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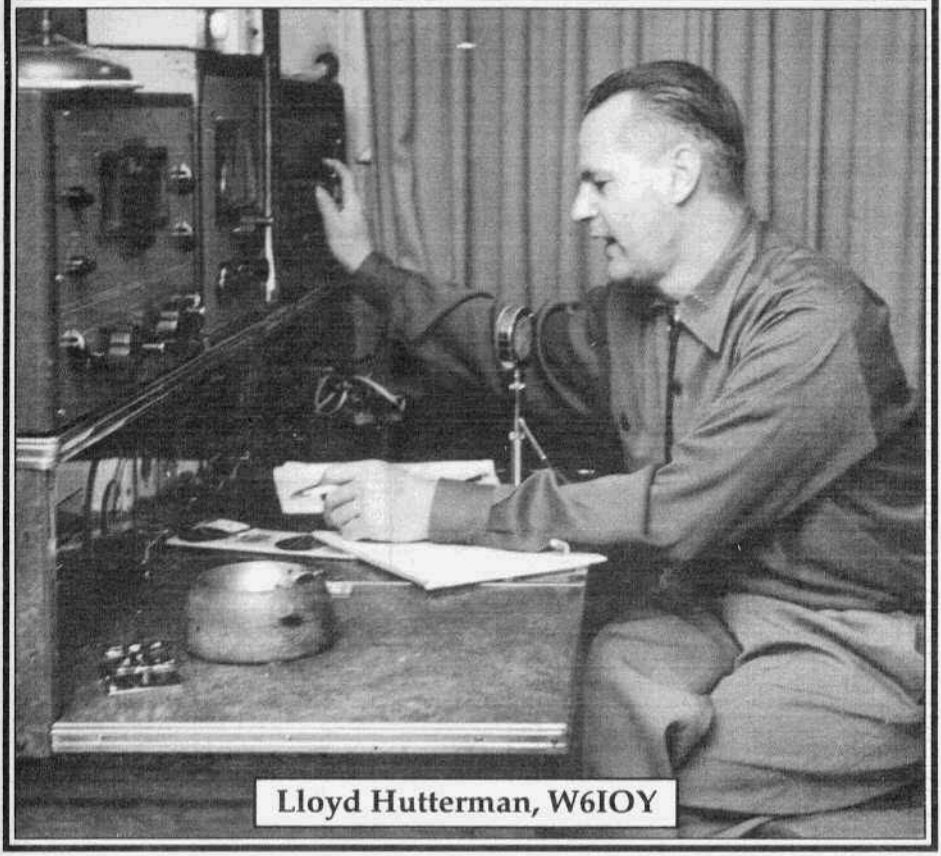
ELECTRIC RADIO

celebrating a bygone era

Number 107 March 1998



Lloyd Hutterman, W6IOY

ELECTRIC RADIO

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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 and others.

Editor's Comments

I've settled on a date for the Second Annual ER Sponsored Vintage Field Day. This year it will also be on the second weekend of June as it was last year (and as it was on the first ARRL Field Day back in 1933) but this year we won't have the conflict of Father's Day occurring on that weekend. And the only other operating event on that weekend is the ARRL VHF QSO Party. We should have no more than the normal amount of QRM to contend with. So please mark your calendars for the weekend of June 13/14.

I'm still in the process of developing the rules for VFD but should have them together for next month's issue. I'll lay them out then. Thanks to everyone who gave me their input on how we might improve VFD this year over last year. All the comments will be taken into consideration when developing the rules. I really hope that we can have a great VFD this year. I hope everyone starts making plans to participate now.

I haven't received very much comment on my idea to have a 15-meter contest/jamboree. I think I'll put that idea on the backburner until we've got VFD behind us. Maybe it would be something good for mid-summer or early next fall when propagation should be better.

At least once a year I use some space here to promote one of my pet projects—the ER Parts Unit Directory. Everyone can benefit from the parts unit directory. If you need a part for a restoration this is a source and if you have a rig that is only good for parts this is a way to dispose of it and help another vintage radio enthusiast in the process. You can get the parts directory—it lists the units alphabetically followed by the owners name, address and phone number—for $2 and an SASE. To put your unit on the list just send the info in to ER. N6CSW

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Cover: My good friend Lloyd Hutterman, W6IOY, back in 1955. The gear shown includes a Viking I transmitter and a Hammarlund HQ-129X receiver.

Looking Back

by Lew McCoy, W1ICP
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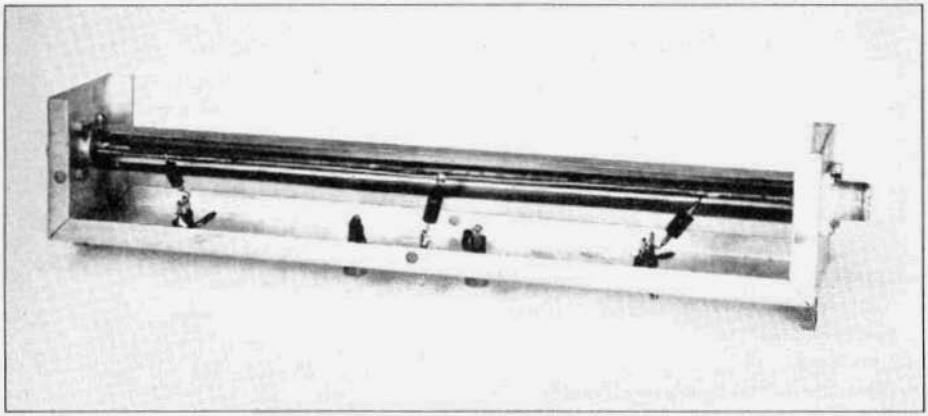
One thing I wanted to recount, and something I have always been proud about, was the design of the Monimatch which took place back in the early 50s. I am sure that most of you know what the Monimatch, is, or was. It is a reflectometer in that it measures forward and reflected voltages in a transmission line. With the advent of the coaxial feed lines, it became more and more important to be able to measure the load impedance and the standing wave ratio that existed in this type of line. There were a few types of such measuring equipment in the early 50s, one in particular that was made by MacMurdo, that would measure SWR but the unit was relatively expensive, and was inclined to be destroyed if too much power was used or if VHF parasitics were present.

One morning, George Grammer, our Technical Director, called me into his office and handed me a paper, in a publication from the United States Naval Observatory. This paper talked about the possibility of the practicality of designing an rf measuring device—but the paper was only theoretical. George told me he wanted me to use the information in that paper to see if we could come up with a practical device. You have to understand that I was practically a congenital idiot on this stuff—not really but close. He told me to build a 50-ohm trough, a section of coaxial line that had 50 ohms impedance. He then dismissed me from his office and I went out scratching my head. Fortunately, my buddy and mentor, By Goodman, W1DX, was a genius on this stuff. I went over to his desk and told him I didn't know where in hell to even start. Of course, Byron was like George in that he wanted me to learn. He said, go over to our library and get the book, "Reference Data for Radio Engineers" and look up design information on transmission lines. (If you have never heard of that book I suggest a trip to the library. It is fairly easy to become an expert if you study the book.)

After I got the book, I went over to my desk and spent considerable time figuring out what I needed. Actually, like many startling inventions or designs, it turned out to be quite easy. I made a metal box (10 inches long, about 3/4 inch to a side), with SO-239 coax chassis terminals on each end and ran a length of 1/4 inch diameter copper tubing inside the box between the coax fittings. That would be my coax inner conductor; the box itself the outer conductor. My next step was to decide how to couple the rf flowing in the box so I could read it and measure it. I solved that by mounting a pickup line of No. 14 solid wire, held in place by plastic spacers. At the center of this wire I had a resistor between the wire and ground and on each end of the pickup lead I installed 1N34 diodes to rectify the induced rf to d.c so that I could read the amount rf flowing.

I spent the rest of that day and the next determining the correct value of the center terminating resistor to show when the circuit was working with 50 ohms. The value turned out to be 150 ohms. My readout was a 0-1 ma meter. When I had the circuit completed to my satisfaction, I tried countless different loads by simply using various value resistors as dummy loads. I learned many things from making the first Monimatch. One thing was that diodes, the 1N34As, regardless of manufacturer, were far from accurate comparing one to another as to their respective "knees", when they started to conduct, how much they conducted, in other words, how



The first Monimatch that was described in the October, 1956 issue of QST. This model was followed by the improved Mark II and Mark III versions.

linear was one compared to another. That problem left me stumped for a while because how would you tell a reader to use "matched" diodes in those days when one didn't find 100 diodes for a couple of bucks!

In any event, I went back in to George's office and told him that when he had a few moments, I would like to show him what I had come up with. He came out to the lab and took over. He made more measurements than I could have imagined. I told him about the diode problem and he simply said just reverse the bridge in the line and you can tell how much difference there is in your readings. (Why didn't I think of that!)

Historically, and it is worth noting, George was not convinced that ham radio was going to go with 50-ohm coax, he was more inclined towards the British view of 70-ohm line. It might have been because the theoretical impedance of a half wavelength dipole was about 70 ohms. But, in this case, George said go ahead and find the matching for a 70-ohm load. I felt like saying he had rocks in his head but I knew damn well I'd better get a 70-ohm bridge or I probably would be working door to door trying to sell real silk hosiery or vacuum cleaners the next day. So I went back to work and started playing with a new trough for 70 ohms plus different terminating resistors. I spent a lot of time on terminating resistors simply because I thought the value would be much higher than 150 ohms which it was in the 50-ohm case. But strangely, it turned out to be a 100-ohm resistor. I also discovered that the trough sizes didn't matter that much. I called George back out to the lab again and he went through his tests again.

He turned to me and said, "Go write this up right away and show me your copy." I did, he looked it over and did his usual job of tearing it apart and redoing it. He then really surprised me, he paid me a compliment and said simply "good job." He told me to take it down to production and that he wanted it to be the lead article in QST the next month, and also plenty of photos. I'll admit I didn't see what he saw, that this was a going to be a major technical breakthrough for the hams. The unit was simple to build, very low cost, but it would revolutionize the hams' ability to match antennas. Now for the first time they could actually 'see' their SWR. In fact, when I would lecture on antennas I used to say that I was probably responsible for more ham injuries than anyone else. I was always worrying

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NEUTRALIZATION

by Warren B. Bruene, W5OLY
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Most grid-driven tube type RF power amplifiers require neutralization of the plate-to-grid capacitance, C_{PG}, to achieve stable operation. This is particularly true of grid-driven triodes to avoid oscillation or instability near the tuned frequency.

Consider the unneutralized, tuned-grid, tuned-plate triode RF power amplifier illustrated in Fig 1. (Only essential circuitry is shown. DC feeds may be either series or shunt. The output tank coil may be inductively coupled to the load, or it may be replaced with a pi-network.) The equations for the resistance and reactance which are coupled across the grid circuit from the plate circuit by C_{PG} were given by Terman[1].

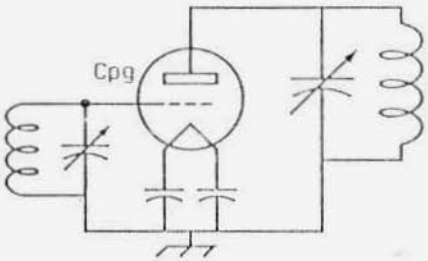

Figure 1. Un-neutralized grid-driven triode.

Coupled shunt resistance = $-(1/wC_{PG})/(A\sin\varnothing)$
Coupled shunt capacitance = $C_{PG}(1+A\cos\varnothing)$
C_{PG} = tube plate-to-grid capacitance
A = grid-to-plate voltage amplification
ø = phase angle of tube plate load impedance

Note that the coupled input resistance is negative when ø is positive. This means that energy is coupled from the plate to the grid circuit at frequencies which are **lower** than the resonant frequency of the plate tank circuit. When the magnitude of this negative resistance is lower than the combined positive resistance across the circuit, the amplifier will oscillate. Positive resistances across the grid circuit are produced by grid coil resistance, output resistance of the driver tube, and grid current.

The voltage amplification, A, is affected by ø. It varies approximately as cosø when the tube plate resistance is much larger than the plate load resistance (typical for linear amplifiers). The bandwidth of the grid circuit and any tuning error affect A to some extent also.

The principle purpose of neutralization is to raise the coupled resistance to such a high value that its effect is negligible.

Figure 2 illustrates how the magnitude of the coupled resistance varies with frequency when both the plate and grid circuits are resonant at 10 MHz. The heavy curves show a representative case for an unneutralized grid-driven triode RF power amplifier. The greatest tendency to oscillate is at approximately 9.8 MHz, which is at the peak of the negative resistance curve (lowest resistance).

Note that there is no resistive coupling at the resonant frequency of the plate circuit. Actually the coupling still exists but it is exactly 90 degrees out of phase with the plate RF voltage. Equal amounts of positive and negative resistance are coupled across the grid circuit which balance each other out. At frequencies below the plate resonant frequency, there is more negative resistance coupling because the phase angle of current through C_{PG} is less than 90 degrees by the magni-

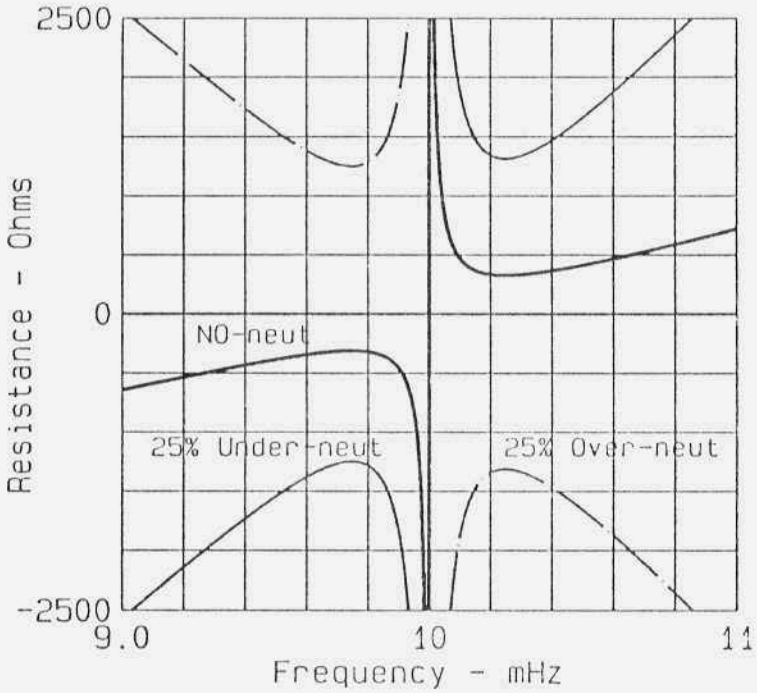

Figure 2. Shunt grid resistance due to no or incorrectly neutralized Cpg.

tude of the phase angle of the plate circuit at that frequency.

Negative resistance means that some power is coupled from the plate circuit to the grid circuit creating a tendency to oscillate. At frequencies above the resonant frequency, the coupled resistance is positive which means that power is coupled from the grid to the plate circuit (fed through power) which loads the grid circuit and reduces the tendency to oscillate.

The lighter solid curves represent the case where the tube is under-neutralized by 25%. The magnitude of resistance is four times larger. As 100% neutralization is approached, the magnitude of the resistance becomes very high. The dashed curve represents the case when the tube is over-neutralized by 25%. Note that the tendency to oscillate is now at approximately 10.2 MHz which is **above** the plate resonant frequency.

The procedure for neutralizing a Class C amplifier is as follows: First set the adjustable neutralizing component to the value estimated to provide correct neutralization. Then apply RF drive on the operating frequency and resonate all tuned circuits. Adjust the loading for the desired power output and re-resonate as necessary. Now rock the plate tuning capacitor through resonance while observing the DC grid current. Tuning through resonance while increasing capacitance (lowering frequency) will cause the grid current to rise if the amplifier is under neutralized. If it lowers, the amplifier is over neutralized. Adjust the neutralizing component in the direction indicated and repeat the test until the grid current peaks at resonance and drops off on both sides. Class AB_1 linears will be discussed later.

Several neutralizing circuits will be discussed. All except the first are called **broad-band** neutralizing circuits. This

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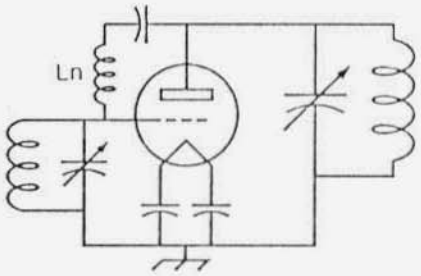

Figure 3. Coil neutralization.

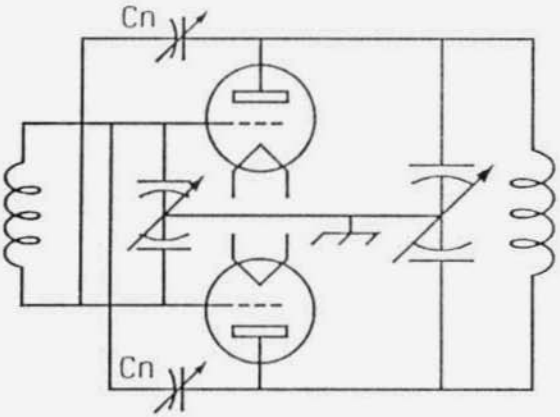

Figure 4. Push-pull cross neutralization.

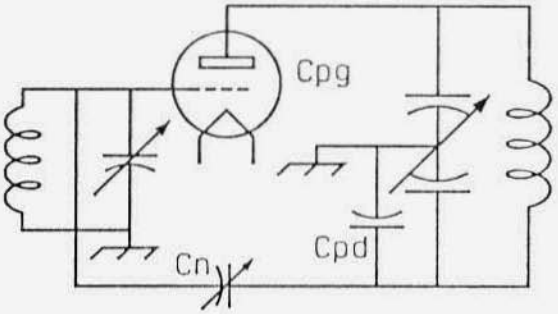

Figure 5. Plate neutralization.

just means that the neutralization does not need readjustment when tuning to another frequency. Actually, the tube(s) are only "neutralized" at the tune frequency. They are not neutralized at harmonic or parasitic frequencies, for example.

Coil Neutralization

Resonating C_{PG} with a shunt inductor, as shown in Fig 3, has been widely used in AM Broadcast Transmitters which use triode tubes. The neutralizing inductor, L_N, is wound on a long slim coil form to minimize distributed capacitance (which increases with coil diameter). The transmitter manufacturer normally performs the neutralizing adjustment during factory test. The factory winds the coil with extra turns and the test technician removes turns until neutralization is achieved.

This form of neutralization is ideal for broadcast transmitters since they operate on just the one assigned station frequency. It is not practical for transmitters which must be frequently retuned to another frequency.

Cross Neutralization

Cross neutralization is ideal for push-pull triode power amplifiers. It requires no extra parts except for the two neutralizing capacitors as shown in Fig 4. Either an inductive coupled or a balanced Pi output network can be used. The neutralizing circuit is completed by connecting neutralizing capacitors from each tube plate to the other tube's grid. The capacitance of each is nominally the same as C_{PG}. It is preferable to set the two neutralizing capacitors to equal values, but it is not absolutely necessary.

Plate Neutralization

A voltage equal to the plate RF voltage, but 180 degrees out of phase with

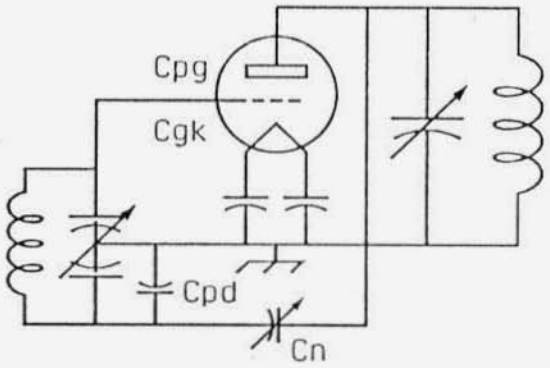

Figure 6. Grid neutralized triode.

it, is produced by a balanced plate tank circuit as shown in Fig 5. The neutralizing capacitor, C_N, couples an RF current into the grid circuit which is equal but of opposite polarity to the current coupled through C_{PG}. Neutralization can be maintained from band to band by padding the lower side of the plate tank circuit with a capacitance C_{PD} which is equal to the tube and stray output capacitance. This maintains equal capacitances across each half of the plate tank circuit regardless of the setting of C_1. If shunt feed is used, two RF chokes need to be used to keep the circuit balanced.

Excellent neutralization can be achieved with plate neutralization. Disadvantages are that the plate tank circuit components are more costly and tank coil losses are double.

Grid Neutralization

A balanced grid circuit, as illustrated in Fig 6, is employed instead. In this case C_N is connected from the tube plate to the bottom end of the balanced grid tank circuit. It is essential that the lower side of the grid circuit be padded with a value of capacitance equal to the tube input and stray capacitance to hold neutralization across all of the HF ham bands.

