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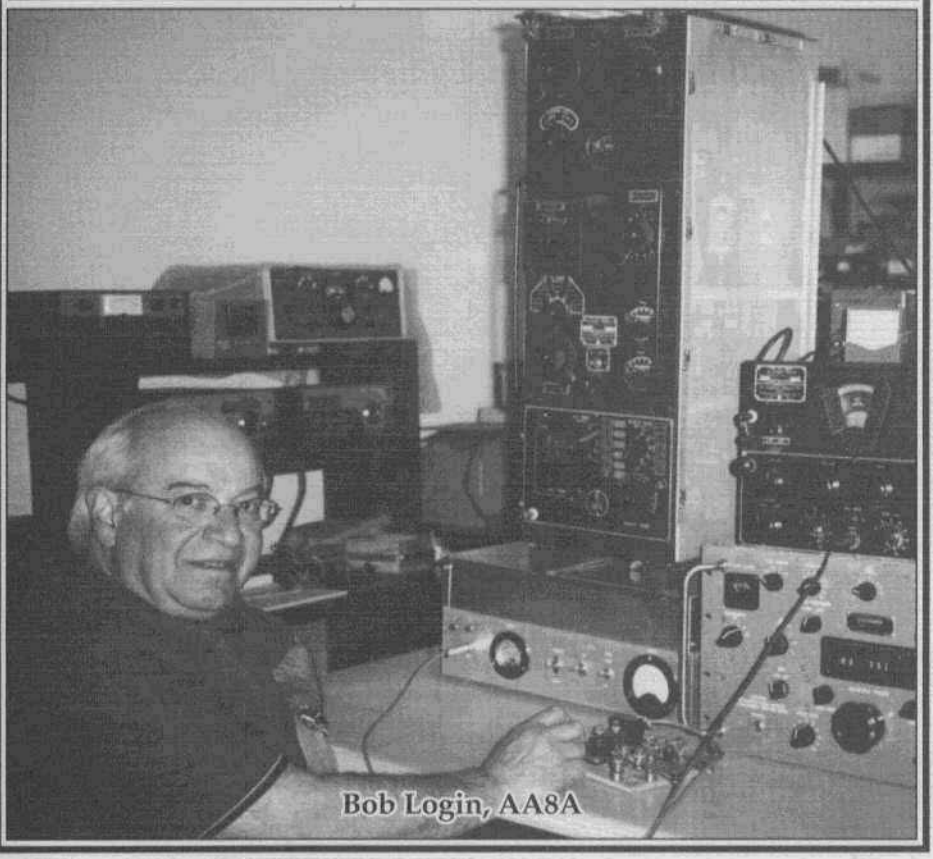
ELECTRIC RADIO

celebrating a bygone era

Number 147 August 2001



Bob Login, AA8A

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:

Bill Breshears, WC3K; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Bob Grinder, K7AK; Jim Hanlon, W8KGI; Brian Harris, WA5UEK; Tom Marcellino, W3BYM; Ray Osterwald, NØDMS; Chuck Teeters, W4MEW; Bruce Vaughan, NR5Q.

Editor's Comments

Collins 300G Broadcast Transmitter

In this issue (on page 36) I've printed a photo of my latest acquisition, a Collins 300G BC transmitter. I've decided to say a few more words about it here. It is truly a wonderful piece of equipment. One thing I find most interesting is its weight. At 1370 lbs. I believe it is the heaviest 250 watt transmitter ever built. It's also the best looking (in my opinion) and the quality of its construction is so good it's beyond mil-spec. So can we judge the quality of a piece of equipment by its weight? Probably not but as the weight of broadcast transmitters came down over the years, I think there was a corresponding drop in quality. Readers correct me if I'm wrong.

When I consider that the 300G was built in 1946 and consider what remarkable condition it's in now I wonder just how long it will stay this way. Another 50 years? Or another 250 years? I suspect the latter. Maybe even longer. Isn't that incredible to contemplate–a piece of equipment built that well.

When I went to pick up the transmitter at Delta, Colo., about 200 miles north of here, I anticipated that it would weigh about 1000 lbs. or less. When I got to the transmitter site the first thing I noticed was the manual lying on a bench. Flipping through it I saw that my estimate of the 300G's weight was way off. Two trips would be required. Out came all the heavy iron, off came the side panels and the front door. Even the manual is a work of art and hard bound. I have never, ever seen a manual for a piece of radio equipment that was hard bound. Needless to say I won't be using it when I'm working on the transmitter–a copy will do just fine.

My life is going to be immensely enriched by the 300G. Just looking at it makes me feel good. And what a rush it's going to be when I first get it on the air. It will be hard to contain my pride, "transmitter here is a Collins 300G". **N6CSW**

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Cover: Bob Login, AA8A, in his hamshack. The transmitter in front of him, a TBW Navy transmitter will be the subject of an article in next month's issue.

R-390A Mechanical Filter Update

by Ray Osterwald, NØDMS
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In the February 2001 issue of ER, I reviewed the new aftermarket Collins mechanical filters for the R-390A HF receivers that are being produced by Longwave Products. Since that article was published I have had correspondence with readers who don't necessarily think that the filter installation is easy, as I had indicated. This update will point out several areas where the experience of others will help to install the Longwave filters.

While not absolutely necessary, having a copy of the R-390A technical manual will make the job much easier. These are available from many sources, including the ER Bookstore. Study the simplified schematics and the circuit descriptions with the IF deck in front of you at your bench until you are familiar with signal flow and locations of the electrical components. Don't try to start the conversion work until you are ready, and are sure that you understand what will be involved.

The first thing to do is make some notes. Write down the wire colors going to the original filters, at the input and output filter sections. After writing down the color codes, trace out each wire routing between the filter and its destination on the bandwidth switch S503-S503 before disconnecting anything. This will fix the circuitry in your mind, and make it far less likely to make a mistake.

For reference, here are the functions of bandwidth switch sections 502 and 503, please see figure #1:

a) S502-Front is the filter input selector. It connects the 1st IF amplifier plate circuit to the desired filter input.

b) S502-Rear grounds the unused filter inputs. There is no B+ on the stock filter input coils, which are called transducers.

c) S503-Front is the filter output selector. Its pole connects to the input grid of V502, the 2nd IF amplifier.

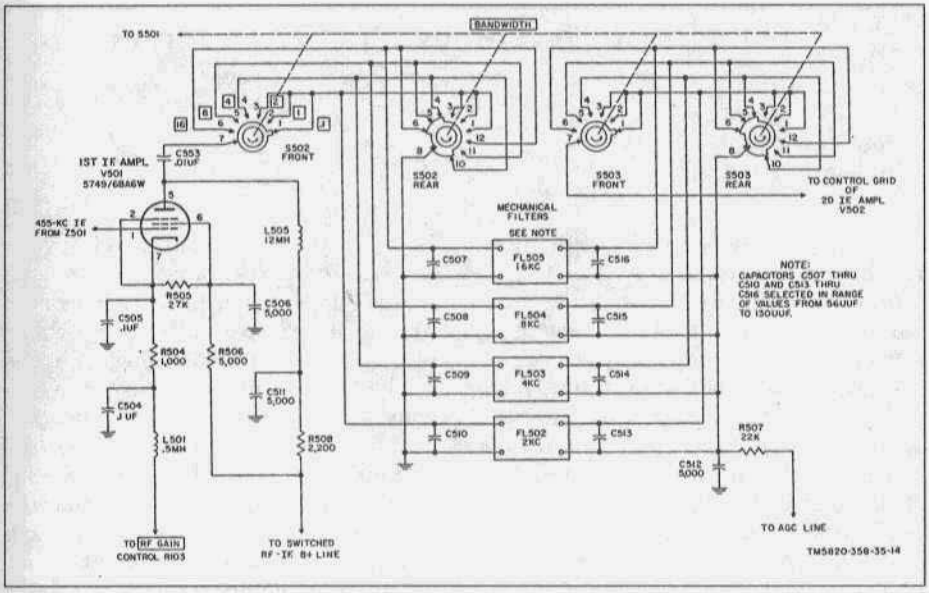
d) S503-Rear switches AGC bias to V502, which is AGC controlled. R507 is the decoupling resistor for the V502 grid circuit, and it is mounted on S503. C512, the AGC bypass, is mounted up on top, on FL504, the original 8 Kc filter.

The input side of the filters is underneath the IF chassis, and the output is on top of the chassis, underneath the metal cover that is held on with a machine nut.

The input side of the filters is DC grounded directly to the chassis with insulated bus wire. The output side, the top section, is AC grounded through C512, mounted on FL504, the 8 Kc filter. All of the other filter output "cold" connections terminate at C512, and a single wire runs back down to S503-Rear. On my receiver this wire was white/orange. You will need to preserve this wiring arrangement if you want the AGC to work right.

The Longwave filters are not polarized. Either connection can be the "grounded" side. This is because of the network used in the new filters to provide coupling and impedance matching.

If you install the Longwave 500 cps CW filter at the old 2 Kc position, which I recommend in order to get the best selectivity in the .1 and 1 Kc filter positions, check to see if the filter case for the new filter is longer than the others. If it is, it is possible that the new filter terminations will bind and short out on the bandswitch shaft. If it is not possible to rotate the filter 180 degrees and eliminate the bind, it will be necessary to rotate the filter assembly slightly inside the case to a new position. One of the end caps is soldered to the



Simplified schematic showing mechanical filters.

filter assembly for a ground, and the other is free. VERY (!) gently pry up on each end to find the loose cap. Remove it. Then you can push the whole filter assembly out of the case and reinsert it to whatever position is necessary to avoid binding on the bandwidth switch shaft.

If you leave some of the original filters in the receiver, I'd like to point out that the ceramic trimmers on the filter input and output terminals, as found in most of the R390As, are not meant to be used as an alignment point to "peak" the IF response. They were put there to flatten the passband response of the filters, and get rid of most of the ripple. To properly align them one would need a sweep generator and some way to examine the response. Peaking the IF response with the trimmers will only introduce passband ripple.

Be very careful of the phenolic tie points used throughout the R-390A They are brittle and break very easily. It is best to use plenty of solder wick and remove everything from them before removing the tie point with a hex driver. For example, the one nearest to FL502 (2 Kc) is the B+ distribution point for V501 and has wire leads and all of the dropping and decoupling resistors mounted on it. These phenolic tie points have a female thread underneath them, and just looking at the assembly from the top, one would think that the 6-32 screw and star washer that is visible from the chassis top simply hold the filter mounting and the tie point. NOT SO! There is a machine nut between the tie point and the chassis, so if you start by twisting on the screw head, the brittle tie point will snap off. Then you will have something else to fix that wasn't expected.

If you have one of the older receivers that used MFP varnish on everything, you will have to remove the varnish before you can de-solder because heat transfer is poor through the varnish. The joint will have to be clean to do a proper re-solder job. I have found the best way to start is to chip away at the stuff with a dental pick or a small jewelers' file until a small spot is opened where the solder may be heated up. The solder point must be completely cleaned

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The North Vietnamese VTS-2 Receiver

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The only known set of North Vietnamese manufacture was the VTS-2 Radio Receiver. The "VTS" designation stands for a North Vietnamese war heroine, Vo Thi Sou—apparently a heroine—although the only evidence that can be found on her is that internet search engines turn up a list of airline offices in Saigon... one of which is on a street named Vo Thi Sou.

The set was contained in a square metal box. The set was 10" x 8" x 7" and used plug-in, tube shaped coils. There were six coils, four were stored in the top of the receiver, and two were in use. It used ten D Cells for power. The use of D cells made it easy to find replacements on the local economy, a prime consideration for an army whose supply lines, better known as the Ho Chi Minh Trail, went through miles of jungle and was subject to constant bombing. In addition to these sets, the Viet Cong used a number of "homemade" sets. The set was first described in the 1967 T.I.B. While I was in Vietnam, from fall 1967 until August 1968, I never saw one of the VTS-2 sets. The first time I saw one was behind glass at the Fort Monmouth Museum in the 1980s.

In the fall of 2000, I was contacted by Dennis Hoffman of Wisconsin who had just gotten one of these sets. After several e-mail discussions, he was kind enough to loan it to me for study and display. It arrived in June 2001.

Physical layout

The set is well constructed and the outer case is made of heavy gauge sheet metal. The case is 7 inches deep, 10-1/2 inches wide and 8-1/2 inches high. The front cover is held on by four spring loaded clamps.

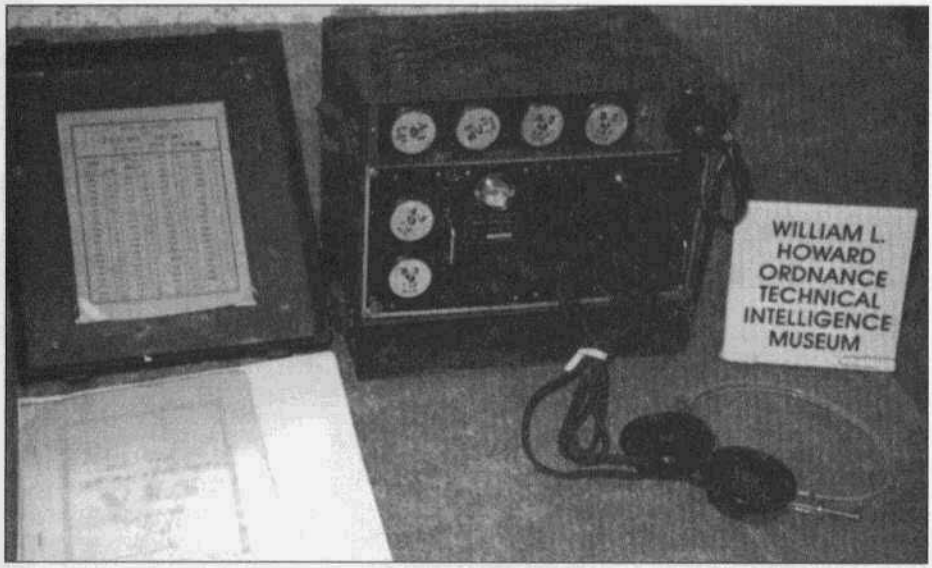
Removal of the front cover reveals detailed workmanship in its manufacture. It even has a rubber gasket to make it water proof. The front section has three compartments. The top section which is 1-3/4 inches, houses the four coils not in use and the power connector. The center section houses the radio itself and the lower compartment, also 1-3/4 inches, holds the headset, antenna wire and any other accessories or spare parts that may be issued with the set.

The front compartments are 4-1/2 inches deep. The rear compartment which is 1-1/2 inches deep houses the batteries needed to run the set. The rear cover is held closed by two captive screws and is hinged.

Several panels of spring loaded contacts hold the batteries. It appeared that there were originally cardboard tubes to hold the batteries. These have long since deteriorated. The battery terminal boards are wired together and are fed through a junction block to the power socket on the front. The power socket is a loctal tube base and the plug in coils also use loctal sockets. Power supplied to the set is 1.5 volts, 6 volts and 6 volts for a total of 12 volts.

Circuit Design and Controls

The radio set itself is a bit more complex than it has to be. It is actually two modules. These are made of light gauge metal and are bolted to the front panel by four screws for each module. The set is unique in that it is a two-tube regenerative receiver with a four-transistor amplification stage. Facing the set, on the far left, are two holes for the plug in coils. On the bottom left is a screw binding post which is for the



The VTS-2 radio receiver is the only known set of North Vietnamese manufacture.

ground connection. On top is a socket for a plug in item which was the antenna connection. It was labeled ANG TEN. This module is mounted to the front panel by stand off spacers. This allows the tuning capacitor drive unit to be mounted between the front panel and the front of the module. The tuning dial is graduated from 0 to 180. An outer knob is a speed dial and the inner is for fine tuning. The dial face is visible through a magnified lens which can be illuminated. Tuning is done by a two gang variable capacitor. The two plug in coil sockets are housed in a metal box which provides some shielding. At the rear of the module are two 7-pin tube sockets and the 1T4 tube seems to be the RF amplifier, and the 1R5 tube is the detector stage. The 1T4 socket is mounted to the metal chassis and the 1R5 tube socket is mounted on rubber spacers.

The second module is the amplification section and is a bakelite board mounted on the metal chassis. This bakelite board is where the components are mounted. It resembles the late 1940s type circuit in the days before printed circuits were used. Across the top are two potentiometers marked 1 - 10 and labeled PHAN UNG and AM LUONG. Across the bottom is another dial for a small variable capacitor, labeled DIEU CHINH CAO TAN, a slide switch labeled MO and TAT (On - Off) and to the far right are two sockets for the headset(s). One is for 4,000 ohm headsets and the other is for 250 ohm headsets. There is also a push button which lights the dial lamp. The set came with a 4000 ohm headset. An interesting feature of this headset is the plug which will allow another headset to be plugged in to the first plug so two people can listen.

It can be seen from the schematic, that this is a most unusual set. The RF stage and the detector stage are tubes while the audio amplification is transistorized. Even more unusual is the fact that the tubes, which one normally thinks of having plate voltages from 22-1/2 to 67 volts are being operated with only 12 volts.

