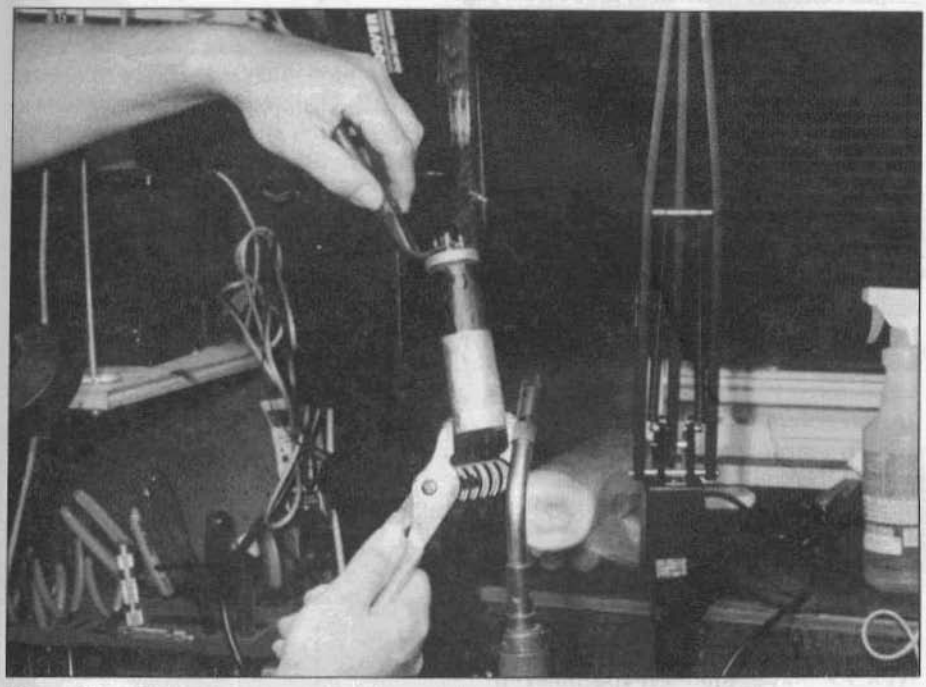

Figure 2

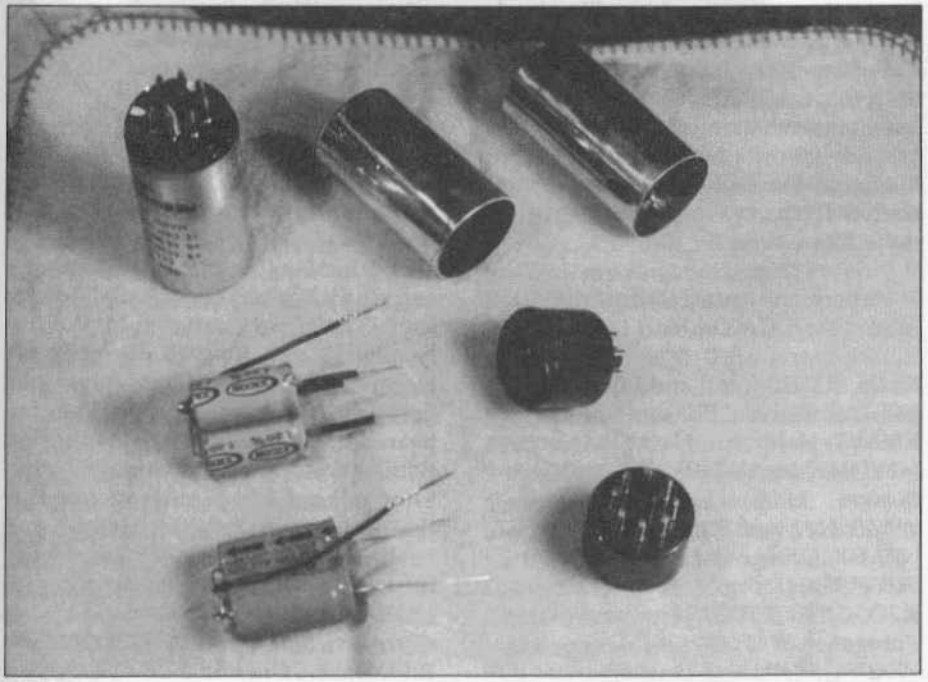

Figure 3

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Collins Collectors Association Cruise from page 35

This CCA cruise managed to put together vintage radio, modern radio, Collins Radios, a sun, fun, pleasure, as well as a field day atmosphere in which to enjoy it all. The cruise only lasted 7 days, visited San Juan, St. Thomas, St., Martin, and a brief stop in the Bahamas, and was thoroughly enjoyed by all. Not only did all the CCA members have fun, but the patient XYL's also had a marvelous time. Lifelong friendships were forged and will be maintained from these members from all walks and locations of life. When is the next one? This event could easily be repeated every few years or so. Perhaps more members of the Collins Collectors Association would like to also enjoy this event, as it truly was exceptional. Special thanks to Bill, W2WIL, Rod Blocksome, KØDAS, and Butch, KØBS for all their special efforts in making this such a success. Those stations that worked WØCXX may claim their special event QSL card from Bill still listed as N2YON by sending a SASE to his callbook address. Again many thanks to the Collins Collectors Association for coming up with this excellent idea. If you want to have a grand time in Amateur Radio, and are interested in classic Collins radios, join the Collins Collectors Association. It is a very rewarding organization. ER

Members and interested parties that joined the CCA Cruise.