Inherent RF Feedback

A small amount of negative RF voltage feedback exists in the grid neutralizing circuit shown in Fig 6. This can be seen more clearly in Fig 7. The magnitude of the RF feedback voltage is the RF plate voltage e_p stepped down by the capacitance voltage division of C_{PG} and $(C_{1A} + C_{GF})$. As a result, a small amount of grid drive power is fed through to the plate circuit. This causes the drive power to be just a little higher than expected.

Tetrode Neutralization

The plate-to-grid capacitance of power tetrodes is typically on the general order 0.1 to 0.5 pF. Any of the neutralizing circuits described above can be used to neutralize tetrodes but there is a simpler way, shown in Fig 8. It was first disclosed by the writer[2] and the circuit is often identified by his name. It has become very widely used.

It is basically an unbalanced grid neutralizing circuit. The required capacitance relationship is:

$$C_N/C_{PG} = C/C_{GG}$$

where C also "bypasses" the bottom of the grid tank circuit to ground (typical values are in the 1000 to 2000 pF region, and C_{GG} is the total capacitance from grid to ground, which includes the capacitance from grid to cathode and from grid to screen. High values of C are required because the amplifier tends to become unstable if the reactance is too high. Also, it is necessary to keep common lead inductance very small for neutralization to hold over the HF band. For this reason feed-thru types are preferred for capacitor C.

Neutralizing Class AB_1 Linear Amplifiers

Linear RF power amplifiers must be neutralized more accurately than Class C RF amplifiers because incorrect neutralization generates phase distortion

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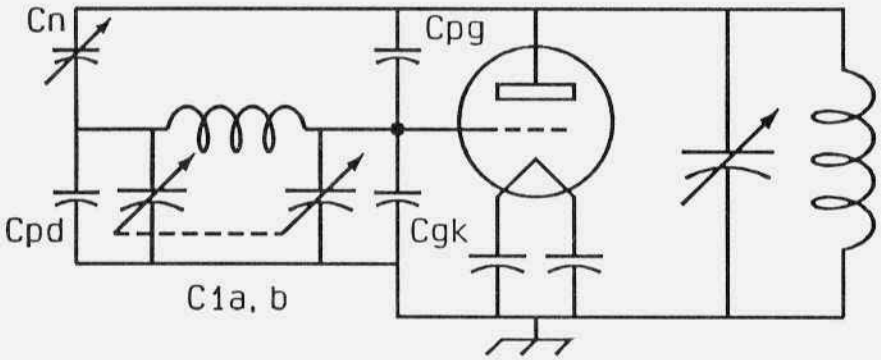

Figure 7. Feedback in grid neutralization.

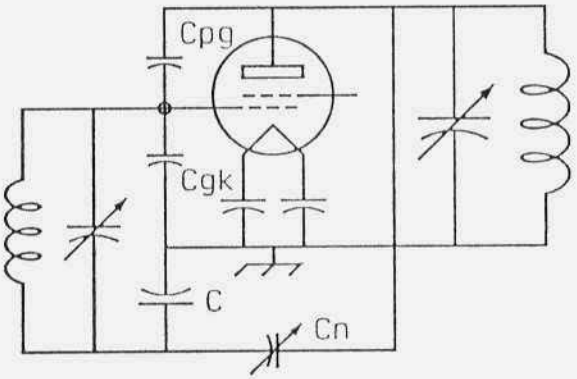

Figure 8. Bruene tetrode neutralization.

IM products (if any amplitude generated IM is present). The PM and AM distortion products add on one side of the signal band but subtract on the other. Unequal 3rd order products, as observed on a spectrum analyzer, indicates the presence of PM products. Also the gain of linear amplifiers is higher than that of Class C amplifiers.

Since no grid current is present in Class AB_1 amplifiers, we must sense something else. An RF voltmeter from grid to ground will give the same sort of indication as grid current.

Since a little RF feedback is present, there will still be some RF coupling from plate to grid even when perfectly neutralized. In the circuits shown in Figures 6, 7, and 8 perfect neutralization exists when an RF voltage on the tube plate produces no current in the grid tank coil.

Neutralizing With Test Instruments

Another method (with all power removed) is to inject a signal into the plate circuit and sense RF current in the grid tank coil. A signal generator is connected to the coax output terminal and the plate circuit is resonated to deliver maximum RF voltage to the plate of the tube. A grid dip meter, or other sensor, is inductively coupled to the grid tank coil to sense RF current in the coil. Resonate the grid circuit for maximum pickup. Then adjust the neutralizing capacitor(s) for zero or minimum pickup. Remove the test equipment. You should find the amplifier correctly neutralized when you apply power and tune for normal operation.

Another procedure, which is specified for the Collins S-Line equipment (pr 6146s driven by a 6CL6 with 2-stage RF feedback) is to disable the power output stage by first removing the plate and screen DC voltages. Then excitation is applied and fed-through power is measured with an RF voltmeter con-

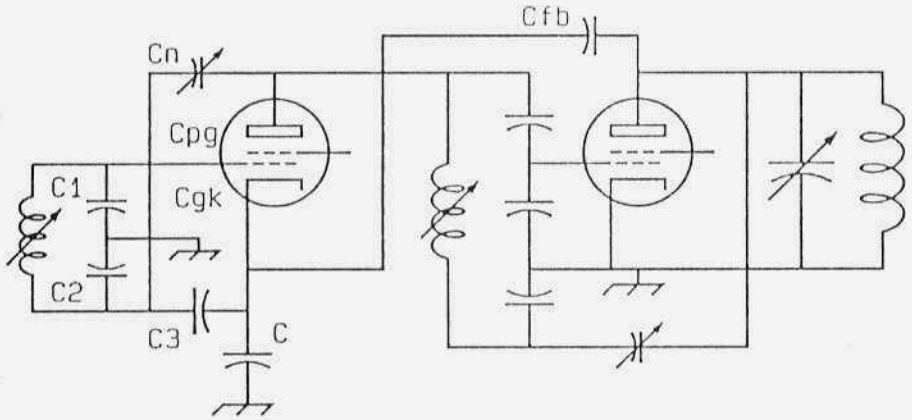

Figure 9. Two-stage feedback neutralization.

nected across the dummy load. The grid and plate circuits should be resonated and adjusted for maximum RF voltage. The RF voltage will be on the order of 0.5 volts. Adjust the power amplifier neutralizing capacitor Cn for minimum RF voltage.

The driver tube is neutralized by first restoring the DC plate and screen voltages to the final amplifier. Filament power is then removed from the 6CL6 by unsoldering a filament lead. (An easier method is to clip the filament pins off an old 6CL6.) Connect an RF voltmeter to the dummy load through a small capacitor consisting of two turns of insulated wire wrapped around the "hot" lead to the dummy load. The case of the probe is connected to the dummy load ground. Excitation is applied to the driver tube and all circuits are resonated for maximum RF output. Cn is then adjusted for minimum RF output.

Neutralizing a Two-Stage RF Feedback Amplifier

Many of the linear amplifiers in Collins transmitters employ the two-stage RF feedback circuit (which was also originated by the writer). The RF feedback voltage is applied to the driver tube cathode while the drive signal is fed to the grid. See Fig 9. It is necessary to neutralize the coupling from cathode to grid through the cathode-to-grid capacitance, C_{GK}. This is achieved by adding C_3 to the Bruene tetrode neutralizing circuit. The capacitance ratios are:

$$C1/C2 = Cgk/C3$$

The procedure for adjusting C3 is place the EMISSION switch in the TUNE position which reduces the power amplifier screen voltage to prevent excessive plate dissipation until the plate is resonated. The low screen voltage also causes grid current which is metered. C3 is adjusted until the grid current dip coincides with the plate current dip as the plate tuning is rocked through resonance.

CONCLUDING REMARKS

The above neutralizing circuits cover the most widely used types for HF grid-driven RF power amplifiers. Neutralization can be avoided by using cathode driven (grounded grid) amplifiers at the expense of much more driving power. Also neutralization can be avoided in tetrode amplifiers by simply connecting a 50-ohm dummy load across the grid. This "swamps" the grid circuit so that the coupling through Cpg has little effect upon the grid voltage. The 50 ohms is much lower than the coupled negative resistance illustrated in Fig 2. The disadvantage is that it

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Some Notes on the Heathkit DX-60

by Don Meadows, N6DM
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Through the swap meet efforts of my friend Dick, W6ZPE, I recently acquired a DX-60. This Heathkit transmitter appeared in its original form only from 1962 to 1964, a rather short period compared to the "A" and "B" versions which prevailed much longer. This little rig from Dick is a beauty to behold - nary a scratch, no mods, absolutely clean. One rarely makes such finds at swap meets anymore. Dick knew I'd always wanted a DX-60. He said I could have this beauty only if I'd write an article about it for ER. So here goes.

The function, crystal, and band switches were frozen and could be turned only with the help of pliers. To avoid damaging the shafts by working them with pliers, I temporarily installed a large-diameter surplus knob with dual setscrews. With this large knob, together with some WD-40, I was able to work the shafts and get the switches back into their original functioning condition. These stiff switches, together with the rig's pristine condition, suggested that the kit was built, was used briefly, and was put aside by the original owner. It probably rested somewhere quietly over the years until it caught Dick's eye at the swap meet—an artifact of novice ham radio apparently untouched by time.

The DX-60 transmitter series must have been very popular, because the Heath Company saw fit to produce these transmitters over a span of 14 years. Many of these little transmitters seem still to be in use among nostalgists. A DX-60 net is listed in the "Vintage Nets" column in ER. Chuck Penson's Heathkit Guide, available through ER, provides a description of this little DX-60 transmitter along with good photos of its three versions.

The manual accompanying this swap-meet DX-60 is also in mint condition, which supports my theory that the rig had only one previous owner—the person who built it. The manual has no wrinkles, no dog-eared pages, no stains. The only marks in the manual are in pencil where the builder checked off each step—and then a secondary series of pencil marks showing that the builder double-checked each step.

The DX-60, in contrast to many rigs of the era aimed at the novice ham, uses grid-block keying instead of cathode keying. Grid-block keying is slightly more complex. It requires a negative-voltage source to cut off the tubes on key-up. But this system makes the shaping of the keyed waveform much easier to control and more predictable. Why did Heathkit go to this extra length at a few dollars' extra cost? Perhaps because the Heathkit engineers saw visions of the competing Johnson Ranger which used time-sequence keying, a method that set a standard for keying quality. This method, requiring a source of negative voltage to bias off the tubes on key-up, commanded respect among hams because it was effective. It let one key the Ranger's built-in VFO and work CW break-in without chirps or clicks, something then rather new in ham radio. The DX-60 is crystal controlled, but its designers provided a VFO kit to drive it—the HG-10, designed to interface with the DX-60's negative-bias keying line.

Why should the Heathkit engineers have gone to so much trouble? After all, they could have cloned some big-name competition that was producing cath-

The author with his DX-60 and homebrew VFO.

ode-keyed transmitter kits in the same power class, kits also aimed at the novice ham. The engineers could have jazzed up the DX-40 with some cosmetic gimmicks and perhaps with some extra TVI suppression. But they chose instead to design a completely new product whose integrity is still respected. The DX-60 appeared at the end of the Daystrom era, a time when Heathkit designers might still have been free to indulge their visions of quality and to make these visions reality. The DX-60A and DX-60B, which show signs of cost cutting, appeared under the Schlumberger administration. These minor variants from the original DX-60 are described in Chuck Penson's excellent Heathkit Guide.

After freeing up the DX-60's control shafts, I faced the problem of interfacing it with my homebrew VFO for break-in keying. My VFO, described in a previous ER article (No. 82, February, 1996), uses cathode keying. At first, I considered homebrewing a VFO similar to the Heathkit HG-10 which is designed to interface with the DX-60. This would have been an interesting project, but I wanted to use my "new" DX-60 right now.

I found, surprisingly, that it was quite easy to key my homebrew VFO and the DX-60 together, while their keying circuits remained electrically independent of each other. It was unnecessary to modify the VFO or the DX-60 in any way. A double-pole single-throw keying relay was the only thing needed, but it had to be one fast enough to follow a bug's rapid dits. The Radio Shack item 275-249 works well. This is a dpdt relay, but the normally-closed contacts aren't used. Its coil is rated at 12 volts DC with a resistance of 200 ohms and its contacts are rated at 5 amps. One set of contacts keys the VFO cathode. The other set keys the DX-60.

Keying the cathode of a hot-cathode Colpitts VFO circuit such as mine has sometimes caused minor clicks if the grid-leak resistor is returned directly to

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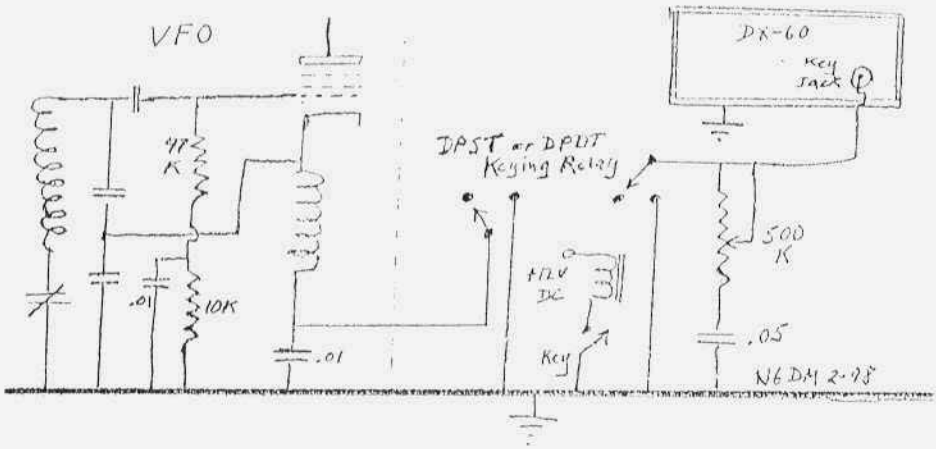

Schematic of the keying-relay interface between the VFO and the DX-60.

ground. The solution to this problem, which I've never seen published, is to bypass part of this resistance to ground through a capacitor. In my VFO, the grid leak consists of a 47K ohm resistor from the grid in series with a 10K ohm resistor to ground. The 10K ohm resistor is bypassed to ground through a .01 mfd capacitor. These values are not at all critical and can be adjusted for optimum shaping of the VFO's keyed waveform. Apart from the VFO driver, however, the DX-60's own keying, to some ears, tends to be a bit on the hard side, although still quite acceptable. The designers may have planned it this way, because softer keying can sometimes introduce a slight chirp with sluggish crystals. The DX-60 was designed for novice hams at a time when they were restricted to crystal control.

I found it was possible to modify the DX-60's keying waveform without touching the DX-60 itself. The shaping of the rig's keying is based on the time it takes (in milliseconds) for the negative-bias line (which cuts off the tubes) to reach ground potential when the key is closed. The timing is based on charging and discharging a capacitance through a resistance -- an application of the phenomenon known as "time constant." For example, it takes one second to charge or discharge 1 mfd through 1 megohm.

Since the DX-60's negative bias line is extended outside the rig to the key, one needs only to experiment with resistance and capacitance values across the key. The rig itself remains untouched.

I first tried a 250K ohm resistor in series with a .05 mfd capacitor across the keying-relay contacts for the DX-60. This made the keying softer, but with crystal control there was a borderline chirp with some crystals. One crystal barely started. With VFO control, the keying was definitely softer, no indication of chirp, but there was just a hint of mushiness when my Vibroplex mechanical bug sent rapid dits. I found the best approach when interfacing my VFO with the DX-60 was to install a half-megohm potentiometer in series with the .05 mfd capacitor across the relay contacts that key the DX-60. Now the time constant could be adjusted easily for optimum shaping of the keyed waveform.

The DX-60, like same of its competitors, featured AM phone. I haven't yet tried my DX-60 on AM phone, mainly because I don't have a high-impedance mic with the proper connector. How-

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A Report on the Winter 1998 Classic Exchange

by Jim Hanlon, W8KGI
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From the reports and stories that showed up on the Boatanchors reflector immediately after the last running of the Classic Exchange, and from this reporter's personal experience, it would appear that this CX was one of the best in a long time. Despite a major snafu, with CQ magazine announcing that the CX was on Saturday, 1/31, instead of Sunday, 2/1, there was a large and enthusiastic turnout on Sunday and enough folks around on Saturday to at least keep each other company.

As reported by Marty, AA4RM and Nick, KD4CPL, there was lively east coast activity on 3885 AM from 3 to 6 p.m. EST, with participants including N4QY, AA8A, KN4R, KD4CPL, K4VVC, W2IQ, WA4AEG, W4DWE, AA4KH, AA4RM, WA4YGG, W4UOC, N4OSJ, W4LN, AK4H, AND N4QNX. The transmitters active on that pileup alone included HT-37, Ranger and Ranger II, Viking II, Valiant and Valiant II, Johnson 500, CE-200V, B&W 5100, 32V2, 32V3, KW-1, 30K-1, 20V-10, Globe Champion 300A, BC-610, Apache, Meissner 150B, DX-100 and DX-100B, and a homebrew, screen modulated 861. The receiver list included HQ-170A, R-388, Mohawk, SX-101, SX-88, NC-400, NC-303, NC-300, S-20, RME-6900, HQ-140, SX-100, 75A4, RME-69, SP-400X, 51J4, S-120, R390A, 75A3, RBB, HRO-5, NC-183, 75A1, SX-115, HQ-129X, and RBG-2. Transceivers included a G-76 and a TR-3. Nick put it very well, "Just picturing all those rigs on the air still makes me grin!!"

The traditional CW spots were also quite hot this year. I myself, being in the wilds of New Mexico where mid-day 40 meter propagation doesn't reach to the lairs of many CX'ers, started on 20 CW. Pickings were slim as usual on 14120, but I did manage to work VE7XF, W2LYH and N1QY and to qualify both my HRO-50/100V and my R4B/T4X pairs in about 45 minutes. I moved down to 7060 around 2200 Z and found the joint to be jumpin'. For the next four hours, I cranked out 35 QSO's. I had one run of an hour and a half where all I did was to sit on one frequency and work one guy right after another with no breaks in between. They just kept calling and calling! By 0130 I thought I'd pretty well played out the gang on the band, and then I looked up and realized that I had yet to get my patiently waiting and warmed HRO/Millen 90711/90800 pair on the air. One CQ CX and I was off again for another solid 40 minute run of 6 QSO's. Stations I worked on 40 included K7DU, W2IBZ/5 (over the hill in Albuquerque), WBØAUQ, W7ZFB, KØTHN, W2HUG (The Dean of the CX'ers), K5CF, K9VKY, W5TA, K8LE, K9TR, VE7XF, KØJY, W8GWR, W2LYH, K7IEY, W0SEG, N6KN, W5FRS, AA4RM, N5AIT, K6NL, N7TM, W6WOV, KB9IUA, K7GA, N6KN, and W9ZEN.

I switched to 3560 around 0300 - after a break for a burger with the family - and I found the band buzzing with mostly 339 to 459 signals. My HQ170A coughed and died in the middle of working Howie, WB2AWQ, (RST 339) so I quickly switched to my FB7/DB20/QF1 combo and pulled him out for the rest of the QSO. All together I worked WS4S, K4MAC, W2HUG and W2LYH again, WB2AWQ, K7LD, W5FRS again, VE3FGU, and W7FG. It was interesting that right up to the end the band was aglow with all of our signals and at the stroke of 0500 it just went blank. I guess we do make a difference.

Transmitters on the CW portion of the CX included DX35, DX-60, DX-100, Apache, homebrew pp 811's, homebrew HK54's, homebrew 808's, homebrew 1923 style, TCK7, Elmac AF67, Ranger II, Ranger/Desk KW!!, Ranger II/Thunder-

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Boyhood Memories

by John Wieder, KØJY
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In 1962, radio seemed to be nature's best kept secret! Living on the farm in southwest Iowa, twelve miles from town at the ripe old age of twelve, radio was my outlet to the world. In the summer, signals from Japan, Europe, Australia, South America, and Nebraska raced through the air and across the corn fields to my room in the second story of the family farm house. On those cold winter nights when the wind howled, and I was supposed to be asleep, the headphones gave warmth to my ears as I lay in bed and marveled at the lighted yellow, red, and green markings from the old Stewart Warner that rested on the floor. I marveled at the mystery behind the signals and these people called hams who seemed to be able to communicate at will with the world. Shortwave was all new to me and the first time I heard my letter to Radio Australia's "Letter Basket" read over the air, I thought I had made the big leagues.

Through the old receiver I discovered my father also had an interest in shortwave and ham radio. In fact, he had gone so far as to purchase an ARRL License Manual, "Wartime Edition" priced at 25 cents. I found the now familiar black on red manual somewhere on the book shelf and discovered that amateur radio operators weren't born that way, they took tests. In fact, according to this book dated 1943, there were license classes, proof of citizenship, and fingerprints to be taken. It sounded like an overwhelming process for a boy of my limited worldly exposure, to say nothing of equipment. This definitely looked like a job for super dad!

Surely hams were fathers who could master electrical theory, and then I would be content to sit and watch for hours while dad made contacts around the world.