The circuit is a regenerative grid leak circuit feeding the plate output to transformer Tr 1. Regeneration is con-

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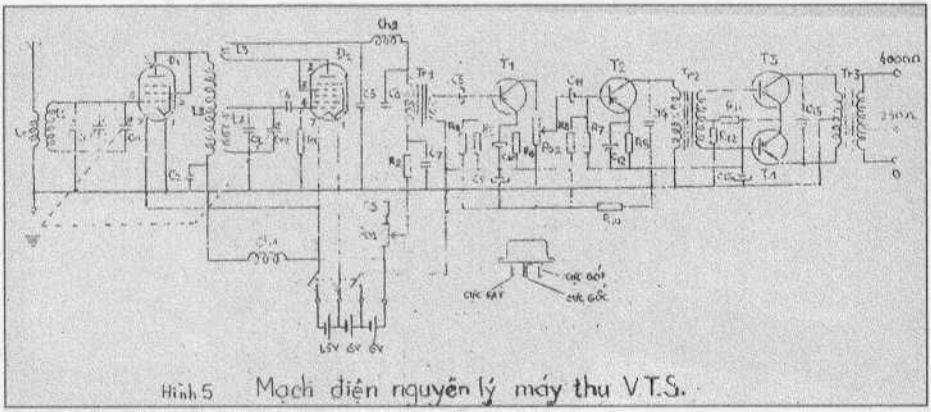


Schematic of the VTS2 receiver

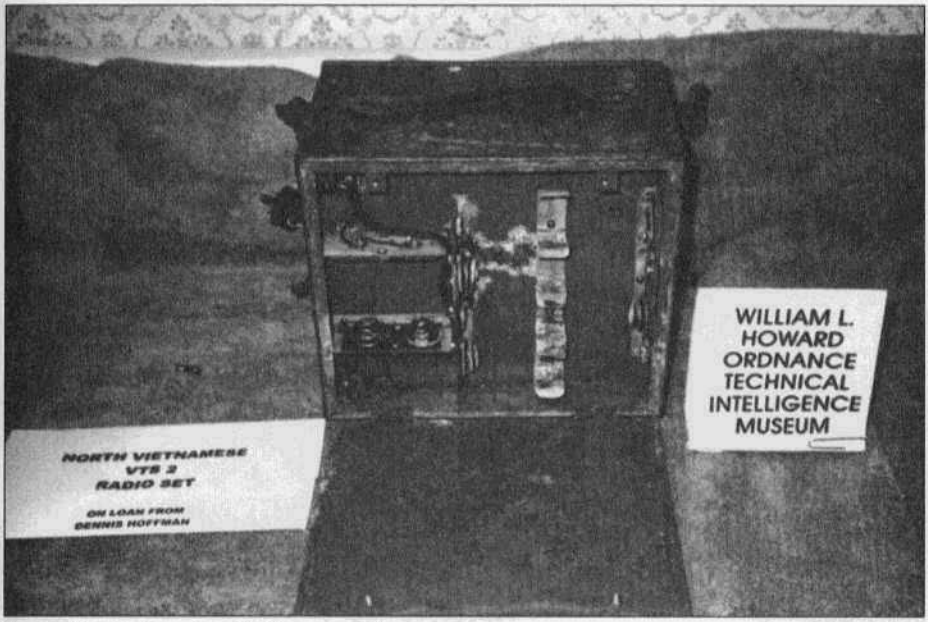
trolled by potentiometer Po 1. The output from transformer Tr 1 is then sent to the transistorized amplification module and, while I am not well versed on transistor circuits, I think the first two steps are referred to as cascade steps and then to transformer Tr 2 and then to a push-pull amplifier with its output to transformer Tr 3. Transformer Tr 3's secondary is wired to the head set plugs, the full secondary to the 4,000 headset connection and the center tap to the 250 ohm headset socket.

According to the book "***Basic Communications Electronics***" by Hudson and Luecke, "If more gain is required, transistor amplifiers may be connected together (cascaded) to provide more gain than is available from one stage alone. Most systems needing amplification will have multiple stages of gain and even have different types of amplifiers, including emitter followers. Amplifiers of this type can have voltage gains well into the thousands. Where designing cascaded amplifiers, the designer must check the last stage in the chain to make sure it is not overdriven, which would cause distortion. The push-pull amplifier uses transformer coupling at both its input and its output. This type of amplifier will have a voltage gain greater than 1 and also exhibit current gain. As with the complementary-symmetry amplifier, each transistor operates for only one-half of the input signal cycle. When the input signal is positive, transformer action produces a positive voltage on the base of Q3 and causes it to conduct. The changing current in the collector is transferred through the output transformer to the load. A negative input signal causes Q4 to conduct and its changing current in the output transformer produces an output voltage across R4. The bias provided from +V through R5 and R6 to the bases of Q3 and Q4 is such that Q3 and Q4 are just at the verge of conduction with no signal. This amplifier uses two of the same type transistors and only a positive voltage power supply."

Operating the set

The operator's manual is dated on the front page by the operator as 25 November 1964. It starts off with / General Introduction (Gioi Thieu Chung), then Part II is Components of the Machine (Cac Bo Phan Cua May). Part III Design and Theory of Operation, Part IV Maintenance and Repair, and components charts and coil data.

The set covers the frequency range from 2 Mc to 12 Mc using three different sets of coils. First one must install 10 D-cell batteries in the rear compartment. Then open the front cover and check to



Rear of set showing battery holders

make certain that you have the correct set of coils for the frequency you wish to receive. A 1 and B 1 cover, 2 to 3.7 Mc, A 2 and B 2 cover 3.5 to 7 Mc and A 3 and B 3 coils cover 7 to 12 Mc. Plug in the headphones, turn the set on and tune to the correct dial setting, based on the chart inside the front cover.

According to the operators manual, the set consisted of:

1 receiver, inside a metal box with two covers, coils (coils A1, B1, A2, B2, A3, B3); 1 headset, 4000 ohms; 1 antenna, 15 meters in length; ground cable, 5 meters in length and rod; canvas cover; bag of accessories; instruction booklet and maintenance log. The operators manual goes on to describe the features of the set. Features: The VTS receiver is designed for rapid tactical deployment and use on the shortwave bands. Amplification: a 1T4T vacuum tube serves as a low-noise amplifier, consuming low power particularly at low audio levels. Active filtering: a 1R5T vacuum tube serves as a filter and amplifier. Audio frequency amplification: type 0C71 semiconductors amplify signals and feed to the push-pull type 0C72 semiconductors to provide power sufficient to drive a headset.

A special feature of this receiver is its ability to be used as a jamming device for other frequencies, even while serving as a receiver.

Again, from the operators manual, Rear of unit: Open the back cover and you will see the battery compartment. The left compartment is for 1.5-volt A-batteries which are connected in parallel to provide filament power to the 1T4T and 1R5T tubes. The right compartment is for 12 volts which is the anode voltage for the two tubes. The 12-volt array is center-tapped at 6 volts which is used to power the semiconductors. The upper 4 batteries are designated batteries B2, the lower batteries B1. The estimated battery life was as follows:2 A batteries, about 200 hours; 4 B1 batteries, about 400 hours and 4 B2 batteries, about 600 hours.

continued next page

Top rear view of set removed from case

Construction of the set

Construction of this set shows a high degree of manufacturing skill. The front panel as well as the front cover had to have been made using a punch press. The screws used to hold components in place all have red paint applied to show they had not been disturbed or to help hold them in place. This was a common practice with WW II German radio sets and to some extent Russian sets. Construction of the outer case requires the use of a brake to bend the metal, however the two modules reveal that they are a lot more complex than they have to be. Rather than make the item from one sheet of metal, many small panels were used. I reached the conclusion that they were stamped out on a hydraulic press but one that could only handle reasonably small size parts, no bigger than 5 inches by 5 inches.

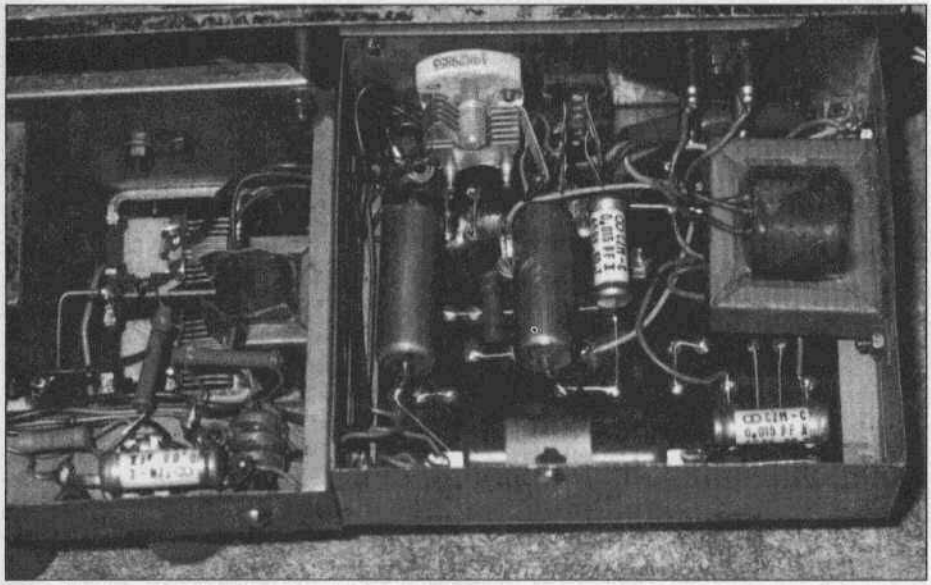
Cost of manufacturing this set

I took the list of parts and went price shopping in the Year 2000 Antique Electronics catalogue. I also listed the major manufacturing processes needed to make the outer case and chassis and estimated the costs. The estimated cost of making a single set in 2001 was $365.42 for parts and assuming a labor cost of $35.00 per hour for a technician, and assuming that the set could be assembled and wired in 4 hours, the labor cost was $ 140 .00 for a total cost of $505.42.

Of course the price of the parts in 1960 was much less and the North Vietnamese assembly workers did not get paid $ 35.00 per hour. I would guess that parts cost would be about half.

The U.S. Army Area Handbook for Vietnam , September 1962, reported the following: "The Ministry of Labor and the Ministry of Light Industry set wages in fields according to the nature of the work performed.

Salaries and family allowances, previously combined, were separated in 1959. The new law "According to



Underside view. Amplifier section on right

government sources, the average monthly industry wage increased from the equivalent of 39 dong a month in 1955 to 66 dong in 1960. A Western observer estimates the monthly earnings in 1961 as follows: unskilled workers, 40 dong; skilled workers, 40 to 60 dong; the most highly skilled miners, 150 dong; factory managers, 100 dong; government ministers, 200 dong; and engineers, 250 dong." Incidentally, a dong in 1959 was valued at $0.263 US. Considering radio assembly workers as skilled, this works out to about 71 cents per day !

Summary and conclusions

This radio set represents an effort by North Vietnam to enter the electronics field and possibly develop a capability independent of China and the U.S.S.R for completed units, however the components all came from either the Warsaw Pact or China. As it is easier to send vast quantities of parts in less space than completed sets, it may have been an effort to cut down on transportation costs and the risks involved. It also reflects a desire for a reliable set that did not depend on hard to obtain and supply dry cell batteries or complex power supplies.

It also makes use of both tubes and transistors but is not really a transition set as they manufactured nothing before except some very crude "home brew" sets and little afterward. According to my electrical engineer friend in China, the components were made in China. The variable capacitors usually used in old tube radios were made in Shanghai, China. The white ceramic tube capacitors were made in Tianjin, China— double circuit is its trade mark. They are very old, and not produced in China anymore. He thought the transistors were also made in China. 3AX**(Ge-PNP-AF). However, my ham radio contact in Russia said: "Electrolytic capacitors are from Czechoslovakia, TESLA electronics plant. Some thick green resistors look like old Russian VS types. Other smaller green and pink ones look like WW II German and postwar Russian duplicates.

Trimmer capacitors and mica caps look like Russian or, possibly, also Czech ones."

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Tx-Rx Audio Monitor

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I'll start off this article with a question. How many of you have tried to monitor your transmitter's AM signal using a receiver? If you have done this and been successful ending up with good sounding audio then you have accomplished something that I've never been able to do. I have tried several of my receivers including a R-390A, NC-303, 51J4, R-2000 and the best I could do was with my Drake 2B with its antenna terminal grounded. Well using the 2B for this dedicated function was not justified so I proceeding down another path.

My shack has four on-line stations and the direction in my shack has been to commonize functions thereby simplifying the setup and reducing the amount of hardware. For instance I have a common oscilloscope in the main transmission line. This allows viewing the outgoing waveform no matter which station is on-line. This idea was carried further with another scope to monitor the I.F.s of any of my receivers. So I thought why not continue this concept and use the RF as a source for my audio monitoring. In fact that's what I did and by adding another inductive pickup to the station RF monitor box I was off to the races.

Figure 1 shows the finished unit. The front panel and cabinet may be recognized by some as a Heathkit Reflective Power and SWR Bridge Model AM-2. The only pieces saved were the power switch, cabinet, front panel, meter, SO-239 connectors, and the internal bracket. Admittedly if I had a cabinet without the large meter hole, the meter would have been left out from the project. Also notice I have included a classic touch by leaving the Heathkit name on the meter face and used some knobs from a Johnson Viking II transmitter.

This project's initial intention was to reproduce good quality transmitter audio. This soon changed at the breadboard level of testing to monitor both transmitted and received audio. Just try listening to your transmitted audio during a QSO with headphones and then turn it over to the other party and listen with your speaker. You soon will get tired of taking the headphones on and off.

The Heathkit cabinet lends itself very well to this project as you can see in Figure 2. The audio board is on the right and the left board contains the switching circuit that allows transmitter/receiver audio toggling. The stock bracket was retained because it is needed to fasten the front panel to the back of the cabinet. The power supply is a 'wall wart' of the 18VDC variety. The RF pickup, as previously discussed, is located in another box and the Detector is housed in a small aluminum box attached to the rear of the cabinet. After reading this you may ask why did I spread out the circuitry to so many boxes? Well the answer is simple. When dealing with audio, 60 Hz AC, and RF you must isolate as much as possible if you want high quality audio reproduced. Much experimenting was done and yes you can combine some of the circuits into one housing if you are willing to accept less quality in the audio. Obviously I

Figure 1. Front panel.

wasn't willing to accept this and being "techno-compulsive" in nature what you read and see in this article will produce extremely clean, crisp audio using all RF power levels.

The RF, detector, and audio circuitry are shown in Figure 3. The inductive pickup for this project is two turns of #14 wire closely spaced to the main RF line which also has two turns of #14. Not shown is another two turn coil in this same box that drives the station RF monitor scope. The pickup is terminated in a RCA chassis jack. A short length of RG-174 connects to the detector circuit. From here the signal is fed into a capacitor coupled FET source follower. The output of this is again capacitor coupled to the high side of the audio gain control. The LM386 is an 8 pin DIP IC audio amplifier connected in the standard configuration. The contacts for K1 are shown in the output of the IC amplifier. Note the normally closed state of the relay is used for feedthru of receiver audio to the headphones. Various schemes of transformers were tried to avoid using the relay and associated electronics but none worked as well as total isolation achieved with a relay. Also note the point at which audio is taken and fed back to point "A" located on figure 4.

Figure 4 shows the circuit that toggles the audio between the transmitter and receiver. It is basically an audio operated relay that uses a type 555 IC configured as a monostable multivibrator. The two transistors, one PNP and one NPN, act as a fast switch when a negative audio pulse inputs point "A". The transistors are nothing special and just about any small switching types in your junk box will work fine. The Threshold Set control sets the trip point of this switch associated with the level of the incoming negative pulse. The 100K ohm delay time control combined with the meter resistance, shunt and 47uF capacitor control the time the relay stays closed. The relay is a 9VDC Radio Shack unit part number 275-0005A. Since I had the large hole in the front panel, I decided to use the meter as stated earlier. Now

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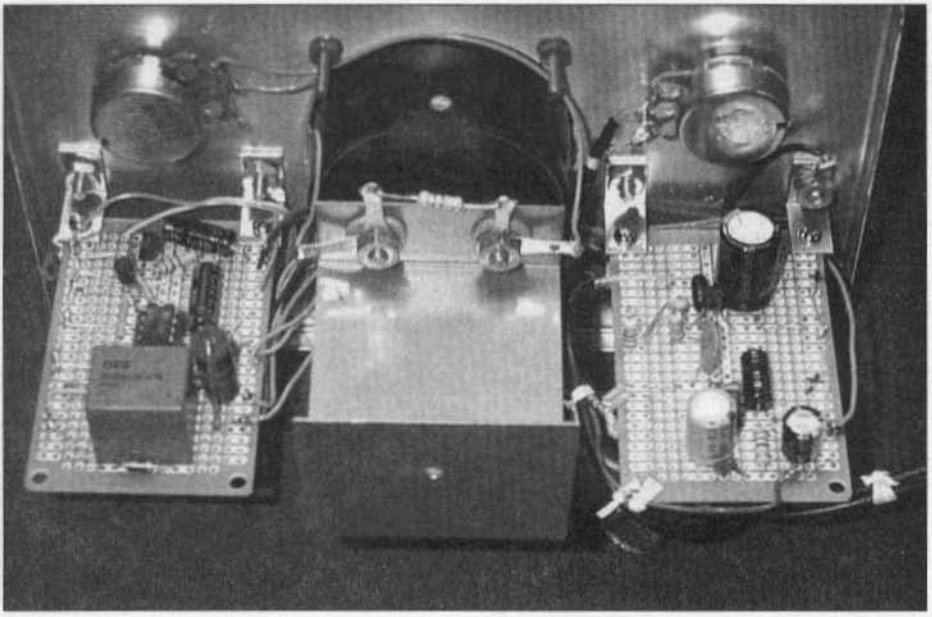

Figure 2. Internal layout.

what to do with the meter to make it a functional part of the unit. Ah the light shines bright once again. Why not calibrate it to read the Delay Time of the multi-vibrator thus you see that is what happened. The 470 ohm meter shunt was chosen for a full scale reading of the meter which is a time delay of one second. At one second delay the time delay control is approximately mid-range. By turning the Delay Time control from its mid-range position the calibrated meter will read from 1 to 5 seconds of delay.

