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# ELECTRIC RADIO

celebrating a bygone era

Number 59 March 1994


Ed Wirtz, KØBKA

# ELECTRIC RADIO

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

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

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

## Regular contributors include:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; John Staples, W6BM; Dave Ishmael, WA6VVL; Jim Hanlon, W8KGI; Chuck Penson, WA7ZZE; Jim Musgrove, K5BZH; Dennis Petrich, KØEOO; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Rob Brownstein, NS6V; Dick Houston, WØPK; Andy Howard, WA4KCY; Skip Green, K7YOO; George Maier, KU1R; Albert Roehm, W2OBJ; Mike O'Brien, NØNLQ, Bob Sitterley, K7POF (photos) and others.

## EDITOR'S COMMENTS Barry Wiseman, N6CSW/Ø

The other day we learned that we had been successful in getting a booth at the Dayton HamVention. Our booth number is 316. We hope all of you who are there will stop by for a visit. This will be my first trip to Dayton and I'm very, very excited about it. For years I've always envied those who had been able to go to Dayton and I'd always hoped that someday I'd be able to go. I've got my wish and I'm crossing off the days on my calendar.

It's coincidental but our fifth anniversary also occurs in April. Going to Dayton is a good way of celebrating it. We're also going to try to make the April issue our best one yet. We'll be adding another 4 pages and I'm carefully selecting what I think are the best articles and photos.

Another reminder that rates will increase May 1, and that it's possible until then to renew for up to 3 years at the old rates. So far a great number of people have taken advantage of our offer and are not going to be affected by the increase for 3 years.

The hamfest season is about to start and I'd like to make a suggestion that could benefit us all. I'd like to see more people buying junkers and parts units and putting them on our Parts Unit Directory. This directory has proved to be a real boon to all of us who restore vintage equipment. But we need more people to put units on the list. I know it's a hassle storing the junkers, removing the parts and then having to pack them up, etc., but you can charge appropriately. Most people who need a part for a vintage restoration are willing to pay a generous price. Please consider following my suggestion.

# TABLE OF CONTENTS



**Cover:** Ed Wirtz, KØBKA, an E.F. Johnson employee, at one of his vintage operating positions which consists of mostly Johnson gear. The bottom left rig is a '500, on top of that is a Viking II and on the very top is a KW Matchbox. The receiver is a Hammarlund HQ-170A.

# There Is No Such Thing As "State of the Art"

**by Ray Osterwald, NØDMS**
**10679 West Dartmouth Ave.**
**Lakewood, CO 80227**

In Mike O'Brien's review last month of Raymond Moore's book, *"Communications Receivers"*, Mike mentioned that author Moore's quest over the years has been to find the ultimate communications receiver. This search is what led to compiling all of the data used in the book. He goes on to point out that Moore believes the ultimate communications receiver, although not yet found, can't be of the vacuum tube variety because solid-state equipment is naturally superior.

I feel that this commonly held view is an invalid comparison. Vacuum tube receivers can not be directly compared to silicon based equipment because they are fundamentally different quantities. In terms of basic receiver performance, some mighty fine vacuum tube receivers exist. These receivers, as excellent as they may be, are totally incompatible with software control and digital techniques in common use as of 1994. Note that I said "incompatible", not "better". My claim is that no one knows what the state of the art is because that state is valid only for a singular instant.

This short article is intended to be a reality check, a reinforcement of fact, and a warning. I'll wager a brand new set of 811A's that every reader of *Electric Radio* has, at one time or another, been chided by a brother amateur for devotion to thermionics. I've been accused of being a "hollow-head", my gear being "empty state", and worse. Who are these high and mighty folks who carry the illusion that they possess the state of an art, and where do they come from? What they do not realize is that within a few abrupt years, vacuum tubes and transistors will have more in common than in difference.

Ed Handy penned the ARRL "Amateur's Code" over sixty years ago, but made no provision for amendment as times changed. In his day, it took human knowledge about 50 years to double its content. Radio transmitters had just changed over from the arc to vacuum tube oscillators. It was easy and reasonable for him to admonish a new amateur to keep his station up to the state of the art. Things changed slowly, and the state of the art could be touched. Prior to then it had taken 150 years, or from 1750 to 1900, for knowledge to double. Since 1950 the growth of knowledge has been doubling at exponential rates. It is estimated that it doubled again between 1950 and 1960, just ten years, and since 1960 it has doubled every 5 years. 25 years from now, it is mathematically estimated that knowledge might double every 73 days! Can people actually absorb this rapid a rate of change?

Judging by the vast amount of worldwide activity in basic research, it's no great secret that within a few years, transistors will become obsolete. Computers will not be electronic, but optical. Main frame computers will be dinosaurs. The fiber optic network of the near future will have signal processing performed inside the fiber loop itself. For a glimpse ahead, we need only to look at the exotic work going on inside electronics research facilities.

Researchers are currently working with electronic device structures which are measured in nanometers (one nanometer is .000,000,001 meter). At these dimensions, called the nano-realm, the familiar properties which govern the behavior of conventional electronics no longer apply. New sets of physical laws are being discovered which describe the behavior of electrons in various levels of their quantum energy states. It is



**continued on page 33**

# AMI Update

**by Dale Gagnon, KW1I, President**

### Northeast Regional Report by Steve Ickes, WB3HUZ

Dobbins Island Expedition QSL cards have been sent out. Any station that worked WB3HUZ/3 on September 10-11, 1993 can receive a QSL card by sending an SASE to HUZ Radio, P.O. Box 752, Savage, MD 20763-0752.

I have received two letters offering help from Northeast AMI members. I have sent one a number of flyers to distribute at club meetings and hamfests.

A new AM frequency has been established on 160 meters. For about the last month Paul, WA3VJB, and I have been utilizing 1900 kHz. Now, I hear unprompted activity on this frequency quite often. We decided to start a second frequency in the low part of the band to ease some of the congestion and large groups that assemble around 1885 kHz. Also, quite a number of 75 meter regulars are taking steps (transmitter & antenna work) to get on 160. The tail end of this 160 meter season and next fall's season should see even more activity on 160.

Several broadcast transmitters will soon show up on 160. Paul, WA3VJB, with a Collins 300G, Tim, N3DRB, with a GE BT-20A, Paul, N3DAN, and Howard, W3HM, with Collins 20V's and Duane, KNØR, with a RCA unit.

Tom Cathey, K1JJ, received a letter from a disabled SWL in New Jersey asking for help in obtaining a receiver. Tom decided to get involved in the project personally. He read the letter on the air during the Northeast AM Swap Net and by the end of the net a receiver had been identified, the price reduced for this project by the seller, Peter Costa, WA1VVF, and a host of other AM'ers had volunteered donations if necessary. The latest correspondence from the SWL finds him studying for his license. Old time values as well as old time equipment are still present in the AM window!

### Armed Forces Day Operating Event

If you're planning on operating a military radio and/or operating from a site of military significance on May 21, 1994, and want to promote your operation in this column next month, please send your planned operation frequency and time information to AMI Headquarters before the end of March. I have already heard from groups in California, Maine and Rhode Island. See the AMI column in February *Electric Radio* for more information on this event. Remember the event is an opportunity for the military radio users to exercise their gear and the rest of us to work as many of these military stations as possible.

### Dayton Hamvention - AM Forum

The AM Forum will be on Saturday, April 30. Check your program guide for exact room and time. It may be different than previous years. The program will include a brief AMI First Anniversary Update, a pictorial segment on some important vintage radio museums around the country and a moderated panel discussion with several AMI Regional directors. if you have an issue you would like to have discussed, send it to AMI Headquarters we will get it to the panelists ahead of time. **ER**


I GOT INTERESTED IN VINTAGE RADIO AND DISCOVERED PLATE CAPS AND ELECTROCUTION AT ABOUT THE SAME TIME.

# Crystal Grinding

**by Walt Hutchens, KJ4KV**
**3123 N. Military Rd.**
**Arlington, VA 22207**

When the homebrew transmitter described in *ER* for July and October 1993 was finished, one of the first things I discovered was that '3885 kcs' might mean anything from 3880 to 3888 kcs. Half a dozen 80 and 40 meter AM window frequency crystals just wasn't enough to let me join most AM roundtables. However, I did have a couple of dozen other crystals for lower frequencies in the 80 and 40 meter bands and a few hours work converted these into a set running from 3870 to 3890 in steps of one kilocycle plus several in the 7280 to 7295 kilocycle range. When I mentioned this on the air one day, the response was "Gosh, I wouldn't have the first idea how to do that" -- hence this article. We will talk first about how quartz crystals work and then discuss a simple method for grinding a crystal to a higher frequency.

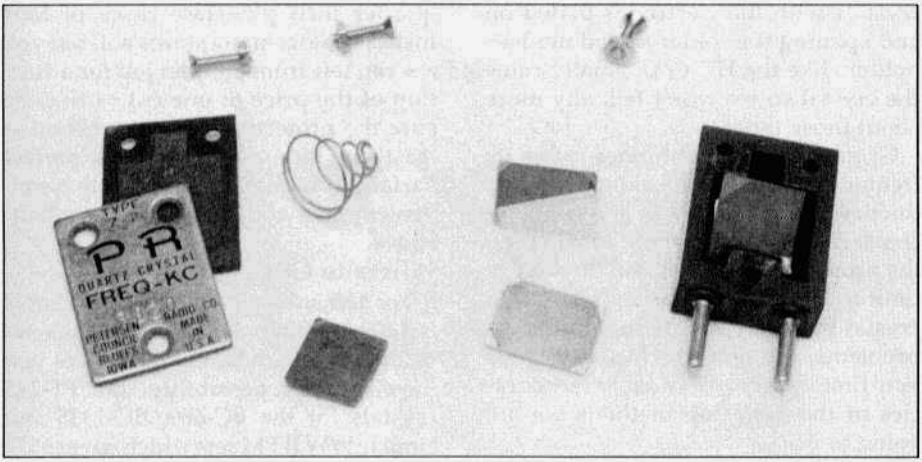
## Quartz Crystal Basics

Quartz crystals are essentially very low loss (high 'Q') mechanical tuned circuits with built-in electrical coupling. This coupling is the result of what is called the piezoelectric effect. When quartz is placed in a properly oriented electric field, the molecules in the crystal pull somewhat out of place. Depending on the way the piece of quartz was sliced from the original crystal (called the 'cut'), the result may be bending, a change of thickness, or displacement of one face or edge relative to the opposite one. The reverse is also true: when a crystal is deformed in the proper way for its cut, an electric field results.

A solid object like a crystal can vibrate in ways (called 'modes') corresponding to all of the shape changes above. A varying electric field can thus produce vibration and a vibrating crystal can provide an AC field which with proper electrodes can furnish an AC voltage.

Ham and military HF crystals since WW II are mostly 'AT' cut units. These operate in thickness shear mode and are sliced from the original piece of quartz at such an angle that this mode has a nearly zero temperature coefficient. [In thickness shear mode the top face of a horizontal crystal plate is going in one direction while the bottom face is going in the other direction.] Very slight changes of the angle at which the crystal is cut give an exactly zero coefficient at different temperatures. Crystals may be designed for best stability at room temperature (the usual case for ham work) or at a specified higher temperature for applications such as frequency standards where the crystal will operate in an oven. The 5547.5 kcs filter crystals for the R-8040 were specified to operate at 25 degrees C (77 degrees F). My R-1051B contains an AT cut frequency standard crystal made (cut) to have a zero temperature coefficient at the oven temperature of 85 degrees C (185 degrees F).

Although every crystal is designed to operate in a particular mode of vibration, any object can vibrate in many (theoretically an infinite number of) modes. The mounting and electrodes for the crystal are designed to encourage the wanted mode and discourage the others but this can't be done perfectly and any practical crystal has spurious resonances as well as the desired




**Disassembled view of a typical FT-243 crystal holder. Left to right, cover plate and rubber gasket, fiber insulator and pressure spring, upper electrode, crystal plate and lower electrode, and molded phenolic holder body. The crystal is held by raised corners on the electrodes which are under pressure from the spring. This is a typical corner clamped air gap mount; the 'air gap' refers to the fact that over most of its surface the crystal doesn't touch the electrodes. Bronze spring contacts soldered into the base pins in the body go below the lower and above the upper electrodes to connect them to the external circuit.**

one. In the worst case these spurious responses can steal so much energy from the desired mode that the crystal will not oscillate at all; another possibility is operation on the right frequency only if an external circuit is tuned to suppress the spurious frequencies. It is thus part of the crystal design process to choose the exact shape of the crystal so that the 'spurs' are as far as possible from the desired mode and have the lowest possible Q's. It is this process which makes it possible to plug a 3885 kcs crystal into an oscillator with no other tuned circuit and get 3885 kcs output. However in crystal filter applications other types of tuned circuits must be used as 'backup' to keep strong signals from getting through via the spurs.