Although my father was a wizard at fixing anything from the refrigerator to the combine, and certainly could master electrical theory in a breeze, the commodity he was lacking was time. The family farm and part-time work as a charter pilot took up plenty of it. In the meantime, I had discovered the mail order pages of something called Heathkit. Equipment you build yourself? No way! I can't recall exactly how I talked my father into it, although in retrospect it was probably not through a convincing argument but sheer badgering, that he placed an order for a Heath GR-91. I can attest to scientist's claims that odors are the sense remembered longest by the human brain. I can still remember the smell of the solder and nights spent with my father as the radio took shape from a box full of parts and a muffin tin filled with resistors and capacitors. As the beige and green front panel with slide rule dial went into place and the "S"meter sprung to life, I knew I had found a hobby.

As luck would have it, I made another ham discovery about that time. It was a place called World Radio Labs in Council Bluffs, Iowa. Much to my parents chagrin we had to visit the radio emporium every time our family made the 60 mile trip to Omaha. I still recall aisle after aisle of equipment, probably because I had to examine in minute detail the front panel of each piece of gear. One set which I was particularly fond of, a Hallicrafters S-85, finally ended up under the Christmas tree not too many months later. I have to admit that I knew what my gift was. By carefully feeling through the wrapping paper and memorizing the position of each knob and toggle switch, I had it pegged before Christmas morning. By the way, I haven't changed a bit!

The author in his first novice station back in 1964. His call was WNØJYJ.

John Wieder, KØJY, in his present-day hamshack.

By this time I was determined to become the first ham of the family. There were just too many mysterious signals coming through those airwaves, and besides I had already spent hours memorizing dots and dashes from the Boy Scout Handbook. Another discovery led to upgrading my code from dot and dash memorization. My dad informed me that there was a ham in the neighborhood! Since neighbors were not "next door" as they were in town it took

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Letters

A letter to Tom Bonomo, K6AD, regarding his article on the Mohawk receiver.

Tom:

We really enjoyed your 3-part series on the Mohawk receiver in ER. Though I've never owned a Mohawk, I've owned other similar vintage receivers and enough of what you shared caused sympathetic resonances within me as to familial weaknesses...particularly VFO instabilities in that equipment.

But I must share this story with you. My mentor in going Novice to General circa 1960 was Has Lang, KØLNI, bless his memory and the memory of his son, Steve, KØLAV who with his father shared the same ham shack. Has was a research chemist at 3M in St. Paul and he and his son Steve really enjoyed the late '50's sunspot activity with an HRO-5TA1 receiver, a homebrewed AM transmitter and a tri-band cubical quad. (They so appreciated the HRO that I acquired one at about the same time and still have it.)

But Has was drooling for the new Heath 'Mohawk'. Finally, he bought the kit and I remember weeks passed with the kit assembly having overtaken the large oak table in the dining room of the family's home, a farmhouse on their hobby farm. And then, on one visit, the glistening Mohawk sat front-n-center in the upstairs shack and the HRO had been shoved aside. BUT, I remember Has' look of consternation as he fiddled with the controls...and in his thoughtful laboratory demeanor his saying something like, "Something's just not quite right!" While he was optimistic and hopeful, it was apparent from the seriousness on his face that somehow this sparkling new receiver in all of its grandeur was more promise than performance. But, simultaneously, he didn't seem capable of admitting that possibility after all the anticipation and past week's efforts at assembly and alignment.

Sunspot activity took a dip for another 11 years and as Explorer Scout leader Has led us on other things along with ham radio such as canoeing on the St. Croix. Then his son Steve, a private pilot, died piloting a small plane, and before too long Has had also become a SK.

I don't think the Mohawk ever got 'redeemed' to Has' experience. In fact, it may have had a predominately discouraging effect on ham radio in the Lang household!

I was a design engineer with E.F. Johnson in their post ham radio years, and I find it very unfortunate that, from your evaluation, Heath apparently did not do their homework on this receiver! While one must always face the fact voiced my John Foster, WØYDX, (retired from E.F.J. and previously with Collins), "every radio is finally a soldered-together bunch of compromises," such seemingly blatant design foibles you report on the Mohawk...AGC, biasing errors, et al, is almost unforgivable! Add to this the ER item which reported that the companion Heath transmitter, the Apache, was an M.E.'s nightmare...necessarily having to use the receiver's control placement to make the transmitter's front panel match. Wow!

Anyhow, really enjoyed your contributions!

John Bipes, KØYQX

Regarding W7QHO's review on the November 1942 Special Corps issue of Radio News (ER Feb. 1998).
Dear ER

As a WW II collector and an amateur WW II historian, I would like to make a few comments on W7QHO's very interesting review on the November 1942 Special Corps issue of Radio News (ER Feb. 1998).

The main point that has to be remembered, is that at the time that issue was being typeset, about August 1942, the United States was desperate for any type of victory. The Japanese were invading many US and allied held areas and we were being overrun 99% of the time. Luzon, Guam, Wake Island, Manila, Solomon Islands, Hong Kong, Singapore, many others, and the Japanese even occupied Attu and Kiska in Alaska for over a year, setting up a submarine base. The Italians and Germans were pushing our allies, the British, Australians, New Zealanders, and South Africans back and forth across North Africa. The US public feared Japanese bombing attacks on our west coast. News of a victory, true or false, had to be announced to the American public. This is where "wartime propaganda" (a polite word for lies) enters the picture.

Lt. Col. Jimmy Doolittle led 16 B-25 bombers on a raid to Tokyo April 18,1942. The raid was a disaster, all 16 bombers were lost and very little damage was done to Tokyo. Yet Doolittle was awarded the Congressional Medal of Honor and promoted to Brig. General, skipping one rank. If a commander would have lost all his bombers two years later in bombing raids over Germany or Japan, he would have been court-martialed and kicked out of the military.

This is a good example of "wartime propaganada" for a public looking for "good news". You also have to write your news so it doesn't aid the enemy. The November 1942 issue of Radio News is an example. Some incorrect information is given in that issue along with very little detail of our current military sets. All of the photos were only the few standard photos the signal corps released to the public. Don't aid the enemy and always make your equipment look superior, even if a lie.

What a difference two years and many victories make. The second "Radio News Signal Corps Issue", Feb. 1944, is full of mostly correct information and is ten times better than the November '42 issue. I recommend the Feb. 1944 issue to anyone looking for information on WWII radios.

"Wartime propaganda" still lives today. Most of us can remember the Gulf War in 1991. Every night on the evening news we were shown "smart bombs" going into trap doors, air conditiong vents, windows of buildings. None could miss, now we know only 40% of these "smart bombs" hit the target, 60% missed. Worse yet, we were shown the "patriot" anti-missile destroying Iraq "scud" missiles, patriot missile batteries were given citations. The "patriot" manufacturer was a given special recognition. Now we know only 5% hit the Iraq "scuds", 95% missed with a few near misses. The patriot's resutls were appalling.

Remeber the old adage, don't aid the enemy and make your equipment look superior. Even if you have to lie to your own people. Take everything you read or hear during "wartime" with a grain of salt.

"The Signals Corps",Sam Hevener, W8KBF

Ten-Meter News.....

Bob Rose, K6GKU, with his 10-M station.

From Bob Rose, K6GKU, 3-1-98

Just a note on the most fun day on ham radio I have had in years. Just like the early days of cycle 19, there were big signals from little rigs. Made 12 good solid, contacts. most "armchair copy." And the solar flux was only 94!!!!!!!!!! On the low upside of cycle 23, that tells me a little bit, this just may be a big cycle.

Got good audio reports from my Globe 65A. Heard several good signals from Rangers and an Elmac AF67. Of course the high end transmitters sounded gangbusters. I have this feeling that when things start to "rock and roll" next fall, the AM portion will expand, the little 50 watt guys shoving out on the edges, as the Viking 500's, etc hold court around 29.0. AM lives and God it sounds good!

On my second log page of a log that started 17 January 98, strictly for 10 AM and am I happy.

From Merle Crowley, W1GZS, 3-3-98

Here is a brief update on what has been happening in the Central Florida area on 10 meters. Up until about a week ago it has been very quite but...For the last week I have been working stations along the West coast from Alaska, Oregon, Washington State, California, Arizona and into Texas. Usually this happens in the afternoon from 2PM to about 4:30 PM Eastern.

Looks like 10 will be coming into it for real in a few months !!

From Don, W3YCH, 2-18-98

From Kennesaw, Georgia. Very good opening into California and Hawaii. Stations all over the 29.0 to 29.1 window. Worked Al, W6NRO; Dennis, KB6VFC; Bob, K6GKU, and Jack, KH6CC. Also worked George K4RYH from the Atlanta area on ground wave. All signals were 5-8 to 5-9+.

VINTAGE NETS

Westcoast AM Net: Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.
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 control is Andy, WA4KCY. 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 3:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control varies with propagation.
Arizona AM Net: Meets Sundays at 3 PM MT on 3855. On 6 meters (50.4) this group meets 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 7290 at 2 PM ET, Sundays. Net control is Jim, N8LUV. 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 Dennis, WA3YXN but sometimes it rotates to other ops. Saturday mornings on 1995 at 0500 ET. Will move to 3885 for summer.
Westcoast Military Radio Collectors Net: Meets Sunday mornings at 0930 local on 3975 + or - QRM, except the 1st Sunday of the month when the net meets at 2130 local. Net control is Tom, WA6OPE.
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. URL: http://www.crompton.com/wa3dsp/grayhair.html
Vintage CW Net: Tracy, WB6TMY, who started the net and has acted as net control over the past few years is unable to carry on with it because of his new job. The net is temperarily inactive.
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 at 0100Z Tuesday nights on 3805 and on Thursday nights on 3875.
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; 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 California Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. Net control 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. For hams who enjoy using AM, restoring and operating
Midwest Classic Radio Net: Saturday mornings on 3885 at 8AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics.
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 14.165 at 1900Z and 3760 at 2000Z. Net control is Dave, VA3ORI.

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

The Heathkit "Chippewa" AB1 Tetrode Linear
Part 2

by Thomas Bonomo, K6AD
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If you had the opportunity to read Part 1 of this article last month, you know that the Chippewa, which ran Class AB1, is one of the all-time winners for using the most tubes in a 2 KW linear - a total of 11. Even though this linear was generally well designed, a few changes were outlined last month which included improved fusing protection and limiting inrush current to avoid tripping the house circuit breakers every time it is turned on.

When I first powered up the Chippewa, I couldn't believe how much noise the centrifugal blower made. It would be nearly impossible to talk on the radio with the Chippewa's fan making all this noise! Unless something was done, I knew I'd rarely use this amplifier. As is often the case, I spent about 25 times longer on this part of the project than I originally thought I would. I had no idea I'd need to spend so many hours trying different approaches in an attempt to get it right.

Cooling requirements

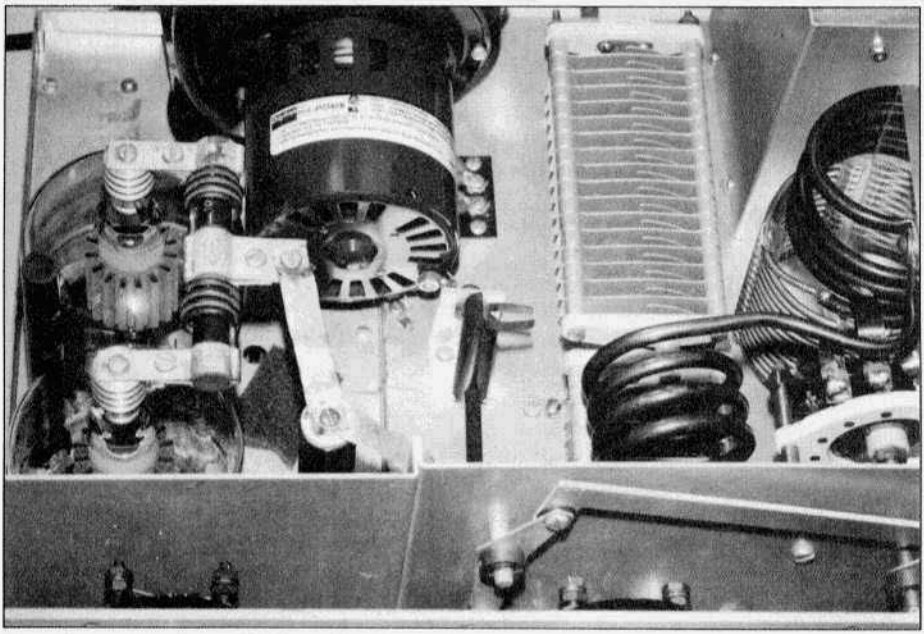
When cooling large glass transmitting tubes, the critical areas requiring the most cooling are the seals. For a 4-400A, the maximum operating temperature is 200° C for the base seals and 225° C for the plate seal. When the EIMAC SK-400 socket is used, a minimum air flow of 14 cubic feet per minute (cfm) at a static pressure of 0.25 inches of water or less, is required to provide adequate cooling under all conditions of operation. It is interesting to note that EIMAC specifies that cooling air be supplied to the tube even when the filament alone is on during standby periods to avoid exceeding maximum seal temperatures. EIMAC also stresses that air flow rates in excess of the minimum requirement will prolong tube life.

Squirrel cage blowers are catalogued according to impeller wheel diameter and rotational speed. Heath used a blower with a 3.5" cage operating at 3050 rpm (i.e. a No. 3 1/2 blower) which is capable of providing about 80 cfm at .25 inches of pressure. The two 4-400A tubes together require 28 cfm plus approximately 10 cfm for the plate seal airpipe, for a total requirement of about 38 cfm. Examination of blower curves provided by EIMAC (airflow vs. backpressure) in Figure 3 reveals that for a given wheel size and design, the cfm delivered is directly proportional to blower speed, as is the ability to withstand back pressure.

Based upon the above data, it is possible to conclude that the speed of Heath's blower can be reduced by approximately half (to roughly 1500 rpm) and still meet minimum cooling requirements. After some experimenting, I determined that 2000 rpm seemed like the ideal compromise between noise and airflow. At 2000 rpm, the fan would still deliver about 52 cfm of air (well exceeding EIMAC's minimum specifications) yet the noise would be much, much more tolerable.

Two cooling alternatives

Well, after lots of digging, I discovered there aren't any motors available that will operate at 1800 to 2000 rpm (except mil-spec units costing hundreds



New fan motor installed on blower unit. Motor dimensions haven't changed in all these years.

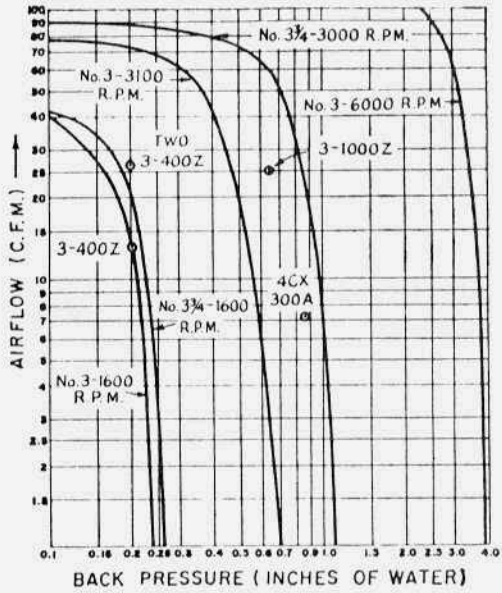


Figure 3. Typical performance data for 3, 3-1/2 and 3-3/4 inch blowers.

of dollars). The choice is 3000 and 1550 rpm, period. There are a few two-speed varieties, but the second speed is only a slight reduction from the primary speed. The drop from 3000 to 2800 is still way to noisy.

Facing the limited supply of available motors, I came up with two practical solutions to the problem. The first involves adding a motor controller to reduce the speed of the 3000 rpm motor. However, because the fan is working into a high backpressure, the system behaves as though it has positive feedback. The motor behaves like it wants to sync up to either 1500 or 3000 rpm, making it very touchy to set the controller. This point is further aggravated by temperature: it will run slow for about 10 minutes, and then when the motor warms up, suddenly start to speed up

continued next page

dramatically. This makes setting the controller very touchy.

If you choose this alternative, here are a few tips. First, replace the original motor with a modern shaded-pole unit. I just couldn't get good, consistent results trying to control the original motor. One of the best sources of new motors is Grainger. They don't have an 800 number, but they have warehouses in most major cities. Their catalog is great: it has 4,100 pages and is over 3" thick. If you are going to use a fan controller, order a Dayton # 4M095. It is a two-speed motor (3000/2800 rpm) and it will bolt right into place without any modifications whatsoever (pretty amazing that the mounting and sizing standards haven't changed in all these years). Connect the controller to the high speed winding for better stability.

When selecting motor controllers, be aware that there are two different types on the market: capacitive and solid state. It is easy to spot the difference when you go to the hardware store because the solid state units are usually infinitely variable, while the capacitive units usually have 3 or 4 switch positions. Avoid the capacitive units because they switch in different amounts of capacitance to control speed and just don't provide enough control - you'll either end up with too much or too little.

The second option is to just replace the original motor with a 1550 rpm unit. This option doesn't provide as much margin of safety, but still provides the minimum cooling recommended by EIMAC. Grainger carries an inexpensive 1/70 hp, self-cooled unit that will bolt on without any modifications. Order Dayton part number #3M560 from Grainger.

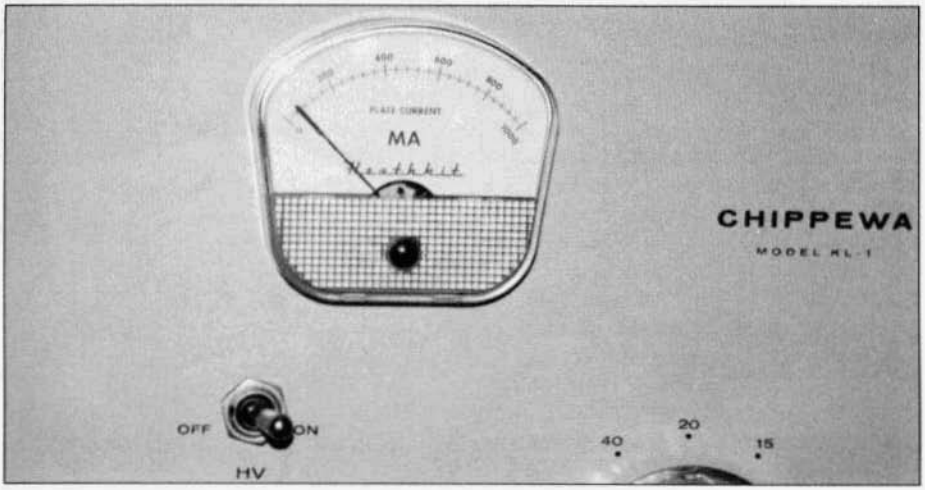
Final cooling system choice

The first option has the benefit that the "ideal" speed of 2000 rpm can be achieved, but the touchiness of setting the controller and variation of speed with temperature led me to choose the second option and just install a 1550 rpm motor. To augment airflow, I decided to add a box fan to exhaust hot air from the cabinet. Even with the Heath's original 3000 rpm fan, the cabinet still got quite hot. There is plenty of room to add a 4 3/4" 120 VAC box fan to the inside of the top of the cabinet. Mine is mounted well away from RF and high voltage components using 2/56 screws. The vent holes of the Heath cabinet are perfect for this size screw so this is a no-holes modification.

A bit of creativity was required to supply power to the box fan without drilling holes. I connected an in-line plug with 8" of wire to the screw terminals which supply power to the centrifugal blower. The box fan is plugged in by reaching through the large round blower hole in back when the chassis is slid out of the cabinet about 4 inches. The centrifugal blower operating at 1550 rpm and the box fan together keep the cabinet much cooler while simultaneously being much, much quieter than Heath's original design. Success!

Sanity check

Just for a sanity check, let's compare these results with a commercial 2 KW amplifier which uses a physically similar cooling approach, the Drake L-4 (the only difference is that Drake used chimneys, while Heath used a slotted air pipe to cool the plate seals). Using the L-4 is a pleasure: it is so quiet that it is difficult to hear that is on. Drake used a No. 2 1/2 blower operating at 1550 rpm which provides something on the order of 15 cfm of air. Despite the fact that this appears to fall well short of the minimum specified by EIMAC, I have not heard reports that final tube are failing in L-4s due to heat prostration. The extent to which the modified Chippewa's airflow vastly exceeds Drake's at least provides some level of comfort that the reduced level of cooling should still be more than adequate.



3,000 volts appears at the plate current meter. Looking for this 60 ma "leak", I finally disconnected one lead from the meter taking it out of the circuit. Just the presence of HV at this meter caused the "leak."!

Plate current meter

The one thing that I would have liked to have changed about the Chippewa is the manner in which plate current is measured. Take a look at Figure 2 (Part 1 of this article last month), and you'll see that Heath measures plate current directly. Not only does it seem somewhat dangerous to have the full 3,000 volt plate supply appearing at the front panel, but I observed numerous weird side effects. For example, when the HV is activated, the meter usually indicates a small residual current (but sometimes it even deflects backwards— that's right, reading negative plate current!!). At first, I thought that the final tubes just weren't being cut off properly. Investigation, however, revealed that it was merely the presence of HV on the meter that caused it to deflect. No current was actually being drawn. As you can see from the picture, the meter indicates about 60 ma, yet all connections from one terminal of the meter have been removed! I considered other schemes to measure current, but good engineering options are limited, since the meter is internally shunted for 1 A. I decided it wasn't worth the chance of ruining the meter when taking it apart, since they are extremely rare.