With a completed and connected monitor, the first thing to adjust is the threshold set control. After finding the trip point of the switching circuit and thus the relay, this control is turned the opposite direction a small amount. Now set the delay time control to say 3 seconds. Plug in a cable from the receiver's headphone jack to the Rx input of the monitor. You should now hear the audio from the receiver. Next turn on the transmitter and start speaking. The monitor will detect on the first word and toggle to the Tx audio mode and you can adjust the Audio Gain to suit. As you speak the meter will be constantly moving from the set point of 3 seconds downward and you can see the multi vibrator reset on every word. As long as the multi-vibrator doesn't time out you will be listening to your transmitted audio 100% of the time. If you are a slow talker and there is more than 3 seconds between words then you will need to use a longer Delay Time of say 4 or 5 seconds to avoid the constant toggling between transmitter and receiver audio.

For the really slow thinkers and for testing purposes, I've included S2 that will pick and hold the relay for as long as S2 is closed. Caution, if this method is used, the circuit will not revert back to receive audio on the last word of your transmission. With S2 open and after the last word of your transmission, the Delay Time will time out and the circuit toggles back to receive audio. Remember the longer the Delay Time is set for the time between words, the

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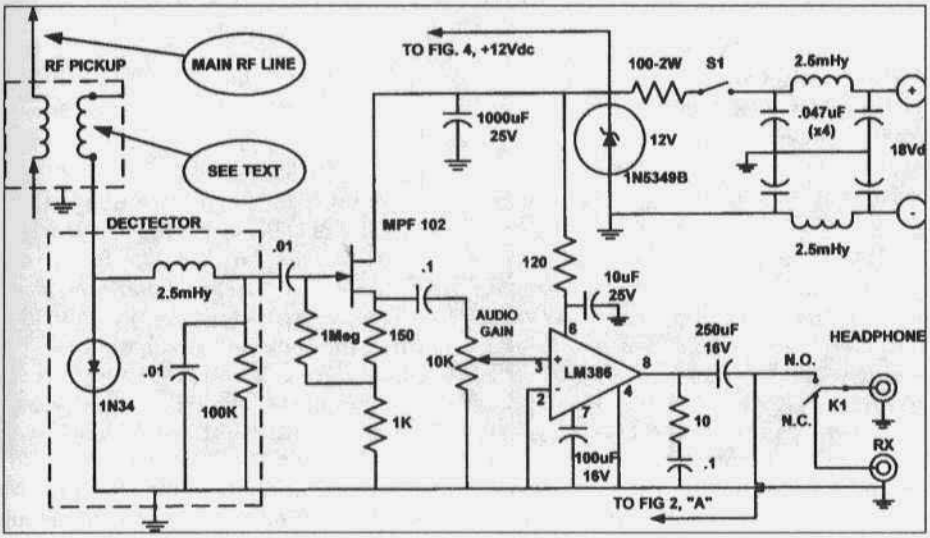

Figure 3. RF, Detector and Audio circuits.

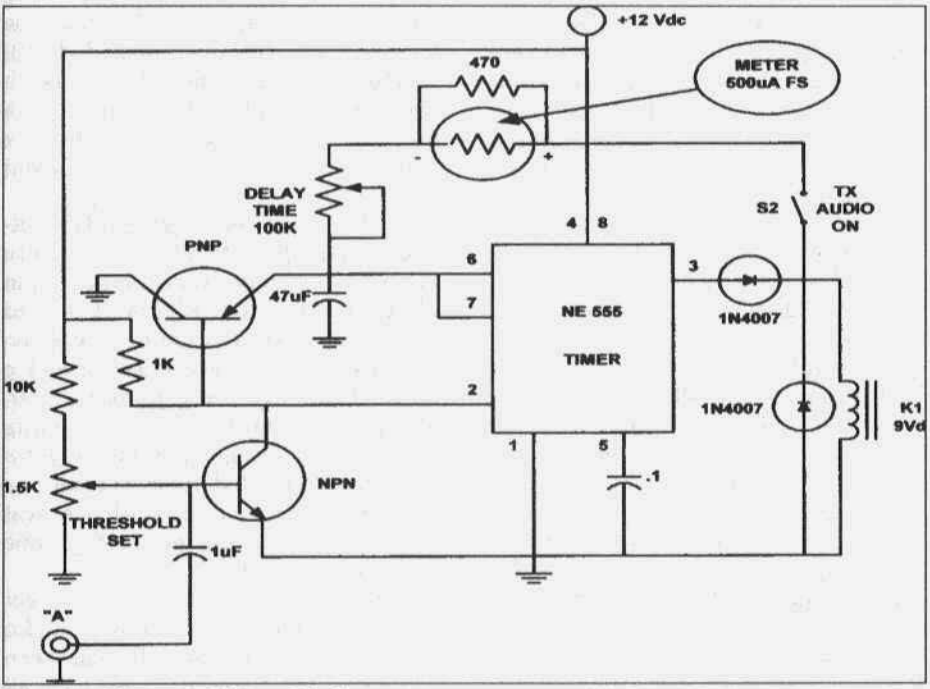

Figure 4. Monostable multivibrator.

Adding an AM Filter to a Drake TR-4CW

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The rig I'll be talking about has been around since 1963 in the form of the TR-3, TR-4, TR-4C, TR-4CW and TR-4CW/RIT. The last two rigs are the ones most sought after, since these where the very last tube-type transceivers that Drake had made in the late 1970's before the solidstate TR-7 transceiver. The Drake TR-4 series has always been a great sideband rig, since the crystal filters are about the best in the business, even today with all the "DSP" stuff out there. The TR-4 uses two filters, one for upper and one for lower sideband, 2.1 kHz wide with a shape factor of 1.6 to 1. This is great for sideband, but AM is out of the question for the receive end. Listening can be frustrating, since the bandwidth is really too narrow for AM. Swinging the "VFO" to one side or the other of the filter, brings up the intelligibility better than if you were to center it.

A note on the different designators of TR-4's: The TR-4CW has a 500 cycle CW filter, the TR-4CW/RIT has the same CW filter, along with the receiver incremental tuning (RIT), or clarifier for the newer ham. RIT was the name given by Hallicrafters in the SR-150 transceiver, when it came out in 1962 and it stuck for many of the American made rigs back then.

There is one other minor change that can be done to the TR-4CW, before the AM filter is added. The transmit function of this rig on AM uses a carrier-controlled type of audio. Basically carrier is inserted at an audio rate along with a tube controlling the screens of the finals. This will sound similar to sideband, but has carrier added, so a diode detector can recover the audio, with plenty of pumping action. This is OK, but having a little more resting carrier sure makes for better sounding AM. I've played around with the screen modulator tube V-14 (13DE7). I lifted the cathode (pin-8) and inserted 100K to 330K 1/2 watt resistor to ground. A potentiometer of similar value would be better so you can adjust the amount of carrier—about 10 to 20 watts will do. Remember the finals for the TR-4 are 6JB6 sweep tubes and are only good for about 20 watts of plate dissipation per tube. Another extra addition that is very helpful to the finals is a small 12 volt DC muffin fan pulling air out the back. I rectified the 6.3 VAC filament supply and added a 470 uFd filter cap to feed the 12 VDC fan with about 8 VDC volts which makes for a quiet fan. Do this mod first as the new AM filter would be in the way if you did it later.

The TR-4CW was the easiest of the TR-4 series to try the AM filter mod in, since the extra switching required is already in place. I have a TR-4CW/RIT, I've used on AM for years but the receive is too narrow for me. The TR-4 series do provide the capability to use an external receiver, along with muting and antenna switching. This is great and many folks do that, but I wanted to see if I could use the receiver in the TR-4, since it has great full bodied audio and the "AGC" is one of the best around!

At the Dayton Hamfest last year I met George the owner of International Radio Corporation (INRAD), who has been producing the many filters we have all come to know as the Fox-Tango filters. He had a 9 MHz filter for AM that looked like it would work in the TR-4CW. INRAD

Front panel of the Drake TR4CW transceiver. Note the AM position on the sideband switch where the CW position was originally.

is the only company that I know of currently providing this type of filter. It is a 9 MHz experimental filter, #2311 in the catalog. The price is $98, not bad for a new filter of this type. The impedance is 500 ohms, just what the doctor wants for the TR-4! INRAD's phone number is (541) 459-5623 or qth.com/INRAD, e-mail is: inrad@rosenet.net.

As I said before the TR-4CW has the CW filter in it and now it has to come out. I know some of you CW folks will not like this, but maybe in the future I'll have another addition to this article for using both filters. The factory CW filter is larger than the AM filter, so there will be some drilling involved. The factory CW filter was added behind the two sideband filters on the bottom (very clever) and there is just enough room for it. I always wondered how Drake could just keep adding to this rig and still make everything fit. Well, now the bracket or plate that the CW filter is mounted on has to come out.

1) Carefully unsolder and remove the two gray coax center leads from the CW filter.

2) Remove the two grounds from the mounting screws on the mounting plate.

3) There are two nuts holding the plate in the front of the sideband filters, just loosen the nuts and pull off the mounting plate.

4) Leave the coax leads off for now and refer to the schematic for the next item.

Transmitter change if desired:

5) You will see V-14 (13DE7) just under where the CW filter was mounted.

6) Cut the lead on pin-8 going to ground and add a 100K to 330K 1/2 watt resistor to ground. You could use a potentiometer and mount it on the back for carrier insertion. The values will very depending on how much output you want on AM (remember not too much—10-20 watts should do).

Back to the AM filter:

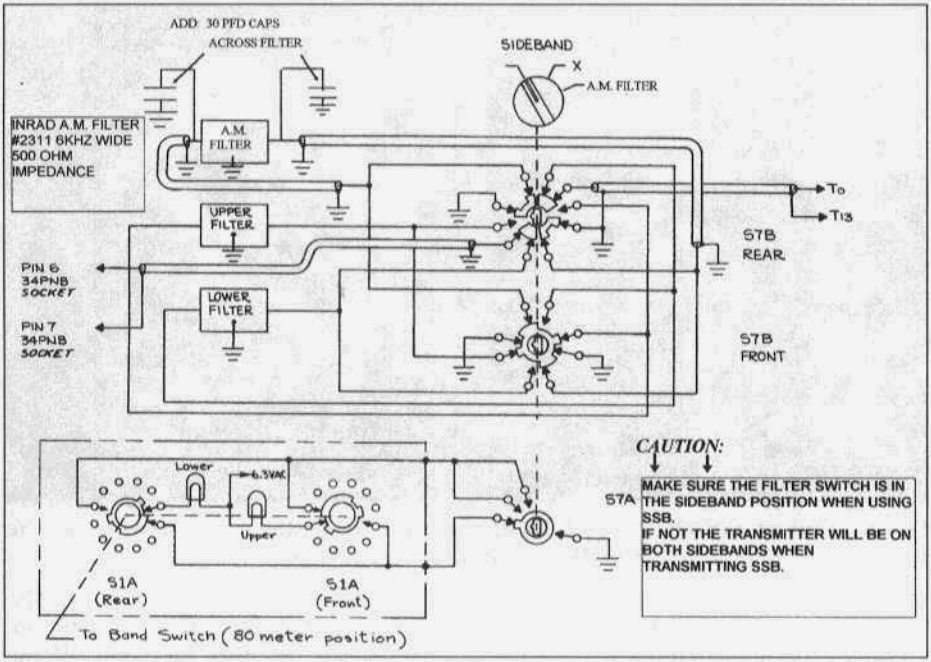
7) Pull the CW filter off the mounting plate and set aside.

8) There is one hole already there in the middle, so only three holes have to be drilled out for the AM filter. Line up the AM filter and drill the holes.

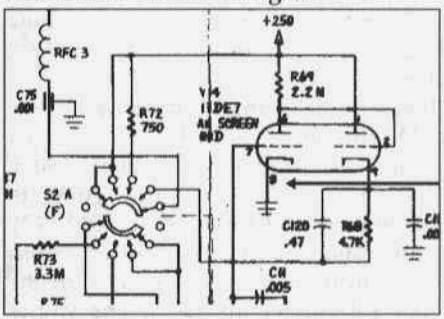
9) Mount the AM filter, and make sure there are no shorts where the filter leads are coming through the holes.

10) Mount the plate back on to the mounting screws.

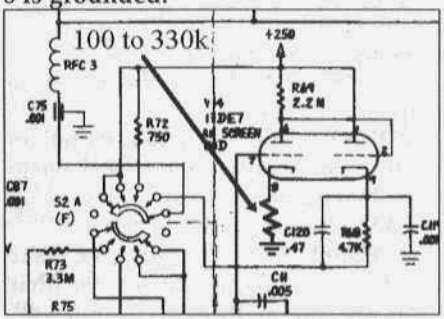
continued next page



TR4-CW schematic diagram



Stock 13DEF modulator. Note that pin 8 is grounded.



Modified 13DEF circuit. Note resistor added to pin 8.

11) There should be just enough length of gray coax for you to solder the two center leads and use the one mounting screw for the grounding of both coax cables.

12) Solder two 30 pFd caps across both sides of the AM filter. If you don't have them it should still work OK.

13) Now check to makes sure all the connections are good and you are ready to try it out.

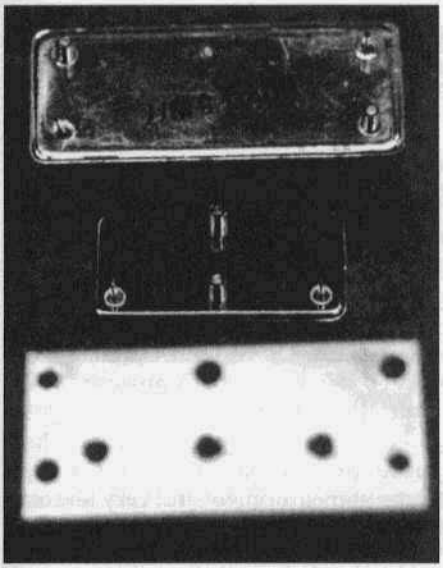
14) Tune in an AM signal on any band, 40 meters is good—CHU is on 7335 kHz. Use the narrow filter to center the signal and now switch to the marked 500 Hz filter, which is now your 6 kHz AM filter. You should be able to tune across the signal and see the difference in audio quality and clarity.

Now you're ready to check the transmitter section:

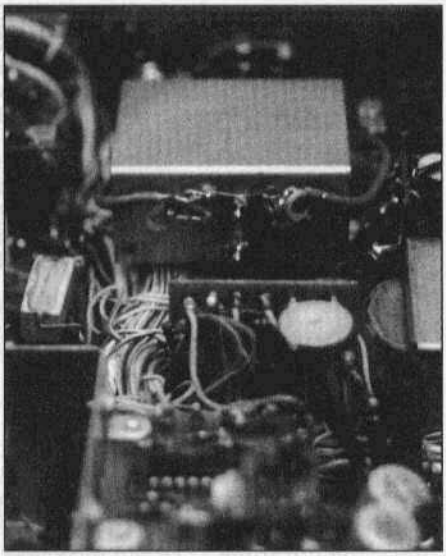
1) Put your filter in the "X" position on the switch.

2) Go to sideband mode and set your bias at 100 mA (.1 on the meter).

3) Tune up as you normally would for



The CW filter that was removed is shown at top; the new AM filter is in the center and the factory plate drilled for the new AM filter is shown at the bottom.



The AM filter in place.

maximum output.

4) Switch in the AM filter.

5) Now go to the AM mode and check for the amount of output you have, it should be idling at around 150 to 200 mA—10 to 20 watts no more than that!

6) As the mic gain is brought up to about 12 o'clock position, talk into the mic at about 6 to 10 inches away and the audio should sound very natural, with just a wiggle on the plate current meter and wattmeter.

7) If you have another receiver, you can hear yourself with headphones to get an idea of how it will sound on the air.

8) Remember the transmitter should be tuned for max output in sideband position, so the output final tank circuit will meet the peaks as you talk.

CAUTION: MAKE SURE YOU PUT THE NEW FILTER SWITCH BACK IN THE SIDEBAND POSITION WHEN USING SSB, OR ELSE YOU WILL BE TRANSMITTING ON BOTH SIDEBANDS!!!!! I only mention this, since the narrow sideband filters are what select the proper sideband. The AM filter is 6 kHz and it will pass both sidebands.

For the folks that have the TR-4's and TR-4C's, I would suggest using a pair of 12 volt DPDT relays, that would be common to the filter matching transformers T-6 and T-13, then mount a small switch on the back of the rig and use the same voltage for the cooling fan I mentioned earlier. You could mount the AM filter near the SSB filters and have the relays do the work.

Now that this is all done, you're ready to go on the air and have a blast on AM. I hope this article has sparked some interest in using an old American transceiver. Now you can enjoy AM without having to lug around a large transmitter and receiver. I've been using my modified TR4-CW for a whileand I've been getting good audio report. And of course the receiver is much better having the wider filter installed. ER

Fort Tuthill Hamfest Report

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The Ft. Tuthill Arizona Flea Market took place as usual on the last weekend in July from dawn to dusk. Vendors began setting up on Thursday evening and things started with a bang at 6:00 AM on Friday morning. The weather was wonderful, and of course very hot, but there were no thunderstorms this year. The vendor's most valuable asset was something to provide shade at their display space, sunscreen and water to avoid dehydration. Attendance was somewhat sparse, as many flea market spaces that usually fill out on Saturday morning went unclaimed. For the first time, admittance was charged at $1.00 for each buyer but no one seemed to mind. Buyer attendance appeared to be down this year compared to the last few years. The majority of attendees appeared to be typical, older generation hams with a few ladies and tolerant wives with a few younger hams rounding out the mix.

The show was again a typical ham radio flea market with just a little computer equipment and very few craft sellers. The majority of the vendors were selling radio oriented items with a great number selling VHF/UHF gear. There was a preponderance of Yaesu, Kenwood and ICOM gear in all flavors from HF to UHF. US Tower had a very impressive mobile tower display that

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Attendance appeared to be down this year compared to the last few years. From left to right: Foster Paulis, W4HCX; Ron Hinze and Rich Baldwin, KD6VK.