KS4N, KD4LXJ, Bill and Eileen Adams
KØDAS, Rod and Elizabeth Blocksome
KM5VT, Heinz and Hannelone Breuer
N2YON, Now W2BIL, Bill and Diane Brown
W4KS, Ned and Diane Buck
N7ARY, George Carle
WB5WUX, George and Ann Donavan
K7OSC, KC7LBG, John and Sharon Ellingson
W9BEA, Wally and Janet Klinger
KK5IM, Jay and Laynie Miller
KE8RN, George and Barbra Misic
K4XH, K4JD, John and Nacy Morris
W1LJN, Joe and Dawn Nyberg
K8GEG, Walter and Pam Parrish
KØBS, Butch and Jane Schartau
WA6FIZ, Mickey and Barbara Siegel
N5RW, KB5WCB, James and Annette Myrick
WØLTL, Mike and Lillian Zonnefeld
N5ARW, Mr&Mrs. James True
Carl and Nancy Constanten
Harry and Elizabeth Linell
Gary and Susan Sanders

In downtown Ottawa, Ontario there is a monument normally referred to as the "Peacekeeping Monument". One of the figures is a Canadian radio operator carrying a PRC-25 or an PRC-77 on his back. The Royal Canadian Mint circulated a $1 coin in 1995 depicting the monument. As far as I know this is the first time that a military radio has appeared on a coin and perhaps the first time on a monument. I would be interested in knowing of other monuments that would have military radios.

The Royal Canadian Mint was helpful in providing the line drawing for clarity.

Chris Bisillion, VE3CBK, 1324 Old Carp Rd., Kanata, Ontario, K2K1X7, Canada

Old Transmitting Tubes from page 31

Mounting a favorite tube, such as an 807 or 6146, on an existing pen & pencil set is an excellent modification for reminding someone of those brass-pounding days as a novice.

Transmitter tubes, just as other memorabilia, can be displayed in an appealing manner to evoke a nostalgic recollection of good times experienced in the past.

References

1.) Vacuum Tubes, Inc.
3246 Floridale Lane
Cincinnati, OH 45239
www.vacuumtubesinc.com
2.) National Artcraft
7996 Darrow Road
Twinsburg, OH 44087
www.nationalartcraft.com

More From W5SJ from page 3

What a wonderful opportunity for a young teen who had only been as far away from home as Houston and Shreveport! It set the seed of wanderlust that has never been satisfied even after several million air miles. While on this trip I operated for the first time as "DX" from Clyde, KH6BTX (SK) Honolulu, HI QTH and later at Gifu Air Force Base Japan, from KA3GG. Imagine the look of those old MARS operators when this kid came in asked to get on the air and then rattled off QSOs at 40 wpm!

Since then I have operated from KH6 as well as PJ8, VP9, C6, ZF2, ZF8, VP2E and just this last month from the shack of Fran ("Cuz" - W2BJI) in Granada at J37XC as J3/W5SJ.

But, I love my old gear and operated the CX contest several times some 15 years ago with W5JM who could make a wet noodle and a gob of spit radiate! He would get the rigs ready (as many as 50 pairings for the CX) and I would operate them. Imagine, the chance to operate every transmitter and receiver that you had heard about (or coveted) all in one day. I was in heaven!

My current station has the Japanese rigs, but my fun rigs are my trusty 75A-4 and Ranger I that is on the air most Sunday mornings on 10 AM. I also have a mint HRO-60 and Viking II and have replicated my novice station of Adventurer, S-40B and VF-1. K5JUC is helping me get the 6L6 modulator for the Adventurer going again for another 10 meter AM rig. A few more boat anchor rigs are operational, as well as a Drake "C" line, and a KWM-2A with 312B5. I know I don't need another rig, but a 32V-3 I heard the other day on 10 sounded sooooo good! It sure would look great with that 75A-4. I'll switch the Ranger and pair it with the HRO ... then, I'll, hmmmmm, well, you know how it goes! ER

P.S. I'd sure like to hear from anyone who might have or know where I can get another Silvertone.

RCA 50 KW Ampliphase from page 7

agreed as the ampliphase is gone. No one ever followed RCA's lead and there were no other BC transmitters built using outphasing modulation that I could find. If you are a glutton for punishment, and want to give it a try, send me a large SASE and I'll send you a schematic of my final version. If I were going to do it over I would start at 1295 kHz and add triplers after the modulators to get to 3885. This would reduce the required phase modulation to 7.5 degrees. Also I would use 813s in the final and go for broke powerwise. It would appear that you could run more than the legal limit without breaking any rules. In the meantime I have gone back to the old plate modulated rig, thanks to a new (1949 RCA) modulation transformer from W3VU, and am trying to reestablish W4MEWS reputation as a decent sounding AM station. ER

PTO Design Recollections from page 9
clear that other production lots would be manufactured, the Collins Burbank Division agreed to build cores and they eventually succeeded. By this time, ferrite materials and firing techniques were becoming better known by ceramics engineers.