Exercise caution around the multimeter as the +810 screen voltage appears here as well. Note that there are no interlocks which prevent operation with the case off. Back when this was designed, they didn't try to protect you from yourself.

Reposition the regulator load resistor

When you first take the Chippewa out of the cabinet, it is important to be careful of the adjustable 100 watt wire wound resistor mounted at the very top of the regulator load assembly. The way Heath had kit builders mount it positions the delicate exposed wires of this adjustable resistor face up. Well, when you pull the heavy chassis out of the cabinet, it is very easy to unknowingly drag the sharp edge of the cabinet across the exposed wires. This is exactly what I did to my unit (aaargh). I found a replacement 20K 100W adjustable resistor at Surplus Sales of Nebraska (800-244-4567) for about $10. Needless to say, the replacement was installed with the delicate wires of the resistor facing

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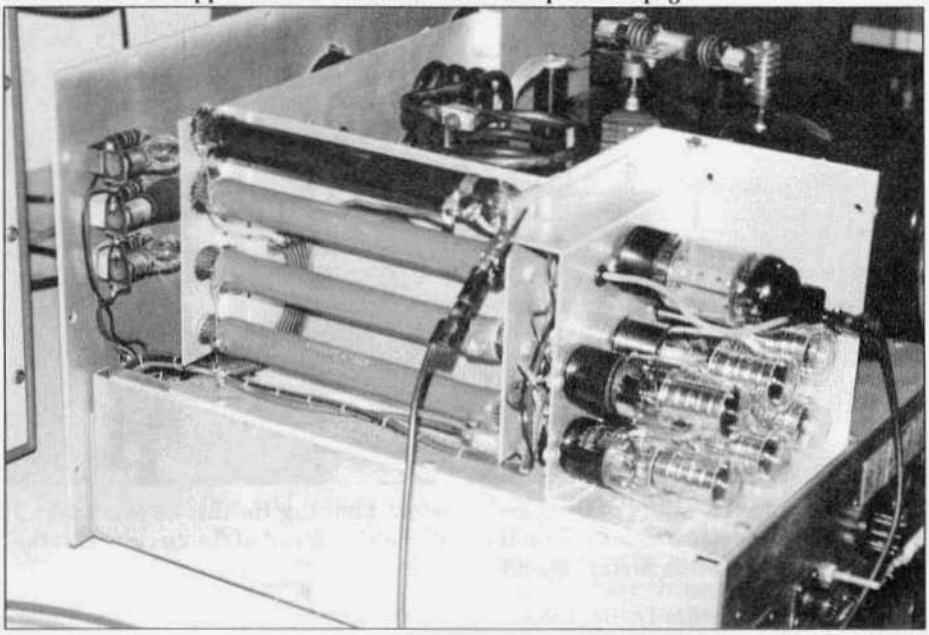
The Heathkit "Chippewa" AB1 Tetrode Linear from previous page



Notice the regulator tubes and load assembly. Remount the top adjustable resistor to avoid ruining the fine exposed wires when taking it out of the cabinet.

down, not up (like they should have been to begin with).

No bypass relay

Heath didn't include a built-in bypass relay, so you must use an external one if you want the option of bypassing the linear when it isn't on. I think this was an unfortunate oversight, although external switching relays were the order of the day back then. A DPDT relay is required, so a simple Dow Key relay won't suffice. I may build an external box or even install an internal relay, although the chassis layout isn't as conducive to this approach as I'd like.

Tuning up a tetrode amplifier

When you tune up, remember that in a tetrode amplifier, screen current is a better indicator of resonance than plate current. Plate current in a tetrode amplifier is not a good indicator of resonance because there is very little plate current dip. This interesting phenomenon isn't too difficult to understand. If I haven't put you to sleep yet and you are able to stay awake through a somewhat technical explanation, you'll be rewarded by understanding how Class AB1 service works.

Take a moment to look at the constant current characteristics shown for a transmitting tetrode in Figure 4 (in this case, an EIMAC 4CX300A). These curves show the instantaneous values of plate and screen current for any given combination of plate and grid voltage conditions. It looks difficult to comprehend, but soon you'll understand what it can tell you.

You'll notice that the lines of constant plate current are nearly horizontal, whereas the constant screen current lines are tilted upward and are concentrated in the left-hand region of the graph. For a given tuned r.f. load, the tube will operate along a straight line at resonance, here represented by the line OA during the positive half of each r.f. cycle. Point O represents the quiescent, or zero crossing point in each r.f. cycle and point A represents the positive

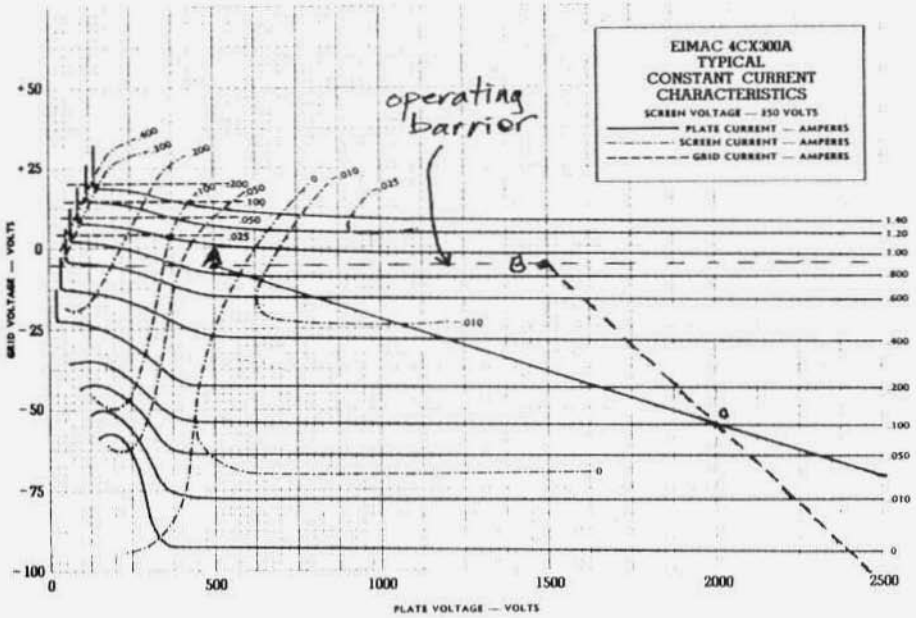


Figure 4. Constant current characteristics for the EIMAC 4CX300A tetrode.

peak. The negative half of the cycle continues out from point 0 beyond the right-hand edge of the graph for an equal distance. This is not shown because the negative half of the cycle is not important since the tube does not do any work here.

Tuning the circuit to resonance is equivalent to increasing the load impedance to a maximum which means that the operating line OA will have a minimum slope. As the plate circuit is tuned out of resonance, the operating line begins to rotate about point O. The dashed line OB is an example of an out of resonance condition. It is important to understand that the end point of the operating line is always constrained to operate at less than 0 grid volts in Class AB1 operation. The operating points at A and B are on a line which intersects the grid volts scale on the left side of the graph just below 0 volts. Think in terms of this imaginary horizontal line just below 0 grid volts as an operating barrier which cuts all the way across the graph (because grid voltage can never go positive). All operating lines must end at this same imaginary horizontal line on the graph just as OA and OB do. Thus, the length of the operating line actually changes while tuning, since it is confined vertically by the maximum grid voltage just below 0 volts.

You'll notice that the operating point, which is constrained to move along the imaginary horizontal line, still intercepts essentially the same plate-current values, whether the plate circuit is in resonance or not (the tube draws about .9 amps points A and B). This is the reason that plate current in a tetrode is not a very good indicator of resonance.

Now take a look at the screen current on the graph. As line OA begins to tilt upward, representing a change in load impedance, point A moves horizontally towards point B and as it does, it crosses through different screen current curves. As you can see from the graph, screen current may be zero or even negative in an out-of-resonance position, but at reso-

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Antenna Switching for the CE 600L

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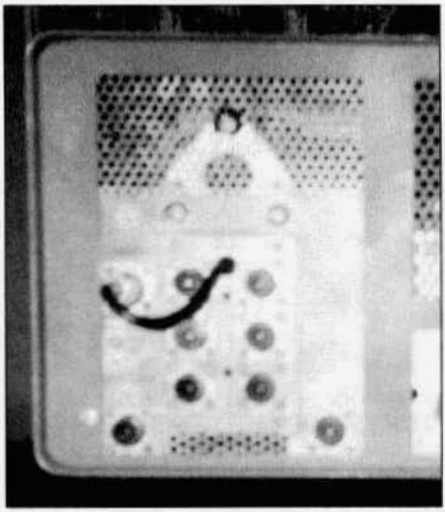
Whenever I travel to Springfield, Missouri I try to stop by a small, out-of-the-way store called Colony Tobacco. Being a non-smoker, tobacco is not the reason for my visits. The truth is....Tobacco is what goes on in front; vintage amateur radio is what goes on in back. After passing through the fragrant front office, it's difficult not to stop for a peek in the store room/work shop. Although there is always something interesting in 'the room on the right', I am usually eager to take the next twenty or so paces that lead to the bedroom-sized room at the back. There one finds a neatly shelved assortment of our beloved boat anchors, many of which are for sale. During one of my visits, a Central Electronics pair (100V/600L) called to me from their shelf saying, "Please take me home." Although I already had nice examples of each, I could not resist their collective price tag. After a few grunts and groans, both were safely loaded in the trunk of my car.

During my inspection/purchasing process I didn't pay much attention to detail other than to be sure the units weren't riddled with holes and modifications or missing major components. Upon arriving home I did what I normally do with new toys, lay them in the middle of the living room floor for a closer examination. On the rear panel of the 600L I noticed two important things that I had missed in my initial examination. The first was the serial number, 56001. Since every 600L I know of has a serial number that begins with '56', I assumed this amplifier was the first off the production line. My second oversight was the six extra SO-239 coax connectors. While I was sure my other 600L did not have these, I dashed to my ham shack to verify I was right (and I was).



Rear of the 600L showing the AS600 panel.

The six coax connectors are mounted vertically on a small panel, three per side. The panel has a silk-screened 'AS600' at the top. Adjacent to each coax connector is a band marking (160, 80, 40, 20, 15, 10). A five inch length of RG-58, with an attached PL-259, extends from the panel. On the inside of the panel is a rotary switch that is ganged, via an insulated shaft, to the bandswitch. If you attach the PL-259 to the ANTENNA connector and your single band antenna feedlines into their respective SO-239's, the proper antenna is automatically selected by the bandswitch, further complementing the no-tune operation of the CE pair.

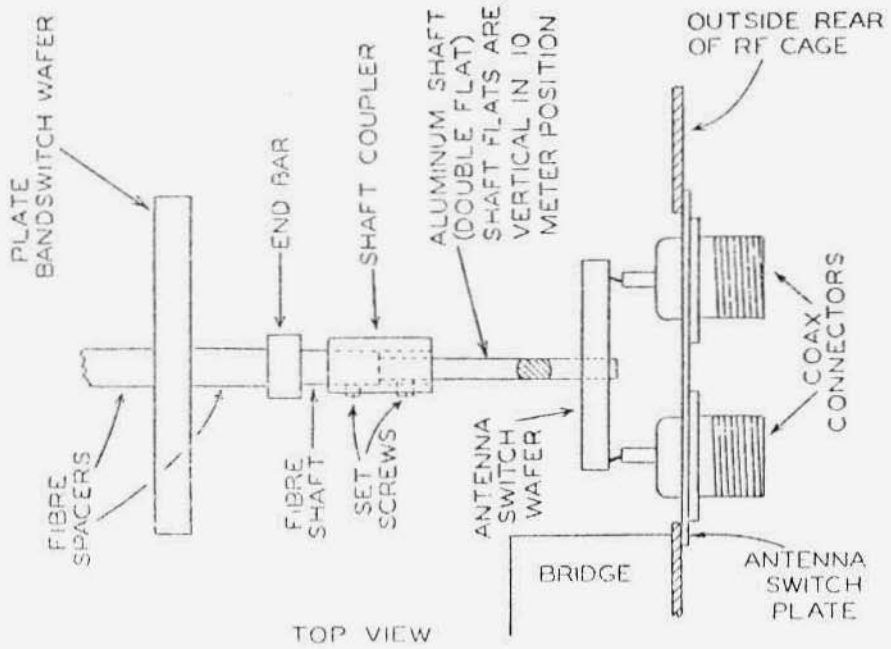


FIG. 1

M158
125MX

Several months after acquiring this second 600L, a third 600L came my way. Like my first, it did not have this antenna switch. My curiosity about the AS600 grew and I decided to do some investigation. I discovered the switch was included in the schematic of the 600L manual. Later I found a Central Electronics brochure that advertised the AS600. Although the prices were blacked out for both the 600L and the AS600, probably indicating a price change, I could still read them. The AS600 sold for $13.65; the 600L for $495.00. Via the Internet I learned of several other 600L owners. Only one had owned a 600L with the accessory, so I suspected it was not very popular.

Since early production units often go to company officers, I thought this 600L might have belonged to a Central Electronics employee. A call to Wes Schum, who has an excellent memory concerning the 600L, confirmed that #56001 was, indeed, the first production unit and that it had not belonged to him. He also confirmed my suspicion that the AS600 accessory was not a big seller, probably because people didn't understand exactly what it did.

For those readers that might want to build their own 'AS600', Central Electronics made it easy. On the rear panel, directly behind the final amplifier section, is a small, removable panel. One merely needs to replace that panel with one of the same size. The new panel should have six female coax connectors of choice, an appropriate rotary switch and a coax with a PL-259. The rotary switch should be the only difficult part to find. It needs to have six positions, with 60 degrees between contacts, and be capable of handling the output power

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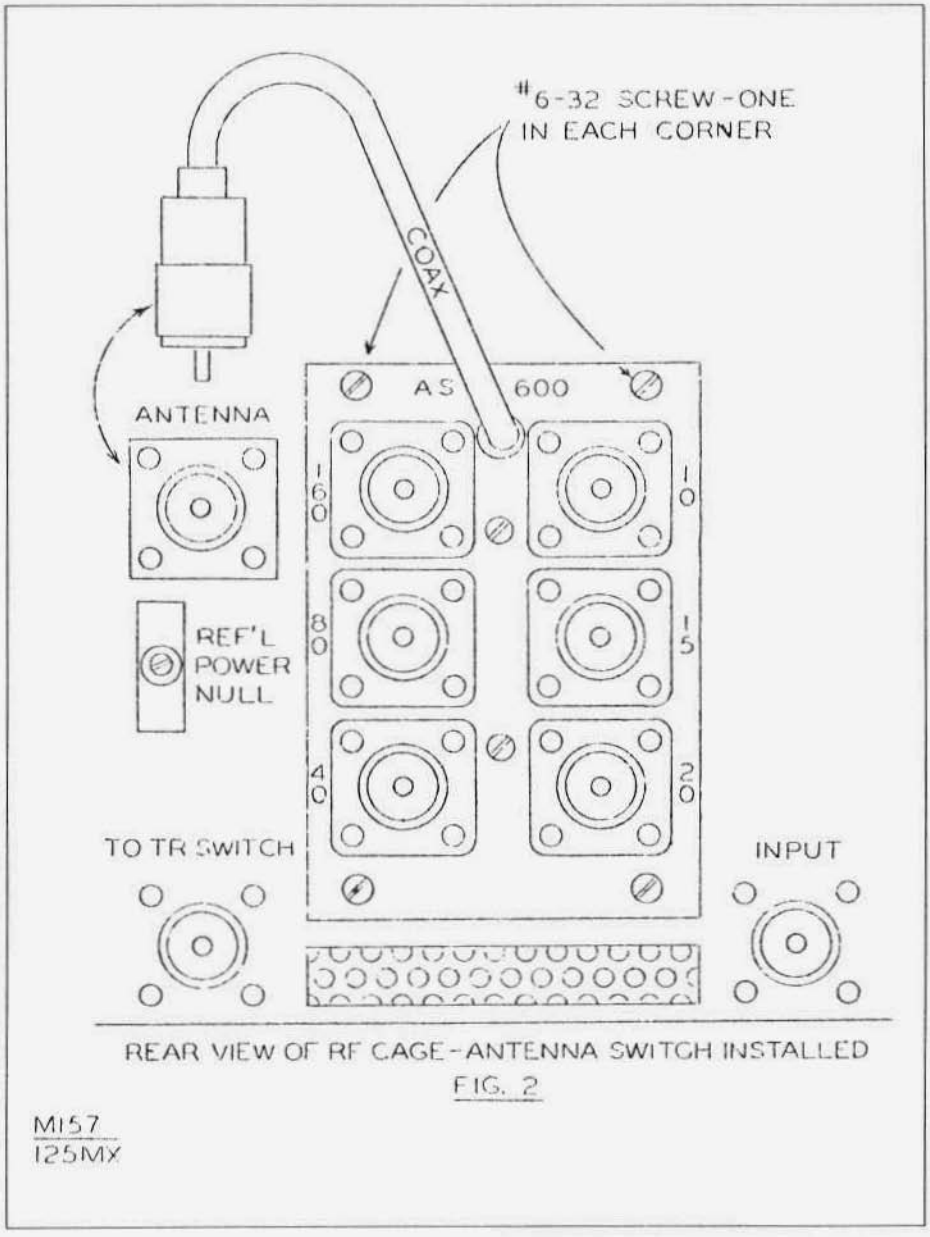

REAR VIEW OF RF CAGE - ANTENNA SWITCH INSTALLED

FIG. 2

M157
125MX

INSTALLING ANTENNA SWITCH AS-600

1. Remove the 600L line cord from A.C. wall receptacle.
2. Remove 600L from case.
3. Remove screws holding side shield to R.F. cage and three #10 screws on front panel.

CAUTION

4. Use a well insulated screwdriver to discharge the filter capacitor under the chassis, or at the R.F. choke bracket near rear of R.F. cage.
5. Remove four screws, washers and nuts holding the perforated plate on rear of R.F. cage. Remove this plate through inside of cage. Be careful not to damage the R.F. choke.
6. Insert double flat shaft into the antenna switch rotor hole and turn the rotor until the wiper is in the 10 meter position.
7. Place shaft coupler over 1/4" double flat shaft.
8. Turn band switch knob on front panel to 10 meters.
9. Mount the antenna switch plate on outside of R.F. cage with the #6 hardware, as shown in Fig. 2. Do not tighten yet.
10. Butt the aluminum shaft up against the fiber shaft, as shown in Fig. 1.
11. Slide the shaft coupler over the fiber shaft for a distance of 3/8".
12. Tighten the set screw on the aluminum shaft. The set screw should make contact with flat part of shaft and be in a horizontal position, as shown.
13. Check position of antenna switch wiper to be sure it is still in 10 meter position.
14. Tighten set screw on fiber shaft.
15. Rotate the band switch knob on front panel a few times and if antenna switch correctly follows the band switch position, you may tighten the four #6 screws on rear of cage.
16. Screw the male coax plug into the ANTENNA coax connector, as shown in Fig. 2.
17. Antennas may be connected to any or all of the six connectors.
18. The INPUT connector is not affected by antenna switch installation. The TR Switch connector is always across output of 600L, therefore is automatically connected to the antenna in use.

PARTS LIST

1 - Plate with connectors and switch wafer
1 - Coupler 1/4" to 1/4"
1 - 1/4" diameter flatted shaft

of the 600L. Since there is no stop on the bandswitch of the 600L to prevent it from turning through 360 degrees, any stop on the new rotary switch should be removed.

To facilitate this modification, I have included the original Central Electronics instructions and diagrams. These were kindly provided by Steve Wenger, KA9QLF. Although this modification takes a bit more work, it seems better than the more common practice of attaching a six-position B&W coax switch to the rear panel, an act that requires drilling a hole in the original panel.

I would appreciate hearing from any 600L owners, specially those that might have the original AS600 accessory. For those keeping track of serial numbers my other 600L serial numbers are 56290 and 56462, the latter being the highest serial number I have found. ER

Calibration of the Cosmos PTO

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This article will focus upon the calibration of the Cosmos permeability tuned oscillator (PTO) for both linearity and endpoint adjustments.

Few devices have been so maligned or poorly understood than the Cosmos PTO employed in the R-390A HF receiver. This device has been mentioned in articles about the R-390A many times, as well as on several Internet mailing lists, often negatively. The features of endpoint and linearity adjustments for this PTO have often been misunderstood, leading one to suspect it may be a poor device. This article will attempt to convince that the Cosmos PTO is worthy of service in the R-390A when adjusted properly.