VINTAGE NETS

Arizona AM Nets: Sat & Sun, 160M 1885 kHz at sunrise,75M 3855 kHz at 6 AM MST, 40M 7293 kHz 10 AM MST; 6M 50.4 MHz on Sat. at 8 PM MST; 2M 144.45 MHz, on Tue. at 7:30 PM MST.
West **Coast AM Net** meets Wednesdays 9PM Pacific on or about 3870kc. Net control alternates between John, W6MIT and Ken, K6CJA.
California Early Bird Net: Saturday mornings at 8 AM PST on 3870.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3860 +/-
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net controls are Andy, WA4KCY and Sam, KF4TXQ. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours.
Colorado Morning Net: An informal group of AM'ers get together on 3875 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.
DX-60 Net: This net meets on 3880 at 0800 AM, ET, Sundays. Net control is Jim, N8LUV, with alternates. This net is all about entry-level AM rigs like the Heath DX-60.
Eastcoast Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is Ted, W3PWW. Saturday mornings at 0500 ET on 3885 + or - QRM.
Westcoast Military Radio Collectors Net: Meets Saturday evenings at 2130 (PT) on 3980 + or - QRM. Net control is Dennis, W7QHO.
Gray Hair Net: The oldest (or one of the oldest - 44+ years) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:00 PM EST & 8:30 EDT. http://www.crompton.com/grayhair
Vintage SSB Net: Net control is Andy, WBØSNF. The Net meets on 14.293 at 1900Z Sunday and is followed by the New Heathkit Net at about 2030Z on the same freq. Net control is Don, WB6LRG.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet on Tues nights on 3805 at 2100 Eastern and on Thur nights on 3875. West Coast 75M net that takes place on 3895 at 2000 Pacific
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Collins Collector Association Monthly AM Night: The first Wed. of each month on 3885 kHz starting at 2000 CST (0200 UTC).
Drake Users Net: This group gets together on 3865 Tuesday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, W8NS; Rob, KE3EE and Huey, KD3UI.
Drake Technical Net: Sunday's on 7238 at 8PM Eastern time hosted by John, KB9AT
Swan **Users Net:** This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. NC is Will, AA6DD.
Old Buzzards Net: Meets daily at 10 AM Local time on 3945. This is an informal net in the New England area . Net hosts are George, W1GAC and Paul, W1ECO.
Canadian Boatanchor Net: Meets Saturday afternoons, 3:00 PM EST on 3745.
Midwest Classic Radio Net: Sat. mornings on 3885 at 7:30AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics. NC is Rob, WA9ZTY.
Boatanchors CW Group: 3546.5, 7050, 7147, 10120, 14050. 80 on winter nights, 40 on summer nights, 30 and 20 meters daytime. Nightly "net" usually around 0200-0400 GMT. Listen for stations calling CQ BA, CQ GB.
Wireless Set No. 19 Net: Meets the second Sunday of every month on 7.175 +/- 25 kHz at 1900Z (3760 +/- 25 kHz alternate). Net control is Dave, VA3ORP.
Hallicrafters Collectors Assoc. Net: Sundays, 1730-1845 UTC on 14.293. Net control varies. Midwest net on Sat. on 7280 at 1700 UTC. Net control Jim, WB8DML. Pacific Northwest net on Sundays at 22.00 UTC on 7220. Net control is Dennis, VE7DH.
Nets that are underlined are new or have changed times or frequency since the last issue.

How to Repair a Transmitter

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Part One

Now that you have your boatanchor receiver working, it's time to get busy on a matching transmitter. This article will give you some tips on fixing up tube type, AM/CW transmitters.

Most of the tube era CW transmitters are really more simple than even the smallest superhet receivers, which is why so many hams either rolled their own our built them from kits. Even an S-38, the "Radio That Amazed the Experts," because it worked so well on so few parts, has six stages, local oscillator/mixer, IF amplifier, detector/AVC, two audio stages and a power supply. The plain S-38 with no suffix letter also has a BFO and a noise limiter. Very few transmitters approach that level of complexity in their RF layout. The 275 watt Johnson Valiant has only four stages, a vfo, crystal oscillator/buffer, multiplier, and final amplifier, as does the Heath DX-100 and Elmac AF-67. Many classic boatanchors have only three stages, the DX-60, Globe King 275, Harvey-Wells Bandmaster TBS-50, and Hallicrafters HT-20 to name just a few in my collection. Two stage rigs also abound, including my DX-20, Millen 90800, Globe Scout and Chief, and the famous ARC-5 Command Sets. You will even find single stage, crystal oscillator transmitters, many home built from the pages of QST or the ARRL Handbook, and some commercials like the Conar 400 and the Ameco AC-1. The point of all this is that in general, most transmitters are much less complicated than receivers and thus much easier to repair and get on the air. So if you've already restored a receiver, do not hesitate to tackle a transmitter.

Danger, High Voltage!

There is one warning that I need to make right up front. The B+ and RF voltages in every one of the transmitters I've mentioned so far are enough to hurt or even kill you! So be careful when you are working on a transmitter, especially a live one. Use suitable caution when you are making measurements or adjustments inside. A good general rule is to keep one hand in your pocket. You might get a shock, but it will go through just one hand or perhaps one arm, not something more critical. Do not trust the bleeder resistors to discharge the power supply filter capacitors, short them to ground just to be sure. Keep your fingers away from parts that are hot with RF, even if they are at ground potential for DC. RF makes a particularly deep burn in fingertips that takes quite a while to heal. And it will strike an arc to a grounded conductor that is not even touching it. Try it with an insulated screwdriver some time if you don't believe me. While you are working on your transmitter on your bench, it is a good idea to arrange the AC plug so you can pull it out without reaching over or being close to any potential emitter of sparks or flame. That happens rarely, but you should be prepared.

Tools and Instruments

If you're still with me, let me suggest some tools and instruments that you should have when working on a transmitter. All of the tools and meters that you've accumulated for receiver work will be handy here as well. (My recommendation included good, needle-nosed pliers and regular pliers,

a wire cutter and insulation stripper, a soldering gun in the 75 to 100 watt range, some rosin core solder, safety glasses for soldering, screwdrivers, a set of Allen wrenches, an electric drill with assorted bits, a good light, a good bench vise, a set of socket wrenches, an assortment of clip leads, and a good VOM or VTVM.) Your VOM or a selection of current reading panel meters will be particularly handy since you are likely to be measuring currents. In addition, it's very important to have a dummy load to absorb the output of your transmitter while you are tuning it and working on it. Find a Heathkit "Cantenna" at the at the next swapfest. It will look like a black, gallon paint can with white writing on it and a UG-259 coax connector in a small mini-box on the lid. A Cantenna looks close to a 50 ohm load on all frequencies through 2 meters, and it can swallow 200 watts continuously and a kilowatt for 10 minutes when filled with transformer oil. If you can't find one you can always use an ordinary 120-volt light bulb rated around the power output of your transmitter. It won't be a 50-ohm load, but it will let you know what happens to your power output as you tune up, and it will flash impressively with keying and modulation.

Another instrument that you really should have if you are going to operate AM phone is an oscilloscope. Even the simplest oscilloscope with nothing but a Cathode Ray Tube and a power supply can be connected to provide the trapezoidal pattern that will tell you what your modulation percentage and linearity are. A scope with a horizontal sweep and either a vertical amplifier with enough band pass for the RF output frequency of your rig or with a direct connection to the vertical deflection plates will display an RF wave-envelope pattern and audio patterns within the modulator, both useful for estimating modulation percentage and for tracing distortion. A scope with adequate RF bandpass can also be used as an indicator when you have to neutralize a triode amplifier stage. A scope with a triggered time base will let you look at your keying waveform, important for evaluating and eliminating key clicks.

A grid dip meter/oscillator (GDO) is also handy for transmitter work. It is a tuned oscillator with its coil outboard so that it can be coupled to the coil of a tuned circuit whose resonant frequency you want to know. The meter on the GDO will "dip" when the GDO is tuned to the circuit's resonant frequency. Heath, Eico and other companies made kit GDO's, and Millen and General Radio built very good commercial ones. Whichever one you get, make sure that it has the plug-in coils that cover the ham bands you are interested in. Knowing the resonance of a tuned circuit can be very handy at times. For example, when I decided last fall to tune up my Globe King 275 on 3545 KC for the Classic Exchange, all of the meters on the transmitter indicated it was properly tuned but my SWR meter, which had previously been indicating zero reflected power on 3545, was going through the roof. I got out my trusty Millen GDO and found that the driver and final in the Globe King were both tuned up on 5317.5 KC (well alright, I certainly couldn't read the GDO that close!), the third harmonic of my 160 meter vfo instead of the second. It turned out that the final grid tank (tuned circuit) would not tune down to 3545, but it hit 5317.5 just fine. I added some fixed capacitors across the coil, and then the Millen told me that it was tuning where I wanted it. Thanks to the GDO my problem was solved and I managed to snag some CX stations instead of getting a pink ticket. By the way, most GDO's also work as a passive, frequency meter in their "diode" mode, so you can use them to tell what frequency a particular transmitter stage is putting

continued next page

out. That is how I actually first found out that the Globe King was making RF at the wrong spot.

You can make a "tuning loop" all by yourself with a pilot light bulb and some insulated, hook-up wire. Wind a couple turn loop into the center of an 18 inch length of wire - your thumb will do just fine for a temporary coil form - and then twist the ends together, starting at the loop, to form a twisted-pair lead. Attach a panel bulb, for example a #40, 6.3 volt, 150 milliamp bulb with a screw base, to the far end of the twisted-pair. A socket for the bulb would be convenient, or you might even solder the wires to it. You "operate" the tuning loop by placing it near (but not too close) to a tank circuit coil. When the associated stage or antenna transmatch circuit is tuned to resonance, the bulb will light to its brightest. This simple little gadget is a good way to find out if a stage is working and an aid in tune up. My 1950's Elmer, W4KKB, used such a loop to tune up both the crystal oscillator and doubler stages on his home brew, 10 meter mobile transmitter. Long before I ever knew what SWR was, I successfully used a tuning loop on my antenna tuner to match my home brew 2E26 novice rig to my center fed Zepp antenna. A panel-size neon bulb, like the NE-51, will also glow in the presence of RF and can be used, carefully, as a hand-held RF indicator.

Get an ARRL Handbook

An ARRL Handbook, vintage 1952 through 1965, is an absolute must for anyone new to transmitter repair. If you grew up on transistors and don't have a good background in vacuum tubes, start by reading Chapter 3, Vacuum Tube Principles. You will learn that a tube is basically a vacuum, field effect device and that the cathode to plate current is controlled by the voltage between the control grid and the cathode. As long as the grid is negative with respect to the cathode, essentially no current flows in the cathode-grid circuit, and the tube can be driven by a high impedance source. Pay particular attention to the "classes" of amplifier circuits and how they are biased. In Class A, the control grid is biased negative with respect to the cathode but so that the tube is still conducting and so that the plate current is essentially linear with respect to changes in grid voltage. In Class B, the control grid is biased (approximately) at the point where the plate current is just cut off. Positive excursions of the grid from that point allow current to flow, but negative excursions do not. Two tubes connected in Class B, push-pull each works over half of the operating cycle, so they form a highly efficient, linear amplifier often used for high power, audio frequency modulator stages. Single tubes biased in class B function as linear amplifiers in RF service. In Class C, the control grid is biased beyond cutoff. A Class C stage normally conducts between 150 and 180 degrees out of a 360 degree, sinusoidal cycle. Class C amplifiers are not linear, even in push-pull, but they are efficient RF amplifier stages. Because they are non-linear, Class C stages generate harmonics. The tuned "tank" used in the plate output circuit filters out most of the harmonics if the amplifier is intended to be a "straight through" amplifier, or it selects the desired harmonic if the amplifier is operated as a frequency multiplier. There is also a class between A and B called, of course, Class AB. The tube is biased so that conduction occurs over more than 180 degrees (class B) but less than 360 degrees (class A) of the cycle. Push-pull class AB stages make very efficient audio amplifiers, and single tube class AB stages make linear RF amplifiers.

The control grid in Class A and AB stages may or may not be driven more positive than the cathode. It is always driven more positive than the cathode

in a Class B stage. When the grid is driven more positive than the cathode (Class A2 or AB2), current starts to flow in the grid-cathode circuit and the impedance presented to the driver stage then changes for that portion of the cycle. To insure good amplifier linearity in the case where the grid is driven positive, the driving amplifier must have a very low impedance output and it must be capable of supplying power as well as just voltage swing. If the grid is not driven positive, the stage can be driven from a high impedance "voltage amplifier" and it is sometimes designated as Class A1 or Class AB1. The grid is also driven into conduction in a Class C stage. The usual method for determining when a Class C stage is driven properly is to measure the average (dc component of) its grid current.

Chapter 6, titled either "High Frequency Transmitters" or "Oscillators, Multipliers, Amplifiers," will introduce you to all of the oscillator, multiplier and amplifier circuits in your transmitter. It will show you the common crystal and variable frequency oscillator circuits, tell you about RF power amplifier tank circuits and coupling power out of them, tell you how operating bias is applied to these stages, and show you how amplifier stages that tend to oscillate on their own can be stabilized. It will discuss parallel and push-pull amplifier circuits, grounded grid amplifiers and frequency multipliers. It will show you several examples of transmitters from a few watts to a kilowatt designed and built in the ARRL laboratory in sufficient detail for you to build them yourself today if you can find suitable parts.

Chapter 8 or 9, titled "Audio Amplifiers and Double-Sideband Phone" or "Speech Amplifiers and Modulators," will cover the theory and practice behind your AM modulator, from microphone through the modulation transformer. It has a table of "Resistance-Coupled Voltage-Amplifier Data" that will tell you what components should be used with what tubes and the resulting stage gain to expect. It will show you several built-up examples of modulators that again you may build yourself. There will be a section or a following chapter on "Amplitude Modulation Methods" offering more theory behind plate modulation and grid modulation. There will be a section in the chapter on "Testing and Monitoring Transmissions" or on "Amplitude Modulation," called "Checking AM Phone Operation" that will show you how to use an oscilloscope to observe the trapezoidal and wave envelope modulation patterns. It has photo examples of how those waveforms look under various conditions.

There will be a chapter on "Power Supplies" that will tell you about rectifier and filter circuits, plate and filament transformers, voltage stabilization and bias supplies. It will contain examples of typical power supplies.

Keying circuits and key click evaluation and elimination are covered in the chapter on "Keying and Break-In" or on "Code Transmission." In the back of the Handbook, just in front of the index and the catalog pages, you will find operating data and base information in the "Vacuum Tube Data" section on every tube in the RF, audio, and power supply stages of your transmitter.

In summary, the ARRL Handbook is a gold mine of information about your transmitter, and you should read at least those sections that I have mentioned above before you begin repairing your new boatanchor.

If you have devoured your ARRL Handbook and you yearn for yet more knowledge there are several other good

continued next page

books you might acquire. The "Radio Handbook" published by Editors and Engineers and edited by Bill Orr W6SAI, is "written especially for the advanced radio amateur and electronic engineer." It gets into a bit more technical depth than the ARRL Handbook does without becoming unreadable. Look for an edition copyright in the 1950's or 1960's for good vacuum tube transmitter information. If you really want the ultimate, find a copy of the "Radio Engineer's Handbook" by F. E. Terman. It was written for the professional radio engineer.

Get a Manual

If at all possible, get a copy of your transmitter's manual. Although you can trace the schematic if necessary, and you can figure out how to adjust and tune up without it, having a manual or at least a schematic will give you the information that the original manufacturer wanted you to have. The same people who supply manuals for receivers also have them for transmitters. W7FG at www.w7fg.com, HI Manuals at www.hi-manuals.com, and the Manual Man at www.manulaman.com are all good sources. You may also be able to find a free copy on the web at http://bama.sdc.edu/.

Put your manual and any other info you might collect into a folder on your transmitter. You will want to keep notes on your repair work in the folder too. A good record of what you do now can help you or your transmitter's next owner when more work needs to be done in the future.

Time to Look Inside

It's about time now to get inside of your new prize. Be careful when you are lifting it, especially if it is one of the heavier rigs. If getting inside involves removing screws or other small parts, find a safe place to keep them so they won't get lost. I usually use a baby food jar that I keep on top of my HQ-105 bench receiver. My buddy Mac, WQ8U, rests his project rigs on an old piece of carpet when he is taking them apart and moving them around. It keeps them from getting scratched, and it catches the screws and other little things that fall out and keeps them from getting forever lost on the floor.

Once you have the box or cabinet open, take a careful look around for any missing or damaged parts. Clean up any obvious dirt - I use Formula 509 and some paper towels for light cleaning after I evict the mud-dauber wasps and remove their nests with heavier weapons. Check the power cord. If it has any cracks or taped over spots, replace it. If it is a three-wire cord, make sure the green wire is attached to chassis ground. Check the fuses. Make sure that they are good and that their holders grip them tightly. Check the "accessory" sockets, usually found on the rear wall. Make sure that the correct jumper plugs are in them or that they are wired across properly on the inside of the socket. Check to make sure that the tubes in the sockets are the right ones. Test the tubes if you can. At least check the filaments for continuity with your VOM/VTVM. If you can't do a full test, don't worry. Weak or dead tubes will show up soon enough in your operating tests. Look at the solder joints, especially if your rig was built from a kit. You may find some that need to be re-flowed or ones where excess solder ought to be removed. If at all possible, find out when and whether the rig worked the last time it was used, or if not what seemed to be wrong with it. Among the thirty-odd rigs I currently have, one Globe Chief 90 was mis-wired, apparently by its original builder, so that the oscillator never did work. I was the first person ever to put that rig on the air! So keep in mind, especially if it was built from a kit and you don't know for sure whether it ever worked, that your rig might possibly be wired incorrectly.