VFO variable-pitch inductors formerly were wound upon a thin-walled phenolic coil form which absorbed humidity and had an undesired instability with aging. Engineers realized that reduced spacing between the tuning core and the inductor wire would increase tuning range. The idea for eliminating the coil form, through winding the wire onto a steel mandrel followed by pouring around the mandrel an epoxy mixture containing fused quartz powder which after curing the mandrel would be pressed out, enabled a significant reduction in the coil wire spacing to the core. The filled epoxy had a lesser temperature expansion than the earlier phenolic coil form and furthermore eliminated the humidity and aging effects found in the former inductor construction. (ER#31 pg 15 provides a process description for that development). It is noteworthy that a later mix addition of Carbonyl E powder into the epoxy/quartz powder increased the effective permeability to enable a 2:1 tuning range achievable with only one inch of core travel. Another benefit of the molding process was in the achievement of a more stable and repeatable inductor winding which made possible elimination of the corrector mechanism. Thus, an equal tuning linearity was achieved without the factory test alignment processing. The KWM-1 and KWM-2 VFO's were without corrector stacks and were not hermetically sealed and exhibited extremely small aging effects.

Prior to the 70H-3 development, the tuning end-point adjustment was made through use of a variable capacitor (trimmer). While effective, the required linear range of the inductor design was lengthened to accommodate the core travel differential. Engineering analysis and experience in the laboratory proved the use of a variable inductor trimmer in series with the main tuning inductor and reduced the amount of extra tuning linearity. This idea, combined with the ferrite core and molded coil usage, made possible in the 70H-3 a 2:1 tuning range and in the 70H-1 (R-389 VFO) a 2.07:1 range.

Development of the wire-pitch specifications to achieve tuning linearity was a lengthy process in the early years of VFO engineering. Winding, testing, "reguessing" the changes in pitch entailed dozens of tries before a suitable specification could be released to production coil-winder cam design. Engineering personnel developed an analytical technique for winding pitch design through use of: the ratio of "desired-to-actual tuning rate" multiplied by the winding pitch in turns-per-inch throughout the coil's linear tuning range. The product gave the "corrected" winding pitch and made possible a completion of design in three to five iterations. This technique was extended to the design of the variable-tuned intermediate amplifier stages for the R-389/390/392 receivers.

Summary

Progress, such as described, came about largely through the research and development of ideas for creative solutions to problems arising from pushing the envelope of technology. Their success was assured when conducted by the team of engineering professionals who were not afraid to "bet the farm" on their ideas and their management who 'found' the funds to support those creative persons! **ER**

A complete index of the entire 10 years of ER is available for viewing or downloading at the following website: http://www.qsl.net/n9oo

Ranger PTT Modification from page 18

current. This may be due to leakage around the grid, or an anomaly in the grid structure, or perhaps it merely approaches zero as a limit. As an extreme example, WW-2 radar modulators operated as high as 15 kV at many amperes, but when cut off they passed about one milliampere, and dissipated as much or more power than when they were conducting! Anyway, I investigated the possibility that a small negative voltage on the 6146 PA and 6AQ5 clamp tube grids might cut-off the 6146 plate current before the clamp tube begins conducting, because its screen voltage is very low in the standby condition. I put a 250 K potentiometer across the -60 volt bias supply, and found at -9 to -10 volts the 6146 plate current minimum is approximately 1 mA or 4 µA. (depending on which meter I choose to disbelieve). At greater negative voltage the clamp tube begins to cut off and the 6146 plate current increases.

The solution then is to put in 9.4 volt Zener fixed bias in the PA grid circuit. Lift the grounded side of the meter circuit at meter switch contact #3 and run a new wire to the meter shunt resistor. Connect the Zener from ground to the formerly grounded side of the meter shunt. To keep the Zener alive, run a 100 K resistor to the -60 volt bias supply. This adds 9.4 volts to the grid bias, which makes the 6146 a trifle harder to drive, but is no problem. ER

The Old and the New from page 13

3885 kc into a dummy load of 50 ohms. The Ranger output was then connected to the Titan. After three minutes the "WAIT" indicator light went out and the plate voltage multimeter read 3000 volts. The Ranger was then keyed and with 18 watts drive, the Titan-2 came to life. After a little peaking and dipping, 400 watts were showing on the bargraph wattmeter as well as on the built in forward power meter and the Bird 43 peak reader. With the mic gain set at 9 o'clock and with a soft sustained whistle the bargraph showed 1500 watts output. Under normal speech conditions the Titan-2 would average 1250 watts and show peaks of 1500 watts on the bargraph. The Titan-2/Ranger/2 combo seemed to be working fine so a phone call was made to Mel Beal, KR4HM. He came up on 3885 kc and listened while I made an old buzzards transmission. Mel thought that the setup sounded very good. Mel left and Don, W3YCH called in and suggested that the mic gain be reduced a tad. This done, Don gave the setup a good report and allowed that I was putting out a strong well modulated clean signal.

So far I have made over 25 contacts on AM in the last week of operation. All reports have been very flattering. It is interesting to note that the Svetlana 4CX1600B is the same tube as used in the Russian army tanks for the past 20/25 years. Ten Tec may have problems in getting this amplifier back, you all know the old saying about possession and the law ! ! ER

One of a Kind Transmitter from page 15

nology) in 1936. It was operated by Jamie and Lela Wilson at 2305 Silver Avenue, El Paso, Texas. It was in operation until December 7, 1941, the start of WW II, when all stations were requested to cease operations by order of the U.S. government. The call of the station was W5DVL. In radio language, regardless of age, a male operator is referred to as "Old Man" and a female operator is referred to as "Young Lady". The large bulb on top was used to tune up the rig. When it reached peak brightness, the unit was ready to operate."