The multiple modes we've been talking about are mechanical ones and shouldn't be confused with the series and parallel resonant electrical modes which are associated with each of the mechanical modes.

## Grinding Basics

The process of making a crystal from a chunk of quartz requires special equipment: optical instruments to determine the axes of the quartz, diamond saws to cut blanks, a lapping machine to bring these to near final size and shape, etching equipment to finish the plate and other tools and instruments for testing, mounting, and sealing the plate in a holder. However moving an existing crystal a few kcs is much simpler and requires only easily obtainable tools and supplies.

Many of the military crystals of WW II and most HF ham crystals for decades after the war were thickness shear plates (mostly AT-cut) in corner clamped air gap mounts. The FT-243 is probably the most familiar example; another is the FT-161 holder used with the BC-610 and other early wartime transmitters. These are the crystals we will be discussing. In general it is not practical to change the frequency of



**continued next page**

**Crystal Grinding from previous page**
crystals with the electrodes plated on and opening the solder-sealed modern holders like the HC-6/U usually ruins the crystal so we won't talk any more about those types.

Grinding a crystal thinner raises its frequency; roughly speaking a 1% reduction in thickness will give a 3% increase of frequency. Provided you keep the proper shape, there's no theoretical limit to how far you can move a given crystal but there are definite practical problems; the one which usually gets you first is the unavoidable inaccuracies of the table top methods we are going to use.

You can't make a crystal thicker but there are other ways to lower its frequency slightly which we will discuss later.

If you read older Handbooks you will find a description of a grinding method using abrasive powder and a glass plate. The materials aren't as easy to find as they once were and the procedure is messy.

A later and much better way uses a strong acid or acid compound to etch the crystal. This method produces the most stable and uniform crystals but the chemicals are dangerous.

The method which has evolved at KJ4KV uses a special kind of sandpaper which is designed to be waterproof and is often used to smooth automotive paintwork. It is simple, safe and works well for the sort of grinding hams are likely to do, namely, moving a 160, 80 or 40 meter crystal to a frequency as much as 50 or 75 kcs higher in the band.

Your local hardware store should have everything you need. The special sandpaper (sold under the trade names of 'WetOrDry', 'Water Sand' and probably others) is available in various grits ranging from about 200 to 600. [The numbers refer to the number of meshes per inch in a screen which will pass the grit so 600 is the finest.] Get one sheet of each available grit. Also get a piece of quarter inch plexglass three of four inches square; many stores will sell you a scrap left from another job for a fraction of the price of one cut to size. Be sure the protective paper is still on at least one side as you need a perfect surface. If necessary trim this to a convenient size and round off any sharp edges.

### Where to Get Crystals

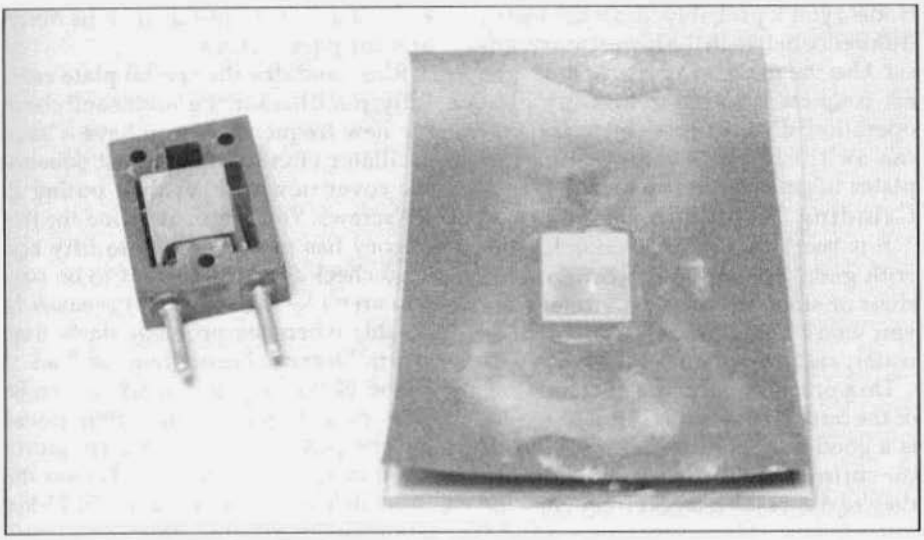
For 160 and 80 meters the best bet is old ham crystals for lower frequencies in the same bands. On 40 meters you have another possibility: the FT-243 crystals for the BC-659, BC-1335 and similar WW II FM sets which cover 5675 to 8650 kcs in steps of 25 kcs. In both cases estate sales and fleamarket junkboxes are your most likely source.

For each band, try to get units of just one type (for example, FT-243) so you can 'mix and match' holder parts if necessary. Try to get more than you expect to need and get a few out of band ones as well, for practice. If there are 'junk' crystals of the same type (broken or modified holders, etc.) get them too, for parts. There are actually several types of FT-243 holders for which internal parts are not interchangeable so if you have a choice, get more rather than fewer of them.

### Test Equipment

You will need a test oscillator of some kind. The ideal is a simple vacuum tube or (don't tell anyone!) transistorized oscillator with a meter to indicate crystal activity; for a vacuum tube oscillator a grid current meter will do fine.

Another possibility is the transmitter in which you plan to use the crystals -- either disable the final or put the set in 'Tune' power position on a dummy load. The transmitter must have a grid current meter which you can use as an indicator of crystal activity. Many transmitters 'pull' the crystal frequency slightly as you tune them up; check this effect and decide how you will handle it if you use this method. Also check



**A crystal plate being ground.**

and record the grid currents obtained with known good crystals on each band for which you will be grinding.

Look at the circuit of your test or transmitter oscillator; if it doesn't put any DC on the crystal (it shouldn't) you can make your initial checks by just pinching the holder parts together with your thumb and fingers. If there's DC in there, however, this method is risky. Both crystal pins should be insulated from the cover but if anything slips or gets left out you could be holding on to the oscillator plate voltage; Publisher Wiseman informs me that he wants all of ER's subscribers to live to a ripe old age.

A frequency counter is the best way to check the frequency but you can get perfectly adequate results with a BC-221 frequency meter or a high quality receiver such as an R-390. Your frequency measuring instrument must be fully warmed up (at least 24 hours) and precisely calibrated before you start work. Don't settle for using the internal calibrator as-is; tune in WWV and zero the calibrator crystal against that, then use the calibrator to check the receiver or frequency meter in the range you'll be using. If (like me) you use a cheap frequency counter, calibrate it before use.

## Preliminaries

Check the crystals you plan to grind for frequency and activity. If you have any which are far off frequency (over 2 kcs) or 'dead', open them up. The 'far out' ones are probably fractured or chipped; these are parts units. If you find a dead crystal which looks okay inside, clean it carefully, reassemble it and try again. It may have had nothing more serious than a bit of corrosion.

Make a list of the frequencies you want. When you start work, aim for the lowest frequency first; that way if you go too far you may still be able to hit one of the higher ones.

Pick the good crystal plate which is below your lowest target frequency and assemble it in a holder with the same spring, cover and insulator (if any) but three different sets of electrodes -- its own and two other pairs stolen from parts units. (Of course you can only do this if you have three crystal assemblies which use the same size electrodes). Measure the frequency at which the crystal operates with each set of elec-



**continued next page**

**Crystal Grinding from previous page**
trodes; you'll probably find a kc or so of difference between the lowest and highest. Use the plates which give the highest frequency for your first grinding operation; if you go just a bit too far you can switch to another (lower) pair of plates to get a second chance.

## Grinding Technique

It is best to work on a smooth table with good lighting and a comfortable chair or stool. Try to pick a time when you won't be disturbed. Get a dish of water, and a few paper towels.

Do a practice piece first. Open up one of the out of band crystals (make sure it is a good one) and take a close look at the surfaces of the plate itself; typically they're dull. Pick a target frequency for this practice that is something like as far away as you want to move your first real crystal. Cut a piece of 240 or 320 grit paper to fit your chunk of plexglass, wet it on both sides and press it grit side up on the plastic; if it doesn't lie flat right away it will before very long.

Put the crystal plate on the center of the paper with its edges parallel to the edges of the paper, put your finger in the center of the plate and begin making figure '8's large enough to almost fill the paper. Use a moderate to light pressure and make ten figures. Stop, rotate the crystal plate 90 degrees to the right, put it back on the paper with the same face down and make ten more figures. Repeat this twice more until you've done a total of forty figure '8's, ten in each direction. try to keep the pressure and the size of the figure the same for the whole series.

Pick up the crystal plate taking care to not flip it over and rinse it in the water. Dry with a paper towel. Look at both surfaces under a good light; you'll probably see that the one which was against the paper is now slightly shinier than the other and also shows some scratches. As you continue to grind, always put the same surface down on the paper; you'll see that it gets shinier each time as the crystal smooths down and the paper wears.

Rinse and dry the crystal plate carefully, put it back in the holder and check the new frequency; if you have a 'safe' oscillator circuit you can just squeeze the cover down rather than puting in the screws. You'll probably find the frequency has moved up ten to fifty kcs. Also check the grid current to be sure you aren't losing activity; it is easier to fix this when the problem starts than when the crystal actually goes dead.

The effect of paper wear can make you crazy: a piece of paper that moves the crystal twenty kcs on the first forty '8's may only move it two kcs on the fifth such series. If you are still 25 kcs below your desired frequency you'll need to use a new piece of paper; this is the time you are likely to use too many '8's and wind up 3 kcs above where you want to be.

As you get close to your target frequency, cut the number of '8's more than you think necessary. At about 1 kcs, check the frequency with the holder screwed together rather than just squeezed. Then let the crystal run in the test oscillator for ten or fifteen minutes; it may drift a bit as it warms up and it may also 'age' somewhat.

For the last 1 kcs or so, switch to using straight strokes in one direction only, use old paper (or a finer grit) and make just one or two strokes per test. From now on, try (it isn't easy) to reassemble the crystal with all the parts oriented the same way each time. When you get to 100 cps or so, quit; that is as close as you can reliably get with this technique and type of crystal holder.

## Problems

If the crystal suddenly goes dead as you grind, take it apart and wash the plate and electrodes with soap and water. (Windex spray is convenient and works well). Rinse, dry, and test again. The most common cause of a dead crystal (assuming you didn't break it) is a


**A set of home-ground FT-243 crystals for the 80 and 40 meter 'window' frequencies. A block of wood drilled to hold the station crystals was a standard feature of ham shacks of the 50's; except for a portable application don't put the holes this close together unless you enjoy using tweezers.**

speck of dirt or greasy fingerprint.

If the crystal does something strange -- say, the frequency goes down by 300 cps after you grind a bit -- clean it as for a dead crystal; this too is probably dirt.

If the activity of the crystal goes down (the grid current or output level gets less), first clean the crystal as above. If that doesn't fix the problem, hold the plate with the edge furthest from you against the paper at about a 45 degree angle and drag it toward you five times; the face you have been grinding must be downward. Bevel each of the four edges in this way. Wash and try again. If still dead, repeat at least twice.

Unless you've ground the crystal quite a ways already (say 75 kcs or more) you will probably now have a good one again and can go ahead with adjusting the frequency. With larger frequency changes, some corners will unavoidably be ground more than others and as the crystal gets out of shape the frequency of the mode in which you want it to operate varies across the plate, the 'Q' goes down, and it stops oscillating.

If you have a micrometer, you can measure the thickness about 1/8" in from each corner; you may be able to spot the problem and flatten things out but you are only looking for a difference of about .0001 (one ten thousandth) of an inch. You will note as you do this that the center is about .0003" thicker than the corners; this is normal and helps to raise the 'Q' of the plate.

Be very careful as you measure not to snap off the corner of the plate; it is easy to do.

I have only been able to reactivate dead crystals by this method about half the time. These days, unless it is a rare item, I just throw them away if beveling doesn't work.

Both beveling and corner leveling raise the frequency so if you were already close you may wind up with a good crystal which is too high in frequency.



**continued on page 32**

# Mechanical Design of Collins Amateur Equipment

**by Fred Johnson**
**6202 Hilltop Trail**
**Sachse, TX 75048**
**Part 2**

After the rush was over, both Gene and Arlo sold their home constructed "30-L's" to outside hams. They replaced them with CRG units. "CRG's" are units returned from customers and refurbished by the factory to original performance specs.