If you find some obvious changes or additions during your inspection, do not always assume sabotage. A previous owner may actually have made some needed improvements, like the guy who added a final grid current metering circuit to my Hammarlund 4-20, or like the shaped, screen grid keying circuit I added to my Globe King 275's driver stage to get rid of its key clicks. In particular you may find improvements that allow the grid bias to be adjusted on the modulator tubes in a Valiant or DX-100. For the moment just make note of the changes you find and try to figure out what they are supposed to do. Ask your friends who might have the same rig - including the guys on the Boatanchor Reflector - whether their rig or a later model has the change or upgrade that you have found. (And see my later remarks about finding modification articles.) If the changes prove to be troublesome later on, you can always return things to their original condition.

Turn all of the knobs and make sure that the switches, pots and variable capacitors work smoothly. Inspect the tuning capacitor plates for shorts. Blow or vacuum out the dust between the capacitor plates. A squirt of DEOXIT on the switch contacts - rotate the switch while it is wet - and in the tuning capacitor wipers would be good preventative medicine.

Check out the Power Supplies

Once you have the previous residents evicted and any obvious problems fixed, it's time to check out the power supply. Depending on the complexity of your rig, it may have one or more relatively low voltage B+ supplies in the 250 to 400 volt range for the low level RF and audio stages, one or more high voltage supplies in the 600 to 3000 volt range for the RF final amplifier and high power modulator stages, and a bias supply that develops negative voltage for fixed bias on the final and modulator.

The first thing I do for the power supply is to check out the transformers and chokes. Typical resistance for the power transformer primary will be a couple of ohms. The primary should measure as an open circuit to the transmitter chassis ground. Typical high voltage windings will measure about 25 to 100 ohms from each rectifier plate to the winding center tap that is usually grounded when the supply is on. When the center tap is not grounded, the high voltage windings should measure as an open circuit to ground. Filament windings will measure a fraction of an ohm. A filter choke will typically measure 50 to several hundred ohms. Check the resistance to ground on the filament windings that supply the high voltage rectifier tubes and on the filter choke windings. They normally run at high voltage potential with respect to ground, and they can develop a short to ground. The filament winding for the 866A high voltage rectifiers in my Viking Valiant shorted to ground. Fortunately the rest of the power transformer survived, so I just ran with an auxiliary filament transformer for a while until I finally did away with the filament transformer entirely by replacing the 866A's with silicon diodes. If the winding on a filter choke is shorted to its case but the choke is still otherwise functional, you may be able to recover it by mounting it off the chassis on insulators. Ceramic blocks or some Plexiglas will do nicely. Just be very careful not to touch the choke body while the transmitter is powered up, because it will be at B+ potential.

After you have made DC resistance measurements on the heavy iron, it is time to apply some power. You will want to do this at first with all of the rectifier tubes and other transmitter tubes pulled so that you can check out the secondary voltages on the power transformer(s) without applying B+ to the rest of the transmitter or loading it

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heavily. Arrange the rig, the power cord and the AC socket so that you can pull the plug out if you need to without reaching over the rig. (Mac even suggests you have a fire extinguisher nearby!) If you have any concern about the transformers, for example if they have a burned look to the wire insulation or a smoky smell, or if they have leaked wax, you might want to put a light bulb in series with one side of the power line cord for the first power-up. Very little current will flow into a good transformer with no load on the secondaries, and the bulb will light dimly or not at all. If there is a problem with the transformer and it looks like a low impedance to the power line, the bulb will light to almost full brilliance. Once you have gotten full primary voltage safely on the transformer, check all of the secondary voltages with your VOM or VTVM. With no load on the transformer they may measure a little on the high side.

With the transformers and chokes checked out, it is time to install the rectifier tubes and check out the filter capacitors and the bleeder resistors. If the rectifier tubes are the high vacuum type, for example a 5U4, you can just plug them in and turn them on. But if they are mercury vapor types, which will be obvious because they will have liquid mercury condensed on the interior glass walls (type 866A, 816, 872 and 83), and if they have not been used for a while, you should warm up their filaments for a good 30 minutes the first time and at least 30 seconds after that before you turn on the high voltage.

At least the lower voltage B+ supply and the bias supply will use electrolytic filter capacitors. The high voltage supply may use electrolytics, which you can readily identify because they will have positive and negative polarity markings, or it may use oil filled filter capacitors that generally come in a sealed can and do not have polarity markings. Oil filled capacitors, unless they measure shorted or have an obvious leak, generally last forever. As in your receiver repair, however, electrolytics that are very old or have not been used for a long time may have lost substantial capacitance. They may possibly come back to life if you reform them. As with electrolytics in your receiver power supply, the basic idea in reforming the capacitors in a transmitter power supply is to bring the voltage up on them slowly and to wait until the leakage current through them subsides before increasing the voltage another step. If you have a capacitor tester, like a Heath C-3 (ER # 135, July/August 2000 and The (AWA's) Old Timer's Bulletin, August 2000, page 20), you can disconnect each filter capacitor, measure its capacitance and try reforming it right on the C-3 by running it up on the Leakage Test ranges. If the high voltage plate transformer is separate from the rectifier filament transformer, you can arrange to vary the plate voltage with a Variac temporarily connected to the plate transformer primary, and you can monitor capacitor leakage current with a milliameter in series with the capacitor. I would advise putting a series resistor in the circuit, about 10K rated at 5 watts or more, to protect the meter from complete annihilation in case the capacitor develops a short. You can also use the technique I suggested for a receiver power supply (ER #142, March 2000, page 26).

Adequately formed filter capacitors will reward you with a hum-free signal. You will soon know whether your capacitors are OK or whether they need to be replaced as you listen to the signal from the RF and audio stages in your receiver.

There should be bleeder resistors connected across the filter capacitors, from B+ or B- to ground. They are there to help the regulation of the supply and

to insure that the capacitors discharge when you turn the power off. Make sure that they are in place, and measure them to insure that they are still alive and have about the correct value.

I skipped what to do if your power transformer is kaput. That is indeed a sad occasion, especially these days when you no longer can find war surplus high voltage transformers listed in the Fair Radio catalog. But all is not necessarily lost. You may be able to turn up a replacement power transformer or other hard-to-find part from a donor rig listed in the ER Parts Unit Directory. You will find a listing for the Directory at the bottom of the "Electric Radio Store" page in this issue of ER. Old, tube-type television sets have husky power transformers with lots of filament windings and B+ on the order of 300 to 450 volts rms. If the B+ is too high for your rig, you can put one or more of the filament windings in series with the transformer's primary winding. One connection will result in lower B+ values; the opposite will make the B+ higher. You will then have to find a separate filament transformer for your rig, but there is still an ample supply in Fair Radio's catalog or even at Radio Shack. There is a replacement TV set transformer inside of my DX-20. The Hammond Manufacturing Company is also still making new transformers. You will find some of their units listed in the Antique Electronic Supply catalog, and AES can supply the full line of Hammond transformers.

One other thing to consider if you can't find a replacement for a dead power transformer, or if your rig is one of the many that didn't come with its own, built-in power supply, just simply use an external power supply. Heathkit sold a zillion HP-23 (A,B,C) supplies for their SB and HW series transceivers and transmitters, and they show up regularly at flea markets. They put out 700 VDC at 250 mA. 250 or 300 VDC at 100 mA., -100 VDC bias at 20 mA., adjustable bias from -40 to -80 VDC at 1 mA., and 6.3 VAC at 11 amps or 12.6 VAC at 5.5 amps. That would power just about any rig with one or two 6146's or 807's or a 4D32 in the final. You could add a second HP23 for modulator power if the first one doesn't have enough current capacity.

I have also found some excellent, regulated power supplies on the shelf at my local electronics surplus store. Lambda made rack mount supplies with adjustable HV, my model 28 is rated at 200 to 325 volt at 100 mA and 6.3 vac at 3 amps. My General Radio "Unit Regulated Power Supply," model 1201C, is a little gray cube about 5" x 5" x 4 1/2", that puts out 300 volts DC at 70 mA and 6.3 volts AC at 4 amps. I use the GR supply as a general-purpose low B+ supply for a variety of rigs in my inside shack. My Lambda supply is the reason why my 210 Hartley (1928 style self excited oscillator) gets T9X reports on 80 meters.

Trying it out

At this point, with the visual inspection and cleanup done, with obvious missing parts replaced, and with the power supply components verified, I usually fire-up the rig to see how it works. So let me talk about how to do that, and we can worry along the way about what to do if something doesn't work.

Attachments

You will need to attach a key, dummy load, a crystal unless your rig has a built-in vfo, and eventually a microphone. If you are using a straight key or a bug, make sure that the frame of the key is attached to the ground (sleeve) side of the plug to minimize the chance of your getting a shock. If you are using an electronic keyer, check to be sure that it is able to handle the load of your transmitter. If you are not sure, measure the open circuit voltage at the

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hot side of the key jack and the short circuit current before you attach your keyer.

The dummy load should be a Heathkit Cantenna or an appropriate 120-volt light bulb. If this is the first time you have used the Cantenna, measure its DC resistance with your VOM or VTVM. It should be somewhere near 50 ohms. Measure the light bulb too to be sure it is not open.

For a crystal, look for one in the FT-243 holder used extensively during and after WW II or in the Bliley AX-2 holder. Both have 0.086" diameter pins spaced on half-inch centers and will fit the crystal sockets in post-war BA rigs. In my experience, the more modern, hermetically sealed HC-6U, can-packaged crystals will chirp (shift frequency) as they are keyed in most BA oscillator circuits. This is probably because they are not designed for the amount of current our rigs pass through them.

The ARRL Handbook has a section on microphones in the chapter on Audio Amplifiers and Modulators. If the hot wire in the mike jack on your rig feeds directly into the control grid (G1) of the first audio amplifier and if there is a 0.5 to 5 megohm resistor from that grid to ground, you will need a "high impedance" microphone of the crystal, ceramic, or dynamic type. If the mike jack feeds a transformer winding and there is not a power source in series with the mike element, you will need a low impedance, dynamic mike of the type commonly used on modern transceivers and tape recorders. If the mike jack feeds a transformer and there is a power source in series with the mike element and the transformer primary, you will need a carbon microphone. Carbon mikes produce several volts of audio and were typically used on mobile rigs to save the power associated with one or more audio stages. You may be able to find a WW II surplus "T-17" or "T-17B" carbon mike at the flea market. Also, the older telephone handsets with screw-on covers on the microphone and earphone usually contain a carbon mike, typically the Western Electric type F-1. If you don't care to use the whole handset, you can take the mike out, solder wires to it, and mount it in a frame or holder of your own invention. Astatic and Shure Brothers made good, high impedance crystal and ceramic mikes for hams. Look them up in the catalog section of your Handbook to get a picture of what to look for. The Astatic models D-104, JT-30 and 200 and the Shure Century and Mercury are all good mikes that you might find. Turner and Electro Voice also made good mikes for the ham market. You can check out a crystal or ceramic mike with your oscilloscope. It should have an output around 0.03 volts, easily seen if your scope has a vertical amplifier. My kids used to love to talk into my D-104 and watch their voice on my Heathkit OL-1, 3-inch scope. If you can't find an old crystal mike, you can still buy a new D-104 for about $40 or a replacement D-104 mike cartridge for about $20 from Amateur Electronic Supply. Because of their low signal level output, crystal, ceramic and dynamic mikes need to have a shielded cable with the shield grounded at both the microphone case and the transmitter chassis. Carbon mikes have a much higher output level and do not require a shielded cable.

First Time for Power

I usually power up a new rig for the first time with its cabinet off and sitting on its side so that I can watch both the top and the bottom for smoke and fire. I start with the rig set for CW, tune it up, and listen to it in my bench receiver. If all is well at that point, I'll proceed to try the modulator to see how that is working. Your rig's operating manual is the best source of information for tune-up procedures, but I'll offer some

advice for a few, generic styles of transmitter.

Single Stage Transmitter

The simplest transmitter you are likely to find is a one-tube, crystal controlled oscillator. They were popular in the 50's and 60's as economical rigs for the new novice class licensees. My Conar 400 is an example and it's quite close to "A Three-Band Oscillator Transmitter for the Novice" shown in the 1965 ARRL Handbook. You will usually find the "grid-plate" oscillator circuit in these rigs. The crystal always oscillates in this circuit no matter what the tuning of the plate tank, and it can be tuned for good output at the crystal fundamental frequency and also at the second and third harmonics. The Conar 400 has a pi-match plate tank, also a very popular circuit because output coupling can be easily adjusted for a variety of loads and because it is easy to bandswitch without changing coils.

To tune up an oscillator with a pi-match plate tank, insert a crystal, attach the dummy load, and set the bandswitch appropriately. Fully mesh the variable capacitor closest to the antenna, usually labeled "loading." Then hit the key and swing the variable capacitor closest to the tube plate, usually labeled "tuning," until the plate current goes through a sharp dip. The dip occurs when you have "resonated" the plate tank at the frequency of the crystal or at one of its harmonics. Once you have set the "tuning" for the resonance dip, open the "loading" control a bit while observing the plate current. The plate current will rise above the initial dip value as the loading is increased. Set the plate current for about half the desired value with the loading control. You can find that value in your manual or in the tube rating section of the Handbook. Then readjust the tuning control for minimum dip current again. The dip will be much broader this time and the minimum current will be larger. Readjust the loading and tuning another time or two until the full desired plate current is flowing at the dip minimum and you will have adjusted the pi-match properly for the correct loading.

Now key your oscillator and listen to it in your receiver. If your receiver is a matching tube boatanchor, turn the AVC off and the BFO on, the Audio Gain all the way up, and control the volume with the RF Gain control. (This is the way you should operate your receiver normally for CW reception.) You may want to use no antenna, or possible even short the receiver antenna terminals to avoid "blocking" from your nearby, strong transmitter signal. Listen to the transmitter's keyed note on your receiver. It should start immediately when you close the key and it should stay on the same frequency as opposed to "chirping."

If the keyed note does not start immediately, it may have a sort of a "weeeep" sound, try reducing the loading and retuning the plate tank for dip. Also, try another crystal and see if it behaves the same way. If the problem seems to be associated with the crystal itself, open up the holder, remove the crystal blank and wash it with mild soap and water. I use an old tooth brush to scrub it a bit, and I hold it by the edges while I rinse it and dry it with a bit of tissue. Reinstall the crystal in the holder and try it again. It may well start oscillating much more easily after it has been cleaned.

If the note "weeps" no matter what you do to the crystal or which crystal you use, you may want to try adjusting the feedback in the oscillator circuit. In the grid-plate circuit, adjust the capacitor between G1 and the cathode. The ARRL Handbook recommends a 3 to 30 pF trimmer capacitor for this use.

If the note "chirps," you may also be able to improve it by decreasing the loading. My Conar has a quite pronounced chirp, especially when tri-

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Radio Service in the Golden Age
1930's through the 50's

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Episode 3

Setting up shop

I walked across Emma Avenue to the Pioneer Lumber Company and purchased enough material to build a workbench, a counter, and shelving for my new business. The total cost was slightly over $60.00—and that included a gallon of gray paint for the shelving, and a quart of light green for trim. This may sound like a 'hot' price, but these were average prices in 1946. In less than one hour the material was delivered to my empty store. I could not afford a carpenter so I planned on doing my own carpenter work and painting. It took me five full days to build and paint the fixtures. When completed, I stood in front of the store, admiring my handiwork. Though the workbench, shelving, and counters were bare I thought my future business looked attractive and businesslike.

In 1946 knotty pine was in vogue. I joined the world of bad taste when I constructed my eight foot long workbench from the material. When finished, I gave it two coats of orange shellac. Amid the neat, clean looking gray and green counter and shelving, the knotty pine workbench stood out like the proverbial sore thumb. Totally inappropriate for a radio shop, the workbench was solidly built and served me well until the shop was closed some thirty-five years later. It worked out so well I may describe its unique construction in a later article.

I realized that my prized 61OHV Harley Davidson was not appropriate transportation for a radio service shop so it was sold for $500.00. I needed something with which I could haul radios, and supplies for the store. Mr. Late, owner of Late Chevrolet Company, made me a deal I could not refuse on a brand new 1946 'panel wagon.' Now, I had an empty store and good transportation, but no inventory or equipment.

After taking delivery of my new service truck I was looking for an excuse to drive it. The following morning I left home just after daylight, and drove to FT. Smith, 70 miles south, to see if I could buy some sort of stock for my store. From my ham radio days I knew that Elmo Wise operated a small radio wholesale supply business from his home on Towson Avenue. The weather looked threatening. I hoped that precipitation, if any, would hold off until I made my return trip back across the Boston Mountains. It takes very little snow or ice to turn those mountains with their corkscrew two lane roads into a disaster area. I had one thing on my side-youth. When young, you do not worry much about those things until they actually happen.

I arrived at Wise Radio a few minutes before eight. Elmo, alone in the store at this early hour, greeted me warmly. "Hi, I'm Elmo Wise," he said, brushing back a lock of brown hair. "I don't think I know you. Have you been in the store before?" I noticed he was rather heavy-

set and appeared to be in his late thirties. I guessed he was a year of so too old to have seen service during the war.

"I'm Bruce Vaughan," I replied. "No we haven't met. I'm opening a radio repair shop in Springdale. I would like to buy a few parts, some test equipment, and perhaps open an account with you."

"Well, now, you should do good. I hear Coy Cantrell is talking of moving to the West Coast," he said. "Seems his son Dick is going to school there. Studying aeronautical engineering, I hear. Of course the goin' may be rough for awhile. We still ain't getting' but a trickle of parts, and test equipment is in very short supply. I received one tube tester yesterday. It is a counter model Triplett and sells for $69.95. I could let you have it."