Let's hope that "the rest of the story" is forthcoming. ER

Postscript

Many thanks to Claude Lee for supplying the photos and making us aware of this unique peice of radio history.

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FOR SALE: Radio books, magazines, catalogs, manuals (copies), radios, hifi, parts. Send 2 stamp LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857-2805. aq253@osfn.org

FOR SALE: KWM-2 fan bracket - $12 ppd. Dave Ishmael, WA6VVL, 2222 Sycamore Ave., Tustin CA 92780. (714) 573-0901.

FOR SALE: Small parts, transformers for projects and repairs of tube gear. Let me know your needs. Van Field, W2OQI, 17 Inwood Rd. Center, Moriches, NY 11934. (516) 878-1591 or wreck_and_rescue@juno.com

FOR SALE: NOS,UTC # F-7101 matching (600-8 ohms) xfmrs (2 W) - $13 ppd./dom./USA. ABEN, POB 4118, Jersey City, NJ 07304-0118,Avidov@aol.com

FOR SALE: Heath VF-1 VFO, good condx, w/ manual, 2 units available - $75 plus shpg. Greg Richardson, WA8JPC, POB 405 , Gallipolis Ferry , WV 25515. wa8jpc@citynet.net

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 20176. (540) 822-5643

FOR SALE: Hallicrafters, RME, Gonset, others. Also some military, test equipment,VHF/RF amps, more. LASE, Don Jeffrey, POB 1164, Monrovia, CA 91017.

FOR SALE: Meters for WW II military radios, have some connectors. Henry Engstrom, KD6KWH, CA, (707) 544-5179. pacifica@sonic.net

FOR SALE: Crosley Pup,complete - $400 shpd. George, (856) 848-6699, rock301@snip.net

FOR SALE: NOS TCS baseplates, still in orig. factory shpg wrap - 2/$15.00 plus shpg. Carl, KN6AL. POB 3531 Laramie, WY 82071. (307) 742-0711, kn6al@uwyo.edu

FOR SALE: T-17B mic w/M-367 cover NIB - $ 25; SA-46-ART-13 switch NIB - $10; more list - $ 1. Joe Orgnero, VE7LBI, 1349 Leask Rd., Nanaimo BC V9X 1P8 Canada (250) 722-2707 joseph@pacificcoast.net

FOR SALE: Audo-Aims personalized guitar sound system; pair sound labs spkrs; 200 lbs audio magazines; S38E; HT40; regen kit all band/plug-in coils; Heath grid dip. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402. (319) 393-8075

NOTICE: At long last Chuck Dachis has opened his web site. Come visit him at http://www.hallicraftercollector.com

FOR SALE: Military and commercial communications items: www.maxpages.com/murphyjunk. For up to date lists: murphy@cts.com. Mike Murphy's Surplus, 401 N. Johnson Ave., El Cajon, CA 92020. (619) 444-7717

FOR SALE: Over 600 electronics magazines, mostly 1960's & '90's - 99¢ ea + shpg; also available: electronics books, parts, etc. List for stamp. Bob Eckert, 133 E. 7th St., Clifton, NJ 07011.

FOR SALE: Racal RA-17, good condx, rack mount, no ship - $600. Harry, WA6IUR, CA, (626) 355-0290, henmark@aol.com

FOR SALE: Radar, APS-88, ex Grumman S2A Tracker, complete, antenna and mount, rcvr/xmtr, synchronizer, control amp, display, antenna control box, system control box, 65KW, X-band - $1500, no cables, manual available, extra. Carl Bloom, (714) 639-1679, 3778111@MCIMAIL.COM

FOR SALE: Naval rcvrs, RAK, RAL, RAO, RBA, RBB, RBC, RBL, pwr splys available, prices from $75 to $350 depending on type, condx. Carl Bloom, (714) 639-1679, 3778111@MCIMAIL.COM

FOR SALE: Tube list, new & used, wide variety audio, ham. Recently expanded. SASE 52¢. Bill McCombs, WB0WNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212.

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

FOR SALE: parts, tubes, books. SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761. wb0cte@arrl.net

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FOR SALE: RBM pair, hi-low band, new condx, matching serial numbers - $750. Carl Bloom, (714) 639-1679, 3778111@MCIMAIL.COM

FOR SALE/TRADE: Collins/KY-45/FRT-5, AN/ART-13; BC-348; Drake/TR-4C; Heath/HW-12, QF-1, EK-2. Sam Timberlake, KF4TXQ, POB 161, Dadeville, AL 36853. (256) 825-7305, stimber@lakemartin.net

FOR SALE: E. F. Johnson SWR meter, catalog Number 250-38, NOS - $25 + S&H. Bruce Hering, 41120 State Highway 13, Waseca, MN 56093. (507) 835-5619, bhering@efjohnson.com

FOR SALE: Kenwood TS130-SE PS30S, mic, manual, boxes, list new condx. - $395 firm. Jack, W9FQK, AZ, (520) 634-2028.

FOR SALE: OEM Heath belts - $2.50 each shpd; or 10+ for $2 each shpd. Send check or money order. Roberta Hummel, 202 Midvale Dr., Marshall, WI 53559.