Arthur Collins had previously organized a similar but larger task team to "practicalize" SSB. One of my M.E.'s was on that team also. That group was housed in Butler buildings behind the main plant. That was late 40's, very early 50's. The SSB program was a classic application of "adapt and apply" vs. invention or innovation. Much of what was done in the Butler building project was applying and refining known principles. At that time we had new steep-slope mechanical filters, very stable oscillators, and most of the "tools". Linear amplifiers still needed improvement, and the measurement equipment to do that had to be created. In order to get RF spectral purity one needed a way to look at the spectrum. A real-time video graphic spectrum analyzer to do that was developed in the department. Numerous copies of the analyzer were put into broad usage. Nowadays one would go to HP and choose among models. At that time there was no alternative but to build the essential test equipment in-house.

The SSB group that worked in the Butler building also got to be known as a "Butler Building" project. But the Butler name didn't stick over the ensuing years nearly as firmly as the Green Room name did. The term Green Room had been in earlier use to describe waiting rooms for artistic performers before they take the stage. However, I don't recall any earlier use of the name Green Room to describe a sweat shop as it came to be known at Collins.

My comments here apply mostly to the portion of Collins engineering that reported to Ernie Pappenfus. The other major engineering department, not under Ernie, handled avionics, aircraft instruments, space equipment, and some government programs. Suffice it to say that they also had a mechanical engineering group. It was an organization conceptually similar to Ernie's. The other mechanical engineers, and we in our group, coordinated on many technical matters. Their technical resources were available to us working on Amateur equipment. Special instrument-grade gear design is a good example. They also did a lot in the thermal evaluation area which we picked up on. That was especially valuable as we designed forced airflow cooling of external anode tubes. But, more on that presently.

Mechanical engineers working on other projects in our group were also a source of help on amateur equipment design. We were seldom unable to find a competent source of good advice or help within an hour or two. The net result is the quality of designs that are now out there to be seen.

It's interesting to think what would have been possible if we had had today's computer-aided design tools, programmable test equipment, today's measurement capabilities, circuit simulation, etc. I recall co-workers stretching out long fan-fold sheets of graphical computer printouts from a mainframe chain printer. The mainframe had been pro-

**The author receiving 30 year Collins service pin from Bob Mullaley in 1978, while VP of microwave engineering.**

grammed for elemental RF filter design. What a comparison to what's routine today!

It's only fair to say here somewhere that more good mechanical engineering was done by E.E.'s at Collins, than was good electrical engineering done by M.E.'s. Many of those E.E.'s are still friends. They deserve recognition. Remember though, that when one goes to look at a potential purchase, what do you see? The mechanical things, not electrons.

Arthur Collins strongly encouraged the use of computers for design and simulation purposes. It became a major issue in his plans for the organization. As he foresaw the future of computers in design and manufacturing, he communicated his visions repeatedly, and in many forms. For some engineers and managers the message was understandable though very difficult to implement on Arthur's schedule and at that time. For others, the concepts were unfathomable. But, that's part of a much broader story. The earliest mechanical design use of the mainframe I recall was when we had the programmers prepare a table of squares of integers from 1 to 100,000. We had these tables printed and distributed. This was for use in precision gear center coordinate calculations. The slide rule fell far short of necessary precision. Pocket calculators were still far in the future. How crude that looks today. Yet, it made possible design of gear center location accuracies to 5 places in record short time.

Mechanical design of Collins tuning mechanisms almost always included analysis of the effects of differential thermal expansions. Material choices were made accordingly. How these affected tuning stability was the issue. There was also a conscious effort to calibrate dial markings so their readability agreed with actual accuracy of the controlled variable. This is something Arthur wanted us to be fastidious about. If you could read it to a kHz, then that's what it was -- and vice versa. We saw flagrant violations of this principle in some competitive equipments.



**continued next page**

Coming back to a specific ham equipment, the KWS-1 was engineered in 1953 when the "New Engineering" building #120 was first occupied. Company employment was about 5800. Arthur named the new sideband amplifier with KW for its power, and "S" for sideband.

I remember some mechanical/electrical design discussions regarding how the KWS-1 was to be configured. We had a strong M.E. assigned. There was an even stronger E.E. project engineer! Parts layout for accessibility to manufacture the unit, and to maintain it, was a red hot topic amongst all of us. When the E.E. project engineer kept moving large power supply components around in the lower cabinet, for what he believed would be best accessibility, the frustrated M.E., who was facing a schedule for completion of fabrication drawings, said in exasperation: "Look, if you keep putting things up front, first thing you know something's in the back!".

In the KWS-1, we mechanically rotated (rocked) the body of the Permeability Tuned Master Oscillator for selection of upper or lower sideband. I believe it was called passband tuning. This was a mechanical way to get a desired frequency shift without affecting center frequency indication on the dial. It was a spring loaded low-friction speed reduction band drive. Other applications of this concept were in use elsewhere around the company.

The KWS-1 employed another spring-loaded band-drive to convert rotary knob inputs to linear movement on a rack of tuning slugs. The band-drive was again chosen for its freedom from backlash, for linearity, and for ease of tailoring to the travel requirement. That type of drive could be expected to last indefinitely without degradation in any of its functions. Life tests on similar designs had been run before, so the choice was obvious. Important, but not foremost, was the fact that the mechanical band-drive is also economical.

There had already been a long history of advanced mechanical design applied to tuning functions. The Collins Autotune, invented by Arthur Collins himself, and Autopositioner, invented by Horst Schweigbofer, and their derivatives, were examples. They were mechanically programmable rotary position memories. Today, that function would be executed electrically on a silicon chip – with immense capability to spare. But the application of mechanics for an electrical objective at this earlier stage of the game was virtually second nature to us. And, silicon for that job had yet to be invented.

An important mechanical characteristic of a mechanical tuning knob drive is its "feel" to the user. Our M.E.'s were alert to this important attribute. If it didn't feel good, it wasn't acceptable. About that time we marveled at the really fundamental work done by IBM on the tactile feel of their Selectric typewriter. If one canvasses users even today, the feel of the old IBM Selectric is still the standard by which every other keyboard is evaluated for "feel". IBM designed the instant of electric contact to be coordinated with the arrival of the keyclick in the users ear, coupled with his or her feel of the slight over-center action. These are what gave the Selectric user a tactile confirmation that the key made contact. The whole thing was a marvel. Plus, it was hard to cause a jam! Compare that to your PC.! These great features of the Selectric were later written up in an article in Scientific American. Although Collins M.E.'s couldn't spend the man-years IBM put into their keyboard, we tried to emulate these principles in the manual controls of our products.

In my travels over intervening years, I have been surprised and pleased to have chance encounters with a few absolute strangers who own Collins gear, and who voluntarily made unsolicited favorable comments about dial feel as a factor in their enjoyment of owning Collins gear.

During this period we also learned some mechanical things to avoid. You won't find these in Collins gear of that period. For example, a free machining grade 303 stainless steel shaft must never be run in a free machining brass bushing. For example, a tuning shaft in a panel bushing. That combination is bad no matter what lubrication, surface finish or other variables. Agree -- it looks fine! BUT, it is bad news! You can bet that a small percentage of designs using this combination will eventually gall and seize. Not enough to be a big number, or to be readily found by ordinary tests. Just enough to kill a design engineer's valuable reputation.

Another bad combination is a free machining stainless steel shaft run in Oilite bearings. Here a manual drive will be OK, but a faster rotating motor-driven shaft can be sawed in half by the Oilite.

Yet another finding was that a heat treatment normally used to develop highest tensile properties in beryllium copper is accompanied by an unpublished change in bulk size. Not much, just enough to require compensation for precision drives. Now, back to specifics.

The upper cabinet of the KSW-1 housed the PA. The final amplifier tubes were 4CX-250's. Forced air was required for the fins of the external anodes. Everyone involved knew forced air is fine for reliability. However, forced air makes noise, and the typical ham shack is quiet. So, a blower was an unwelcome requirement -- especially in the eyes of an E.E. on whose turf the blower is a foreign object. In this case, the project E.E. believed the required blower should be located on the base of the bottom cabinet. A hose would be used to duct air from the blower up to the PA tubes. That configuration prevailed in all production.

Meanwhile, the M.E.'s were accumulating data on a better way. The world wasn't ready for that better way at the time. We were concerned because the hose and ducting hardware created such an additional pressure requirement that the blower had to be larger than it would have to be if the blower could be connected directly to the tube. Since that didn't seem practical at the time, we went ahead with the larger blower and hose.

A problem M.E.'s had to solve at that time was the ability to measure airflows and temperatures in the presence of high voltages and RF. Those skills were still embryonic. Thus the arguments to do the job right -- without a hose -- didn't prevail. By the time a later unit, the 30S-1, came along, the cooling job was done with a small, but adequate, blower right under the final tube socket. By then we had indisputably measured air flows and anode temperatures to show what the cooling system was doing. It was a good feeling to know the measured truth. It confirmed that desired margins actually existed. The hose was eliminated and the smaller blower was reasonably quiet. My earlier article touches on measuring temperatures and airflows.

The rest of the KWS-1 mechanical design was relatively routine for the day. The black crackle finish matched other products, and the dial escutcheon carried on the corporate image.

The 75A-4 was the SSB receiver companion to the KWS-1. We lavished on it the same design margins that were normal for the day. It is my understanding that present-day solid-state receivers still have trouble equalling or bettering its performance. Its appearance melded with the KWS-1 very well by design. The customer community knew its performance would be state of art. **ER**

**Part 3 next month.**

# A Universal Receiving Tube, the RV 12 P2000

**by Horst Geipel, WAØNUH**
**2231 Hampshire Ave.**
**Fort Collins, CO 80524**

At a recent hamfest I could not resist buying a German military tube of WW II vintage. It brought back memories of the early days of my radio hobby, as my first regenerative receiver used a pair of tubes just like that. How a young boy was able to procure tubes and other radio parts in the early post WW II years in Germany, however, is a story all by itself. Before I describe this universal receiving tube, therefore, permit me to digress and tell you about the challenges a twelve year old boy in the Germany of 1946 faced if he wanted to build a radio.

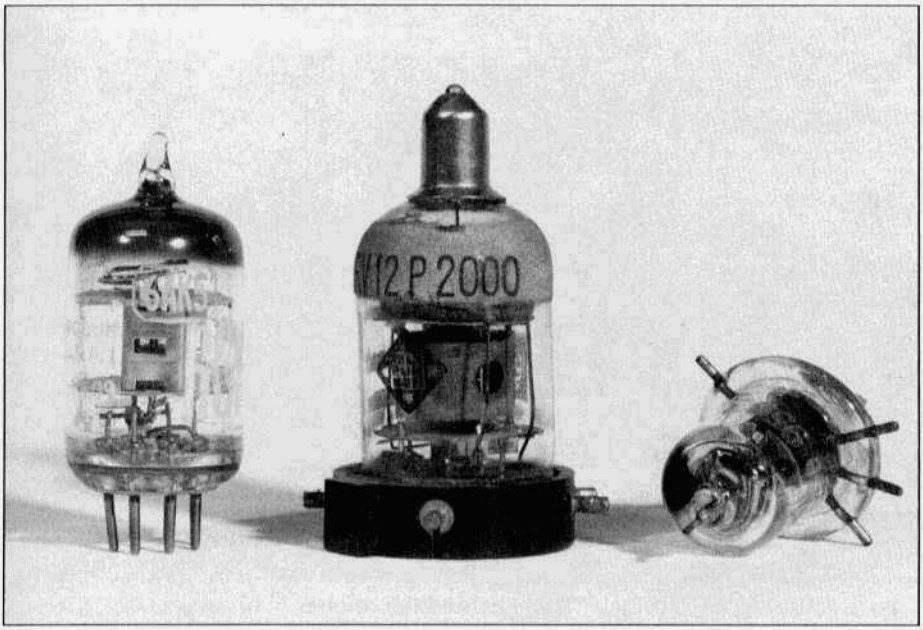
I was living in Munich at that time and about sixty percent of the city was in ruins. We had a military government, food was rationed and scarce, the money was practically worthless and anything of value including some food items could only be bought on the black market. Radio parts were no exception. To be sure, a few radio stores which survived the bombing were selling small parts like resistors and capacitors. Other vital parts like transformers, loudspeakers, variable capacitors and especially tubes, could only be found on the black market or be traded for other valuables such as watches, cameras, cigarettes and food. And here I was, a school boy with no money to spend on the black market and wanting to build a radio with two of the most sought after and hard to get tubes!

The black market price for an RV 12 P2000, the tube type to be used in my radio, was about the same as that of twenty cigarettes. Cigarettes were not available in stores, but American GI's could buy them cheaply at the PX. The GI's did, therefore, not bother to pick up any cigarettes they dropped when they got one out of the box while driving. This led me to search the floor boards of every parked U.S. military vehicle I came upon for cigarettes.