"I'll take it," I answered, not bothering to look at what I was buying. I sure could use a new VOM. I've got an old meter I bought before the war, but it's not very good."

"Sorry, I am afraid you'll have to make it do for awhile. We are only gettin' a piece of equipment now and then," said Elmo. "I guess it takes a while to switch back to makin' civilian goods after being in war production so long. It is almost impossible to find parts. I'll show you what I have."

We walked through what had been the living room of the old residence, picking up a few resistors, condensers, (capacitors) some solder and 100 watt soldering iron, dial cord, service cement, two speakers, two output transformers, a Centralab volume control kit, and some nut drivers. I was shocked to find I had spent $160.00 when it came time to check out. I noted that my bank balance now stood at exactly $37.50.

"Bruce," said Elmo, "Hold on a minute while I look through some shipping orders on my desk. I want you to get off to a good start. Let me see what equipment I've got coming in. If you want to put your name on something for delivery when it arrives, you won't have to pay for it until the tenth of the month following delivery. We looked at incoming orders. I placed an order for a Meissner Analyst, a Jackson VOM, and a Sprague condenser analyzer. The Meissner Analyst was sort of a poor man's version of the pricy Ryder analyzer-I've forgotten the name. In place of meters it used 'magic eye' tubes. When it finally arrived I found it awkward and slow to use. It actually took longer to hook up and adjust than it did to find the problem using simple equipment like my old VOM. Perhaps it was my fault. Maybe if I had used it more.....

Elmo and I returned to the living room-excuse me-main showroom. "Have you any ideas to help me get a start?" I asked. "Other that what I bought here today, I don't have anything but a few hand tools and the old meter I mentioned before."

"Why don't you drop by Hunt's Appliance Store, down on Garrison." Replied Elmo. "They've been in business for years, and I know they have been without a radio repairman since Bill left them for the service right after Pearl Harbor. I'll bet their storeroom is full of inoperative trade-ins they accumulated before their supply of new radios dried up. You could junk out the rough ones for parts, and repair the rest. This would give you a few sets to sell, and some used parts to tide you over until you can do better. People understand that new parts are scarce. Just tell 'em the truth—that you can't get their set going with what you have."

I thanked Elmo for all his help and advice, then left the store. I looked at the sky; the weather seemed to be clearing. Glancing at my watch, I was pleased to see it was only 11:00 AM. I decided to grab a quick lunch at the White Spot Café before going by Hunt's. The White Spot served a large hamburger steak covered with onions,

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French fries, Texas toast, and coffee for 75 cents. The food was top-notch then, and still is today.

I walked into Hunt's Appliance Store and was greeted by a Salesman-the only person in the store at that time. "And what can I do for you today?" he asked.

"I thought you might have some old, inoperative, radios for sale," I replied.

I thought the salesman was going to kiss me.

"Just how many would you like to buy?" he asked. Leading the way into a dimly lit back room, he pointed to a wall. "There they are, take your pick for five bucks."

There must have been over twenty dusty old radios in the stack, I counted eight large console radios and one record player-radio combination. I knew some of the radios would bring a good price-if I could get them working.

I took out my bank book, studied the balance the way I thought a businessman should, then said, "Tell you what—I'll give you 37.50 for the whole mess, good bad, and indifferent. No complaints, no returns, no questions, I'll even load 'em myself."

"Fella, you just bought yourself a load of radios. Pull your truck around back and start loading."

Well, now I had no place to go but up. I had spent every last cent in my bank account.

It was not easy getting so many large sets into the panel wagon. I wanted to get them to my shop without any further damage. A stack of cardboard boxes in the alley behind the appliance store saved the day. Cutting the boxes up with my trusty pocketknife, I used the corrugated board as packing material around the better units. When all the sets were finally on board, I was surprised to find I had spent only two hours in the store and getting all the sets loaded. I drove directly from Garrison Avenue to my shop in Springdale. I had plenty of time to stop and eat-but did not have the money. I was running on empty.

It was after five when I arrived in Springdale-most of the retail stores had closed for the day. Feeling quite proud of my first stock of radios, I carefully unloaded them, then drove home for our evening meal. Dad and Mother had already finished eating, I quickly ate a plate of leftovers and returned to the shop to appraise my day's acquisitions.

The hours seemed to fly by. Though tired, I thoroughly enjoyed troubleshooting the old radios. By 1:00 AM three nice console radios were ready for the showroom floor. One set, a large 'black dial' Zenith, was a real beauty. Oh, how I wish I had it today. The big 12-inch speaker produced the rich, deep tone that customers liked. I knew it would not last long before someone took it home with them. I applied a heavy coat of furniture polish to the three sets, rubbing them until the fine furniture glowed like new.

I opened my shop early the following morning, beating the rest of the downtown merchants by 30 minutes. Normally, the 'broom brigade' (downtown store owners) showed up between six-thirty and a quarter to seven. After sweeping the sidewalk, then their places of business, almost all stores were open for business by seven.

Only those who lived through the immediate postwar era can understand the business climate at that time. Practically no nonessential, and not nearly enough essential, merchandise was available to the retail trade after Pearl Harbor. The change over from wartime to peacetime production took longer than people anticipated. Raw materials, as well as machine tools, were difficult to obtain. Finally, after many months, the production facilities of our country gained momentum. Industry awoke, slowly at first, then stretched a bit, and like a sleeping giant arose to its full height, larger and stronger than that of any other nation in the world.

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Improving "Boat Anchor" Receiver Performance
With TV Type Baluns

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For about $2.00 (or even less), the sensitivity of many "boat anchor" receivers can be improved up to 20 dB (or even more!). This improvement involves no modifications to the receiver except, possibly, to remove the external ground jumper from the antenna terminal strip on the back of the receiver.

Many of the older receivers were designed for balanced antenna feeds with an impedance of from 300 to 600 ohms. Just take a look at the service manual. For example, my HQ-140X manual states that the antenna impedance is 400 ohms. My Collins 51J-2 has an antenna impedance of 300 ohms. The Hallicrafters S-85 manual says antenna impedances from 52 to 600 ohms, the same thing for the S-107. The list goes on.

Back in late 1966, I was given Collins 75A-1 serial number 4. Frankly, it was a "basket case", but, I was able to pull a "Frankenstein" and revive the old girl from the dead. Unfortunately, I traded it off during the mid 1970s when these "boat anchors" were not worth the gasoline to haul them off (sure wish I had it back!). After getting the 75A-1 working, I put the "normal" jumper on the antenna terminals (the antenna terminal nearest to the ground lug connected to it). Frankly, the sensitivity of the receiver "sucked"! After trying all sorts of things, I finally built a small antenna tuner just for the receiver and that worked like a charm.

After getting rid of the receiver, I did not think much upon this "low sensitivity" problem for a number of years. Then, after acquiring a number of receivers from the same era, I found the same problem: low receiver sensitivity when connected to an antenna. Since I now have a "fairly" good test bench including several service monitors, the receivers were "put to the test". Each one was fully aligned and the sensitivity, using the "normal" 50 ohm output of the service monitors, was noted. They were "OK", but not what I really thought they should be.

Remembering my days with old s/n 4, I realized that the impedance of the coaxial fed antennas was not matching well into the receivers. However, I was just too lazy to build a tuner for each receiver. Also, I wanted a method of using the receivers without having to retune every time I decided to change bands. Then a "light bulb" went on over my head (remember the old cartoon strip characters?). How about using those "cheap" TV baluns that can be had from all sorts of sources (including free with video tape players, etc.).

A trip to the kitchen cabinet, where my wife stores all of the little accessories that came with various appliances that we have purchased over the almost 30 years we have lived in this house, produced a couple of the TV type baluns. After adapting the type "F" connector to take a PL-259, I hooked the coaxial fed antenna into the receivers. Every one of them really "perked up" from the performance prior to the installation of the balun.

Next, since my 51J-2 was sitting on the floor next to my service bench, I made some measurements using the calibrated attenuator in one of my service monitors. Depending on the

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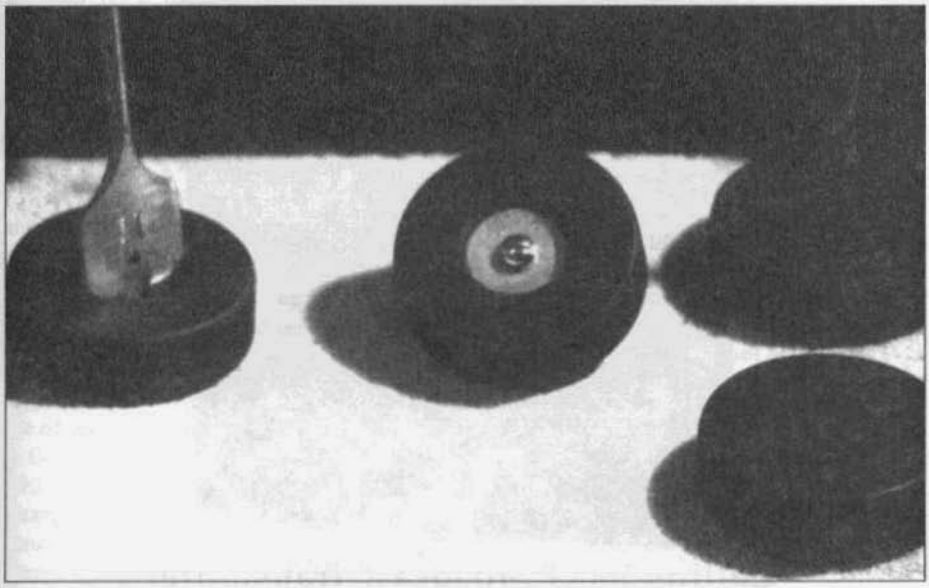
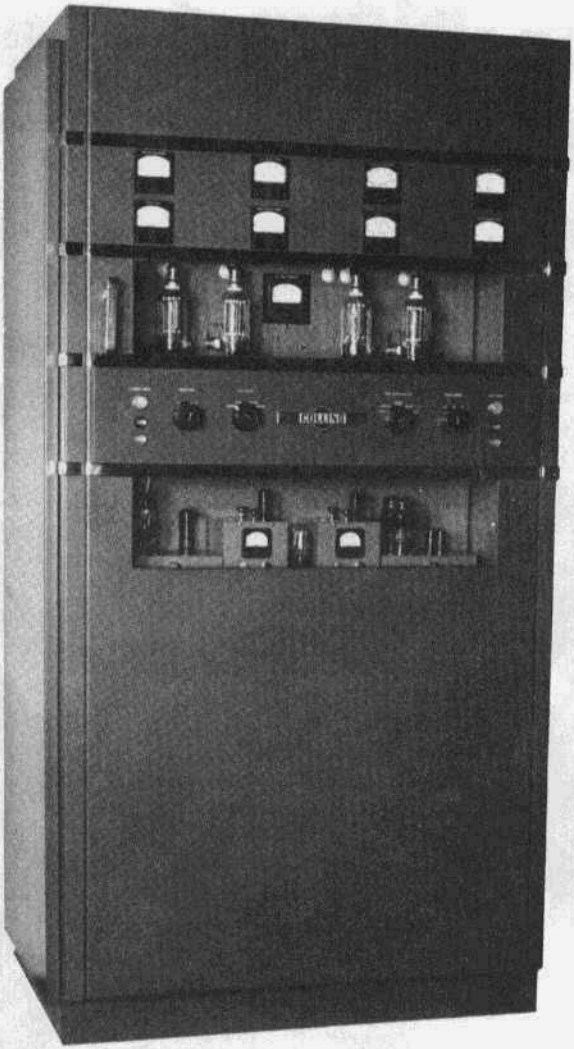
Andy Anderson, W5QXX (ex-N5JBT) in his Ingram, Texas hamshack. *Photo by K7POF.*

Al Morrill, W7AAM, in his hamshack. He lives in Chelalis, Washington. *Photo by K7POF.*

Last month (on page 17) I printed a photo of an odd antenna that I have and asked readers for info on it. Harold Blocher Sr., W4YWH sent in the ad above from the March, 1976 issue of *Ham Radio*. Thanks Harold. N6CSW



George Rancourt, K1ANX sent in this photo of his novel way of homebrewing feet for vintage gear. He uses standard hockey pucks that can be purchased for about $1.50 at almost any department store in the US. As you can see from the photo, he first countersinks a large hole (left) and then drills a smaller hole for the bolt (right). In the center is a puck all ready for installation. George says that the pucks look best when used with big heavy gear. He installed his on an RBB receiver.



Collins 300G Broadcast Transmitter

A while back I acquired a beautiful Collins 300G broadcast transmitter and have been telling everyone I talk to about it. Many people have no idea what it looks like so I decided to run this photo which I scanned from the manual.

The 250W 300G was manufactured in 1946. It uses 810s in the final and also in the modulator. It weighs 1370 lbs!

According to Paul Courson, WA3VJB, who owns and operates a 300G and who has also been researching the history of this transmitter, Collins built about 150 of these units. He knows of seven that are in the hands of AM'ers.

Over the course of the next few months my plans are to restore the 300G and put it on 160 meters. I'll try to document the whole process and put it together as an article. N6CSW

Mechanical Filter Update from page 3

of old solder and varnish; otherwise a good solder joint can't be made. I am NOT a fan of MFP varnish!

Also be VERY CAREFUL when you solder to the new filters. The filter new terminations are super-thin printed circuit board traces. I would suggest soldering "pig-tails" of #28 solid wire to these terminals before you mount them in the chassis, and don't use too much heat or the traces will separate from the board, leaving you with a big mess to fix. Please note that this problem with heat and printed circuit traces goes with the territory, and that there is nothing at all wrong with the circuit board construction or the traces the manufacturer uses to build his filters.

I'm sure I will set somebody off with my next comment: While the IF deck is out of the mainframe, now would be the perfect time to replace those pesky paper caps, the "classic" ones with the black bodies.

One reader asked if I thought all of the carbon resistors should be replaced with metal film types for better stability. My thoughts are that if the voltages given in the manual are within 10 or 15%, the resistors are fine, and will probably last another 30, 40, or 50 years. Changing them now would only be a lot of work.

One other observation about the R-390A might be in order. Now that the sharp 500 cps filter is available, a nice, smooth VFO is desirable. 95% of the time a jumpy or noisy PTO can be traced to a dirty ground strap. You don't have to disassemble anything to fix it either. With the receiver upside down, look for the ground strap with a flashlight. It is a bent piece of spring steel towards the front of the PTO. One end has two small machine screws to hold it to the PTO frame, and the other end presses on the PTO tuning shaft. A squirt or two of your favorite contact cleaner is usually enough. Lubrication is your option, but lube attracts dirt.

Double and triple check your wiring before applying power. Be sure to check that nothing around the tie points is touching the side of the new filter cases. A short circuit here is sure to cause fireworks.

I hope this helps your installation of Curry filters. They are well worth the time it takes to do the job right! **ER**

VTS 2 Receiver from page 9

The operation of the tubes with only 12 volts plate voltage shows a remarkable and innovative use of the tubes. The data plate on this set had 64 - 0293 or 5. I assume that 64 means it was made in 1964 and was set serial number 0293 which means that there were not very many of these sets made and fewer still captured by US Forces, compared to the usual Chinese supplied radios, the 102E, XD 6 and Type 63 sets.

This set's value comes from the fact that it is a rare set, was not made in quantity, and was a part of the Vietnam War. There are, however very few Chinese radio sets and even fewer collectors of Chinese radio sets. I would place the value of the set at $500.00 U.S. dollars and that figure is based on the cost to replicate it. **ER**

TUBE COLLECTORS GROUP FORMED: The new tube collectors association is now in operation. This is a non-profit, non-commercial organization of collectors & history enthusiasts focusing on all phases & vintages of tube design. The founding president of the group is Al Jones, W1ITX, who is known for his award winning tube collection. For more details & complimentary copy of the association's bulletin contact Al Jones, CA, (707) 464-6470, Ludwell Sibley, OR, (541) 855-5207, or mail request to POB 1181, Medford, OR 97501.

2001 Collins Users Conference

October 19 -21, 2001
Dallas, Texas
Organized, presented and underwritten by The Dallas Posse.
Website: www.dallasposse.org

Collins users, collectors, restorers, merchandisers and afficionados from all over the world will gather in Dallas, Texas October 19 -21 for the 2001 Collins Users Conference. Organized, presented and underwritten by The Dallas Posse, the Conference is open to all interested Collins enthusiasts without regard to membership in any Collins organization.

The best and the brightest technical and historical experts in the country have been invited to present programs on Friday. Among those who have accepted and confirmed include:

Joe Veras, N4QB- Joe is a professional photographer and author of the famous CQ Calendars- he'll give a preview of his new book on vintage equipment with lots of Collins material.

Bill Carns, N7OTQ and Elliott Klein, K7ER - The boys will talk about converting broadcast transmitters for amateur use.

Butch Schartau, KØBS on painting and restoration

Rod Blocksome, KØDAS- Rod will discuss some recent work he's done on production history of Collins amateur gear.

Dave Knepper, W3ST- Dave will present a photo and historical discussion.

Dario Hernandez, N5QVF- A newcomer to our group, Dario has some fantastic restoration hints for R-390s.

Jay Miller, KK5IM- Jay will give a program on the development of single sideband.

Dave Medley, KI6QE- Dave is retired from Collins and will talk about R-390s and R-391s.

Gayle Lawson, KØFLY- Gayle was in field service with Collins and will offer up some hints and kinks for the KWS-1

On Saturday, October 20 attendees will have the opportunity to sit at the knees of the masters for a Hands-On-Workshop. The two program rooms will be opened up into one large space and these experts will man tables around the room. The workshops will run from 8:00 to 1:00 on Saturday and you can spend as much time in each session as you like. Equipment, test gear, tools, antennas and power will be provided.