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FOR SALE: Radio, TV tubes NOS, send want list & SASE. Dan Hill, POB 49, Dixmont, ME 04932. (207) 234-2315

FOR SALE: Manuals for old ham gear of the '30s to the '70s. Check WEB Catalog www.hi-manuals.com

FOR SALE: Nice Heath HW-101, w/HP-23C pwr sply, all books. Fred Clinger, WA8KJJ, OH, (419) 468-6117, after 6 PM EST.

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FOR SALE: QST 1977 to 1999, mint condx - $350 + UPS. Sorry, no single copies. Onerio Sabetto, W8PIU, 1717 Burgess Rd., Cleveland, OH 44112. (216) 481-1036

FOR SALE: Ohmite rheostats 50Ω 50W; 10Ω 100W; 200Ω 50W - $9 ea. Joe, W6CAS, CA, (916) 731-8261.

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FOR SALE: National NCX-500 xcvr - $150; HP-302a wave analyzer - $ 75; Hammarlund S-100 speaker - $75. Carter, (804) 979-7383, CElliott146@aol.com

FOR SALE: Microphones: RCA BC Lavalier - $10; Astatic 10M5 - $10; xfmrs, capacitors, publications, SASE list. Bill Riley, W7EXB, 863 W. 38th Ave., Eugene, OR 97405.

FOR SALE: Fall 1962 callbook - $20 + shpg; Railroad magazine collection - just pay UPS. Louis L. D'Antuono, WA2CBZ, 8802 Ridge Blvd., Brooklyn, NY 11209. (718) 748-9612 after 6 pm.

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FOR SALE: New model galena xtal detector, w/ station finder & vibration resistant - $15 ea. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150.

FOR SALE: Large collection of electronic & radio books. Harry Weber, 4845 W. 107th, Oak Lawn, IL 60453-5252

FOR SALE: My collection of WW II military radios & stuff. Send SASE for list. Robert Martin, 111 Bancroft, Rochester, NY 14616. (716) 663-4182

FOR SALE: Tektronix LC130 ind. cap. meter - $100; General Radio 1214A unit audio oscillator - $35. Norm Roscoe, W1CIX, POB 402, W. Bridgewater, MA 02379. (508) 583-8349

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FOR SALE: Gonset Communicators; IV, 6 meter - $115; III, 2 meter - $75; IV, 2 meter, needs work - $35; VFO, needs work - $35; Lafayette HA-410 10M complete - $150; Starflight xmtr - $65; 6M VFO - $35; Heath HW-12 & pwr sply, nice - $165; HW101 & pwr sply - $195. Richard Prester, 131 Ridge Rd., W. Milford, NJ 07480. (973) 728-2454, rprester@warwick.net

FOR SALE: Used xmtg tubes: (1) 2E26; (1) 5763 - $5 ea + shpg. Tubes untested but believed okay; also available: electronics books, mags, parts, etc. List for stamp. Bob Eckert, 133 E. 7th St., Clifton, NJ 07011. (973) 340-0579

WANTED: Collins - Amateur catalogs, sales literature, manuals, promotional items & Signals. Richard Coyne, POB 2000-200, Mission Viejo, CA 92690.

WANTED: Howard radios of any type. Andy Howard, WA4KCY, 105 Sweet Bay Ln, Carrollton, GA 30116. wa4kcy@usa.net

WANTED: E. F. Johnson Co. HAMALOGs, unusual photos and information 1923-70. Bruce Hering, 41120 State Highway 13, Waseca, MN 56093. (507) 835-5619. bhering@efjohnson.com

WANTED: Top dollar paid for Winchester Radios and Winchester related items. Donald Daggett, 122 Hall Rd., Grahamsville, NY 12740. (914) 985-7249. wc2e@webtv.com

WANTED: For purchase. Equipment & technical information related to AN/ARN-6 Radio Compass. Jim Cavan, 6 Timberline, Norfolk, MA 02056. (508) 528-0908, jcavan566@aol.com

WANTED: Gearshift for Teletype Model 28, or complete machine with one. Ivan, WA6SWA, POB 248, Reno, NV 89504. (775) 329-7738, idb@cs.unr.edu

WANTED: SW3 #33A and #35 coils. I will trade my extra coils SW3 coils. Hank Bredehorst, 2440 Adrian St., Newbury Park, CA 91320. (805) 498-8907

WANTED: Parts for a TMC GPT-750 xmtr. I need the AM modulator deck and other parts to restore this unit. John, KF2JQ (716) 873-0524 jprusso@acsu.buffalo.edu

WANTED: Long wire ants AT101, AT102, GRC-9; DY88/105; PP327GRC9; counterpoise CP12 & 13 GRC9; BC348 pwr conn PLQ102/103. KA1ZQR, 348 N. Main St., Stonington, CT 06378.