Another source of "income" for me was salvage. In the vicinity of Munich were several abandoned German military airfields. There, parked among the trees, were hundreds of former Luftwaffe planes. Anything worth salvaging had already been stripped from the cockpits of those planes, particularly radios, radar equipment and meters. But, there were still antenna tuners, dynamotors, relay boxes, coax cables and hundreds of feet of copper wire way back in the fuselages of those small Messerschmitt ME 109's and Focke Wulf FW 190's because an adult person could not easily get at these goodies. A small boy, however, could crawl back there to salvage them! Parts thus obtained which I could not use myself were sold or traded for parts I needed, and the copper from all the wire was a hot black market item back then.

The RV 12 P2000 was a miniature pentode designed for military applications in the VHF and UHF spectrum. It had a side contact base and a grid cap. The tube disappeared completely into the associated socket which made contact not only with the side contacts but with the grid cap as well. The filament voltage was 12.6 V and the filament current a very low 75 mA. With a plate voltage of 250 V, the rated plate current was 10.5 mA.

Because the tube was indirectly heated and had such low filament ratings, it was ideal for replacement of tubes in commercially produced AC/DC broadcast receivers built prior to the war. Tube production had not yet resumed in those early postwar days. While transformer operated sets were using 4 V glass tubes



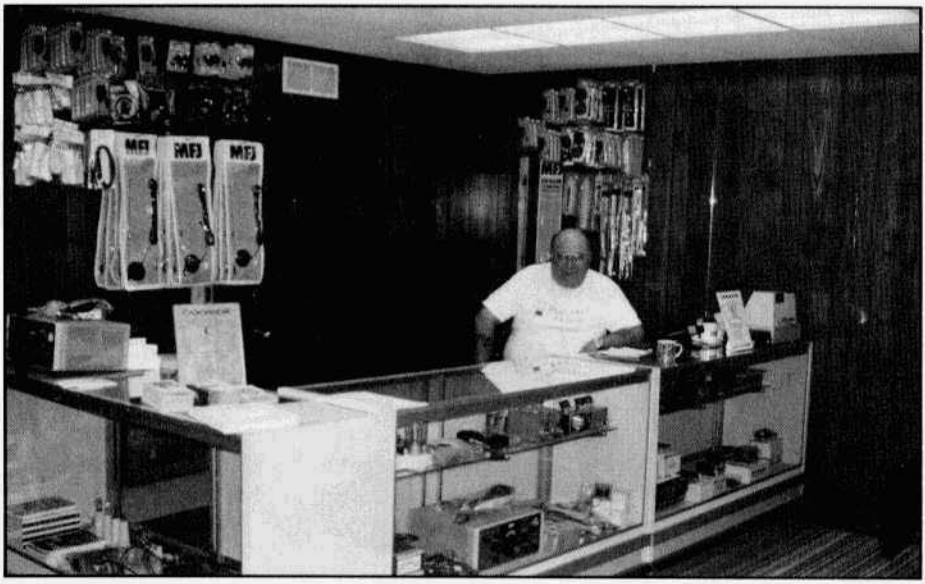

**RV 12 P2000 (center) compared to 6AK5 (left) and 957 acorn tube (right).**

or 6.3 V metal tubes, the AC/DC sets used tubes with filament voltages as high as 50 V. It was, therefore, an easy matter to replace these tubes with the RV 12 P2000. One only had to add the proper series and shunt resistors to match the filament ratings of the tube to be replaced. To replace a defective tube with an RV 12 P2000, the original tube's base was carefully removed and the P2000 was then mounted on top of it, complete with the filament resistors as required. Multifunction tubes were replaced with two or more P2000's, which were then usually mounted on metal brackets attached to the original tube's base for support. The RV 12 P2000 was used to replace not only pentodes but also diodes, triodes, hexodes and low current AC rectifier tubes. It was even used by radio manufacturers in new sets produced before regular tube production was resumed. The German electronics giant Grundig started its existence by selling a two-tube regenerative broadcast receiver kit which used two RV 12 P2000's and a selenium rectifier.

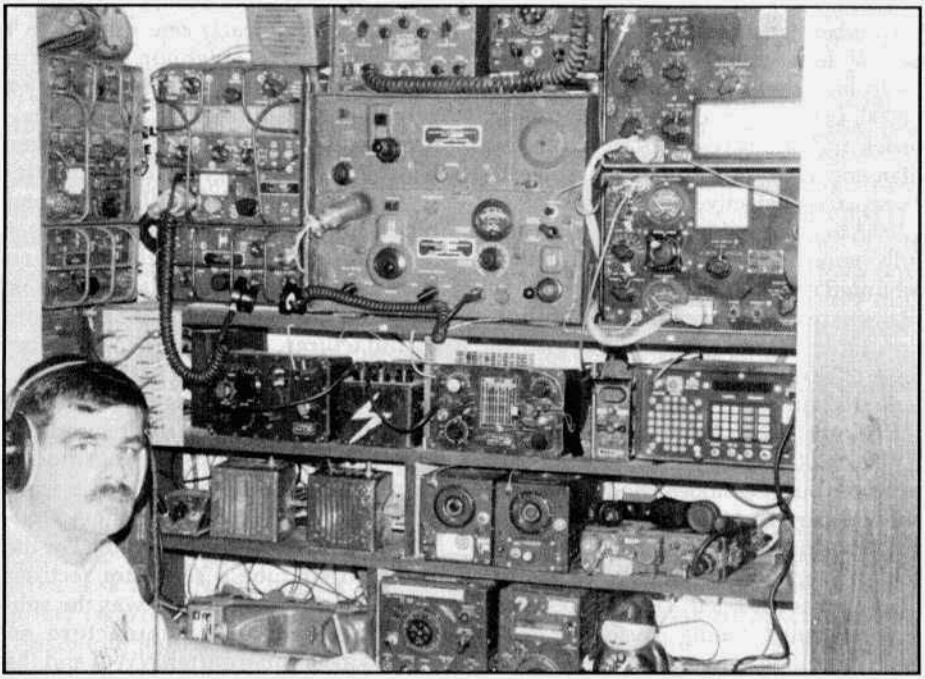
That the RV 12 P2000 was truly a universal receiving tube was demonstrated to me clearly one day when I was asked by a neighbor to repair a postwar production superhet built by a prominent manufacturer still in business today. The receiver was a three band AC/DC superhet and was designed for prewar series filament metal tubes. It was wired with the proper octal sockets for these tubes but - no such tubes were yet available! In their place, manufactured by this same radio manufacturer, were plug in adapters with RV 12 P2000 tubes. For the hexode/triode mixer and oscillator tube there were two P2000's, for the pentode IF amplifier one P2000, for the duo diode/pentode demodulator and AF preamplifier three P2000's and for the AF output tube two P2000's in parallel. For the AC rectifier tube a selenium rectifier mounted on an octal base was the substitute. When tube manufacture resumed in Germany after WW II and the tube types this receiver was designed for became available again, all the set owner would have to do was pull the



**continued on page 31**

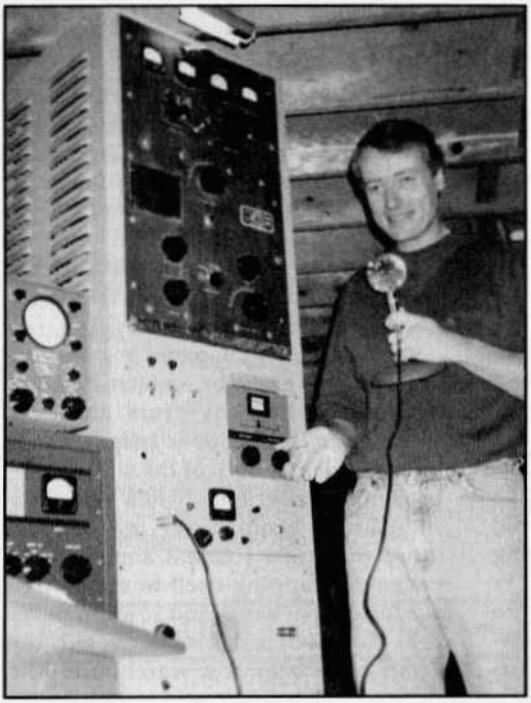


**Dave Kamlin, AB6XK, ('Uncle Dave') behind the counter in his new store "Wireless World". The store is located in Laguna Nigel, Calif. and specializes in vintage gear, accessories and parts.**



**Tim Sammons, N6CC, a regular on the 75-meter westcoast military radio collectors net. He says the group is contemplating a field day trip to Treasure Island for Armed Forces Day.**

**Ron Skipper, AA8AD/2, in his shack with his vintage equipment. The large transmitter behind him is a T-368. Photo by W3PWW.**



**Pat Keogh, WB9GKZ, with his latest acquisition, a Mackay Radio transmitter model 2013. He calls it his "poor man's KW-1". This transmitter was used aboard ship for passenger radiotelephone ship to shore communications.**

**It has 813's in the final and 811A modulators. It runs 250 watts out. Pat has it on 160, 80 and 40 meters. Note the Johnson 122 VFO.**

# LETTERS

**Dear ER,**

I read with great interest Rob Brownstein, NS6V's, article on his HQ-110 in the January 1994 edition of *Electric Radio*. I learned to love Hammarlund receivers while in the Army. I started out using the Super Pro and graduated to the SP-600.

I must take exception to one statement in Rob's article. He said that he "... .. drilled a hole and installed an SO-239." In many of the articles in *ER* dealing with antique or collectable radios the authors condemn the various non-reversible modifications done in the past. A hole drilled in a radio is clearly "nonreversible." Perhaps someday there will be a collector who finds a "near mint" HQ-110 with only one problem, a hole drilled and an SO-239 installed and writes an article for *ER*.

Let us treat all this fine old gear with the respect it deserves. All "modifications" should be reversible. In other words, any "modification" can be removed and the radio returned to its original, factory condition.

If my memory serves me Hammarlund added the "C" designation to their receivers that had a clock mounted. Therefore, shouldn't Rob's be called an Hammarlund HQ-110C?

**Gerald A. Morris, WA6NAR**

**Dear ER,**

I read with interest James Viele's, N8IRL, letter regarding interference from AM stations and your editorial in the February issue. I got into a discussion in a round table on 75 meters the other morning with a number of "old timers", one of whom was commenting on having to throw a number of B&W air coils, NIB and other nice parts into the dumpster to make way for repairmen who were going to replace his furnace. I grabbed my issue of ER and read the editorial on the air, trying to change their minds, and assuring them that many of us are still building and there was a demand for their basement treasures. None of the participants were aware of *ER*, but after they found out that it promoted AM, I was politely told that the dump was a better home for these parts than selling or giving them to a "AMer"! Many had been victims of AM QRM and were not happy about their experiences. Just thought I would pass that along as something to think about. These same people, I should mention, have little use for packet or AMTOR operation on the HF bands. Being narrow minded or not, they do have a legitimate complaint. Let us all keep this in mind, whatever mode we may be operating. Courtesy seems to be a way of hamming long forgotten. Bad behavior might be expected from new "no code" people in our hobby, but not from those of us so "much longer in the tooth".

**Gary Reiss, WAØJRM**

**Dear ER**

I enjoyed reading the article by Chuck Penson, WA7ZZE, about the Heath TX-1 and RX-1 Green Machines. The article was particularly timely since I am in the process of putting an Apache (TX-1) on the air.

One problem I ran into was with the "pulleys" Chuck mentioned. The driver and plate tuning capacitors are connected to the front panel via flexible belts. In my Apache, which had not been used for many years, the belts were made from copper strips as supplied by Heath. Both of the straps were broken and after I made new ones, one soon broke again. After trying some other materials I found some plastic package strapping used to strap large cardboard packages and to strap packages to wooden pallets. It was in the scrap heap behind a warehouse. The



continued on page 33

# VINTAGE NETS

**Westcoast AM Net:** Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.
**California Early Bird Net:** Wednesday nights at 8 PM PT on 3835.
**Southeast Swap Net:** Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
**Eastern AM Swap Net:** Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
**Northwest AM Net:** Recently started by Pat, K7YIR, this net is on 3875, Mondays and Fridays at 9:30 PT. 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.
**Twenty Meter AM Net:** This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 4:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control is Les, K6HQI.
**Arizona AM Net:** Meets Sundays at 3 PM MT on 3860. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.
**Colorado Morning Net:** An informal group of AM'ers get together on 3875 Monday, Wednesday and Friday mornings at 7AM MT.
**DX-60 Net:** This net meets on 7290 at 2 PM ET. Net control is Jim, N8LUV. This net is all about entry-level AM rigs like the Heath DX-60.
**Military Net:** It isn't necessary to check in with military gear but that is what this net is all about. Net control is usually Walt, KJ4KV, but sometimes it rotates to other ops. It starts at 5 AM ET Saturday mornings on 3885.
**Military Radio Collectors Net:** Meets Sundays at 4 PT on 3905. Net control is Tom, WA6OPE. It is not necessary to check in with military gear.
**Grey Hair Net:** The oldest (or one of the oldest) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8 PM in the winter and 9 PM ET in the summer.
**Vintage CW Net:** For CW ops who enjoy using vintage equipment.This is not a traffic net; speed is not important. The net meets on 14.062, Saturdays at 3 PM PT. Net control is Tracy, WB6TMY.
**Vintage SSB Net:** Net control is Chuck, N5SWO. The group meets on 14.293 at 1 PM CT, Sunday afternoons.
**Collins Users Net:** The oldest of the 'users nets'. It meets on 14.263 Sunday afternoons at 2 PM CT. The net control revolves. This group also gets together for an informal ragchew on 3805 Tuesday evenings at 7 PM CT.
**Drake Users Net:** Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.
**Heath Users Net:** A new net started by Marty, WB2FOU/5. Net control is shared by Fred, AA5LW. It meets on 14.275 at 4 PM CT Sundays. Check in on either AM or SSB.
**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 has been meeting since 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.
**NBFM Net:** 3885 at 10.30 PT, Thursdays. Net control is Dennis Petrich, KØEOO.