Conducting workshops will be: Howard Mills, W3HM, "All About A-Line Equipment"; Bud Whitney, K7RMT, "All about the 516F-2"; Collins AM Forum with Bill Carns, N7OTQ and Elliott Klein, K7ER; Don Reaves, W5OR, "The Collins R-390"; Butch Schartau, KØBS, "Working on the S-Line" and Wayne Spring, W6IRD, "The KWM-380."

That evening, the gang will board air conditioned tour buses for a ride across the prairie to Dallas' beautiful White Rock Lake park. And upon arrival, treated to a real Texas Bar-B-Que dished up by master Chuck Wagon cook "Big Mac" McCullough, W5HPM, and his faithful assistant Ron Freeman, K5MM.

A breakfast on Sunday morning followed by shack tours will round out the Conference. Shacks on the tour include Pete Zilliox, K5PZ; Mac McCullough, W5HPM; J. B. Jenkins, W5EU and Jay Miller, KK5IM.

A special event station will be operational during the Conference signing the Collins Amateur Radio Club call signs of WØCXX/5 and K5ROK. Station equipment will be provided in Jim Stitzinger's fully-restored Collins Communications Van.

Dealers, sellers, swappers and

merchandisers of all kinds of Collins equipment, parts, services and memorabilia have been invited to display and sell their wares. In addition, a special display area will be available for individual equipment displays and a display of odd and unusual Collins prototypes. Representatives from the Collins Collectors Association and the Collins Radio Association have also been invited to be on hand to promote their respective activities and answer questions.

For complete information and registration information, please see the Posse website at: www.dallasposse.org. Or, drop a note to the 2001 Collins Users Conference, P. O. Box 141231, Dallas, TX 75214.

The Dallas Posse started out in 1997 as a small group of Dallas area Collins radio enthusiasts who were first and foremost good friends. It has since grown to include a few "outlanders" who share friendship and activities. Together they enjoy the vintage radio hobby by helping each other and promoting the use and enjoyment of amateur radio in general and Collins radios in particular. The Posse is a social group and not a structured organization. It has no elected officers, no dues and no bylaws. Membership is by invitation. The Posse is acting as a nonprofit group to fund, sponsor and organize the 2001 Collins Users Conference. Any revenues in excess of costs from the Conference will be retained as seed money for future Conferences. ER

Jay H. Miller, KK5IM, jay@kk5im.com

Audio Monitor from page 12

longer will be the toggle back to receive audio. What this means is you may miss a word or two from the other party but since most of us "drag our feet" you probably won't miss a thing.

If your main interest is just monitoring your transmitted audio, then you only need portions of this project and can operate on 9 volt battery power with a current drain of about 5 mA. The battery life can be extended even longer if a push button is used to momentarily check your audio. All you would require is the Detector, FET Source Follower and LM386 circuits. You don't even need the RF pick loops because a short whip will be acceptable. In this version of the monitor the 9 Volt battery can be mounted inside the cabinet since AC hum is no longer an issue. I elected the RF "hard" connection because I wanted consistency in the RF level.

Much time was devoted to developing and laying out these circuits with one thing in mind - having the best reproduction of the transmitted audio. Many schemes were tried to eliminate the relay and toggle circuits and to reduce the hum monster but to obtain the best quality, undistorted, hum free audio, the relay offering total isolation between the receiver's output and the LM386 output and the multi-circuit isolation was needed. This monitor has been in operation for several months and trouble free. The unit does have extra bells and whistles but what's a few more knobs and switches in a shack that has over 200 active ones to control the four stations!! ER

A complete index of the entire 12 years of ER is available for viewing or downloading at the following website: http://www.qsl.net/n9oo

Clatternet: 850 shift RTTY roundtable, on 10137 kcs USB Saturday, starts 0930-1000 Pacific time.

Receiver Performance from page 33

band, the signals improved by a minimum of 10 dB to almost 20 dB when comparing the direct 50 ohm feed into the receiver as opposed to using the TV balun. Frankly, this is a pretty good improvement!

About this time, a couple of local amateurs got "new" 75A-1 receivers and found that they were just not as sensitive on the bands as their "newer", coaxial matched receivers. I suggested putting in one of the TV baluns and both amateurs reported that the sensitivity of their 75A-1 had improved to be at least equal to their newer equipment.

One of these amateurs, before he retired, was in the CATV business for over 30 years. He has run bandwidth tests on many baluns over the years since they have to pass a minimum frequency of 5 MHz. This is because of certain signals that may be present on the CATV system. Most of these baluns made it down to the broadcast band with no problems at all. Of course when mentioning the $2.00 price he laughs. It seems that the CATV people get these for well under a "quarter" and he still had several lying around his shack.

Not every "boat anchor" receiver seems to need these. My Collins 75A-2, 75A-3, and 75A-4 work fine with the direct feed from the coax. However, my Hallicrafters SX-100, S-85, and S-107 like the baluns as do my Hammarlund HQ-140X and National NC-2-40D. The newer receivers like my 75S1, 75S3A, SB-301, AX-190, etc. all were designed for 50 ohm coax and definitely do not need the assistance of the TV balun.

The TV type baluns are designed to convert 300 ohms into 75 ohms. But, they do an excellent job of matching the 50 ohms feed to the balanced requirements of the "boat anchor" receiver. Is it exact? Of course not! But, the nominal impedance of the receiver varies with the particular band, and, especially on general coverage receivers, within the band itself.

Therefore, as a "cheap", but effective, method of "perking up" "boat anchor" receivers, the TV balun cannot be beat! Try it, you'll like it! Besides, they are "cheap"! ER

Fort Tuthill Hamfest from page 18

they erected in the flea market area. Boat anchor items in evidence were Collins St. James gray and S-Line gear, Johnson, Hammarlund, Heath, National, Hallicrafters, and EICO. There were a couple of R-390s, a gorgeous R-390A and a very nice ART-13. Some nice test equipment was available but didn't seem to be selling very well. You could buy almost any electronic part imaginable as well as a good selection of Vacuum tubes, both NOS and used.

The commercial vendor building was well attended with a few manufacturers and several retailers. MFJ had one separate side of the building and their space was always packed. It appeared that many of the vendors provided very attractive show special pricing for their products.

As we left Saturday evening, it looked like the amount of gear available for the Club auction on Sunday was quite extensive. If you've never attended the gathering, on Sunday the club auctions any gear that the vendors contribute. Outstanding deals can be had for the hearty souls that are still there on Sunday.

The Amateur Radio Club of Ft. Tuthill again did a tremendous job of planning and manning the affair this year. Those of you that can get to Flagstaff, Arizona next year should make the effort as this affair reminds you of days gone by. You can get information about next years affair from: ARCATHILL@AOL.COM. **If you plan on attending, the motel/hotel reservations in Flagstaff go quickly so you need to plan ahead to assure that you have space.** ER

Fall 2001 Classic (& Homebrew) Radio Exchange

The Classic Radio Exchange ("CX") is a contest celebrating the older commercial and homebrew equipment that was the pride of our ham shacks and our bands just a few short decades ago. Our object is to encourage restoration, operation and enjoyment of this older equipment. A "Classic" radio is at least ten years old (age figured from first year of manufacture), but is NOT REQUIRED to participate in the Classic Exchange. YOU MAY USE ANYTHING in the contest, although new gear is a distinct scoring liability. You can still work the "great ones" with your new equipment!

The Classic Exchange will run from 1900 UTC September 30 to 0400 UTC October 1, 2001 (3 PM EDT Sunday to midnight EDT). Exchange your name, RST QTH (state US, province for Canada; country for DX), receiver and transmitter type (homebrew send final amp tube or transistor), and other interesting conversation.

The same station may be worked with different equipment combinations on each band and on each mode. CW call "CQ CX;" phone call "CQ Classic Exchange." Nonparticipants may be worked for credit.

Suggested frequencies:
CW: 3.545, 7.045, 14.045, 21.135, 28.180
Novice/Tech Plus: 3.695, 7.120, 21.135, 28.180
Phone: 3.880, 7.290, 14.280, 21.380, 28.320.
7.045 and 3.545 will probably be the most popular CX frequencies.

Scoring: Multiply total QSO's (all bands) by total number of different receivers plus transmitters (transceivers count as both xmtr and rcvr) plus states/provinces/countries worked on each band and mode. Multiply that total by your CX Multiplier, the total years old of all receivers and transmitters used, three QSO's minimum per unit. For transceiver, multiply age by two. If equipment is homebrew, count it as a minimum of 25 years old unless actual construction date or date of its construction article (in the case of a "reproduction") is older:

Total QSO's all bands times RCVRs + XMTRs + states/provinces/countries (total each band and mode separately; add totals together) times CX Multiplier:
SCORE = QSO's x (Rx + Tx + QTH's) x CX Mult

Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, exotic equipment, best excuses and other unusual achievements. Send logs, comments, anecdotes, pictures to Allan Stephens, 106 Bobolink Dr., Richmond, KY 40475.

Include two stamps and your mailing address for next CX Newsletter and announcement of next CX. E-mail reports may be sent to Allan.Stephens@eku.edu (AI, N5AIT). Questions about CX may be directed to WB2AWQ@arrl.net.

Heathkit Special Event Station

The Heathkit Amateur Radio Group and the Blossomland Amateur Radio Association will host a Special Event Station to celebrate the 75th anniversary of the Heathkit Company. The planned operation will be from 1400Z to 2400Z on September 15 and 16, 2001. The frequencies will be 7.250, 14.260, and 21.360 MHz, plus or minus QRM, and we will be using the callsign W8KIT. Please direct questions or comments to either:
Randy Kaeding
<rkaeding@HEATHKIT.COM> or
Larry Knapp
<kc8jx@yahoo.com>
For a QSL card, send an SASE to:
W8KIT
C/O Heathkit Educational Systems
455 Riverview Drive - Bldg 2
Benton Harbor MI 49022

How to Repair a Transmitter from page 29

pling from a 40-meter crystal to 15 meters. I strongly suspect it could be improved if I included the voltage regulator on the screen grid (G2) that is included in the Handbook transmitter but absent in the Conar. Thus far I am just living with its "distinctive" note.

If the oscillator doesn't work at all and you have tried several crystals, then you have other trouble-shooting to do. Test the tube or substitute a known good one. Measure the resistors and if possible the capacitors in the circuit. Check the voltages at the tube socket. You can get a pretty good idea of what the voltages ought to be for oscillators, buffers, multipliers and amplifiers from the Triode, Tetrode and Pentode Transmitting Ratings in the back of your ARRL Handbook. You cannot get an accurate reading of the dc voltage level on the control grid (G1) or plate if RF voltage is also present because a VOM or VTVM is likely to load down the RF circuit too much. Put a 2.5 millihenry Radio Frequency Choke in series with your ungrounded meter lead if you need to make such a measurement, or better yet use an oscilloscope with a high impedance probe. Crystal oscillators are not all that stubborn, and once you find and fix the trouble yours should take off and do a good job.

Once you get your rig (regardless of its number of stages) going to your satisfaction, check to make sure that its output is on the correct frequency. You can use a frequency counter coupled to the dummy load or that grid dip meter operating as a passive frequency meter or another wavemeter lightly coupled to the plate tank. If your oscilloscope has a time base that is fast enough, you can actually measure the amount of time (the "Period") that one full cycle of the output signal takes. From that you can find the frequency from the formula, Frequency = 1/Period. For example, the Period associated with a 3.5 MHz, 80-meter signal is 0.285 microseconds. Check to see that there is output where you want it and no output where you don't want it. ER

Ed: This series will continue next month.

Radio Service from page 32

For a period of three years or so, production was far behind demand. During this time a merchant could sell almost anything. It seemed there were waiting lists for everything. This was especially true of home appliances, radios, automobiles, and other large ticket items.

I noticed that merchants seemed to have better sales of certain items if they displayed them outside their store on the sidewalk. I carried the big Zenith up front, and placed it on the sidewalk outside my door. A hand-lettered sign on top of the big radio proclaimed that for the low price of only $95.00 you could be the proud owner of this fine instrument. I ran an extension cord to the set, and turned it on loud enough to annoy the loafers in front of the nearest of three beer joints in my block.

I sold the set before noon. The following day, the GE sold for $65.00, and two smaller radios for $25.00, and $30.00. Two days ago I was dead broke. Now I had over $200.00 in my pocket, and a small stock of radios and parts from which to do business. The thought occurred to me-there must be other large appliance stores with stocks of inoperative radios just waiting for me.

Bruce's Radio Shop was off and running... ER

CLASSIFIEDS

Advertising Information

Subscribers receive 1 free - 20 word- ad per month. **Extra words are .20.** Here's how to count the words in your ad: the heading - For Sale, Wanted, etc count as **1 word**. Your name, call, address and telephone number count as **6 words**. Hyphenated words count as **2 words**. **Please count the words in your ad and if you're over 20 words send payment for the extra words.**

Non-subscribers: $3 minimum for each ad (up to 20 words). Each additional word is .25. **Please call or write for display rates.**

VINTAGE EQUIPMENT ONLY

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Deadline for the September Issue: September 1

FOR SALE: Repair and restoration on all vintage equipment; 45 years experience. Barney Wooters,W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. (303) 770-5314

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. ka1edp@juno.com

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

FOR SALE: New Ranger I, Valiant I, & Navigator plastic dials, freq numbers in green, with all the holes just like orig. - $17.50 ppd. Bruce Kryder, W9LWW, 336 Sliders Knob Ave., Franklin, TN 37067

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

FOR SALE: Hallicrafters SX-115 - $1000; assort'd tubes - $25 per/100, shpg included. Tom Stiefel, AB1ER, 611 2nd St., Yutan, NE 68073. (402) 625-2014

FOR SALE: Millen Antenna Bridge - $85; Clegg Thor 6 - $245; Lafayette HA-410 10M xcvr - $145. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (973) 728-2454, rprester@warwick.net

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

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

FOR SALE: New Collins winged lapel pin, still have meatball version, either type - $5.95 + 75¢ s/h. W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029. (760) 747-8710

FOR SALE: Send SASE for large list of excess parts, publications, ham & test gear. K4AFW, 104 Glenwood Dr., Williamsburg, VA 23185

FOR SALE: 75-A4 with three filters and installed noise blanker, exc condx, orig manual. Serial number 3579 - $1150. Prefer pickup or arranged delivery rather than shipping. Steve, WA9ASZ, RR 3, Box 413, Bloomfield IN 47424. (812) 863-2088, ssauer@bluemarble.net

FOR SALE: Mohawk/Apache drum dial reproductions, email for details. Ron, AB5WG, (281) 491-7823, ab5wg@mylinuxisp.com

FOR SALE: SX-122 - $190 + shpg. Ed Sauer, KC9SP, 787 N. Peterman Rd., Greenwood, IN 46142. (317) 881-1483

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

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

FOR SALE: NOS TCS baseplates still in factory shipping wrap - 2/$15 plus shpg. Carl, KN6AL, POB 3531, Laramie, WY 82071. (307) 742-0711 kn6al@uwyo.edu

FOR SALE: 2001 COLLINS CALENDAR now shipping. 15-months, all color! $14.95 postpaid USA and Canada. Trinity Graphics, 5402 1/2 Morningside, Dallas, TX 75206. www.kk5im.com

FOR SALE/TRADE: Misc. parts, tubes, for tube gear. Sandy Blaize W5TVW, 40460 Edgar Traylor Rd., Hammond, LA 70403. ebjr@i-55.com

FOR SALE: Vintage equipment at the K8CX Ham Gallery Classified Ads section. Visit the largest Antique QSL Card Gallery http://hamgallery.com

NOTICE: T-368 Registry. For info w2zr@aol.com. Subscribe to the T-368 & BC-610 reflector at: http://groups.yahoo.com/group/T-368_BC-610

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

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: Potracab Aluminum cabinet, 8-1/8x12x9, carrying handle, matching chassis, 7x11x2, NOS - $20, ppd USA. Louis L. D'Antuono, 8802 Ridge Blvd., Brooklyn, NY 11209. (718) 748-9612

FOR SALE: Older type electronic parts & hardware; free vintage flyer. Mail order since 1954. Bigelow Electronics, POB 125, Bluffton, OH 45817

FOR SALE: VM parts, new boxed electron tubes, new Heathkit parts, new panel meters. Norm, 1440 Milton St., Benton Harbor, MI 49022

FOR SALE: Books, all electronics related; 300 titles; SASE. Paul Washa, 4916 Three Points Blvd, Mound, MN 55364. wøtok@email.msn.com

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

FOR SALE: Parts, tubes, books, ect. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761. wb0cte@arrl.net

FOR SALE: Tubes. We specialize in early receiving & collector tubes & tube related books. Send for free catalog or see fathauer@home.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281. (480) 968-7686, tubes@qwest.net

FOR SALE: Collins restoration. Everything inside & out to make it as Art Collins built it. 50 yrs experience. W90JI / N4PZ, IL, (815) 734-4255 or N4PZ@aol.com

FOR SALE: Tubes, NIB or tested good, priced low. SASE for list. WA7HDL, 167 Hwy 93 S, Salmon, ID 83467

FOR SALE: MFJ tuners 949E w/AC adaptor 962C, both very good. Cliff, WA9SUE, WI, (608) 625-4527 after 6 PM.

FOR SALE: National NPW-0 dial & geared drive unit (as on HRO) - $75 + UPS. Richard Cohen, K4UTI, FL, (813) 962-2460.