Collins designed and built the first R-390A receivers utilizing its own 70H-12 PTO. This PTO covers a frequency range of 3.455 Kcs to 2.455 Kcs in ten clockwise turns. It is a robust device constructed of the highest quality materials, including an encapsulated main coil, sturdy compensating stack, and a temperature controlled oven.

The R-390A receiver was produced by many manufacturers other than Collins. These manufacturers were at liberty to employ the PTO's of suppliers other than Collins, as long as their performance met the specification MIL-R-13947. Consequently, PTO's employed in the R-390A were supplied by many other manufacturers including Motorola, Progresstron, Dubrow, Cosmos and Raytheon. Of all PTO types, the Cosmos seems to be the most common. Electronics Assistance Corporation used these PTO's exclusively in its production run of 11,000 R-390A's around 1967.

Cosmos Industries was a New York manufacturer of radio equipment located at 31-28 Queens Boulevard, Long Island. Among its products was the well known Cosmophone HF-SSB transceiver. The improvements made in the Cosmos PTO over the original Collins device were designed by Lewis Metzger and Harold Goodman, both instrumental in the development of the Cosmophone. They received US patent number 3,098,989 in July, 1963 for their idea and working model of a PTO that could be linearized with external adjustments, unlike the Collins PTO.

Anyone who has ever worked on an R-390A PTO soon finds out that there are two important adjustments that can be made. The first is that the PTO must be adjusted such that its output is exactly 1000 Kcs in ten turns. This is commonly referred to as the endpoint adjustment, and is as far as most users will go in PTO calibration. Endpoint adjustment is important as it not only affects dial calibration, but can also compromise front end track tuning on the lower bands.

The second important adjustment is linearity. If one were to graph the ideal PTO output frequency versus the shaft position in number of turns, the graph would make a straight line. This was the goal of Collins Radio in all of its designs of the era, including the 75A, 32V and all of the later models. Art Collins wanted a linear output, and that was that. The Collins PTO was famous for being able to achieve this goal, as well it had to, because the inherently linear Veedor-Root counter of the R-390A exposed nonlinear PTOs with errors as low as 0.1 Kcs.

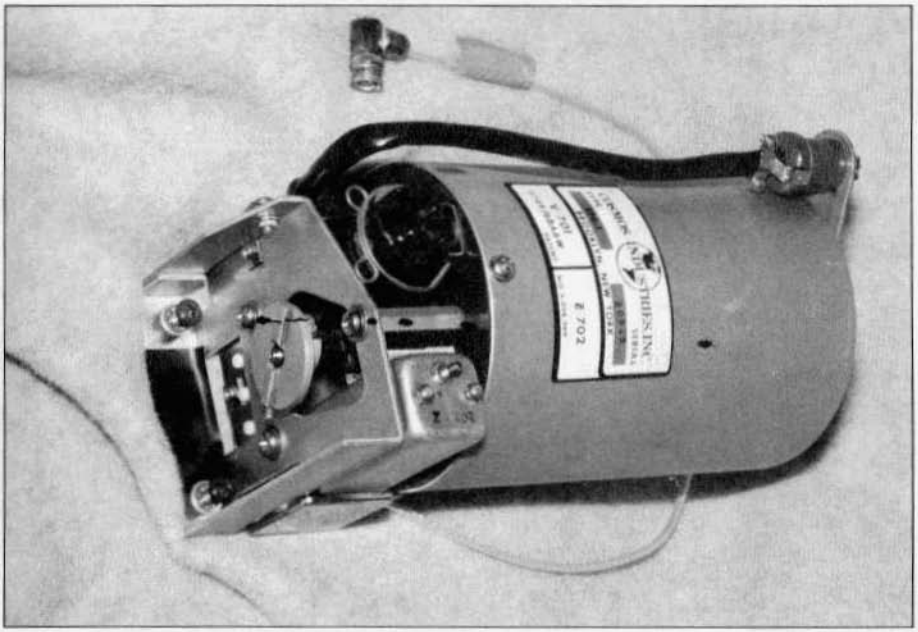

Figure 1. Cosmos PTO for the R-390A.

All PTO's employed in R-390A service have an endpoint adjustment screw. This screw is typically located underneath a sealed screw hole behind the PTO' s transformer can. As a PTO ages, its output will typically decrease, i.e., it will have an output of less than 1000 Kcs in ten turns. To remedy this, the endpoint adjustment screw must be turned (usually clockwise) until the PTO's output is increased to exactly 1000 Kcs in ten turns. The turning of this screw moves a tuning core into a second coil in the PTO to make the adjustment. PTO's of the Collins design will have two inductor coils, a main coil and an endpoint adjustment coil.

Adjustment of the PTO's linearity is another matter entirely. In the Collins PTO, the company employed an internal corrector stack which accomplished this task. This stack is constructed from a set of adjustable shims upon which a cam follower rides. As the PTO shaft is turned, the main tuning slug is advanced axially on a lead screw, and the cam follower is simultaneously advanced on the corrector stack. Naturally, advancement of the main slug on the lead screw is exactly linear, but unfortunately the coil and powdered iron tuning slug do not usually cooperate in linear fashion. The cam follower mechanism allows the tuning slug to either increase or decrease the overall rate of advancement on the lead screw by imposing a slight twist of the tuning slug. This increase or decrease in tuning rate is determined by the shape of the corrector stack and is what accomplishes the linearity correction. If a graph were made of the nonlinear response of the PTO, it might look very much like the profile of the Collins corrector stack when properly adjusted.

Linearity correction is necessary because it is virtually impossible to wind the main tuning coil and match it with an iron slug for an overall linear output. The only problem with the Collins design is that the corrector stack is inside the PTO cover. Naturally, adjust-

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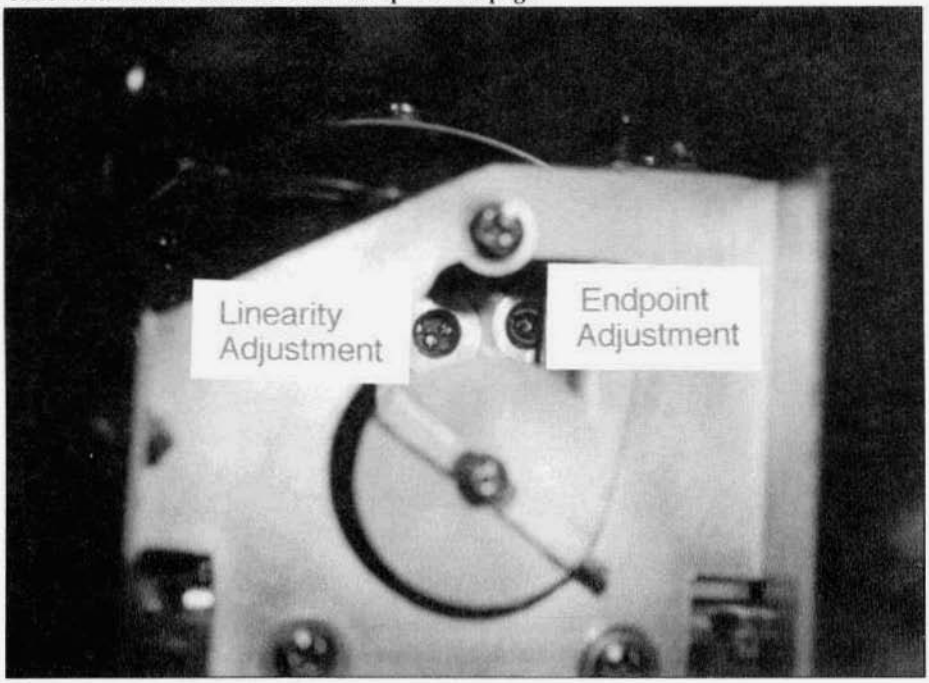


Figure 2. Cosmos PTO adjustment screws.

ments must be done with the cover off, but unfortunately, replacement of the cover influences the adjustment requiring multiple attempts and no shortage of frustration. Metzger and Goodman solved this problem by improving the Collins PTO design. The Cosmos endpoint adjustment is similar to the Collins adjustment, however the real innovation is found in their external adjustment for linearity. This is the most misunderstood feature of the Cosmos PTO.

Upon careful examination of the Cosmos PTO, one will find the endpoint adjustment in its usual location as described above. To the left of the endpoint screw hole will be found an additional screw cover. Underneath this second screw cover will be found a series of very small screws (see Fig 2). During clockwise rotation of the PTO shaft, this series of screws passes underneath this window from left to right. One screw will pass with every 90 degree turn (25 Kcs) of the PTO shaft. It is this series of screws that are used to adjust linearity of the Cosmos PTO.

The Cosmos PTO has three inductor coils instead of two employed by Collins (refer to schematic in Fig. 3). There is the familiar main tuning coil, an endpoint adjustment coil, and a third coil that is part of the linearizing device. Like the endpoint coil, the linearizing coil is in series with the others. The inductance change of the corrector coil is controlled by a core which goes in or out as the PTO is rotated through its ten turns.

To help visualize the corrector mechanism, picture if you will a Teflon disk laid onto the front face of the PTO. This disk acts as a cam. A cam follower contacts the slug of the third coil. The corrector disk rotates through a reduction drive as the PTO is advanced its ten turns. Under this disk is a series of screws which are laid out in a staggered fashion all along its circumference, forming a circle. The flat heads of the

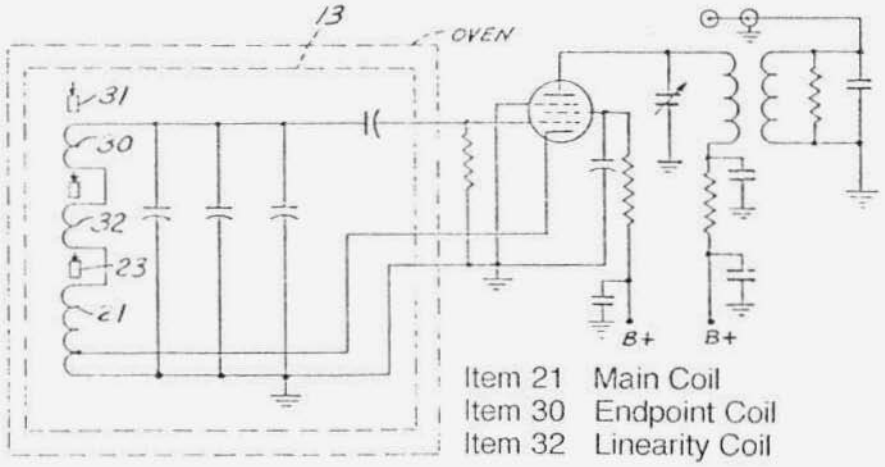


Figure 3. Schematic of Cosmos PTO.

screws, which are adjusted to varying heights in close proximity to their neighboring screw, make up a (typically uneven) surface upon which the flexible Teflon disk rests. As the screws are adjusted in or out, the Teflon disk (formerly and initially flat) is shaped into a wavy surface (a cam) upon which a cam follower rides. You've seen the kiddy motorcycle rides at the carnival where the miniature vehicles go round and round, and also make a gentle up/down motion on the wavy surface of the merry-go-round floor. It is this slight vertical displacement of the vehicles that is analogous to the in/out motion of the core in the compensating coil. Note: One should refer to the R-390A service manual before attempting to service the radio.

The two things needed to calibrate the PTO at 25 Kcs points are 1) an accurate means of measuring frequency, and 2) an accurate means of turning the PTO shaft exactly 90 degrees at a time. The author uses a frequency counter to measure the PTO output, and the Veedor-Root counter in the radio to measure the turns of the PTO. When using the radio's counter to measure turns, take the time to tape exposed 120 VAC power and fuse connections to prevent electrical shock while performing the more than 40 PTO remove/install maneuvers. The frequency counter is connected directly to the output cable of the PTO. A handy crossover connector from the PTO fitting to BNC can be found on the back bulkhead of the radio. Simply borrow the adapter that is present at the IF output jack. There are many alternatives to using the radio frame to measure turns, including using a sacrificial R-392 frame (credit Wally Chambers, K5OP), and various calibrated knobs.

Setting the endpoint on a Cosmos PTO is similar to the Collins PTOs. Test the PTO to see how many turns it takes to achieve an output starting at 3455 Kcs and ending at 2455 Kcs. Most aged PTO's that have not been recalibrated will typically require an additional 1-15 Kcs past the ten turn mark to achieve the proper range. To bring it back to 1000 Kcs output in ten turns, adjust the endpoint screw (usually clockwise). If the proper output cannot be achieved within the adjustment range of the endpoint screw, one must open the PTO

continued next page

and remove one turn from the endpoint adjusting coil. This change in overall inductance of the coil will bring the endpoint back 7 Kcs or so. Once this is accomplished, setting the endpoint can usually be achieved. While the PTO is open, the lead screw and bearing can be lubricated. The author usually takes this opportunity to bake an open PTO in an oven at 150F for several hours to dry it out and regenerate the desiccant. Perform the calibration only after baking, and keep the PTO in a zip lock bag if you plan to leave the adjustment window screws open for an extended length of time.

When setting the 25 Kcs calibration points, it is extremely important that the screw being adjusted is directly lined up behind the adjustment window. This may be accomplished by simply rotating the PTO shaft until the nearest screw is lined up exactly with the window. The reason this is so important is that the cam follower which rides on the compensating cam is directly behind this window, and will thus be directly under this screw at this point. If this caveat is not followed, adjustment can still be made, but there will be interaction between the point that one is attempting to adjust and its neighboring points. This will yield poor results and will be very frustrating. Be advised that if the screw being adjusted is directly behind the window, the PTO position may not yield an exact 25 Kcs calibration point on the dial, e.g. 000, 025, 050, etc. This is not a real problem, but it may be necessary to shift the starting point of the 25 Kcs check points by 5, 10, or 15 Kcs up or down. Simply remember that the PTO has an output of 3455 Kcs at dial indication 000, and 2455 Kcs at dial indication +000. Armed with this information, one can make a spreadsheet calibration chart for all 40 calibration points in 25 Kcs increments. An example chart might look like this:

Frequency (Kcs)	Veeder-Root Counter	Error (Kcs)
3465	-010	
3440	015	
3415	040	
3390	065	

And so on ..... or 40 to 42 calibration points

The above example is for a PTO that has the nearest linearity alignment screw falling at a frequency of 3465 Kcs on the frequency counter. This corresponds to a starting point on the Veeder-Root counter of -010. Note that this starting point is not on an even 25 Kcs point, but that is OK as it is most important to start with the nearest screw directly lined up with the adjustment slug at the center of the window. To complete the chart, subtract 25 Kcs from the frequency and add 25 units to the Veeder-Root counter for each point out to 2455 Kcs.

Each screw will have an adjustment range of about 5 Kcs +/-. Clockwise rotation of the screws will reduce the PTO's frequency output at a given checkpoint. One should avoid adjusting the screws to near their full clockwise position as this will cause excessive drag in the PTO.

Advanced Procedure for the Stout Hearted

To remedy problems with excessive drag due to adjustment screws reaching their clockwise limits, back all 40+ screws out to their counterclockwise stops, and then turn each screw one turn clockwise. This will give the cam an initially flat position. Start PTO calibration with the screw nearest 3455 Kcs moving up the dial toward 2455 Kcs (+000 on the Veedor-Root counter).

Remember to check each calibration point against the frequencies on the calibration check chart (it is not hard to get 5 Kcs off). Some check points may require a touch-up calibration after completion of the first pass. This will be especially true if the PTO calibration

was re-started with the cam in the initial flat position as described above. Extreme adjustment changes (5 Kcs) at any given point may cause output changes at neighboring points. These can be worked out with multiple checks and adjustments at problem checkpoints.

With this linearization procedure, it is possible to obtain checkpoint accuracies of +/- .100 Kcs with an initial dial calibration at 000 using the crystal calibrator. This greatly exceeds the specifications listed in MIL-R-13947B which require a +/- .300 Kcs with a dial calibration at the nearest 100 Kcs check point using the crystal calibrator.

In conclusion, the reader should be left with these points.

- the Cosmos PTO can be calibrated for both endpoint and linearity.
- calibration can be done at 25 Kcs points, typically exceeding military specifications. **ER**

References:

Military Specification MIL-R-13947B, "RADIO RECEIVER R-390( )/URR", 26 October 1960

TM 11-5820-358-35, "Field and Depot Maintenance Manual, Radio Receiver R-390A/URR", pp. 107-108.

"Serially Connected Course and Fine Inductors with Continuous Adjustment",

U.S. Patent number 3,098,989 awarded to Metzger and Goodman, 23 July 1963

Discussions with Wally Chambers, K5OP, Memphis, TN.

Boyhood Memories from page 15

a few days to get a ride to the farm of Frank, WØDVS, to see a real antenna farm complete with steel tower, a beam, and peacocks roosting on top. It took a little more badgering to get my father to arrange for a first-hand tour of the DVS shack. I can still recall the DX-100 and SX-71 aglow as I entered the room and heard a YV5 on AM talking to Frank. To this day I am not sure if I overcame my mike fright long enough to actually participate in the QSO. The one thing I do recall is that I was hooked for life! Thanks to Frank and my dad, I left with a set of 45 rpm code records, plenty of encouragement, and my first Elmer. A short time later a new "one-year novice" was born and on the air with a DX-40 and S-85.

The past 32 years of ham radio have been very exciting and have opened up a world that would never have been available to me. Even though I have never been employed in the electronics industry, I know that my exposure to thousands of people all over the globe has helped me in my line of work.

Three of the four people in my family are now hams, but I realize that it doesn't hold the mystery for them that it does for me. After all, they have grown up with watching live TV shots from space and America's Cup Race off the coast of Australia. The computer has added another dimension to radio and in my perspective may have taken a lot of the old mystery out of communication. However, I use it begrudgingly to help find those needed parts to keep the old tube rigs aglow and the missing pieces in reconstructing my first ham stations.

I still look forward to visits back to the family farm. The old GR-91 still sits upstairs in the bedroom and pulls in a respectable signal. When I sit down in front of the rig at home, it's a time to recapture some of that original adventure. I am still waiting in anticipation when calling CQ to see who will come back.

I realize that this is probably how a lot of ER readers' ham radio careers started. I just wanted to jog some memories. Maybe it's time for all of us to rekindle the excitement of those first QSO's, fire up the old rigs, and pass the excitement and mystery on to others. **ER**

Hallicrafters S-14 Sky Chief

by Chuck Teeters, W4MEW
841 Wimbledon Dr.
Augusta, GA 30909

With $30 from grass cutting in my pocket, I went to Genesee Radio in Buffalo to buy a Hallicrafters S-19 Sky Buddy, but the S-19s were sold out. They did have a used, two year old, 1936, S-14 Sky Chief for $30. Paul, W8UKT said it was better than the S-19 because the S-14 had an RF amplifier, tuning eye, RF gain control and a two speed dial. I brought the Sky Chief home.

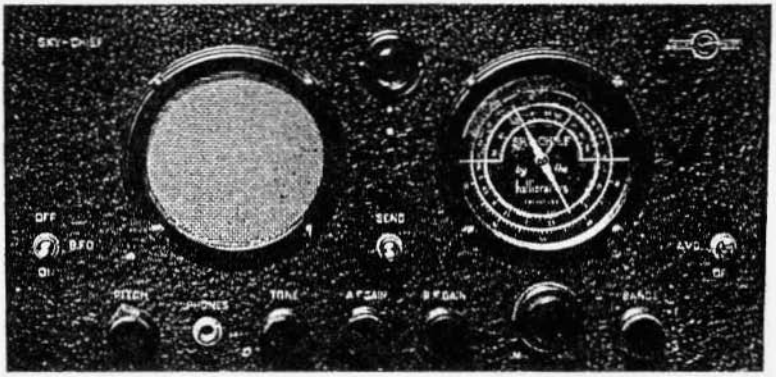
After two years with the Sky Chief, I had proven I could copy 13 wpm, found 20 CW went farther than 160, and knew 3962 kHz belonged to Harry, W8RHZ, which was great for checking dial calibration. December 7, 1941 changed the S-14 from ham to SWL status. The government was buying ham receivers for the war effort but the Sky Chief was not on their wanted list, so I listened, joined WERS, tried carrier current, went to school, and waited.

When the war was over in 1945 the FCC opened 112 MHz and then 28 MHz. That was exciting news to someone who had a receiver with an 18 MHz upper frequency limit. While trying to decide how to get the S-14 on 10, Byron Goodman, W1JPE, then described a simple 10 meter converter in the February 1946 QST. I built the converter and got on 10. My log shows the first contact was Bill, W5NHV, in Corpus Christi, Texas. The S-14 and 10 meter converter combination was replaced by a used SX-24 in 1948. Logs, QSLs and mostly my memories make the S-14 a great receiver.

Several years ago I started looking for a Sky Chief to see how good it really was. A chance remark from Marty, AA4RM, at the Lauranceville, GA, hamfest, brought good and bad news, he had one, but he wouldn't part with it. I must have bugged Marty a hundred times since about the S-14, as he finally gave in to an extended loan, and I got to bring a Sky Chief home again.