**Good News! UPS has raised their weight limit to 150 lbs.**

# The Gonset G-76 - Revisited

**by Bill Kleronomos, KDØHG**
**P.O. Box 1456**
**Lyons, CO 80540**

It was with great interest that I read Walt Hutchens' excellent review of this classic Gonset rig in *ER* #53 as I was in the process of acquiring one for mobile AM'ing on the Colorado morning net. As it turns out, I ended up purchasing two of them - one a "parts" rig in fair condition, and the other in great, rust-free shape complete with power supplies and factory calibrator.

Four months and some 100 bench hours of work later, I decided that what I found and did during my rig's workover merited mention for those of you interested in putting this unique example of a compact AM/CW "transceiver" on the air.

**"Get 'em Out the Door!"**

One of the most valuable things acquired with the rigs was two sets of documentation - an early manual and schematic courtesy of K7YOO, and a late set of same complete with dated revision notes. With these, I could trace the design evolution that occurred during this rig's relatively short manufactured lifespan. What I found wasn't pretty!

The basic design of this transceiver, as Walt put it, wasn't bad, even showing flashes of creative engineering in places. However, the first production run of these units suffered from some major oversights in an attempt to keep costs down. Revisions were made that in many cases were ill-advised or poorly thought out. Had I bought a late model G-76 at my friendly radio store I would have come close to tossing it through the front window if my request for a refund was refused!

It is clear that Gonset was not going to spend any effort or money on properly correcting the following faults - I'm sure corporate management made a decision to ship units as is, recoup design costs and end production as soon as possible. Why spend money on an AM rig when SSB was clearly the way the world was going?

**The Drifty VFOs, Etc.**

The single most critical Achilles Heel in this rig is the drifty TX and RX VFOs. With either no, or poorly implemented temperature compensation, both receiver and transmitter drift an unacceptable amount - as much as 10 kHz+ over the first half hour, and they never do quite settle down. Gonset's first mistake was to broaden the IF response of the receiver in an effort to mask the drift! Instead of using a crystal controlled 2327 kHz 1st oscillator in the receiver, an IF can is used to control an LC oscillator - which adds its own contribution to the overall drift.

The original design cathode keyed the final for CW operation, works great except for those times when grid drive is lost due to a crystal falling out of the socket or detuning of the grid network - then goodbye 6DQ5! No grid bias, no tube. So, a clamp tube and keying of the driver cathode were added in September of 1960. The final receives its screen voltage through a 47K, 2 watt resistor with one side to the 600 volt plate supply. Now kids, remember your radio math? What happens when one side of the resistor is clamped to ground and the other goes to +600? If P=E2/R, then during "key up" in CW this 47K/2 watt resistor dissipates over 7 watts (Walt, this is probably why the resistor in your rig was changed!). Some genius at Gonset ("Hey, give the problem to the new kid") thought they simply solved the problem by paralleling a 2nd 47k with the first - no guys, that's not how

**The G-76 mounted in KDØHG's pickup.**

you increase resistor power handling ability!

The 47K in my rig looked great - but it had scorched itself to a value of some 70K.

A second problem reared its head during CW operation. Even though the screen of the final is clamped to ground during key-up, as the tube heated up secondary emission from the screen caused plate current creep - after some 2 minutes of pounding the J-38, key up plate current was more than 100 mA - and rising fast! No tube would take that kind of abuse for long. This problem was nonexistent with some brands of final tubes, but occurred with many made by obscure manufacturers like RCA and GE. . . (OK, Sylvanias worked best - the ones with the internal heat radiating fins attached to the tops of the grids.)

Didja ever try to operate CW without the use of a sidetone? A sidetone oscillator was added to the list of things that needed adding - listening to a power transformer's grunts as a monitor just doesn't cut it.

## OK-What to Do

The absolute first thing to do is temperature compensate the VFOs. Walt's suggestions in *ER* were right on the money. Beg, borrow or steal a fistful of negative TC small value ceramic capacitors in -330, -470 and -750 flavors, if possible. In general, approximately 1/3 of the total capacitance across the coils needs to be replaced with a -TC type, the rest to be NPO or dipped mica. Don't even try this unless you have a counter and generator. It also helps to live in a place that gets brr-cold in the winter. Setting the rig outside for an hour and bringing it in and firing it up greatly magnifies drifting and shortens the time this thankless task takes. It is important to remember that the <u>total</u> capacitance you end up with across a given inductor must be close to the original factory value or the VFO dial calibration will not track!

Once the TX and RX VFOs are reasonably well compensated (or you run out of patience) it's time to fix the receiver's selectivity. If there are 100K resistors across the primary and secondary of the IF transformers as well as 5 pF ceramics from top of primary to secondary, get out the cutters - your receiver's selectivity is in excess of 8 kHz at 6 dB down and near 40 kHz at -60 dB, about good enough to work several AM sta-



**continued next page**

tions at once, or engage in a new concept - a roundtable that covers 3870 to 3900, all at once. . . Clip out the 100 K resistors on the primary (plate side) of the transformers; leave the 100 K resistors on the secondary (grid) sides in place. Clip out and throw away the 5 pF ceramics. Realign the IF. Congratulations - you just restored the receiver's performance to that originally designed, about 3.2 kHz wide at the nose with a 5:1 shape factor. Earlier units will not have these added components, so don't lose sleep trying to find them.

A final and minor improvement in skirt selectivity can be achieved by bypassing the hot side of each 12BA6 heater to ground with a .1 uF/50V disc ceramic. This helps prevent IF signal leakage around the two IF amplifiers via heater to cathode capacitance and improves skirt selectivity.

## Holy Smokes Department

As previously mentioned, the screen dropping resistor(s) is hopelessly inadequate for the job. Replace the paralleled 47K 2 watt resistors (located on the top of the chassis) with a single 50K 10 or 12 watt wirewound. Make sure the body of the new resistor doesn't have a chance to short to the shield of the 6BZ6 RF amp or to the chassis.

The thermal runaway of the 6DQ5 under key-up conditions can be cured by adding some cathode bias with the use of a zener diode. Solder a small two or three lug terminal strip to the VFO coil shield behind the socket of the 6DQ5. Remove the insulated wire and the lead to the 22 ohm resistor from pin 3 of the 6DQ5 socket; connect them instead to a lug on the new strip. Leave the wire on pin 3 that goes to pin 6 and the bypass cap alone. Connect the cathode end of an 8 to 12 volt, 5-watt zener diode to pin 3 and connect the anode to the lug you moved the wire and resistor lead to. (Leave the zener's leads as long as possible, they're its heat sink). This adds enough fixed bias to the final to prevent thermal runaway during key-up conditions.

For those of you interested in such things, I measured about 400 microamps of reverse grid current off the screen of a reasonably fresh 6DQ5, enough to raise its voltage to almost 10 volts and cause about 150 mA of idle current. If you never, ever plan to operate the rig on CW, this mod is unnecessary, but don't forget your promise during a burst of enthusiasm on Straight Key night!

While on the subject of CW, see figure 1 for the schematic of a nifty little RF powered sidetone oscillator. It produces a sweet sounding sine wave tone instead of the usual raunchy squarewave generated by digital circuitry like the 555 timers. R1 through R4, D1 and D2, and C1 are conveniently located on a terminal strip added immediately behind the loading capacitor. The rest of the circuit can be built on a small piece of perfboard and bolted next to the modulation transformer or any other available crevice - the use of a mini 1" speaker helps. The enable line is connected to the switched ground available at the cold end of T6 - the BFO coil. As a result, whenever more than 10 watts of RF is present and the BFO is switched to SSB-CW, a sidetone will be generated. Note: if the circuit fails to oscillate and the wiring is good (right?) increase the value of R6 to a few tens of ohms.

## Bits and Pieces

One of the goof-ups Gonset added was the alteration of the value of C92, at the grid of V12B, the second AF amp from the original value of 100 pF to .001 uF. This must have been done to roll off some of the added hiss when the IF strip was widened. Unfortunately, it rolls off all TX and RF audio beginning at 200 Hz. If you restore the IF strip as described earlier, or care to have some mid-freq punch in your audio, replace this cap with the original value of 100 pF.

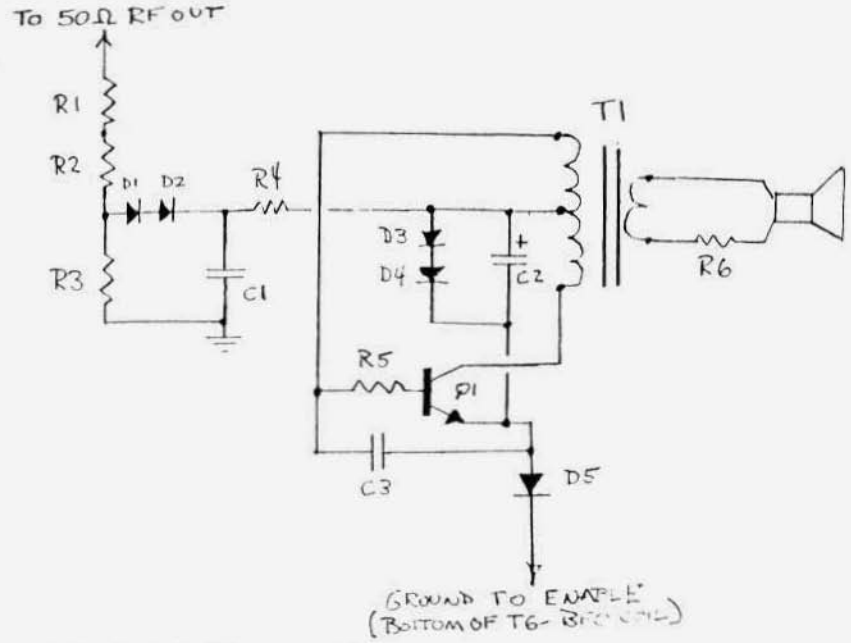



**Figure 1, Handy little RF powered CW sidetone oscillator.**

**Parts List**

R1, R2, R3 - 470 ohm, 2-W carbon
R4 - 470 ohm, 1/2-W
R5 - 3.3K, 1/2-W
R6 - 10 to 100 ohm - optional (sets volume)
C1 - .1 uF, 50-V ceramic
C2 - 10 uF, 10-V electrolytic or tantalum
C3 - .22, 50-V ceramic or tantalum (sets freq. of tone)
D1, D2, D3, D4 - small signal silicon switching diode (1N4148, etc)
D5 - 200 PIV rectifier diode
Q1 - 2N2222 or equiv.
T1 - 1K C.T. to 8 ohm transistor output xfmr, Radio Shack #273-1380 or rob from old radio.
L.S. miniature 8 to 32 ohm loudspeaker
Misc - perfboard

To better increase AGC action and the dynamic range of the receiver change R 32 (cathode bias of 1st IF amp) from 270 ohms to about 560 ohms. Add a 1.5 meg resistor from the cold side of the last IF transformer secondary to the AVC bus - (in parallel with the existing 1 meg contained within the "printed circuit"). Change C 82, the .01 uF AVC bypass cap, to a .05 uF/100 volt disc or mylar. Finally, parallel a 22K resistor across R34, the 10K plate dropping resistor of V7, the first IF amp. That's all there is to it. Rezero the S-meter after a warm up.