WANTED: Globe King 500 B/C; Viking Valiant I/II; Viking 500; Heathkit Mohawk. Frank, (916) 635-4994, frankdellechaie@sprintmail.com

WANTED: Globe King 500 B or C for California PU. Bob, CA, (562) 928-8820. rrjlife@earthlink.net

WANTED: National Company emblems, escutcheons; National S-101 impedance coupler; NC-2-40D knobs. Don Barsema, 1458 Byron SE, Grand Rapids, MI 49506. (616) 451-9874, DBARSEMA@prodigy.net

WANTED: Military radios: British A-13, A-14, & Soviet R(P)-129. Leroy Sparks, W6SYC, 924 W. Mc Fadden Ave., Santa Ana, CA 92707. (714) 540-8123. leroysparks@earthlink.net

WANTED: Hallicrafters B-42 adjustable base for SX-42 rcvr. Don, W7KCK, (503) 298-2326, dgkck@teleport.com

WANTED: Military surplus model RDO rcvr and/or RDP panadapter. John M. Franke, 23 Parkwood Dr. Apt. 201, Yorktown, VA 23693. (757) 865 8127.

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

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

WANTED: British, Commonwealth W.S. 62, W.S. 22, W.S. 18, W.S. 48, W.S. 46. George Rancourt, K1ANX, MA, (413) 527-4304

WANTED: Knight-kits; Ocean Hopper, Star Roamer II, T-150A, and others. Also Allied/Knight catalogs, especially 1959-1962, 1965, 1969-1972. Steve Donahue, 1773 Sterling Pointe, Cleveland, TN 37312.

WANTED: Contact w/Bendix fans, especially those working on the TA-12 xmtr & the RA-10 or similar rcvrs. Sam Kelly, W6JTT, CA, (714) 893-2092 or skellycp@aol.com

WANTED: PreWW-II Iowa QSL cards; materials of 1920s Iowa Radio Relay League. Will trade or purchase. Bill Smith, W5USM, w5usm@aol.com

WANTED: Yaesu FT-101-ZD. Joel Thurtell, 11803 Priscilla Ln., Plymouth, MI 48170. (734) 454-1890, finder@radiofinder.com

WANTED: Manual, schematic or other info for a Navy DF set, model DAQ. Frank, wa6rbq@aol.com or (541) 479-7935. Callbook OK.

WANTED: Manual and/or schematic for Sylvania CU-1388/FLR-9 antenna multicoupler. Steve Byan, 12 Oak Ridge Rd., Littleton, MA 01460. (978) 486-4241, smb@world.std.com

WANTED: Hallicrafter SX-42, in good cosmetic shape. Jim Tolar, (713) 821-8474 days or (281) 561-6426 eves, W5SQE@iname.com

WANTED: HF-300 tubes. Don Chester, K4KYV, 2116 Oldover Rd., Woodlawn, TN 37191. (931) 647-2179, k4kyv@hotmail.com

WANTED: 1930s Navy radios, any condx. I can pick up from very far away. William Donzelli, 15 Gen MacArthur Dr., Carmel, NY 10512. (914) 225-2547, aw288@osfn.org

WANTED: Vibroplex bug with 3" wide grey or black base; EAC R-390A front panel. Brian Roberts, K9VKY, 130 Tara Dr., Fombell, PA 16123. (724) 758-2688, k9vky@stargate.net

WANTED: WW-2 Japanese military radio of any kind; Hammarlund PRO-310. Takashi Doi 1-21-4, Minamidai, Seyaku, Yokohama, 246 Japan. Fax 011-8145-301-8069, takadoi@carrot.ocn.ne.jp

FOR SALE: Hallicrafter's manuals, copies starting at $5, some Johnson, WRL, others. SASE for list. DSM Diversified, 909 Walnut St., Erie, PA 16502.

FOR SALE: Vintage radios on display, bought, sold, traded and repaired. Webpage - http://www.tiac.net/users/hobfact. Rick Galardi, W1DEJ, Boston, MA, (781) 485-1414, Fax 289-1717, hobfact@tiac.net

FOR SALE: Military radio TM's, origs & reprints. New list. Send $1 & address label to Robert Downs, WA5CAB, 2027 Mapleton Dr., Houston, TX 77043-2410. (713) 467-5614

FOR SALE: LSASE for list of old parts, many V caps, Hphones, mics, accessories, rigs. Carl, WA7LUY, 644 Pineview Pl, Casper, WY 82609.

FOR SALE: I repair all tube type amplifiers. Licensed in 1955. Steve Gross, N4PZ-W9OJL, IL, (815) 734-4255.

FOR SALE: Dr. Radio repairs vintage ham gear. Steve Trimble, K5DJH, Box 73, Weston, TX 75097-0073. (888) 73-K5DJH. k5djh@texoma.net

FOR SALE/TRADE: RME manuals: 45, 45B, 69, 99, 4300, 4350, 4350A, 6900, VHF126, VHF152A. NI4Q, POB 690098, Orlando, FL 32869. (407) 351-5536, ni4q@juno.com

FOR SALE: Signal Corps BC-221-AL, frequency meter, pwr sply, manual - $60 + UPS. Clarence Filley, W7KE, 1109 S. 2nd St., Hamilton, MT 59840. (406) 363-1946

FOR SALE: Johnson Viking II, good condx - $175. **WANTED:** Drake T-4X & R-4C. Robert Braza, W1RMB, MA (508) 222-5553.

FOR SALE: Collins KWM-2, WE - $495; Heath HP-23B sply - $55; Johnson LoPass filter - $25; Swan 410 VFO - $75; tubes NIB: 8072 - $40; 7360 - $12. U-ship. WA7HDL, ID (208) 756-4147 after 0030Z.

FOR SALE: US military generators MEP-026A 24-28 VDC gasoline engine, great running condx - $350. PU only St Louis, MO. Shawn, MO, (636) 343-5263.