The Sky Chief is the same size as the S-20R, S-40, or S-85, which were the 1939, 1946, and 1954 equivalents in the Hallicrafters line, but the S-14 is at least 10 lbs. heavier. Lots of metal in the chassis, transformers, speaker, and cabinet. It covers from broadcast to 18 MHz in three bands. Has a 6D6 RF, a 6A7 converter, and one 6F7 465 kHz IF stage. A 75 detector and 6B5 audio amp complete the signal path. The 6F7 also houses the BFO, and an 80 rectifier provides plate voltage. It has a 6G5 eye tube tuning indicator tied to the AVC. A 5" speaker occupies the left side of the front panel. There are no terminals on the rear, just three wires for antenna and ground connections. The instruction book says use the red wire for a flat top, the red and yellow for a doublet, and try grounding the black wire if it cuts down noise. The book also gives the frequency range, tubes, schematic, and that 110V alternating current is required, and that is the sum total of technical specifications.

The 5" circular dial is referred to as an airplane dial. The dial assembly is belt driven from the tuning knob. A double ended pointer moves through 180 degrees, reading directly in MHz. Later models had a single ended pointer that moved through 320 degrees. Both had a second single ended pointer that sweeps through 360 degrees 8 times for a half circle sweep of the main pointer. The second pointer reads against a 0 to 100,



360 degree scale on the outer edge of the glass covered dial. 160 meters is spread over 70 divisions on the outer scale, 75 phone over 23 divisions and 20 is spread over 11 divisions. A warm receiver can be reset to 3885 within 2 kHz and 14,286 within 20 KHz.

Drift is something else, from a cold start the S-14 drifts 3 kHz on 160, and 13 kHz on 20 meters, in twenty minutes. Then it moves about 1 kHz on 160, and 5 kHz on 20 for the next hour. The BFO is reasonably stable, but just minimum injection, and some hum which makes it difficult to use on SSB. Doesn't sound bad on CW, but giving someone a T9X report is guess work.

Sensitivity checks as 14 uv on the BC band, 8 uv on 160, and 15 uv on 20 meters, which is not bad for the old coils and a 6D6. I built up the 10 meter converter, as per the 1946 QST. It uses 1/2 of a 6SN7 as a mixer, with a 6J5 oscillator. The other half of the 6SN7 is a regenerative detector on 1500 kHZ. The detector acts like a Q multiplier when feeding the S-14. My signal generator leakage produced a bearable signal on 10 meters, probably around 3 or 4 uv with the regeneration control cranked up just short of oscillating. Other than 10 meters with the converter, the S-14 sensitivity is not outstanding but certainly usable considering the noise level hereabouts.

The 6 db bandwidth measured 11 kHz and opened up to 23 kHz down at the noise. The AVC seemed sluggish, only rising to a max of 5 volts, but I could not overload the S-14 with 0.1 volt RF input. Giving a signal report using the tuning eye would be pure speculation, but it's good for comparing two signals, and the green eye sure looks great against the black panel. Image response on 20 meters measured 13 db down. The S-14 heard 19 meter broadcast stations on 20. With the 10 meter converter, CB images showed up on the high end of 10 meters, but 28 to 29.3 was clean.

Overall, the Sky Chief did what it was supposed to do, receive AM and CW on 160, 80, 40, and 20. Would I want to use it as my main receiver? After a week's use, no. I don't think the S-14 is a practical receiver today. Bandwidth is poor for crowded bands, and it has excessive drift. If you were using a two tube regen receiver, which many hams were, the Sky Chief was an improvement in 1936. However the years between 1936 and 39 introduced better tubes, RF coils, IF transformers, and switches which show up in receivers like the S-20P, and SX-24 which will provide a credible performance even today. Whatever, I have Marty's Sky Chief for a while longer, and use it when I feel like going back 62 years even if it isn't as good as I remember, but then neither am I. **ER**

bolt, Valiant, 32V3, T4X, T4XC, HT-20, HT-32, HT32A, HT32B, HT37, Globe Scouts (One Orange and one Green!), T195, BC457, BC459, 100V, Lettine 240, Millen 90711/90800, Harvey Wells TBS-50C, and a 1941 Meissner Signal Shifter. CW was received by W2LYH's homebrew, Elmac PMR-7, 2B, R4B, R4C, RME-69, FB7/DB20, HRO, HRO-5, HRO-50, NC-173, NC-200, NC-300, 75A3, 75A4, 75S3, BC455, R388, R390A, SX28, SX73, SX101A, SX-115, HQ-140X, HQ-150, HQ-170A, and SP-600. CW transceivers included classics HW16/HG10, TR-3, TR-4 and NCX-3, and moderns TS140S, TS-830S, TS850, TS430S, TS-530, TS950, FT101ZD, Omni 6, and IC-728.

Murphy was active again this year. I lost my HQ-170A, the BC453 that I use as a second IF for my BC454 and BC455 quit as well, and one of the coil clips for my antenna tuner took a dive off into the fifth dimension just at the beginning of the contest and I've yet to find it. It took Marty, AA4RM, an hour to get his TCS transmitter to fire up - he forgot that he had to turn its receiver on too for the power supply to light up. John, WB5OAU/4, managed to call several CQ's into his dummy load, miswire a jumper for his keyer, and discover steel wool shards in his paddle. But Paul, N6EV, had the worst encounter. He could hear only "24 hours of Show Tunes" on his SX101 regardless of its band or frequency. Turns out it was courtesy of neighboring KGII., Costa Mesa, CA, newly ensconced on 1650 KC - and right in the middle of his IF passband! Darn this expanded AM broadcast band!!!

The Boatanchorites seem to divide into two camps, those who knew where and when to find other CX'ers and those who did not. Perhaps we can get Al, N5AIT, to report where and when the hot spots were when he puts out the Newsletter again next fall. (For a newsletter copy, send an SASE to W8KGI, QTH above, or e-mail to Al Stephens at modstephen@acs.eku.edu). Speaking from my 20 year experience with the CX, I'd say to look for CW activity on 7060 from the start of the contest to about 0100 or 0200 and then to switch to 3560 for the remainder of the evening. If you can't hear anyone on 7060 early, go up to 14120 and work a few CX-DX QSO's until 40 opens up in your area. And if you're an Eastcoaster, keep an eye on 3885 for the AM crew in the early part of the contest as well.

Finally, here are a few words from Big Al about our Saturday/Sunday mixup.

"_ Which leaves us with the problem of how do we handle it? And of course the answer is simple: CX was originated to encourage y'all to restore and operate all those older pieces out there. When we started it we wanted to make it a low-key contest from an operating standpoint, not something that'd wring you out over an extended period of time, so we deliberately set time and hours accordingly. We added one hour to the original eight-hour operating event, but never wanted to go to two days - we all have other things happening in our lives.

"But I am delighted that there is a bunch out there firing up the heavy metal. So the executive decision is go ahead and have a ball. Send in results from Saturday and/or Sunday: just indicate which day the operating was on. If you go both days, separate the two and score as separate events. That should take care of it. And of course, have a ball! Remember this is for the fun of it!"

The Fall 1998 CX will run on SUNDAY, September 27, same times, frequencies, and on still more stations across North America and the WORLD! You've been told, and there's absolutely no excuse for not getting those Boatanchors up and running between now and then. And in case there is an excuse, get your Yaecomwood on instead and have fun anyway. CU on the CX! ER

The Heathkit Linear from page 25
nance, it will be positive. A peak in screen current thus represents resonance. It is very easy to see the peak in screen current when tuning the Chippewa.

If loading is changed, the operating line tilts about 0. As the load impedance is reduced through more coupling, the operating line becomes steeper just like line OB. Thus, the effect of increased loading is to decrease screen current. As the load impedance is increased through less coupling, the operating line becomes less steep and screen current increases dramatically (the operating point continues to move left along the imaginary horizontal line as coupling is reduced). Screen current is therefore also an indication of loading.

Grid current is normally not drawn in Class AB1 operation because the grid voltage is always below 0. It is easy to see when maximum required exciter power has been reached when operating SSB because the grid current will start to kick up when you go beyond this point.

Happy hunting

Someday I hope to get my hands on a good spectrum analyzer to compare the spectral purity of this AB1 linear with some popular grounded grid designs. Such may be the subject of a future article.

Hopefully this article will encourage you to purchase one of these wonderful beasts if you should be lucky enough to see one at a swapmeet. Because of their rarity, they usually aren't cheap, but you'll have the pleasure of owning and operating a real collector's item. Don't expect operation of this linear to be as trouble-free as your typical grounded-grid design. There is just a lot more to this linear, and with 11 tubes, it will probably need more regular servicing. There are more operating parameters and adjustments to keep track of than when operating a grounded grid linear, but that's all part of the charm. And if you like the big and heavy style, well... this linear is made just for you. ER

NEUTRALIZATION from page 9
requires more drive power.

Maintaining good neutralization requires a well designed amplifier with short leads, proper grounding, shielding between grid and plate circuits, and good screen bypassing in the case of tetrodes. It is best to make the neutralizing adjustments at or near the highest band because it is more critical at higher frequencies. The lower bands should be checked, but a little error is of negligible consequence on the lower HF bands.

Addendum

Art Collins always had a strong interest in RF amplifier designs. After I discovered how to achieve neutralization and RF feedback at the same time we built and tested the 2-stage feedback circuit in December 1952. Shortly afterward Art wrote the following:

"Definition of Neutralization in an RF amplifier with feedback.

Neutralization in a tuned amplifier with inverse feedback has as its purpose limiting the change of phase and gain within the feedback loop to that of the resonant circuits alone. Accomplishment of this purpose requires that the passive coupling between resonant circuits be balanced out, but does not require that the output signals be cancelled on the input grids since the latter is a necessary consequence of feedback."

Transcribed to my Engineering Notebook 1-3-53. ER

1. F.E. Terman, RADIO ENGINEERS HANDBOOK, McGraw Hill 1943.

2. W. B. Bruene, "How to Neutralize Your Single Ended Tetrode Final", CQ, August 1950.

Looking Back from page 3

about hams falling off towers trying to get their SWR down to 1 to 1. That doggone Monimatch convinced hams that they had to have a 1 to 1 SWR or else their doggone systems wouldn't work!

There is a footnote to all this. My wife and I were walking through Dayton one year and it seemed every dealer had a Monimatch on sale. Literally thousands were being manufactured and sold. I told Martha, "Just think, I invented that, just think how rich we would be if I could have patented the unit!"

A couple of strange stories are attached to the history of the Monimatch. Years later I went out to sit in on a forum/display on the part of Heath Co. I was invited into the then president's office. Sitting on his desk was the Heathkit version of the Monimatch. He told me that this was one of the luckiest inventions of Heath because they sold tons of the units. I was polite but I told him that the Monimatch was first described by me in QST. He didn't believe me. But he had a bookcase with a complete bound copies of QST so I got up, walked over and took out the 1956 volumes for October and opened the book to the issue and set it down in front of him. He looked at it, read the article, noted the date, picked up the phone, and told someone to come down to his office immediately. This guy came in, whom I was not acquainted with, and the president said, "I would like you to meet Lew McCoy, W1ICP. The guy actually turned white because he saw the issue of QST setting on the desk. The president then dismissed the guy and then he said to me, "That was our engineer who "claimed he invented our unit." I tried to make things right because believe it or not, I really didn't feel it was that important, however, I never knew what really followed.

I eventually made several more versions of the Monimatch and they all appeared in later issues of QST. Warren Bruene, my good friend whom many of you know, was one of the engineers at Collins Radio, came up with a power bridge which was easy to make and was more accurate for measuring power and it has over the years replaced the Monimatch. The Monimatch is extremely accurate for measuring a 50-ohm match but the device is power sensitive, while Bruene's circuit is not. In this column, "Looking Back" I kind of have the feeling that the readers would like to hear about these relatively early happenings regarding circuits so I plan to write more on the subject. I am also working on another column about 10 meters in those olden, golden days, and how I managed to get the DXers to QSL. W1ICP

Notes on the DX-60 from page 12

ever, I recently ran a very unscientific test into a dummy load. After switching to the AM function, I rubbed my finger across the mic jack's center contact. The plate current of the 6146 increased and fluctuated—just like the manual said it should with modulation.

The Heathkit DX-60 transmitter is a classic in ham radio. It was well designed, electrically and mechanically. Its three versions (the DX-60, DX-60A, and DX-60B) were produced from 1962 to 1976—a rather long production run which attests to its popularity. Having just recently acquired one these little gems for the first time, thanks to Dick, W6ZPE, I may be a couple decades late —but the experience has been worth the wait. **ER**

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FOR SALE: R-390A Orig. Maint. Manual,TM11-5820-358-35,189 pgs - $28 incl. Dom Priority Mail. Aben, POB 4118, Jersey City, NJ 07304. avidov@aol.com

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

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FOR SALE: Tubes, Penta Labs 811A - $20; 572B - $55; 3-500Z, matched pr - $300; US NOS 811A - $35. Many other US NOS. VISA/MC. Dee, W4PNT VA (800) 755-2365, soundnmind@rica.net

FOR SALE: WW-II tuning units: TU-6,7,8,26-B and BC-306 for BC-375 xmtr, new in the box - $50 each. Steve Johnston, WD8DAS, 3350 Oakham Dr., York PA 17402. (717) 755-3920.

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3JCH, 13192 Pinnacle Lane, Leesburg, VA 20176. (540) 822-5643

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

FOR SALE/TRADE: 75A-2, 75A-4; NC-300, NC-183R; RME/4350A; TMC/SBE-2; HW-101; HW-16; HQ-110-VHF, HQ-145A. Sam Timberlake, KF4TXQ, POB 161, Dadeville, AL 36853. (205) 825-7305, stimber@lakemartin.net

FOR SALE: B&W850 final KW tank coil in very good condx, heavy duty silver plated contacts - $85 shpd. Al, W1BY, VT, (802) 878-8714, w1by@hotmail.com

FOR SALE: NIB J-45 knee code keys w/ cord/plug - $24; NIB subminiature tubes, 5798, 5907, 6112, 6BA5 - $2.50; Tektronix 130 'LC' meter, depot recond. w/ manual, cables - $85. Lowell Thomas, K6KC, POB 15026, Fresno CA 93702. (209) 227-1605, k6kc@lightspeed.net

FOR SALE: Sweep tubes! Why pay big bucks? 6KD6,6DQ6,6MJ6,6LQ6,6JB6,6JE6 - make offer. Bernie, WA6HDY, 300 James Way, Arroyo Grande, CA 93420. (805) 481-6558

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

WANTED: Marantz, McIntosh, or similar tube audio amplifier in any condition; Heath catalogs. Mike Nowlen, WB4UKB, POB 1941, Herndon, VA 20172

WANTED: Western Electric aircraft radios, xmtrs pre-WW II. Also Telephonics RS-76 throat mic. James Treherne, 11909 Chapel Rd., Clifton, VA 20124. (703) 830-6272.

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

WANTED: Top dollar paid for Winchester Radios and Winchester related items. Donald Daggett 918 Casey Cove Dr. Nokomis, FL 34275. (941) 484-7371, wc2e@webtv.com

WANTED: German W.W.2. military radio/avionics gear. Clandestine sets all periods. Cash or swap. Rag Otterstad, OZ8RO. Hosterkobvej 10. DK 3460 Birkerod, Denmark. Ph: ++45-4281 5205, otterstad@tnet.uni2.dk

WANTED: Entertainment radios, espey TRR-5; Zenith R-520; Jetronics R-853; Belmont REA; Ansley model ?. Henry Engstrom, KD6KWH, POB 5846, Santa Rosa, CA 95402. (707) 544-5179, ph/fx.

WANTED: 516F-2 cabinet, have 312B-4 same to trade; sale list on diskette - $2 refundable. Joe Orgnero, VE6RST, Box 32 Site 7 SS 1, Calgary, AB T2M 4N3, Canada. (403) 239-0489

WANTED: Collins 310A-1 &/or -3, 30J, 30K-(any) 302C-1, any mechanical filter adapters, small trim rings or any other Collins, any condx or model. Butch, KØBS, MN, (507) 282-2141

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

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WANTED: Collins 310A-1 &/or 310A-3, any condx; 30J, 30K-(any); 302C-1, 312A-1. **FOR SALE:** SC-101 lamp hoods & grills. Butch, KØBS, MN, (507) 282-2141

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WANTED: The front bezel and frequeny pointer for the E. H. Scott Navy RBO-2 rcvr. Keith Heitzmann, KK5FE, 31 Claudia Dr., Covington, LA 504-892-4538, kk5fe@communique.net

WANTED: Some sheet metal parts from junker 75A4. Can anyone help? Randy, W9ZR, (614) 965 5331, w9zr@aol.com

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WANTED: Temco 75GA; Supreme AF100, both post WWII amateur desktop xmtrs. Robert Perlstein, W1IV, POB 642, Old Orchard Beach, ME 04064. (207) 934-9206, perls@compuserve.com

WANTED: Valiant, Viking II or similar, good operating condx. Dan, K3XR, 218 Balthaser Rd., Sinking Spring, PA 19608. (610) 670 2980, k3xr@juno.com

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FOR SALE: BC610 tuning units TU52, TU54 - $5 ea.; BC610 coil, 4.5 - 5.7 MC - $10. Ron Skipper, W8ACR, N.D., (701) 776-5492. skipperclan@stellarnet.com

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NOTICE: Central Wisconsin Radio Amateur Swapfest-Auction Sunday June 7, 1998, Junction City, Wisc. Featuring both big and small dealers. Tailgaters welcome. Contact John, W9JN, (715) 457-2506, jfw9jn@tznet.com

FOR SALE: Mint SX-140 $125; Fair PRO-310, no cabinet, $150; Cosmophone 35 manuals, $25. Brian.Harris@sv.sc.philips.com or (972) 596-2914, TX.

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FOR SALE: Heathkits, AC-1 - $75; AM-2 - $20; HW-16 - $90; Hallicrafters S-38B - $70; Novex GDO - $50. All ppd. Richard Lucchesi, WA2RQY, NY, (516) 798-1230, rlucch2098@aol.com

FOR SALE: R-390 bottom cover (used mine as top) - $35 ppd in USA. Jim Clifford, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511. (813) 654-7531, j.c.clifford@juno.com

FOR SALE: Hallicrafters SX-100 - $150, SX-25 - $140; R-46 spkr - $50.00 with radio. All plus shipping; Carleton T. Rand W1PZI, 85 Black Hall Road, Epsom, NH, 03234. (603) 736-9695.

FOR SALE: S40 rcvr; S38 EB rcvr; NC98 rcvr; RME 45 w/matching spkr. PU only. KB4YST, KY, (502) 895-1705

FOR SALE: Collins 75A4 rcvr, Ser. No. 1466 w/ manual, exc condx - $800, U ship. Frank, KL7IBA, CO, (719) 632-7630

FOR SALE: BC-654 w/manual copy & PE-104 3.8-5.8Mc AM/CW 15/30 watt xcvr (ER#60), VGC, missing orig. pwr jack, key, untested - $185; BC-1306 w/manual copy 3.8-6.5Mc 8/15 watt AM/CW xcvr, like GRC-9 but smaller (ER#6), no cover, grills, tune lamp or jewel, wrong power plug, OK out, VG in, untested - $60; National NC-60 0.54-31 Mc, 4-band, 7-pin-tube, "AA-5" design rx, looks good, works- $50; Link 250 UFS RF power amp deck w/250TL, untested, looks good - $50; NARDA Microline RF heads, 0.2-0.5 GHz Mdl 18500-5 & 8.9-9.5 GHz Mdl 18500-121, exc ,untested - $10 each; BC-646 control box, empty shell, front complete, VGC - $5; VRC control boxes C-2298 & C-2742 - $15 each; F-15/U RF output lo-pass filter $12.50; SECO horiz. output tube in-line ammeter, untested - $15; Heath IM-13 VTVM, unchecked, 2 knobs wrong, w/probe - $10; two automotive test sets from 1953 - T&H coil/condenser checker, VOM $10 each; B&K 440 CRT tester/rejuvenator, w/manual, untested - $20; RCA WR-64B color bar-dot generator, works, weak tubes - $20; TS-251/UPLORAN sig-gen, 1700-2010 kc, NOS- $15; Heath G-5 sig-gen, 150kc-205mc, untested - $10; modulator foundations, Muzak 8-watt audio amp - $10; Challenger CH-8 audio amp - $10; Precision S-35 audio amp - $15; Tek 504 scope dud - no light - $10. Hickok MAC-700 null amp - $5. **WANTED:** Weston 798 tube checker manual/repair info; Conar 230 & 311 manuals; male plug for PP-846 - will be inside R-394 & C-845 (buy whole unit); 2-meter conversion info for T-416; PP-448/241/242, the 3x4x6 boxes w/octal socket used inside R-108/9/10, etc; 6 meter all mode xcvr - need not work. Eric A. Jones, N4TGC, 6537 County Road 61, Florence, AL 35634. (205) 764-0675, eaj@hiwaay.net

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. (817) 799-5931, w5nwx@juno.com

FOR SALE: New reproduction HQ129-X panels - $53, ppd. Ron Hankins, KK4PK, 555 Seminole Woods Blvd., Geneva, FL 32732. (407) 349-9150, rh8421@usa.net; www.gate.net/~rh8421/radio/html

FOR SALE: Techtronics dual beam scope #555 - $35, local PU only. Allen Lurie, W9KCB, 605 E. Armstrong Ave., Peoria, IL 61603. (309) 682-1674

FOR SALE: CQ 1945 Feb., May, July, Oct., Dec. - $7 ea; 1946 CQ Feb., Mar., Apr., May, June, July, Aug., Oct., Nov. - $5 ea. **WANTED:** June '45, Aug. '45, CQ Magazine. Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (773) 262-5360, 262-0016

FOR SALE: CP-1 xtal pack, complete, tested - $125; Collins plug-in 1.8 kHz, 526 9690 010 (755-38) - $75; Collins R-648/ARR-41 orig, VG - $200. WA5THJ, RT9 Box 163, Alvin, TX 77511. (281) 331-2956.