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

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

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

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

WANTED: National SW-3 model1, version 3. Uses 32-32 30 tubes. Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Collins 32V & Collins 75A series; Globe Scout; National SW54. KBØW, CA, (916) 635-4994. frankdellechaie@sprintmail.com

WANTED: J W Miller IF coil #913-CD; J W Miller 455kc IF trans w/center tap. Weber, 4845 W. 107th St., Oak Lawn, IL 60453

WANTED: MacKay 3007/A rcvr. Earl, K1DCI, NH, (603) 434-8326

WANTED: Acc. for BC-610I: BC-614, BC-639, tank coils xtals. Frank, K4BVQ, POB 35430, Charlotte, NC 28235. (704) 348-6488

WANTED: National Company emblems, escutcheons, logos from equipment. Also WW II rcvr's manufactured by National. Don Barsema, 1458 Byron SE, Grand Rapids, MI 49506. (616) 451-9874, dbarsema@prodigy.net

WANTED: National AR2, AR5, XR50, XR60, XR70 coil forms. K1MBI, 21 Freestone Ave., Portland, CT 06480

WANTED: 1-1/8" knob for Ranger 1, with or without the little white pointer. Doug Knoll, KA9IQA, (507) 835-1175

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

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

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

WANTED: Hallicrafters SX88 or SX115. Larry Redmond, 413 Bedfort Dr., Duluth, GA 30096. (770) 495-7196

WANTED: Drake T4XB, C, R4ABC & cabinet top & bottom. Keith, WA9CUE, IL, (217) 258-0012, ketker@yahoo.com

WANTED: 1930s Army Navy control boxes, pwr splies, dynamotors - any wierd types. William Donzelli, 15 MacArthur Dr., Carmel, NY, 10512. (845) 225-2547, aw288@osfn.org

WANTED: Back issues of QRP or RADIO AGE magazines. Gary Fender, W5UUO, 450 Cunningham Rd., Celina, TN, 38551. (931) 243-5323, gdfender@multipro.com

WANTED: Antique tubes. Paying $40 ea for good used type 201 tubes (not A). Buy list & new 2000-2001 catalog of collector tubes available. See fathauer@home.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281. (480) 968-7686, tubes@qwest.net

WANTED: To recover one of my own early QSL cards from the 50s. Any ole tymer have an Iowa KNØCER or KØCER card in your archives? Tnx. 73. w5uxm@aol.com

WANTED: Manuals, signal generators: General Radio 1021A, 50-250 MC, 250-900 MC. HP Glideslope 232A, Boontown 202M. Allan Lurie, W9KCB, 605 E. Armstrong, Peoria, IL 61603. (309) 682-1674

WANTED: WW II Military Television

Looking for the following for a restoration project: round & square cameras, #AXT, CRV, ATH; transmitters, #AXT-6, 7, ART-26, 28; dynamotor CRV-21; test set, I-232, 231, 206, TS-93, CRV-60058.

Maurice Schechter, 590 Willis Ave., Willis Park, NY 11596
516-294-4416, mauricsch@cs.com

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

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

FOR SALE: 51J-4 filter replacements, direct plugin—6.0 kc Collins mech. filter, 3.3 xtal lattice, 2.3 kc xtal latice ,500 cycle xtal latice - $215 each; R-390A 16 kHz flat phase filter, for Hi-Fi AM - $245. Chuck Felton, KDØZS, WY, (307) 322-5858, feltoned@coffey.com

FOR SALE: New Release. For details send 2-stamp LSASE to: Olde Tyme Radio Co, 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910

FOR SALE: Military and commercial communications items: http://www.maxpages.com/murphyjunk. Murphy's Surplus, 401 N. Johnson Ave., El Cajon, CA 92020. (619) 444-7717

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

NOTICE: A website dedicated to traditional ham radio & classical radio resources. Visit Ham Radio USA, http://www.hamradiousa.com

FOR SALE: Hallicrafters S40B, S108; Collins 75S1, 75A4, 30L1; Heathkit SB303, SB100. John Thuren, AA5T, (281) 530-6130, jbthuren@hal-pc.org

FOR SALE: Old electrical books: Induction Coils 1904; Coyne Electrical & Radio Encyclopedia, Vol-1, 1942 - $6 ea., includes shpg. Allan Lurie, W9KCB, 605 E. Armstrong, Peoria, IL 61603. (309) 682-1674

FOR SALE: Collins RE S-line station consisting of: 32-S3, 75S-3B, 312B-4, 516F2 (2 ea) & D-10 mic, manuals, interconnect cables & plastic dust covers, exc mechnical, cosmetic & operational condx. Bill Mills, KC4AA, GA, (478) 452-2957, kc4aa@alltel.net

FOR SALE: Rider manuals, military whip antennas, 24 volt dynamotors. Bruce Beckeney, 5472 Timberway, Presque Isle, MI 49777. (989) 595-6483

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@rust.net

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

FOR SALE: Repair, upgrade, performance modification of tube communications & test equip. Accepting most military, all Collins & Drake designs, & the better efforts from others. Laboratory performance documentation on request. Work guaranteed. Chuck Felton, KDØZS, Felton Electronic Design, Box 187, Wheatland, WY 82201. (307) 322-5858, feltoned@coffey.com

FOR SALE: I am making aluminum plate and grid connectors for T series tubes. If interested contact Alan Price at fixr75268@cs.com

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

FOR SALE: Ur old QSL card? Search by call free, buy find at $3.50 ppd. Chuck, NZ5M, CRBCS1@prodigy.net

FOR SALE: Radio tubes, 7 & 9-pin - 25¢ ea; 5/ $1, your choice or mine. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150. radiolen@aol

FOR SALE: Hallicrafters S36 good condx except S meter - $60 + shpg. Don Hudson, KA1TZR, 97 Southwood Dr., New Canaan, CT 06840.

FOR SALE: HT9 clean, all good tubes; ICOM 756; Pro Globe King 400; 3 Patterson radios. Pete Anderson, 1209 W. Cochiti, Hobbs, NM 88240. (505) 392-8866

FOR SALE: (2) Jensen Corner Horns for 12-inch (or 15) woofers, used but exc condx - $75 ea. Can shp but Northeast best. Request drawing, further specs. Charles Graham, K2GVE, 4 Fieldwood Dr., Bedford Hills, NY 10507. (914) 666-4523

FOR SALE: Heath Cantenna dummy load; navy field strength meter; grey National spkr; National knob pots; KWM PM2 pwr transistors; Western Union sounder T-5. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids, IA 52402. (319) 393-8075

WANTED: Swan VX-1 VOX or other Swan stuff. xcvrs, meters, etc. Working or not. Butch, WA8X, (989) 275-3420, jpeitsch@voyager.net

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 1572 Newman Ave., Lakewood, OH 44107.

WANTED: Orig Heath manuals for ham & test equip. Please state condx & price. Warren, K1BOX, POB 1051, Spruce Pine, NC 28777. (828) 688-1922

WANTED: Hickok tube tester. Best one offered for $ 100. or less. Ellsworth, WA. (509) 838-2161 eojohnsonww2@home.com

WANTED: Globe King 500/A/B/C xmtr. Will pick up anywhere near Chicago. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (630) 852-4704. JandRJor@interaccess.com

WANTED: NC enamelled spkr logo; SX-73 knobs; 10.5" Bud Classic II cabinet; Johnson Thunderbolt for parts; CDR-M ham rotator base; clamp or plate or whole rotator for parts. Pete Patton, WØEWQ, MN, (651) 767-4794 days, pcpatton@mediaone.net

WANTED: Bendix radio rcvr RA-1B; Belguim set RST-101. George Rancourt, K1ANX, MA, (413) 527-4304 or k1anx@mindspring.com

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

WANTED: Junker Viking Ranger I for parts. Robert, K6SWS, CA, (800) 874-8663, robert@norcommcorp.com

WANTED: RBB/RBC rcvrs, pwr splys, cables & RAK/RAL equip. Andy Miller, KD6TKX, CA, (831) 484-2389, amillertkx@aol.com

WANTED: Mics: Astatic JT 30/40; UT-48; Shure CR80/81/41; 707A; Turner VT-73; CD/BD; parts for same. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225. tomsmics@flexcomp.com

WANTED: Desperate for museum display: lge AC cooled or water cooled xmtg tubes. Certain types including RCA, 898, 862, 893A or R & 5831s; other manufacturers such as Federal Telephone & Radio F 124R. Name your price. Tommy Bolack, 3901 Bloomfield Hwy, Farmingon, NM 87401. (505) 325-4275

WANTED: R-390A rcvrs, parts rigs or restorable, will restore yours at reasonable prices. Walter Wilson, KK4DF, (706) 733-8323, wewilson@knology.net, www.knology.net/~wewilson

WANTED: WWII BC-610-E series or earlier xmtr; BC-739 interphone control box. BC-652 rcvr. Steve Finelli, N3NNG, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211, navrad@enter.net

WANTED: Plug-in coils 4, 5, 6-pin types; Hammarlund, Millen amphenol, used or new. Henry Mohr, W3NCX, 1005 W. Wyoming St., Allentown, PA 18103

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: 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: 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: RCA 140, 141, AVR5A. GE K80, K80X, K85. Any condx. James Treherne, 11909 Chapel Rd., Clifton, VA 20124. treherne@erols.com

WANTED: Seeking unbuilt Heathkits, Knightkits. Gene Peroni, POB 7164, St. Davids, PA 19087. (610) 293-2421

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

WANTED: Collins 310B3, basket case OK - welcomed; & Chicago 500W CMS-2, high-level modulation xfmr; Taylor T21. Jerry, W8EGD, CO, (303) 979-2323.

WANTED: Clean Mackay 3010C & Kenwood R599D w/all filters & manual. Ric, C6ANI, POB N4106, Nassau NP, Bahamas

WANTED: National SW3, complete tube shield. State price & condition. Roger, K1TG, rwkuchera@snet.net

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

WANTED: National NTE. I love National. Sylvia, N1VJ, 33 Lawton Foster Rd., Hopkinton, RI 02833. (401) 377-4912

WANTED: Collins 30K1 xmtr; also need orig manuals & literature for 75A1, 32V1, 30K1. Paul Kluwe, W8ZO, POB 84, Manchester, MI 48158. (734) 428-2000

WANTED: Hammarlund HQ-180; Scott Special Communications rcvr; RCA Channalist. EA4JL, phone Kurt Keller, CT, (203) 431-9740 or k2112@earthlink.net

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

WANTED: Friction drive and knob for Heath SB series main tuning calibration. Brian Roberts, K9VKY, 130 Tara Dr., Fombell, PA 16123. (724) 758-2688. k9vky@stargate.net

CDs From the ER Bookstore

By Radio Era Archives

R390-R390A/URR Technical CD-ROM - $ 57.
RCA HB-3 Tube Handbook - $ 75.
RCA Radiotron Handbook, 4th Edition - $ 62
Radio Boys on CD-ROM - $ 39.
80 years of QST - $ 39.95 per set (generally 5 or 10 year set).
All 11 volumes - special package price - $ 373.
Collins Radios Technical CD-ROM series. Vol. 1 - Collins Receivers; Vol. 2 - Collins Transmitters & Amplifiers; Vol. 3 - Collins Transceivers; Vol. 4 - Accessories, Power Supplies, VFO's, etc. Each CD - $79, Complete Set - $279

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Drake equipment operator and service manuals on a two CD set by Bill Turini, KA4GAV - $71.95

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970-564-9185, er@frontier.net

WANTED: Old Callbooks, especially those covering the years before 1930. Alan, W3BV, PA, (215) 795-0943 or W3BV@arrl.net

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

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

WANTED: New or used unmodified BC459A, BC696, T18/ARC/5, T19/ARC/5, CBY52232. Louis Lytch, K2DET, 117-33 230th St., Cambria Heights, Jamaica, NY 11411-1806. (718) 528-5065

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

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

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

WANTED: Meissner 14 tube Traffic Master & 9 tube Traffic Scout rcvrs. Richard, KØCAB, IA, (319) 377-9126.

WANTED: BC-620, 20-27 Mc FM xcvr w/all tubes & unmodified. Ted Bracco, WØNZW, 203 E. Main St., Teutopolis, IL 62467. (217) 857-6404 x306, braccot@hotmail.com

WANTED: HRO-5 "silver front" G Coil 180-430 Kc. Also PP-327 AC pwr sply for GRC-9. Tony, (703) 522-1568, k4kyo@arrl.net

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

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

WANTED: Electric Radio; Antique Radio Classifieds; Old Timers Bulletin. Alan Mark, POB 372, Pembroke, MA 02359

WANTED: WW II military remote control rcvrs #ARW/CRW, xmtrs, dynamotors PE186 PE126, joy sticks, Gyroscopes for the GB, Azon glide bombs. Maurice Schechter, NY, (516) 294-4416 or mauricsch@cs.com

WANTED: Multi-Products Company M-1070 pwr sply, must be working. Tom, KØUL, CO, (970) 328-0316, kd6mh@yahoo.com

WANTED: QSL cards from old/pre WW II Ham DX countries; old regen kits. Hajime Suzuki, Nishikuniyoshi 1644-24, Ichihara-Shi, Chiba-Ken, 290-0231 Japan

WANTED: BC-191 or BC-375 also mod xfmr or other parts for same. Bill Hill, W4ZXW, 510 E. 25th Ave., Cordele, GA 31015.

WANTED: Abbott TR 3 or TR 4 or Meisner 21/2 meter tranciever. Rich Wurtzinger, 1140S. Taylor Ave., Oak Park, IL 60304. (708) 383 4579 richwurtz@juno.com

WANTED: (1) tuning unit, BC-375 any frequency. Jim Barton, WØKNJ, POB 417, Burke, SD 57523. (605) 775-2044

WANTED: E.F. Johnson speech amp, P/N 250-33; Band Hopper VFO and 2 thermo couples for TMC TAC-1. Butch, KØBS, (507) 282-2141

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FOR SALE: RCA tube manuals, RC-15, RC-20, RC-25; ARRL Handbooks, 1965, 1968, 1972 & 1978. LSASE for list. Charles Brett, 5980 Old Ranch Rd., Colorado Springs, CO 80908. (719) 495-8660, brett37296@aol.com

FOR SALE: Collins drum overlays. 75A-2, 3, 51J#. For 75A-4 & KWS-1, specify new/old - $8.50 ea. 2/$15 ppd. Correct colors. Charlie Talbott, K3ICH, 13192 Pinnacle Ln., Leesburg, VA 20176-6146. (540) 822-5643.

FOR SALE: Repro Nameplates, R-390A generic - $9; 51J-3 and 51J-4 exact replicas - $12. Tom Marcotte, N5OFF, 242 Chestnut Oak Dr., Mandeville, LA 70448. marcotte@iamerica.net

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

FOR SALE: Homemade galena xtal radio &/or parts to make your own. L. Gardner, 458 Two Mile Creek Rd., Tanawanda, NY 14150. radiolen@aol.com

FOR SALE: Japanese WW II rcvr, 6 tubes, complete. Call for info. Bill, KB8IJC, WV, (304) 842-4635

FOR SALE: DX-35, DX-40 reproduction crystal doors. $11.50 shipped. Texans add 8.25% sales tax. Glen Zook, 410 Lawndale Dr., Richardson, TX 75080

FOR SALE: Hickok 533 tube tester; Astatic JT-30 mic; RS-6 rcvr (RR-6); Valiant manuals. Carter Elliott, (804) 979 7383, CElliott14@aol.com

FOR TRADE: Original Johnson Manuals 6N2, Valiant, Adventurer, VFO-122. **WANTED:** Valiant II manual. Bernard, NI4Q, FL, (407) 351-5536, ni4q@juno.com

FOR SALE: Hallicrafters HA-2 &HA-6 w/pwr sply & manuals - $375. **WANTED:** DrakeTR-7. Robert Braza, W1RMB, MA, (508) 222-5553

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FOR SALE/TRADE: G186A panadaptor (IF 21.4 mHz) - $100 or trade for G186B (IF 500 kHz). Joe Orgnero, VE7LBI, 1349 Leask Rd., Nanaimo BC V1X 1P8 Canada. joseph@pacificcoast.net

FOR SALE: R-390A rcvr, exc condx, a lead class DX'ing set, not salvage, w/spkr, cabinet & SSB converter - $1000 or best trade w/cash. Ron, MI, (517) 374-1107

FOR SALE: Powerstat 0-135V, 7-1/2 amp, 115V, 50/60c bench testing portable, orig box - $90. Joe, W6CAS, (916) 731-8261

FOR SALE: Johnson & Hammarlund panels, cabs refinished. Done in same finish as new cars. Ranger-1, II (price, call), Valiant-1, HQ-180 (series), $250. + shpg. Visa/MC/AMX. Dee, W4PNT, VA, (540)249-3161, cell (540)471-7023 or w4pnt@vais.net for jpg's

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: Repair! Radio repair, tube or solid state. Reasonable charges. J. Dan Rupe, W7DDF, 998 Whipple, POB 697, Grayland, WA 98547. (360) 267-4011, w7ddf@yahoo.com

FOR SALE: Books, 200+ radio titles. Great prices. SASE or email for New Revised List. Paul Washa, 4916 Three Points Blvd., Mound, MN 55364. w0tok@msn.com

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FOR SALE: Gates 1000W AM broadcast xmtr, complete. In Las Vegas, you pickup. Rich Baldwin, KD6VK, (702) 222-9941, richard@wizard.com

FOR SALE: Collins KWM-1 w/516F1 AC pwr sply, can supply digital pictures if desired. Lee, K7LTB, (775) 575-6705 , ltb@birdhouse.fernley.nv.us

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

FOR SALE: Heath Signal Tracer IT5283 with probe and manual - $25 + $5 shpg. R.J.Eastwick, W2RJE, 400 N. Haddon Ave., Haddonfield, NJ 08033. (856)429-2477

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FOR SALE: Parts for restoration/construction projects (connectors, meters, relays, etc) List - $1. Joe Orgnero, VE7LBI, 1349 LeasK Rd., Nanaimo BC V9X 1P8 Canada

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