FOR SALE: HQ-100A - $100; HQ-170A - $130; Swan 350 w/Swan sply - $150; S-40B - $50; NC-300 w/NC spkr - $200; Ranger w/PTT/ant relay - $275; DX-100 w/PTT/ant relay - $175; HA-350 Allied rcvr - $100; SR-160 w/sply & cadaver unit - $175; HW101 w/sply - $150; RME 4350 - $150; SB-33 w/DC sply - $175; SR-46 AM/6 mtr xcvr - $100; Conar 400 xmtr 20 watts - $50; (2) Heath QF-1 multipliers - $50; Dentron HR-200A SSB xcvr - $150; Super Pro-500 kc to 20 MC, early 1938 - $100; SX-24 - $100. All + shpg. Ken Sands, K8TFD, 15614 Edgewood Circle, Plymouth, MI 48170. (734) 420-3448

FOR SALE: Two classic rcvr both mint - Hallicrafters S-20 Sky Champion and National NC-98. Serious offers. Ron, MI, (517) 374-1107

FOR SALE: WACO-5NWX telephone filters. Just plug in. 1/$13.95, 2/$25, 3/$34. Money back. Cecil Palmer, 4500 Timbercrest Ln., Waco, TX 76705. (254) 799-5931, w5nwx@juno.com

FOR SALE: Collins 30L1 owners new Cetron 811A's - $19; 32V owners Raytheon 4D32 - $19; major credit cards accepted. Don, W4GIT, FL, (352) 475-3306.

FOR SALE: Heath Nostalgia, 124 pg book contains history, pictures, many stories by longtime Heath employees. (See BOOKS inside back cover.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028.

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FOR SALE: Tube type kits for CW/AM. Vintage Radio Kit Co, 427 North Main St., Sharon, MA 02067. email us at CTCW-5 @aol.com or visit our web site at: http://www.mnsinc.com/bry/vintage.htm

FOR SALE: Collins 51J series drum overlay - $10 ea, specify which. Ron Hankins, KK4PK, 555 Seminole Woods Blvd., Geneva, FL 32732. (407) 349-9150

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WANTED: Help! Need manual (copy OK) for Hallicrafters SX-11 Super Skyrider. K9QPM, 12855 Hadley Rd., Lockport, Il 60441.

WANTED: BC-610E mod xfmr; BC-191 or BC-375. Pete Hamersma, WB2JWU, POB 467, Holderness, NH 03245.

WANTED: Small 1" panel meters, especially DC ammeters. Send price info. Chris Cross, POB 94, McConnell, IL 61050.

WANTED: NC-300 4H4C ballast; XCU300 calibrator unit; late issue foreign QSL callbook. Gerald Liccione, 118 Hiawatha Trail, Liverpool, NY 13088. (315) 457-7928

WANTED: Grisby-Grunow (Majestic) horn driver, working or not. **FOR SALE:** RADA - $375. W. Harder, 911 W. Northrup St., Lansing, MI 48911. (517) 882-2303, harderw@pilot.msu.edu

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WANTED: Hallicrafters Village/Hamlet radios TR-5/TR-20 & Gonset Civil Defense 6m radios/accessories, manuals also. Daniel Cahn, 3444 Greenwood Ave., Los Angeles, CA 90066. Fx/msg (310) 398-7159 or danielc411@aol.com

WANTED: Cash for Collins: SM-1, 2, 3; 312A-1, 2; 55G-1; 399C-1; 62S-1; KWM-1; 302C-3; 515-1; 75S-3C; 32S-3A. I buy any Collins equip. Leo, KJ6HI, CA, Ph/Fx (310) 670-6969. radioleo@earthlink.net

WANTED: Information-WW2 TCS Radio System: Design, Manufacturing & Operation for article. Any help appreciated. Thanks. Greg Greenwood, WB6FZH, POB 1325, Weaverville, CA 96093. (707) 523-9122 (message) greg6fzh@aol.com

WANTED: Military rcvs ARB no mods; RAX 1, 2 or 3; MN26 compass rcvr &/or access's: loop, control head, azmuth indicator tuning meter, etc. Joe, W5JDY, 317 White St., Norman, OK 73069. (405) 321-4717

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WANTED: Stancor/Chicago PCC200, PCO/PS0150, RC8150; Triad A-9-J, A-10-J, A-11-J, A-12-J. **FOR SALE:** Books, send SASE. Richard Robinson, POB 1425, Wallingford, CT 06492. (203) 949-0871, richmix@erols.com

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WANTED: Visitors and tubes by museum. Old and odd amateur or commercial tubes, foreign and domestic purchased, traded or donations welcome. All correspondence answered. K6DIA, Ye Olde Transmitting Tube Museum, POB 97, Crescent City, CA 95531. (707) 464-6470

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WANTED: Parts for TCS rcvr & xmtr that I am restoring. K6GPB, 5319 Sierra Vista Rd., Murphys, CA 95247. earlw@goldrush.com

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

WANTED: TMC GPT-750, TAC Tuner, GPR-90/92 & GSB-1. Alan Gray, W3BV, PA, (215) 795-0943.