ELECTRON TUBES FREE Catalog, over 2,000 types in stock. **Electron Tube Enterprises,** Box 8311, Essex, VT 05451. (802) 879-1844, FAX (802) 879-7764

FOR SALE: T-Shirts w/Johnson Viking logo - $15, state size. Viking Radio Amateur Radio Society, POB 3, Waseca, MN 56093.

FOR SALE: Used technical books - radio, electronics, math, military, magazines, etc. List $1 (stamps OK). Softwave, 2 Dept. ER, 1515 Sashabaw, Ortonville, MI 48462.

FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. (516) 653-5350.

FOR SALE: Dial/clock covers. Send bezel, old or drawing, make/model, guaranteed satisfaction - $10 ppd. William P. Turner, WA0ABI, 1117 Pike St., St. Charles, MO 63301. (314) 949-2210.

FOR SALE: Free info on many topics related to vintage amateur radio equipment & operations at http://www.mnsinc.com/bry/hamlynx.htm Everyone welcome. Brian Carling, G3XLQ/AF4K.

FOR SALE: New Ranger I, Valiant I & Navigator plaster dials, 160-10 freq no's in green, w/all holes like orig - $17.50 ppd. Bruce Kryder, 4003 Laurawood Ln., Franklin, TN 37067. (615) 794-9692.

FOR SALE: Zenith Transoceanic B600 - $150; Drake 2B - $175. All #10 rated. **WANTED:** B&K model 606 Dynajet tube tester. Jack, W9FQK, AZ, (520) 634-2028.

FOR SALE: 2 post war ARC rcvrs w/control box - $75 + shpg. Steve Bartkowski, 4923 W. 28th St., Cicero, IL 60804. (708) 863-3090.

FOR SALE: Galaxy base amps 600, 800, 1K, 1.5K & 2K, models available now, dealers only. Charley, (800) 536-0333.

FOR SALE: SC-101 lamp hoods & grills, KWS-1 HVB-1 fuses - $8 & 3TF4A ballast tubes - $7. Butch, KØBIS, MN, (507) 282-2141.

FOR SALE: Collins manuals HF-8050, 8010, HF80 series; R392 spkr w/connector; R388 parts; KWM2A carrying case; meter labratory pwr sply; Collins orig 50th yr book; Allied catalogs 650, 660; HP23 pwr sply, spkr, manuals; Hammarlund HC-10 converter, matching spkr; KWM-380 paper work. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402-2933. (319) 393-8075.

FOR SALE: Viking Valiant, presently using, w/book - $295; Heath HM-102 SWR/pwr meter - $30. U-ship. WA7HDL, ID, (208) 756-4147 after 0030Z.

FOR SALE: Magazines, manuals, surplus books, some surplus xtmrs, & other parts. Call your needs. Vic Edmondson, W4MYF, RT 1 Box 2599, Lee, FL, 32059. (904) 971-5580.

FOR SALE: Collins 516F-2 bias mod, parts/instr - $12, ppd/US. Cory, N2AQS, 1000 E 14th/178, Plano, TX 75074-6249. hinecilicgate.dl.nec.com

FOR SALE: BC610 in overseas packing crate, manual. BC6141 speech amp w/cables, 8 tuning units, 6 coils - $500, U ship. Frank, KL7IBA, CO (719) 632-7630.

FOR SALE: Hammarlund SP600 J25, rack mount, re-caped, works good - $225, pick up only. Larry, Cerritos Calif., (562) 860 3131, 110242.164@compuserve.com

FOR SALE: Plessy Radio PR2250 Professional HF rcvr, mint w/manual - $3000; Racal TA99 1 kw linear amp (requires pwr unit) 1.5 to 25 MHz - $600; Racal 1kw HF Servo tuned linear amp type TA349C - $1600; Racal HF xmtrs TA127, TA83, TTA371C & HF rcvr RTA191, all in orig 19 inch cabinets lage & heavy but very well made, call for info & prices; military HF automatic antenna tuner CU2351, unused - $500; HALST6000 RTTY terminal unit, mint in box - $150; Plantronics/Frederick Electronics 1280 RTTY demodulator, like new - $400; various Morse keys from Europe, call for info. Nigel Boyd, K4UGD, 4290 Day Rd., Conyers, GA 30012. (770) 414-0550 (w), 922-8546 res.

FOR SALE: Working Instructions, Wireless Set (Canadian) No. 19 Mark III, mint, 140 pgs, limited quantity - $25 US ppd. Chris Bisaillion, VE3CBK, 1324 Old Carp Rd, Kanata, Ontario, K2K 1X7, Canada.

FOR SALE: Vacuum tube VTI labeled "Licensed only for amateur, experimental & entertainment purposes" - Offer. Frank S. Law, W8SET, 1 Wildacre Rd, Charleston, WV 25314. (304) 343-0415.

FOR SALE/TRADE: Hallicrafters SX43. **WANTED:** Hallicrafters S-76. Les Mathews, WB2DQV, 421 Carvin St., Clayton, NJ 08312. (609) 881-5603.

FOR SALE: The Radio Handbook, 1937, 1938, 1940, 1947 - $10 ea, 1956, 1959 - $15 ea. Howard Edson, KK6OB, 1505 N. M St., Tulare, CA 93274. (209) 688-8506.

FOR SALE: Vietnam era complete ARC-73 digital 100-150 MHz xmtr rcvr control mount - $175. Sam Hevener, W8KBF "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286-9723. (330) 659-3244.

FOR SALE: Heath units & literature. Vic Edmondson, W4MYF, Rt1 Box 2599, Lee, FL 32059. (850) 971-5580.

FOR SALE: Collins Radio KWS1, very good - $1800 US; 75S3B WE - $900 US. Lorne, VE7BOX, Canada, (250) 675-3338.

FOR SALE: 75A-4 MHz drum decals, 20.5 or 20.8 MHz (you specify), buff color, install instructions - $8.50 ppd. W3HM, Rt 3 Box 712, Harpers ferry, WV 25425

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

FOR SALE: Yaesu FTDX-560, 80-10 meters, needs work - $175; Tram D-201A, manual, D-104 mic, nice shape - $375; Ham III rotor & control box, clean & VGC - $175; Heath HP-1144 pwr xfmr - $30. All items, U-ship. **WANTED:** LA-B amplifier working or not. Dan Langston, KO4RA, GA, (912) 453-9066

FOR SALE: NOS Eimac 304TL - $40 ea; Eimac 4CX300A - $45 ea; HK 4E27 - $20 ea. GNTD; X-EC HM-103 VFO-exciter w/ps - $75. All + shpg. **WANTED:** Bandswitch knob for Hallicrafters SX-100; control box for Hygain roto brakde 400; plug-ins for HP180 series scope. Donzil, W5OF, AZ, (520) 772-1297

FOR SALE: Harris RF-550 rcvrs, AM, LSB, USB, ISB, RF-583 tuning option, mint condx, checked, serviced - $795. Shawn Daniels, MO, (314) 343-5263

FOR SALE: T-195/GRC-19 maintenance kit - $15; ARRL Handbooks 1963, 1955 - $25 ea; Jones Radio Handbook 1938 - $35; Command sets (CQ) - $30. Gary, MN, (612) 496-3794

FOR SALE: Repair! Radio repair, tube or solid state, reasonable rates. Jim Rupe, AB7DR, Western Amateur Radio Repair Co., (WARRC), 998 Whipple, Grayland, WA 98547-0697. (360) 267-4011

FOR SALE: Collins repair: FCC Licensed Technician, we repair the Collins Gray Line i.e. S-Line, KWM-2/2A etc. & other select models. Merle, W1GZS, FL, (352) 568-1676

FOR SALE: R-390A Repro nameplates - $9 shpd. N5OFF, 111 Destiny, Lafayette, LA 70506. trinit69@dt.net, (318) 989-3430

FOR SALE: Johnson Valiant, exc condx - $300. Marty, NJ, (609) 466-4519

FOR SALE: NCX-5 xcvr, NCX-A pwr sply, VX-501 remote VFO, orig manuals, fair to good condx. Fred Clinger, OH, (419) 468-6117 after 6 PM Eastern

FOR SALE: Manuals & equip: Collins, Drake, Hallicrafters, Heath, Hammarlund, National, RME, Johnson & others. Free list. Richard Prester, 131 Ridge Rd., W. Milford, NJ 07480. (973) 728-2454

FOR SALE: 75A2, 32V3, extras, CCA, VG to exc - $850, PU only. George M. Bonanno, K2XL, 34 Charles St., Clifton, NJ 07013. (973) 746-5953, k2xl@webtv.net

FOR SALE: General Radio 1650B LCR bridge - $250 ppd. Boonton 202J 195-270 MHz AM/FM signal generator - $125 ppd. Gregory Muir, CO, (303) 747-2274, eves

WANTED: Very early Hallicrafters and Hallicrafters/Silver Marshall equipment including Skyriders with entire front panel dull aluminum color, S-30 radio compass, S-33 Skytrainer, S-35 panadaptor, wood console speakers - R-8 & R-12, HT-2, HT-3, BC-939 antenna tuner, parts, advertising signs, paper memorabilia of Hallicrafters. Also want RCA model AVR-11 airport tower receiver. Chuck Dachis, WD5EOG, "The Hallicrafters Collector", 4500 Russell Dr., Austin, TX 78745. (512) 443-5027

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

WANTED: WW II Japanese, German, Italian radios & communication equip for display in intelligence museum. LTC William L. Howard, 2191 Harborview Ln., Largo, FL 33770. (813) 585-7756, wlhoward@gte.net

WANTED: BC348, EH Scott rcvrs only in very good condx. EA4JL, contact in the States, Kurt Keller, CT, (203) 431-6850

WANTED: Manual schematic, parts list for Heath IP-2728 & ps; SW-717 rcvr. Paul Gregg, W9POC, 725 College Way, Carmel, IN 46032. (317) 846-3094.

WANTED: BC610B speech amp, 250TH, 100TH, 2A3 tubes. PU NE area. John, NH, (603) 437-2819.

WANTED: A Drake T-4 or T-4X xmtr in exc condx. Jerome Roebuck, 1003 Melrose Ave, Chula Vista, CA 91911. (619) 420-2265

WANTED: Conar 400 rcvr panel, V70D tube for Globe King 275. Chuck, K6KDZ, CA, (916) 273-6847.

WANTED: Two ea, 8-pin Jones type pwr connectors for BC-348; type PL-Q102 straight or PL-Q103 rt. angle. KA1ZQR, CT, (860) 535-1286.

WANTED: VFO knob for Ranger II or Valiant II; modulation xfmr for B&W 5100, need not be orig. Andy, KA0SDT, 201 Moore Dr., LaCrescent, MN 55947. (507) 895-8926

WANTED: SX101 tuning knob & S-meter; manuals for TS413 signal generator, Olsen KB47 cap checker, Sams CB eleven. Bill, ND, (701) 772-6531.

WANTED: For BC-1031A Panoramic adaptor, coil assembly, oscillator reactor, Z101-01. Looks like an IF xfmr; also outer case, or a parts unit w/these parts on it. Jon Chamberlin, 1458 Wilderness Dr., Maumee, OH 43537-2621. (419) 893-1737

WANTED: Manual, operation & service for Racal TRA931X xcvr; MA937 sply. Joe, W7ISJ, 10332 Camino Dela Placita, Tucson, AZ 85748. (520) 886-3087

WANTED: Kleinschmidt teleprinter models: 311, 321, (AN/FGC-40, AN/GGC-16, AN/UGC-39...) Tom Kleinschmidt, 506 N. Maple St., Prospect Hts., IL 60070-1321. (847) 255-8128

WANTED: Old tube amps & xfmr's by Western Electric, UTC, Acro, Peerless, Thordarson; Jensen, JBL, EV, Altec, WE spkr's. Mike Somers, 2432 W. Frago, Chicago, IL 60645. (312) 338-0153

WANTED: CB radio equip. I am looking for all types of old/vintage CB radio, amps, manuals, magazines, mics etc. Walter, CA, (818) 297-7249

WANTED: Valiant II; Swan 600R Custom; Hammarlund SP600-JX21A; TMC GPR-92. Ric, C6ANI, POB N4106, Nassau NP, Bahamas.

WANTED: Nixie tubes, National Electronics NL9055, NL5859CS, or Burroughs B58595. Jim Clifford, KE4DSI', 108 Bayfield Dr., Brandon, FL 33511. (813) 654-7531. j.c.clifford@juno.com

WANTED: EV638/641; Astatic UT-38, 820, JT-30/40, T-3; Shure 54PE/545S, CR81/80; Turner BX/CX. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225, Fax 328-4217, tomsmics@flexcomp.com

WANTED: Hammarlund SP600-JX17; XC-100P xtal calibrator; ARRL Antenna Handbook 2nd-Edition; EFJ Ranger II in VG-exc condx. Brian, IL, (888) 851-4202

WANTED: Minerva Tropic Master W117 rcvr, working condx. Will pay up to $100. Wally Gibbons, WB7ASQ, 1520 E. 2100 N., North Logan, UT 84341. (435) 752-2929

WANTED: Radio Handbook, First Edition, published May 1935. Lynn Stolz, N8AJ 428 Hopewell Dr., Powell, OH 43065. (614) 885-5428

WANTED: Table spkr for National HRO or RAS rcvr; S meter for 40s-50s HRO series; Globe Scout 40, 40A, 65, 65A, 66 or 680 xmtr; coax relay, Heath SB-10; manual for WW2 GF series xmtr; B&W Turret. Thanks. Greg Greenwood, WB6FZH, POB 1325, Weaverville, CA 96093. (707) 523-9122 (message) http://members.aol.com/gregb6zh/

WANTED: 3051 thermal relay; housing for B+ cannon plug J402 on KWS-1; xmtr kits. Brian Roberts, K9VKY, 130 Tara Dr., Fombell, PA 16123. (724) 758-2688

WANTED: Schematic for BC-348-0 rcvr. Charles R. Lackey, W4QBE, HC-10 Box 567, Lakemont, GA 30552. (706) 782-3670

WANTED: Military survival communications equip: radios, beacons, manuals, books, historical info/photos. Daniel Cahn, 3444 Greenwood Ave., Los Angeles, CA 90066. (310) 398-7159. danielc411@aol.com

WANTED: KWT-6 WRC-32 modules, extender cables & extender boards. Rolynn, K7DFW, 23471 Cedar Grove Rd., Clatskanie, OR 97016. (503) 728-4157

FOR SALE: New list -hundreds of manuals, schematics and service information. Send 2-stamp LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857-2805. (401) 934-1845

FOR SALE: Join SPAM, the Society for Promotion of AM. Learn about Advanced Modulation Certificate, Circuits - $1 plus large SASE 3 stamps. W4CJL, 202 Baker Dr., Florence, AL 35630.

FOR SALE: Galena xtal radios &/or parts to make your own. Len Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150. (716) 873-0447

FOR TRADE: Two good RCA 833A's for one Taylor 833A; also looking for Taylor 803, 813, 875A. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455. johnh.walker@alliedsignal.com

FOR SALE: Large stock fixed & variable air capacitors (xmtg) - SASE for list. Bill Riley, W7EXB, 863 W. 38th Ave., Eugene, OR 97405-2375. (541) 345-2169

FOR SALE: HQ120X - $135; HQ150 - $145. **WANTED:** Heath HX-10 pwr sfmr. W7RBF, AZ, (602) 864-9987

FOR SALE: 1946-1996 QST, CQ, HR, & 73, total issues, 1570 - $300, if local PU, - $700 mailed. Details: SASE. Hal Layer, KK6HY, POB 27676, San Francisco, CA 94127. (650) 366-5060, hlayer@worldnet.att.net

FOR SALE: New Collins 500 kHz filters 2.75 kHz wide, plugs into 51J-4 for extra 12 dB gain - $125. Walter M. Chambers, K5OP, POB 241371, Memphis, TN 38124-1371. (901) 761-9381

FOR SALE: Hundreds of books: ARRL; Rad; Lab; RCA, Receiver Design, 2-stamp SASE for list. Charles Brett, 5980 Old Ranch Rd., Colorado Springs, CO 80908. (719) 495-8660

FOR SALE: New Release: Send 2-stamp LSASE for Olde Tyme Radio's latest flyer No. 197 to: Olde Tyme Radio Co., 2445 Lyttonsville Rd., Ste 317, Silver Spring, MD 20910. Ph/Fax (301) 587-5280

FOR SALE: Ancient (30s - 40s) neons, one watt 110V, size 1-1/4 inch globe - $5 ea, 7.50 for two, etc. Request info. Charles Graham, 4 Fieldwood Dr., Bedford Hills, NY 10507. (914) 666-4523

FOR SALE: Collins Repair. I specialize in S-line equipment. Reasonable, & work guaranteed. Steve, N6HK, Box 1136, Goleta, CA 93116. (805) 967-7466

FOR SALE: RCA WV-77-E Voltohmyst, WO-33-A 3 inch scope & WR-59-C sweep generator - $25 ea, + UPS. Ken Tountas, TX, (254) 772-7307

FOR SALE: (4) 2MFD 7500V filter caps - $10 ea. Franicis Waggoner, W2PTI, 268 Barben Ave., Watertown, NY 13601. (315) 788-1621

FOR SALE: Collins WE 30L-1, v.g.c., copy of manual - $485, shpd CONUS. Mike, CA, (209) 322-0459

WANTED: Anything related to Tecraft & Ameco, cheap stuff only; Tecraft pwr sply & manuals. Bud Fritz, N3SFE, 104 2nd St., Montgomery, PA 17752.

WANTED: Military sets WS #29 Canadian A set; US DAS-2 Loran rcvr-indicator. Leroy Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123

WANTED: Collins R389, 30K-, 310-, 399C-1, KW-1, HF80 i.e. HF8014, 851S-1, Hallicrafters SX-115. Richard, WAØAKG, NE, (402) 464-8682

WANTED: National SW-3 model I, 2 volt version, Taylor 203Z, T-21 tubes. Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: R-901/GR rcvr; #48 key; manual for Navy DP-12 rcvr. Tom Brent, Box 1552, Sumas, WA 98295-1552. (604) 826-4051

WANTED: T-368 or GPT-750 xmtr. Jeff, W9XRT, WI, (414) 962-6383. obitt@csd.uwm.edu

WANTED: National NC303 & spkr, exc to mint. James B. Geer, WB5LXZ, 1013 Overhill, Bedford, TX 76022-7206. (817) 540-4331

WANTED: GSB1-SSB adapter for Technical Material Corp rcvr GPR90. Ray, VK4FH, POB 5263, Daisy Hill, Brisbane, Australia 4127.

WANTED: Heath HW-32, HW-22 & HW-10. Pete Cullum, KØWRX, 1332 Harlow Blvd., Rockford, IL 61103. (815) 965-6677

WANTED: WW-2 Japanese military radio of any kind. Takashi Doi, 1-21-4, Minamidai, Seyaku, Yokohama, 246 Japan. Fax: 011-8145-301-8069, taka-doi@kk.iijtu.or.jp

WANTED: Info: Learadio RCB tuning unit; Waters 369 SWR; Geloso G207DR rcvr; G212 TR xmtr. Mel, K2AOQ, NY, (716) 671-0776

WANTED: BC-610, BC-614, BC-939, TU-49, TU-52 & TBY manual. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407.

WANTED: Huge Navy equipment: shipboard & shore radio, radar, & sonar, mint thru junkers. William Donzelli, 304 S. Chester Ave., Park Ridge, IL 60068. (847) 825-2630, integrat@usr.com

WANTED: Military electronics, RDF, radar, communications, test, manuals, literature, etc. What have you got? William Van Lennep, POB 211, Pepperell, MA 01463. (508) 433-6031

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: Globe King 500, A, B or C xmtrs, any condx., reasonably priced. Terry Collins, KB9AUP, 18 N. Tomahawk Ave., Tomahawk, WI 54487. (715) 453-3707 d, 453-4633 eves

WANTED: In pristine condx.: Collins 32V3, 75A1, 3051, 270G-1, 32S3A (RE), 310B3, 30K1, mech filter adapters. Lee, W9VTC, IL, (847) 439-4700 d, 726-1660 eves.