What did the preceding step accomplish? You increased the receiver's distortion point or overload level by about 10 dB for a 60% modulated AM signal and made S9 on the meter closely correspond to 100 microvolts on all bands - just like the S-Line. Of course, make sure the entire receiver is correctly aligned when all is said and done. Speaking of the meter, some versions of the G-76 were shipped with the meter bolted behind the front panel, not in


**continued on page 31**

# A Homebrew CW Receiver

**by Donald F. Meadows, N6DM**
**1683 Daphne Lane**
**Yuba City, CA 95993**

I built the prototype of this receiver in 1957 to replace my old Hallicrafters S-40A receiver and a surplus BC-453 "Q-5er," gear that I used prior to entering military service in June, 1953. Being on a tight budget, I decided to test a hypothesis: that a homebrew receiver, properly designed and constructed and limited to one mode of reception (CW), could provide superior performance. The prototype of my receiver was inspired by the published models of Ted Crosby, W6TC. His series of homebrew (HBR) receivers described in *QST* articles during the later fifties and early sixties proved that homebrew receivers could approach, equal, or even surpass the standards of many than-current commercial products. Ted's pioneering work with homebrew superhet receivers blazed a trail for low-budgeted hams. His memory deserves a prominent place in homebrewing's Hall of Fame. Ted Crosby is now a Silent Key and his call has been reassigned, but I still treasure the QSL card Ted sent me while still active from his retirement home in Sun City, CA. The card acknowledges a QSO we had on May 15, 1965. We ragchewed for over an hour on 40 CW about how my homebrew receiver design, then still in use, was influenced by his articles in *QST*.

Ted's HBR receivers used plug-in coils for the different bands. Each band required three coils: RF grid, mixer grid, and HF-oscillator grid. Ted proved that his designs could approach commercial standards--at a fraction of the cost--in terms of sensitivity, selectivity, and stability. The trade-off was a lack of bandswitched operating convenience. In 1957, his findings were a bit revolutionary, as most hams observed traditional practice--one homebrewed the transmitter but relied on a commercial receiver. Homebrewing state-of-the-art superhet receivers was deemed not cost effective. The time frame of Ted's articles, however, included the golden years of electronic surplus. Government material left over from both WW II and the Korean Conflict was plentiful and bargain priced.

My receiver, designed only for superior CW reception, stressed stability and selectivity. There would be no design compromises in achieving this goal. I didn't copy Ted's designs, although I borrowed ideas freely from him. The first step was to set down on paper a block diagram. The receiver would be single conversion, using an IF at 455 kHz with three cascaded crystal-filter stages for selectivity. Single conversion reduces the number of stages amplifying at RF and thus improves the receiver's blocking threshold. It also simplifies the design by eliminating an additional heterodyne oscillator stage. The receiver would have a tuned RF stage treated as a preselector with separate tuning, thus simplifying tracking with the HF oscillator. The second detector would be a so-called "product detector," where the IF and BFO voltages are heterodyned to audio. The receiver would include an S-meter with linear scale. This feature later proved to be of great value in aligning the receiver for maximum selectivity. There would be an audio noise limiter with adjustable threshold, and audio-derived AGC with adjustable time constants. A Selectoject configuration would be included for audio selectivity. For precise adjustment of signal to noise and overload characteristics, there would be three manual gain controls: RF, IF, and audio. A 100-kHz crystal frequency standard for precise dial calibration was also included in the design. Once these features were block diagrammed, the


**A homebrew receiver designed to tune only the 80-meter CW band. The power supply is on a separate chassis.**

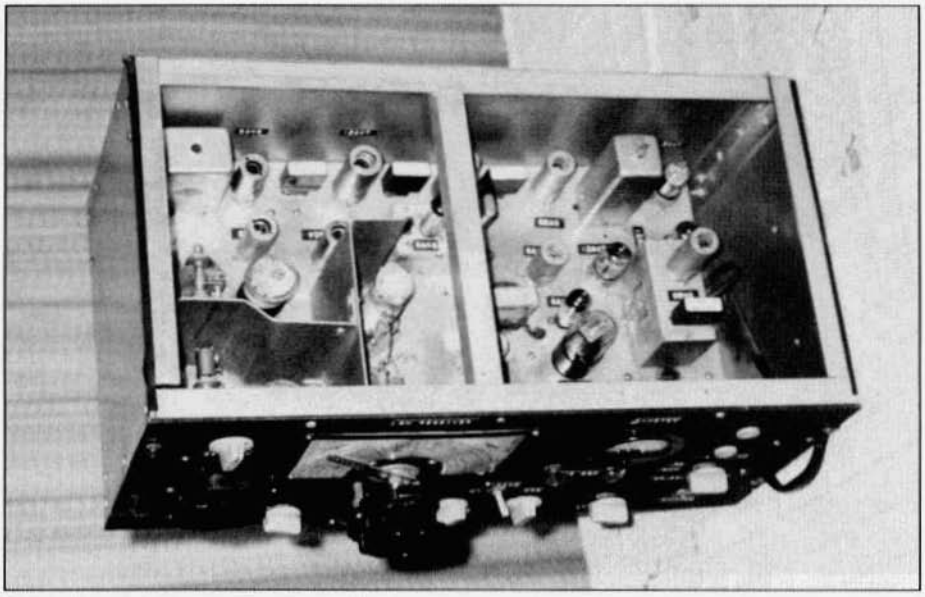
next step was to expend more paper in arriving at the optimum physical layout.

The original version, which I'll call "Mark I" after British practice, used plug-in coils, following Ted's example. These coils were all wound on Amphenol coil forms made of polystyrene, a transparent plastic which would soften well below soldering temperature. Soldering wires in their pins required a technique whose description is beyond the scope of this article. For now, we'll just call it a hassle. The Mark I version of the receiver also used a built-in power supply. This version worked fairly well for about two years but stability was not great for CW. Changing HF oscillator plug-in coils always affected dial calibration unpredictably, something quite undesirable for an extremely selective CW receiver. The built-in power supply produced extra heat from the 5Y3GT rectifier, which caused additional drift in both the HF and BFO oscillators. Also, the power transformer induced low-level hum in the audio.

The Mark II version of this receiver, shown in the photos, appeared around 1960 and represented a gradual modification of the original. The power supply was now on a separate chassis. Plug-in coils were no longer used in the HF oscillator. The receiver was designed to tune only the 80-meter CW band. The RF and mixer stages still used the original 80-meter plug-in coils, but these were always left in place. The HF oscillator grid circuit used a surplus ceramic-form inductor permanently soldered in place together with temperature compensation elements. The Mark II version depended on external crystal-controlled converters to cover the higher-frequency bands. In addition to heat reduction through the external power supply, drift was further reduced by changing the BFO to crystal control. The vacuum-tube Selectoject circuit was replaced in the early seventies by a commercial solid-state audio filter module, one of the first products offered by the fledgling MFJ Company. This substitution explains the two plugged holes on the front panel's left side.



**continued next page**

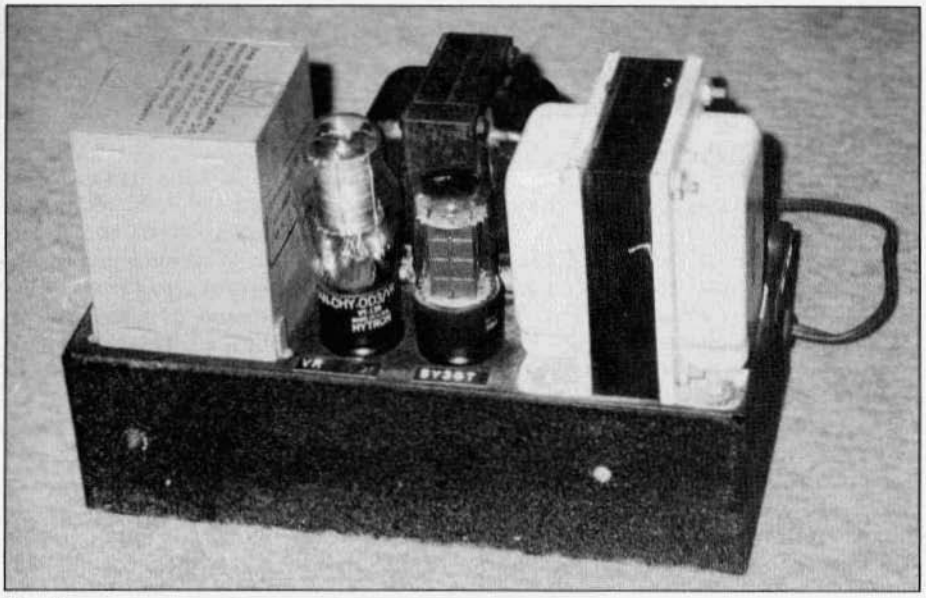


**Receiver with top cover removed.**

The heart of this receiver's CW selectivity is the two-stage IF cascaded crystal filter on approximately 455 kHz using three FT-241 surplus crystals on the same frequency. The circuit was originally published by W6YBR in *QST* in 1955 or 1956. The beauty of this circuit is that no IF transformers are necessary. Also, nose selectivity is wide enough to prevent ringing. The 12AX7 tubes use a resistance-capacitance configuration similar to phase-inverter circuits in audio amplifiers. Proper adjustment of the mica phasing trimmers produces a narrow bandpass with very steep skirts. The selectivity of the three cascaded crystals approximates 500 Hz at 80 dB down, a figure based on measurements.

To support such a degree of selectivity, the receiver's stability requirements are stringent. Electrical stability is provided by the absence of bandswitching, by externalizing the power supply, and by using a BFO that is crystal controlled, using an additional surplus FT-241 crystal near the IF frequency, contained in a separate module mounted on the chassis. Its frequency is trimmed to the desired beat note with a capacitor. Drift is therefore limited to the HF oscillator. The external power supply for the Mark II version also included a VR tube to regulate voltages to these oscillators.

Mechanical stability was always a top-priority item in this homebrew project. Some commercial receivers of the period had a beat note that could waver if one slammed the shack's door. Therefore, I used a commercial relay-rack panel of one-eighth inch thick aluminum for the receiver's panel, together with brackets then commonly used to tie the panel to a chassis bearing considerable weight. This worked fairly well for the Mark I version; I could pound on the panel with my fist and the beat note wouldn't waver. However, Mark I could not pass the two-inch drop test. Raising the receiver two inches above the table and letting it fall still produced enough mechanical shock to affect the beat note. This was caused by microscopic torque of the chassis. The Mark II version, as shown in the photos, was therefore completely encased in aluminum. This provided not only further mechanical rigidity, but also desirable



**Receiver power supply.**

shielding. The trade-off was an increased level of thermal drift due to reduced ventilation of the chassis, but this was slow and would stabilize within a half hour if the "hatch" was left open.

No complete schematic circuit diagram ever existed for this homebrew creation. Once the overall circuit was blocked and optimum physical layout was determined, stages in each section were built one at a time, tested, and most likely modified over time for optimum performance. I forget whether I began at the audio end and worked toward the RF stages, or the other way around. With the possible exception of W6YBR's crystal IF configuration, this receiver contains no unconventional circuits; they all came directly out of current handbooks or from Ted Crosby's articles. Only their combination was perhaps original. The receiver's tube lineup is as follows: 6BA6 RF; 6AG5 mixer; 6C4 HF osc; 6AK5 1st IF; 12AX7 3rd IF; 6BA6 4th IF ; 12AU7 product detector; 12AU7 AGC amp and rectifier; 6BH6 BFO; 6AL5 AF noise limiter; 6AV6 1st audio; 6K6GT audio output; 6C4 S-meter amplifier; 6AK6 100 kc calibrator; 5Y3GT power rectifier.

This homebrew receiver was the main station receiver until 1975 when I purchased a Heathkit SB-303 receiver and SB-401 transmitter, both in kit form. A need was felt for multiband equipment with SSB transceive capability. However, the homebrew receiver still remained on line. It proved to be an excellent outboard "Q-5er" working with the SB-303 for CW operation. In 1989, the homebrew receiver was finally mothballed along with the Heathkit gear. In its place I acquired an imported box that does everything. This box is friendly and cooperative, but I have no rapport with its soul. When it ultimately falters, it will need to be cured in the manufacturer's sanitarium for sick gear instead of on my own workbench. I've always been proud of this homebrew receiver. It did its job exceedingly well. Retrieving recently this old friend from storage for photographs, cleaning out the dust and dead insects, inspecting its wiring up close--all this evoked fond memories. **ER**

# The MEGADYNE - A HI-POWER OSCILLODYNE
## Loudspeaker Volume with only 1-tube!

**by Bob Dennison, W2HBE**
**82 Virginia Ave.**
**Westmont, NJ 08108**

In the 1930's, Short Wave Craft magazine featured a steady stream of exciting projects for the radio craftsman. The glamorized and retouched magazine covers that illustrated these marvels of radio science brought joy to my heart and I eagerly sought to discover what new magic was about to be revealed.

Short Wave Craft was not bashful in its choice of exciting words skillfully employed to attract your attention and whet your desire to own one of these "Globe Trotter" radios. Typical words and phrases often encountered were these: Brand new, revolutionary, super, marvelous, fantastic, incredible, high performance, awesome, gratifying, wonderful, remarkable, etc.