WANTED: Hallicrafters S-39 rcvr Skyranger. Bob, K1YJK, CO, (303) 768-9200, k1yjk@arrl.net

WANTED: National HRO black wrinkle spkrs, oak coil boxes, coils; Western Electric horns, spkrs, amps, mics. Barry Nadel, POB 29303, San Francisco, CA 94129. bnadel@ccnet.com

WANTED: Collins 70K-2 PTOs working or not; IN82A diodes; Bretting 14/14AX manual. Clark, WØBT, KS, (785) 286-2132

WANTED: Looking for quality rcvr for my AM station, ie; 75A3, 75A4, 51J4, R390A. Tom, W3BYM, (301) 871-7463, W3BYM@arrl.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: Cabinet for Heath AT-1. Bob Gravel, K1BUB, MA, (413) 568-3120.

WANTED: Navy xmtrs: MQ, TCA, TCE, TCN, TCX, TDE; rcvrs: RAW, RAX, RBD, RBJ. Steve Finelli, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211. navrad@enter.net

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. (501) 318-1844, Fx 623-8783, james.true@ibm.net

WANTED: Test equipment & tube audio amplifiers. Mike Nowlen, WB4UKB, 2212 Burgee Ct., Reston, VA 20191. mike@3dnet.com

WANTED: Cash for Collins: SM-1, 2, 3; 55G-1; 62S-1; 399C-1, 51S-1; 75S-3A, C 32S-3A; any Collins equip. Leo, KJ6HI, CA, ph/fx (310) 670-6969, radioleo@earthlink.net

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WANTED: Mclaughlin signal splitter; any radios of the OSS; also BC-652/653. Gary, MN, (612) 496-3794

WANTED: BC-610 Parts: coils, tuning units, tubes, cable for speech amp, meters, (anything). George, N1TNQ, (401) 331-1279

WANTED: RME-6900 or HQ-170A; Hallicrafter TO keyer. Steve Davis, KD2NX, 11 Vineyard Ave., Middletown, NJ 07748. (732) 495-3241

WANTED: A large British straight key made of brass on wooden base, sold thru Florida Co about 20 yrs ago. I can't recall the name of the key or company. Tom Waters, 3703 Bonview Ave., Baltimore, MD 21213. (410) 488-5356

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WANTED

Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (805) 259-2011. FAX (805) 259-3830

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WANTED: Squires-Sanders SS-1R, SS-1T, SS-1V, SS-1S, see my web page tulsa.oklahoma.net/~wd5jfr. Hank, WD5JFR, OK, (800) 364-4265

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

WANTED: Collecting military electronics including radio, radar, RDF and test, manuals & literature. William Van Lennep, POB 211, Pepperell, MA 01463. (978) 433-6031

WANTED: Early 2 & 3 digit tubes. E-mail fathauer@home.com for bid list. George H. Fathauer, 688 W. First St. Ste. 4, Tempe, AZ 85281. (480) 921-9961, Fax 921-9957.

WANTED: Watkins-Johnson or Communications Electronics Inc. info, catalogs, manuals or equipment. Terry O'Laughlin, WB9GVB, P.O. Box 3461, Madison, WI, 53704-0461, 608-244-3135

WANTED: Hallicrafters HT-1, HT-9, HT-31, 5-T, SX-11, SX-17, SX-25; Howard rcvrs; Harvey xmtrs. Ken Seymour, KA7OSM, 9115 SW 176th Ave., Beaverton, OR 97007. (503) 306-7439 24 hrs. ken.seymour@attws.com

WANTED: 80 & 40 meter xtals in FT243 holders. Howard Weinstein, K3HW, 4041 Ridge Ave. Apt 4-405, Philadelphia, PA 19129. (215) 843-1180. k3hw@arrl.net

WANTED: Merchant ship radio memorabilia, radios, keys, parts, clocks, documentation. Tom Mackie, W2ILA, 14 Washington St., Jamestown, RI 02835. (401) 846-1200

WANTED: HT-5 speech amp for BC-610; also tubes 250TH & 100TH. Gary Willey, W4ZXS, 8125 Lunenburg Rd., Keysville, VA 23947. (804) 736-9029

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. (541) 923-1013. klakin@aol.com

WANTED: National SW-3, model 1 version 3 (uses 32-32-30 tubes). Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

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WANTED: Johnson Viking Valiant II w/TR switch & orig manual. C6ANI, POB N4106, Nassau NP, Bahamas.

WANTED: Drake 1A rcvr; 399C1 Collins VFO; JRC 505 twins. K5YY, AR, (501) 756-5010. k5yy@arrl.net

WANTED: Any info/schematic for Harvey-Wells SM-1 station monitor, all cards answered. Kelley, W8GFG, 9010 Marquette St., St. John, IN 46373. (219) 365-4730

WANTED: GF-11 & GF-12 aircraft xmtr equip. Mike, WØBVA, 305 N. Keith St., Scammon, KS 66773. (316) 479-2756

WANTED: Swan 400G or 400H military xcvr. Bill Smitherman, 9401 Hwy 67, E. Bend, NC 27018. (336) 699-8699

WANTED: Postcards of old wireless stations; QSL cards showing pre-WWII ham shacks/equip. George, W2KRM, NY, (631) 360-9011, george2f@aol.com

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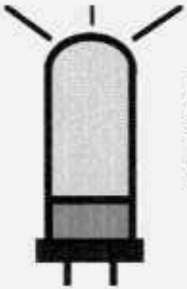

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