WANTED: Hallicrafters HT-1, HT-9, HT-31, S-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: Cash for Collins: SM-1, 2, 3; 312A-1, 2; 55G-1; 625-1; 399C-1; 515-1; 302C-3; KWM-1; KWM-380; also buy estates. Leo, KJ6HI, CA, Ph/Fax (310) 670-6969.

WANTED: Manuals, manuals, manuals for radio-related equipment to buy or swap. Catalog available. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

WANTED: Broadcast gear, compressors, limiters, old mics, consoles, EQ, tube recorders, thanks! Mike States, Box 81485, Fairbanks, AK 99708. (907) 456-3419 ph/fax

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: 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: Info on 160 meter conversion for an old Collins 300FA broadcast xmtr. Fred Watson, K3BP, 581 W. Summit St., McClure, OH 43534. (419) 748-8798

WANTED: A very clean Hallicrafters model SX-62 rcvr, must be in case & good working order. Will pay top dollar. Billy Burdette, K4NJS, 764 N. Church St., APE 1012, Spartanburg, SC 29303. (864) 585-2810

WANTED: 4-3C24 or 24G tubes; 2-811, new or used. John Martin, 111 Bancroft Dr., Rochester, NY 14616. (716) 663-4182

R-390A Components

RF & xtal deck - $75
audio deck - $50
IF deck - $65
power supply - $20
PTO - $45
complete knob sets - $10

Complete units available minus top and bottom cover, minus some tubes & without meters - $125, 5 or more units - $100 each

George Rancourt, K1ANX,
82 White Loaf Rd.,
Southampton, MA 01073.
(413) 527-4304

FOR SALE/TRADE: Transmitting tubes, new & used - $0.55. LSASE for list. I collect old & unique tubes of any type. **WANTED:** Taylor & Heintz-Kaufman types & large tubes from the old Eimac line; 152T thru 2000T for display. John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455. johnh.walker@alliedsignal.com

FOR SALE: Collins 75A-4 rcvr, very clean w/ manual, working - $1100. S.T. Carter, II, W4NHC, 680 Fernwood Dr., Melbourne, FL. 32904-1995. (407) 727-3015

FOR SALE: Heath catalogs, 1954, 1956, 1957, 1958, 1961, 1962, 1973 & 1955, 1957 flyers - $80 for all; Heath Twoer - $35; IG-72 audio generator - $50; AVT-112A aircraft xmtr - $50; Type SSR-5A rcvr (spy radio) - $50; RT654A/TRC-77, 2 to 8 MHz CW - $75. Norbert C. Wokasch, WA0KJE, 3312 W. Bijou, Colorado Springs, CO 80904

FOR SALE: Control box BC944A, 5FP7 radar tube, low hours - $25 ea ppd. RJ Eastwick, N2AWC, 224 Chestnut St., Haddonfield, NJ 08033. (609) 429-2477

FOR SALE: AM equip at the Pendleton Oregon Swapfest, April 11th, various amateurs. Pat Stewart, W7GVC, 1404 Ruth Ave., Walla Walla, WA 99362-3558

FOR SALE: Repair & restoration, tube & transistor vintage radio. FCC licensed. Mike Zuccaro, 8795 Corvus Pl., San Diego, CA 92126. (619) 271-8294

FOR SALE: Rare radio rcvr reputedly from a P-39 aircraft. L. Schimmel, POB 1234, Spanaway, WA 98387

FOR SALE: PRC9 - $75; TCS5 spkr - $25; orig manuals: 3253 Pacemaker, TCS14, HQ200, CQ Surplus Conversion Manual - $25 ea. **WANTED:** RCA AVR20A rcvr. Mel Stoller, K2AOQ, 100 Stockton Ln., Rochester, NY 14625. (716) 671-0776

FOR SALE: NC300, matching spkr, manuel copy - $200; NC188, clean & works - $75; Hallicrafters S38, very good - $50; S-19R Sky Buddy, very good, manual - $90; SX24 Skyrider Defiant, good - $85; S-120, clean & works - $25; WRL Globe Sidebander, I've been told it's rare, clean & works - trade or offer; Viking Challenger, clean & works, manual copy - $100; Precision signal-marker generator, E-200-C, 90KC to 400MC, works & clean - $50. All + UPS. Dick Dixon, W7QZO, 16032 Lost coyote Ln., Mitchell, OR 97750. (541) 462-3078

FOR SALE: Swan 350, exc condx - $325. **WANTED:** Johnson Invader 200 & Central Electronics 600L amplifier. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

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MARCH SPECIALS

AMATEUR TRANSMITTERS: COLLINS KW-1, #70, works FB; KW-1, #31, needs work; 30-K w/ 31A-3 exciter; 30S-1; 32S-1; 32S-3; 30L-1; **DRAKE** T4-X; **JOHNSON** Invader 2000; Ranger; Valiant; Thunderbolt; Johnson Mobile VFO; **GONSET** GSB-100; **HALLICRAFTERS** HT-32; HT-37; HT-40; **HEATH** DX-100; Apache; HA-10 Warrior amp; **CENTRAL ELECTRONICS** 100-V w/160; **MULTI-ELMAC** AF-67; AF-68; **DENTRON** GLA-1000 amp; Command transmitters.

AMATEUR RECEIVERS: COLLINS 75A-3; 75A-2; 75S-3B; 75S-3; 312B-3 speaker; 516F-2 case only w/speaker; CP-1; DL-1; SM-1 mic; **HALLICRAFTERS** SX-88; SX-101-A; SX-71; SX-62A; SX-17; S-40B; R46/R46B speakers; **HAMMARLUND** SP-600-JX w/prod. det.; SP-600-JX-16; SP-200 (BC-779) w/ power supply; HQ-180-X; HQ-120; **NATIONAL** HRO-5RA1 complete rack set; HRO-60; NC-2-40-D w/spkr; NC-183D; NC-300; NATIONAL RBL-5 WW II LF receiver; **NATIONAL** speaker; **SCOTT** SLR-F "anti-submarine" receiver

TRANSCEIVERS: COLLINS KWM-1; 516F-1 AC; 516E-1 DC; KWM-2 w/blanker, Waters; KWM-2A; 312B-5 prototype; KWM-2 in suitcase; KWM-2 DC supplies; **DRAKE** TR-4C w/AC-4/MS-4; **GONSET** Communicator II, III, IV; **HALLICRAFTERS** SR-150; **HEATH** SB-102; HW-16; Twoer; **NATIONAL** NCX-1000; **SBE** SB-34; **YAESU** FT-101-ZD; FT-101-E; FT-101-E accessories: remote VFO, monitor scope, Landliner phonepatch, digital readout; FTDX-560

MILITARY RECEIVERS: COLLINS/Miltronix R-390-A; Arvin/Miltronix R-725; good just serviced, working R-390; R-390-A; CV-157A/Miltronix; CEI 354; **WATKINS-JOHNSON** DMS 105A; BC-348-Q; BC-453 Command receivers; **MOTOROLA** R-644/URR 20-30 MHz AM/FM receiver; Command receiver racks.

FILTERS: 75A-3 6 KHz, 800 Hz; DRAKE R4C-250 Hz.

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FOR SALE: Tube list, new & used, wide variety audio, ham. Recently expanded. SASE 52¢. Bill McCombs, WB9WNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212.

FOR SALE: Rare HRO60SC-2 spkr/10 coil cabinet - $350; Hallicrafters R46, VG - $100; Collins 270G1 - $250; 270G3 - $200. K5YY, AR, (501) 756-5010

FOR SALE: Millen 90881 RF amp & 90800 exciter - $150. Jerry, N5KYE, OK, (405) 373-2228

FOR SALE: Fiberglass rods, 5/8" dia., 13' long, UV resistant, good standoff insulators, twinlead spreaders, ten ppd - $10. Ron, K5YNR, NM, (505) 327-5646.

FOR SALE: Radio & electronics related books, 160 titles, call or write for list. Paul Washa, WØTOK, 4916 Three Points Blvd., Mound, MN 55364-1245. (612) 472-3389

FOR SALE: R-390As complete units, modules, small parts, call & ask, no covers or meters; M/C, Visa,Discover. Howard or Tony, NC, (919) 441-1360. fax 441-7322. 9 AM - 6 PM EST.

FOR SALE: Hallicrafters R46-B, spkr, clean, few scratches - $50 + shpg. Louis D'Antuono, 8802 Ridge Blvd, Brooklyn, NY 11209. (718) 748-9612 after 6 PM

FOR SALE: Classic gear - SASE for list. **WANTED:** Vintage rigs. The Radio Finder, Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. Tel/Fax (313) 454-1890

FOR SALE: Copies: Hard to find schematics for radios, also kit radios 1922-1950, manuals: test equip. ham gear. Contact me for prices, availability. Duane Ballew, KB7QZK, 6813 152nd St. Ct., NW, Gig Harbor, WA 98332. (206) 851-4505

FOR SALE: Vintage Heath test equip, parts, more! 2-stamp SASE or $1 for list. Jim Miccolis, N2EY, 126 Summit Ave., Upper Darby, PA 19082. (610) 352-5247

FOR SALE: Convert any wattmeter to read PEP! Perfect for AM/SSB - $19.99 ppd for complete kit! HI-RES, 8232 Woodview, Clarkston, MI 48348. (248) 391-6660, hires@trust.net

FOR SALE: RIT for KWM-2 and S-Line. No modifications for KWM-2. $59.95 tested/42.95 for kit. SASE for details and order info. John Webb, W1ETC, Box 747, Amherst, NH 03031.

MESSAGE: See me again at Dayton, Space 1353. Look for the WWII uniform. Sam Hevener, W8KBF, "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286-9723. (330) 659-3244

MESSAGE: "Transistor Network." Free sample! Magazine for collectors of regular & novelty transistor radios. Articles & ads. Free 20 word ad monthly. Subscription: $17 (US); $28 (Canada); $36 (Foreign). POB 43, Live Oak, FL 32064-0043

FOR SALE: Collins 75A-1, spkr, GC - $500; 180F-1 antenna tuner, manual - $200; Ten-Tec RX-10 - $200. Gary, WA9IYF, 11102 N. Hwy 421, Madison, IN 47250. (812) 273-5379

FOR SALE: Collins orig filters - $150 ea; 75S-1, 500 Hz CW INC 455.8 xtal; 75S-3, 200 Hz CW INC mount; 75A-1, 800 Hz CW; 75A-3, 800 Hz CW; 75A-3, 3.1 kHz; 75A-3, 6.0 kHz AM; F-455D, 6.0 kHz AM; KWM-2/S line, 2.1 kHz SSB INC USB/LSB xtals; 51J4, 1400 Hz - $75; pair WW2 Bathtub CW keys - $80; 8R-1 xtal calibrator, complete - $90; vernier tuning knob INC inst book suit; 75A-4, exc - $90; 136A-1, 75S-1 blanker - $80. Garry Marcon, VK3GY, 2 Lowan Ct., Frankston 3199, Victoria, Australia. (Phone) 03 9789 4363

WANTED: Triplett Modulation Monitor 1696A; Chicago splatter choke SR-500; Chicago modulation transformer CMS-3; UTC bias transformer S-51; Triad splatter chokes C-26X. Mike Ruggiero, W2NVR, Rd 3, Box 3358, Saylorsburg, PA 18353. (610) 381-3211, w2nvr@ptd.net

FOR SALE: New orig. PJ-068 mic plugs for Collins S-line/KWM-2A/HF-380 shp'd in USA - $8 ea. Clint Hancock, KD6H, 6567 Ashfield Ct., San Jose, CA 95120-4502.

FOR SALE: National NBS-1, made for the F.C.C. (special version of the NC-183), excellent condition, restored - $350; unrestored National NC 240-D with original speaker & original manual, very good condition - $300; unrestored Hallicrafters SX-17, with restored original 12 inch speaker, very good condition - $375; unrestored Hallicrafters S-9, fair condition, with schematic - $200; restored Drake 1-A, good condition with excellent condition rare matching speaker - $275; restored, excellent condition RME-69 with matching speaker & 50% original manual & copy of full manual - $400; Murch Electronics UT-2000B 2KW roller inductor antenna tuner, includes internal giant 4:1 balun, excellent, with manual - $260; various, large roller inductors and air variable capacitors suitable for antenna tuners/matching networks; KWM-2 junker for parts; unrestored Heathkit HX-11 cw novice transmitter, fair condition - $40. Mike, W5MP, 16707 Creeksouth Rd., Houston, TX 77068. (281) 444-7737

FOR SALE: Heath Station, SB-104A, SB-604/PS, SB-614, SB-634 & SB-644, GC w/manuals - $500, cash & carry. Marvin Fortune, 2957 Gaffney Rd., Richmond, VA 23237. (804) 275-1252, wa4tqj@juno.com

FOR SALE: Heath Chippewa amplifier w/HB pwr sply, not pretty, but restorable - $350, w/wout sply, pictures available to serious buyers; Johnson KW tuner, near mint - $275; Hallicrafters R42 spkr - $100. All + shpg; ARRL handbooks & other stuff, LSASE for list. WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149

FOR SALE: 10 National general coverage rcvrs - $750 for all, + shpg. Noonan, SC, (803) 726-5762.

FOR SALE: Ameco CD-1 Conelrad monitor, NIB instruction - $30; Heath MM-1 VOM - $30. K1BOX, MA, (508) 624-4340.

FOR SALE: 6 Tube Graetz Sinfonia (AM, SW) chasis, rough condx, German lettering. A great conversation piece! Make reasonable offer. Dan Langston, KO4RA, (912) 453-9066.

FOR SALE: Boatanchor paints; Heathkit Tech Journal Subscriptions; phone filters - call or write for free catalog. R&R Designs, 202 Midvale, Marshall, WI 53559. (800) 372-4287

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This video is four hours of information on how to repair, maintain and restore this classic receiver. Butch Schartau, KØBS, guides you through all aspects of keeping your own 75A-4 running like a top.
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WANTED: 4-250/4-400 sockets; 250TH tubes; calibrator for 75A-4. Dave, K9HDQ, IN, (765) 354-2884

WANTED: Military entertainment radios, Jetronics R-583, LRR-6, Zenith R-520 or any info on Morale radios. Henry Engstrom, KD6KWH, POB 5846, Santa Rosa, CA 95402. Ph/Fx (707) 544-5179

WANTED: National audio xfmr, type S101, coils, NIB parts. I love National. Sylvia K. Thompson, N1WVJ, 33 Lawton-Foster Rd., Hopkinton, RI 02833. (401) 377-4912

WANTED: Rcvrs: Guthman U17, U50; Meissner Scout. Henry Mohr, W3NCX, 1005 W. Wyoming, Allentown, PA 18103.

WANTED: National coils, dog house pwr splys & NIB parts. I love National. Sylvia K. Thompson, N1WVJ, 33 Lawton-Foster Rd., Hopkinton, RI 02833. (401) 377-4912

WANTED: To buy or trade military surveillance & countermeasures rcvrs & jammer or related gear 1960 - present. Tony Snider, VA, (757) 721-7129.

WANTED: SSB audio adapter for R390A, CV591 or MSR4. Mike Samarco, W1JZ, 111 Glen Ave., Upton, MA 01568. (508) 529-4427, before 8 PM.

WANTED: Hammarlund SP600-VLF rcvr. Harry Weber, 4845 W. 107th St., Oak Lawn, IL 60453-5252

WANTED: Heathkits SB110A, SB650, HM2103, GR78, HD8999, HM2141; Kenwood TV506 6 meter xmtr. Don, CA, Ph/Fx (818) 368-7374.

WANTED: Western Electric model 60A amp, any condx; Western Electric model 47A amp; Western Electric 244A tube; any black rack mounted Western Electric equipment; UTC model CS-293 & CS-452 xfrms; Western Electric model 134A RET choke; Western Electric model 138A condensers; Western Electric model 1B xmtr MTG; Stephens model 206AX 500 ohm spkr; Stephens model 103LX 500 ohm spkr; Stephens model 216 or P-35 500 ohm drivers. Eric Lenius, POB 685, Port Orchard, WA 98366. (360) 871-5921, lenius@tscnet.com

WANTED: Collector/builder seeks lge & small vacuum tubes & vacuum tube collections, sockets, etc. Will pay good prices. Please call Marc, OR, (800) 330-2004.

WANTED: 51J-2/3 parts. Don Stanton, WA4JLL, FL, (954) 771-1290

WANTED: National S-101 audio couplers, good or bad; NC600U or similar small neutralizing condensors; Electrovoice desk stand #419; Browning labs preselector. Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: WRL "Meteor" SB-175 xmtr & 1952, 1953 & 1963 WRL catalogs. NI4Q, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: Nems Clark radio rcvrs, service & operating manuals, parts, etc, any condx. Chuck Dachis, The Hallicrafter Collector, 4500 Russell Dr., Austin, TX 78745. (512) 443-5027

WANTED: Xmtg tube sockets, 813s, etc. Send SASE for list 4 tubes & socket extenders. Typetronics, POB 8873, Ft. Lauderdale, FL 33310-8873. (954) 583-1340, fax 583-0777

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: Keyer paddles of all kinds. Cap, WØXC, CO, (970) 247-0088. capallen@frontier.net

WANTED: Collins S-line, KWM2A, 30L-1, etc. Mark pays the most for clean gear. WD4AAS, FL, (954) 776-5996 (d), 566-0014 (n).

WANTED: Command sets ART-13's; Collins radios & all accessories top $ paid; also most radios repaired reasonable. FCC licensed. WA1DEJ, MA, (781) 485-1414 eves, hobfact@tiac.net

WANTED: Squires-Sanders equip. H. Weber, 4845 W. 107th, Oak Lawn, IL 60453-5252.

WANTED: UTC A-12, copy of MIL-T-27A spec; Fairchild, Langevin, B'cast gear. R. Robinson, 868 S. Main St., Plantsville, CT 06479. (860) 276-8763

WANTED: Repairable Gonset 903 & 913 linear's for parts & restoration, cheap. John Smart, W8JKS 1344 McDonald Hill Rd., Frankfort, OH 45628-9575. (740) 998-4518

WANTED: Pair of matching 3-inch diameter RF ammeters with a 0-5 to 0-10 amp range for antique xmtr restoration. Prefer metal bezel. If you have only one available, let me know for I might find two people with similar meters. Bob Deuel, KA7COS, POB 1181, Medford, OR 97501. (541) 482-8751, bobd@ci.medford.or.us

WANTED: Pilot lite bulbs for R-1051B rcvr or old bulbs for parts to see if I can rebuild them. Dave Sundheimer, WØNBZ, 13020 Lakeview Dr., Burnsville, MN 55337. (612) 890-1844 wonbz@juno.com

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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: Condenser, carbon and other early broadcast microphones; cash or trade. James Steele, Box 620, Kingsland, GA 31548. (912) 729-2242

WANTED: Millen 90800 xmtr; Select-O-Ject Don, W7KCK, OR, (503) 289-2326.

WANTED: Compressor amplifiers & other pro-audio gear: mics, preamps etc-tube or solidstate. Mark Linett, CA, (818) 244-1909.

WANTED: Centralab rotary switch #60B98; Westinghouse ICs #WC1146T & #WC183T; transistor for amp #sent-172 or cross reference to above. Paul, WB7SWR, 3103 Arrow Pl., Las Vegas, NV 89108. (702) 646-9041

WANTED: SBE sweep tube amp SBLA-1 or SBLA-2; also nice SX-96 or SX-100. Bill, KD4AF, (910) 699-8699

FOR SALE: Collins meatball lapel pin - $5.95 + $.75 S & H. George Pugsley, W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029

WANTED

Vintage AM equipment for personal use. Must be collector quality or mint. Prefer Collins, will consider others. Bob Tapper, K1YJK, 5 Polo Club Dr., Denver, CO 80209-3309. (303) 740-2272, FAX (303) 777-6491

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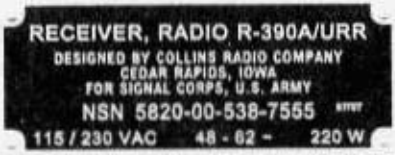

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FOR SALE: Collins 32V owners - new Raytheon 4D32 tubes- $19 while they last. Don Gies, W4GIT, (352) 475-1950

FOR SALE: Drake TR-4C w/AC-4, MS-4, D-104 mic, cables, manuals, spare tubes, exc. + condx - $400. Hallicrafters SX-43 w/R-42 spkr, manual, mint condx - $350; (2) British Wireless Sets No. 19, MK II, w/ps, connectors, manual, exc condx - $250, $300. All + pkg/shpg. Ed Field, K4GPK, RR2, Box 825, Palmyra, VA 22963. (804) 589-1293

FOR SALE: Collins KWS-1, ser #284, exc condx - $1850, OBO. Dave, FL, (352) 544-7424, dgardner@mnet.com

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Service Modification Compendium for the KWS-1, 32V and 75A series - 42 pages - $15 plus $3 S&H

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If you need a part for a vintage restoration send $2 and an LSASE (.32 postage) for a list of parts units. If you have a parts unit, consider putting it on the list.

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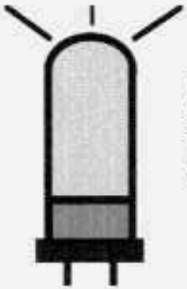

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