Many articles were headlined with boxed testimonials from the editorial staff proclaiming that now you can have it all - sensitivity, selectivity, economy, power, efficiency and simplicity! Here are some typical statements:

1. We challenge any radio constructor to equal its performance or effectiveness.
2. In our NYC offices, it brought in dozens of foreign short wave stations on the loudspeaker.
3. Astounding efficiency which increases as the frequency increases.
4. It incorporates the latest advances in tube and circuit design.
5. Unbelievable sensitivity and power.

**The Oscillodyne Principle**

The Megadyne is based on a principle that was first set forth in Short Wave Craft magazine in April1933. There in an article entitled "The Oscillodyne, 1-Tube Wonder Set", the author, J. A. Worcester, Jr., explains that by using feedback considerably greater than normal, there will ensue irregular oscillations similar to those employed in super-regenerative sets. By adjusting the gridleak resistance, these can be made to occur at a super-audible rate. Mr. Worcester goes on to explain by means of oscillograms that his circuit is not the same as a super-regen but I couldn't follow all of his statements. I suggest you read his article if you are curious. The set was such a big success that the next three issues of Short Wave Craft carried articles on variations and embellishments of the Oscillodyne.

**The Megadyne**

The Megadyne is the epitome of 1-tube Oscillodyne radios. To achieve high output, a powerful tube is recommended. I used a Western Electric 211-A but an 852 or a 203A should give comparable results. The coil is wound on a 3-3/8 inch diameter cardboard tube. The secondary has 52 turns of No. 23 SCE wire and the tickler has 20 turns. The antenna taps are at 1-1/2, 3-1/2, 5-1/2 and 7-1/2 turns. The home-made RF choke is wound with the same size wire on a plastic form made from a discarded Colgate toothpaste pump. The winding is made in two sections-one 3" and the other 1-3/4" with a 3/8" gap between. An Allen-Bradley adjustable carbon-pile gridleak is located between the two Cardwell variable condensers.

Mr. Worcester explains that the damping constant of the tuning coil and the condenser is important and that the natural frequency of the tickler should always be higher than that of the grid circuit. I used a very old, badly tarnished tuning condenser to ensure that this condition would be met. For further details I recommend a close study of his article.

**Conclusion**

The day is long past when you need a whole lot of tubes to do the job - now you can let one BIG tube do it all. APRIL FOOL! ER

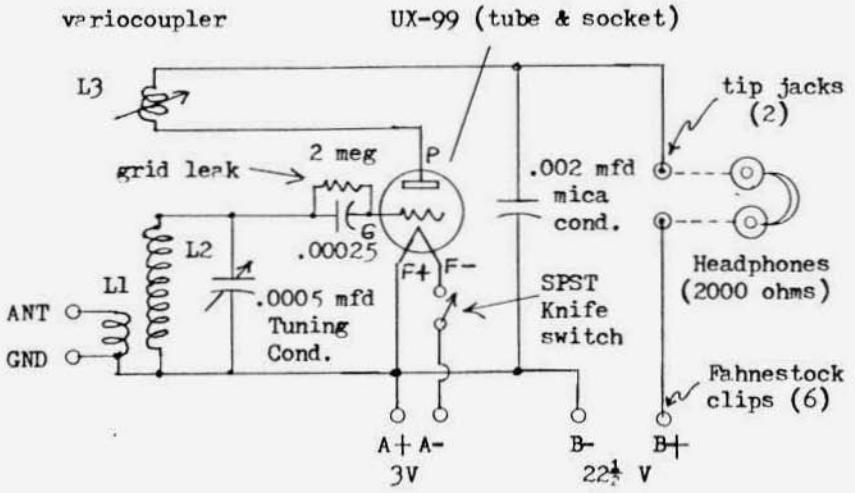




Fig. 1. Circuit details of one-tube radio.

# Review: McElroy biography reveals real 'character'

**by Mike O'Brien, NØNLQ**
**1031 E. University St.**
**Springfield, MO 65807**

The American public's fascination with the exciting technologies that emerged during the 1920s and '30s elevated a few masters of the new machines to "superstar" status.

Charles Lindbergh was king of the skies. Barney Oldfield was the terror of the autodromes. E.H. Scott's deluxe home radio receivers won him acclaim as the "Dean of DX." Admiral Richard Byrd was hailed as the conqueror of the North and South poles. And T.R. "Ted" McElroy made headlines as the "World's Champion Radio Telegrapher."

That title also serves as the name of a remarkable new biography of McElroy authored by Tom French, W1IMQ. The book is a thoroughly researched, carefully written and unflinchingly detailed portrait of one of the most flamboyant figures of radio's boom era.

The public in general and ham operators in particular became familiar with McElroy's name because of his astounding knack for copying Morse and Continental code at better than 70 words per minute. Reports of his victories in exhibitions and official contests conducted between 1922 and 1939 appeared regularly in newspapers and magazines as well as in *QST*.

However, French doesn't rely solely on readily available press accounts. Capitalizing on fortunate access to some of McElroy's personal and business papers, French vividly fleshes out a character whose ambitions and accomplishments went far beyond the ability to decipher blazing strings of dots and dashes.

McElroy's business ventures, especially his manufacture of telegraph keys and automatic code-practice devices, are richly documented by French. And McElroy's mercurial personality is explored -- some might say exposed -- as well.

French traces Theodore Roosevelt McElroy's life back to modest beginnings in a Boston suburb in 1901. From the time he was 6 years old, McElroy was helping put food on the family table by working (and, by his own later admission, pilfering) at a grocery store.

His formal schooling ended at age 14, but a job as a Western Union messenger provided real-world lessons that led McElroy to appointment as a WU telegraph operator at the extraordinarily young age of 15.

McElroy's entry into speed-copy contesting was encouraged and subtly sponsored by his employers, who bragged on his records and basked in his reflected glory in much the same way athletic shoe manufacturers capitalize on the feats (no pun intended) of sports stars today. Two decades after he won his last title, McElroy himself continued to boast of his records in ads for his own firm's products.

French dutifully documents McElroy's many professional exploits. However, it is his candid reporting of McElroy's less-well-known personal doings that sets the book apart -- and could upset some readers who may feel they're told more about the colorful private side of Ted McElroy than they really wanted to know. Nothing really scandalous, mind you. Just stuff like his problems with weight (McElroy, standing only 5'8", ballooned to near 300 pounds) and his fondness for liquor (even McElroy joked that his ham call, W1JYN, should've been W1GIN).

Most readers will thank French for dredging up long-buried trivia such as:

-- McElroy's tactic of unnerving competitors in the heat of code contests by appearing to quit -- taking a leisurely drink of water, or lighting up a cigar -- then typing furiously to catch up with

text he'd copied in his head.

-- His habit of driving a tiny Crosley automobile through his factory, until an employee sued him for injuries suffered in a bizarre in-house collision.

-- The hilarious clash with the local fire chief and police when, after flames erupted at his plant, McElroy arrived on the scene at the wheel of his own fire truck, bent on directing all fire-fighting efforts.

-- His unsuccessful attempt to buy the Brooklyn Dodgers major league baseball team and to win political office in Massachusetts.

The book's 156 pages contain numerous photographs of individuals and equipment mentioned in the text. (Of particular interest to Hallicrafter buffs is a shot of McElroy with Bill Halligan in a ham shack that features a super-rare S-35 receiver, which was an SX-28 combined with a five-inch CRT spectrum display.)

After gently laying McElroy to rest (he died of heart ailments in 1963), the final third of the book is devoted to close-up looks at McElroy-manufactured gear, plus extensive notes documenting sources, and appendices and indices offering additional details.

In "*McElroy: World's Champion Radio Telegrapher*," Tom French has produced a volume that is at once scholarly and entertaining, well worth a reader's investment of time and money ($21.95 from ER).

Despite his own busy career -- he's an electronics engineer-turned-attorney -- French somehow also found time to recently publish two other worthwhile books: "*Introduction to Key Collecting*," an informative and well-illustrated primer aimed at a general audience; and "*Vibroplex Collector's Guide*" for hardcore Vibroplex-brand buffs who enjoy wading through U.S. patent applications. Also, French publishes the quarterly "*Vail Correspondent*" journal for collectors of telegraph instruments. ER

**Gonset G-76 - Revisited from page 23**

front as pictured in the Hutchens article. I personally think the meter looks better bolted behind the panel and the illumination from the panel bulb is greatly improved. If you do move the meter, the screws may be a bit long and hit the inside chassis. Simply lop off 1/8" or so with a small blot cutter as on a crimping tool.

Final suggestions: Adding a small 12 volt DC fan to the DC supply works wonders in keeping it cool during "old buzzard" transmissions. It may also be worthwhile considering the construction of an IC based product detector. Lastly, the addition of a mini-sized ultra modulation circuit is worthwhile - I've done it, and it works great! (Hint: a 6K 20 watt slider equipped wirewound resistor fits great immediately behind the TX LO/HI/CW switch when mounted on standoffs screwed into the switch's frame screws. . .) ER

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**A Universal Receiving Tube from page 15**

RV 12 P2000 adapters from the sockets and replace them with the appropriate tube.

When tube manufacturing resumed in Germany, one manufacturer continued to produce the RV 12 P2000 for several years even though it was by then an obsolete military type. That was to replace RV 12 P2000's used by so many radio amateurs in simple broadcast receivers built by them to be sold on the black market or to be traded for food. They were, of course, also intended for replacement of RV 12 P2000's in commercially produced sets like the simple early Grundig receiver kit. ER

**Crystal Grinding from page 9**

If you grind your crystal a bit too high, what to do depends on how far high it is. You can often get a variation of 200 cps just by rearranging the crystal plate and electrodes in various ways -- rotating, flipping, etc. If you need more than you can get this way see if you have a 'lower' pair of electrodes which will do the job. If you have a pair which is (say) 300 cps high, look closely at the raised corners and if they're not already very low make one swipe on your grinding paper. Reducing the size of the air gap in this way will reduce the frequency at which the crystal oscillates by about 100 cps per swipe.

About 1 kc of lowering can be obtained by rubbing a bit of solder on the face of the crystal. You can't get much to stay on the face you ground but on the other side a narrow diagonal streak at the center might give you around 100 cps. If you are using solder with a flux core, bend a piece double and rub with the bent end as you don't want flux on the crystal. After rubbing the streak on, rub the crystal firmly but carefully with a paper towel to be sure there's nothing which will easily come off.

If you 'lead' the crystal just a bit too low, you can move it back up with a coarse pencil eraser; keep away from the holder and electrodes while doing this and wash the plate carefully to avoid contaminating the works.

Old timers may remember lowering crystals a lot more than 1 kcs with solder but the more you use, the lower the Q and the more drift you will get later as pieces of lead fall off. The 1 kc limit will give you a crystal which is as good as any ham FT-243 unit.

I have heard of other things being rubbed on, most commonly pencil lead. It doesn't work as well because it is lighter and doesn't stick as tightly.

## Examples

In preparation for this article I filled some of the holes in my set of 40 meter crystals. The following results are typical except that this is the first time I can recall having had five in a row turn out okay. In these examples, "10 figure '8's" means 10 in each direction unless otherwise stated. This job took about an hour per crystal.

1. Started at 7275. Five figure '8's brought it to 7286.4 and swapping electrodes got 7287.2; I ground one electrode slightly to hit 7287.087

2. Started at 7225. Successive 10's of figure 8's gave 7242, 7247 (I changed paper), 7257, 7262, 7268, 7273, 7275; I then switched to 20 figure 8's and hit 7284.2. Then 5 figure 8's in one direction only, repeated a few times got it to 7285.3 and a couple of light touches on the electrodes yielded 7284.985 kcs.

3. Crystal was marked as 7275 kcs but it was dead; beveling the edges 10 strokes on each brought it to life at 7280.5 kcs. I ground the electrodes to hit 7280.046 kcs.

4. Started at 7225. Ten figure 8's on new 240 grit paper got it to 7276. Two more figure 8's hit 7281, and successive additional 2's to 7284.4, 7286.8, 7289.8 (I switched to the used sheet of 320 grit paper), then successive groups of two figure 8's hit 7290.2, 7290.5, and finally 7291.074.

5. Starting at 7225, five sets of ten figure 8's with the same piece of 240 grit paper reached 7287 then two groups of ten got 7289.5 -- notice how rapidly the paper wears. Half an hour of tinkering with different springs, plates, and a streak of solder produced a crystal on 7289.043 kcs.

## Conclusions

Regrinding FT-243 crystals isn't for everyone, but if you have or can find convenient lower frequency units for 'parts', it can be a good way to get spot frequencies. As the *QST* ads for Petersen Radio used to say, if you have enough crystals you can be "Crystal controlled -- but not rock-bound". **ER**

**There is No Such Thing as "State of the Art" from page 2**

here where the secrets to superconductivity are kept and the fundamental relationships between matter and energy will likely be found.

A conventional transistor is a "bulk charge" device, and so are devices which are made up of groups of them, such as logic gates. Conventional electronics describes the movement of large groups of electrons within the silicon devices. In the nanometer region, there exist certain devices which only transfer the charge of a single electron. By the end of the decade of the 1990's, voltages will be maintained across oxide layers which approach the wavelength of the electron itself. When this happens, an electronic device will be able to be built which has dimensions of only a few atomic layers, and we will no longer need the large, cumbersome, power-hungry device known as a transistor!

So how will the electronics work? The new electronic structures have names like "quantum wires" which exist in a single dimension, and "quantum dots" which have no dimensions at all but can act like gates. According to MIT research, when an electron is confined inside a single-electron waveguide, it is laterally confined to dimensions which are smaller than its wavelength. The wave nature of the electron then dominates its behavior, and discrete voltage levels are defined precisely by the electron's charge. These voltage "steps" are then used to simulate an electronic device, such as a high-speed A/D converter. Other similar effects can be used to create micro-lasers which control a single electron and photon to provide electronic switching. This is known as "resonant tunneling".

Silicon and carbon are in the same group on the Periodic Table of the Elements, and share many molecular properties. There is a brand new branch of science known as Nanophase Engineering, in which both organic and inorganic materials are designed to have properties of both electronics and optics. By studying the properties of complex organic molecules, some scientists believe it may be possible to literally grow electronic machines.

When all of this turns out to be the future of electronics, I'll bet that we won't be able to experiment with any of it in the garage, attic, or basement! Has anyone noticed how easy it is to buy a tube originally produced 50 years ago, and how impossible it is to find recently discontinued IC's? It's like they never existed. Unless someone starts to hoard away mass quantities of old-fashioned parts like transistors, resistors, ICs, LEDs, etc., conventional electronics as a hobby will disappear. Indeed, the entire electronics industry will change, again. Machines running software will be all that is needed to produce other machines.

What's my point in all of this? Vintage electric radio equipment has the luxury of employing a stable, unchanging technology, one that we can see, touch, and build with. Unless we are legislated out of existence, this should continue for a long time to come. The next time someone runs down my favorite branch of our hobby, I'll be able to silently pity the poor fool who has the nerve to assume he's got the "state of the art." **ER**

References

Electronic Engineering Times, various issues, 1993-1994

Electronic Design News, various issues, 1993

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**Letters from page 18**

material is opaque white, about 1/2" wide, and very flexible. The key asset is it doesn't stretch. Drill holes to the same dimensions as the copper strips. The additional thickness will make it fit nice and snug around the shaft drums. Be sure to use flat washers under the anchoring bolts to keep flexing at a minimum.

**Bob MacDonald, N2NIR**

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## DEADLINE FOR THE APRIL ISSUE: APRIL 3

**FOR SALE:** Repair and restoration on all vintage equipment; 35 years experience. Barney Wooters,W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. (303) 770-5314

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**FOR SALE:** Vintage airborne electronics from the '40's. Rcvr/xmtr model AT-99-44 by Motorola for Beechcraft; fixed ant. unit type FT-2 for Learadio; G.E. VHF rcvr/xmtr model 4AT3A (small personal plane); remote control and pwr cable for G.E. xcvr. All units VG to exc. condx. Best offer for the lot. John Snow, 4539 N. Bartlett Ave., Shorewood, WI 53211. (414) 964-0194

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**FOR SALE:** Rare SC-2/SC-6 converters w/ CPS-1 pwr sply in CC-1 converter console, w/all manuals. Absolutely like new. Best offer. Joe, N5UX, 3700 Cliffwood Dr., Bedford, TX 76021. (817) 281-1128

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**WANTED:** Collins 70E8A, any condx or parts; 310B-3; CMS-2 500-W mod xfmr & 810's for KW-1. Jerry, W8EGD, (303) 979-2323

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**FOR SALE:** 75S3; rack panel for S-Line; CP-1 xtal pack; Heath antenna noise bridge; B&K deluxe semi-conductor tester; URM-25D and HP 608F sig. generators. Mike Palmer, K5FZ, 16707 Creeksouth, Houston, TX 77068. (713) 444-7737

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**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 22075. (703) 822-5643

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**FOR SALE:** SX-62; SX-101A; NC-300; SX-28; R-390A. All clean & working radios. PU only. Don Winfield, K5DUT, 6080 Anahuac Ave., Fort Worth, TX 76114. (817) 732-3976

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**FOR SALE:** ART-13 parts & other interesting stuff. SASE for "The Bone Yard List." eLKay electronics, 231 Shenandoah Trail, Warner Robins, GA 31088-6289.

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**TRADE:** Tube Bank Exchange. Swap your new-in-box tubes for our NIB tubes. SASE for info. TBE, POB 806, Lake City, MI 49651.

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**FOR SALE:** Wavemeter dial assy. - $20; 2.5 volt Navy bridge, fil. 14A-7-7, 120 pri. - $20; Bendix xfmr 1250-V CT 335 mA, 5-6.3-6.3-6.3-120P - $50; Cap-Cer-Mica, .002, 12500V - $10. Joe, W6CAS, (916) 731-8261

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**WANTED:** All types of military electronics, especially RDF and radar items, manuals too. Also need URD2 antenna. William Van Lennep, POB 211 Pepperell, MA 01463. (508) 433-6031

**FOR SALE:** Used technical books - radio, electronics, math, military, magazines, etc. List $1 (stamps ok); vacuum tubes list SASE. Softwave, Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

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**FOR SALE:** Replacement meter glass - $2.50 ppd. **FREE:** Meter newsletter with free ads. **WANTED:** Anything S.S. Titanic related. **TRADE:** Tubes, books for meters. Chris Cross, POB 94, McConnell, IL 61050.

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**WANTED:** To borrow/buy PTO adjustment tool for 75A-3; schematic/manual for Frederick 1500B RX/1550 synth. Dave Heil, A22MN, Gaborone/Dept. of State, Wash. D.C. 20521-2170.

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**FOR SALE:** New tubes - 5U4G, 6L6GC, 6V6, 5881 from Russian military and from U.S.A., 5R4GY, 5U4G, 5Z3, 5Y3, 6L6G, 6V6G, VT25, 6AS7G, 6SN7WGT, 6SL7WGT, 6SJ7Y, 6005, 6080WA, 6550A, 7581A, VT4C, 807 and many others. Send your wants. $1 for reply via airmail. Andrea Moretti, Via Colle Bisenzio 31, 50040 Usella FI, Italy.

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**FOR SALE:** Communications Receivers, The Vacuum Tube Era: 1932-1981, Second Edition by Raymond Moore - $8 ppd. Ken Greenberg, 4858 Lee, Skokie, IL 60077. (708) 679-8641

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**WANTED:** Schematic for National R1230 Receiver Countermeasures and Hammarlund SP-200 SuperPro. Nick Hall-Patch, 1538 Amphion St., Victoria, B.C. V8R 4Z6 Canada.

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**FOR SALE:** R-392 audio modules, NIB, w/ tubes - $30; 4D32 tube, NIB - $65; TA312 field phones, GC - $50 each; Collins CP-1 xtal pack, GC - $125. U-ship. Bob, (315) 468-2691 after 6 PM EST.

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**WANTED:** Adventurer; T-60; S-38; 100 kc calibrator for Drake 2C rcvr. Bob Braeger, WA6KER, 6634 Navel Ct., Riverside, CA 92506. (909) 682-5084

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**WANTED:** Knight T-150, must be working condx. Larry Wolf, 2320 E. Central Ave., #19, Duarte, CA 91010. (818) 334-8600

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**FOR SALE:** Nice AM station complete plus much more - cheap. Pick up central Oklahoma. Jerry Boles, N5KYE, (405) 373-2228.

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**TRADE:** Riders 16 for 17. Need 18-21. **FOR SALE:** BC-639A - $25. Add UPS. Ted Stewart, W6NPB, 2157 Braemar Rd., Oakland, CA 94602. (510) 531-7042

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**Lafayette Radio and Vintage Manuals Available.** Over 2000 manuals in stock. Satisfaction Guaranteed. List, low price quote, write or call, Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

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**WANTED:** SC-101; SC-301; KW-1; 30K-1 thru 5; 302C1; 75A thru 75A-4 rcvrs and spkrs, any condx. Purchase entire estates, pick up 48 states and top $ paid. Rick, (800) 462-2972

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**FOR SALE:** They're beautiful! Replacement VFO dial numeral bezels for Collins 51J, 75A and B&W 5100 units. Easy to install - not an adhesive decal. $10 postpaid. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803.

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**WANTED:** Heath WA-A1, W-2, W-3(AM), W-5(M) or similar audio amplifier in any condx or manual for same. Mike Nowlen, WB4UKB, POB 1941, Herndon, VA 22070. (703) 481-9614

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**FOR SALE:** USSR issue radio sets for collecting. (Not to be operated.) Models R-105M, R-108D, R-109M. All exc. condx, w/acc., in transit case - $280 each, 3 for $750. Michael Murphy, (619) 561-2726, FAX 390-8611.

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**FOR SALE:** Hallicrafters SX-99, w/R-46 spkr and S-38E, both w/manuals; Gemtronics GTX3000 CB. **WANTED:** J.H. Bunnell single earpiece headset and telegraph items. J.H. Jacobs, 60 Seaview Terr., Northport, NJ 11768. (516) 261-1576, FAX 361-2173

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**WANTED:** E.F. Johnson Viking Courier amplifier, Viking 500 xmtr and KW Matchbox. Bert Garcia, N8NN, 2150 Silentree Dr., Vienna, VA 22182. (703) 448-8016

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**WANTED:** Drake 4NB, 4LF, 34NB, FL-500, 7075, 7072; HRO coils H,J and 6-V pwr sply. Jim Leathem, K7BTB, Box 50355, Parks, AZ 86018. (602) 635-2117

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**FOR SALE:** HB 500-W AM xmtr, 4-125's in final, 811A's in mod. Needs rehab. PU only. Joe, NM1V, (508) 658-6186

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**WANTED:** TM 11-5985-243-35, CU-1638/GR Depot Maint. book. Ed Alves, KD6EU, 305 Acorn Cr., Monrovia, CA 91016-1807.

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**WANTED:** Circuit diagram and manual for Eico model 482 dual trace scope. Copies OK. Dave Beckman, W5MHY, 2705 Churchill, Pearland, TX 77581. (713) 485-3159

**FOR SALE:** R-390A service: Module repair and alignment to complete remanufacture, new front panels, knob sets, VFO calibration,expert service, reasonable, any condition accepted. Rick Mish, (419) 726-2249

**WANTED:** Manual for Heath scope model 10-104 (copy OK) and Heath Ham-Scan monitor model HO-13. John Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

**FOR SALE:** Receiving tubes, new and used; multi-section twistlock electrolytic caps to 500-VDC; SAMS photofacts. Send stamp for lists. Turner Electronics, 16701 Main St., Ste. 121, Hesperia, CA 92345.

**FOR SALE:** Crystal radio kits, complete with face panel, base board, variable capacitor, prewound coil and many parts for old style radio. Remit $22.50. Carl & Grace Ent., 5636 Romeyn, Detroit, MI 48209.

**FOR SALE:** National MB40SL tuner assembly, w/orig. knob - $18 shpd. **WANTED:** Speed-X keys and bugs. The Speed-X collector, Pete, WB2BYQ, (201) 251-9747

**WANTED:** Meter for Johnson Valiant xmtr; model 3201 modulator/pwr sply for Gonset G-77A HF xmtr. Norman Hall, W6JOD, 6506 Jetta Ave., Bakersfield, CA 93308. (805) 399-4101

**WANTED:** Collins 70E8A, any condx or parts; 310B-3; CMS-2 500-W mod xfmr & pr. of 810's for KW-1. Jerry, W8EGD, (303) 979-2323

**FOR SALE:** Magnacord PT6A w/electronics, full track, good heads - $40; Magnacord M33-30 w/electronics, half track - $30. Both units in portable cases. B&K 707 Dyna-Jet tube tester, no manual or charts - $40. Bill McCombs, WBØWNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212. (316) 722-7669

**WANTED:** Manual/copy for Heath Voltage Calibrator VC-3 and Q-Multiplier QF1. W. Britton, W7MN, 225 S. 17th St., St. Helens, OR 97051.

**FOR SALE:** Hallicrafters scarce SX-73 - $475; Johnson KW Matchbox - $250; Hy Gain Discoverer 3, 40-M, 3-element beam - $450. Sam Thompson, W6HDU, 1031 San Antonio Ave., Alameda, CA 94501. (510) 521-1429

**FOR SALE:** Two roller inductors 28 uH; one 500 pF cap. New. Build KW balanced ATU? $100. Jay, WBØL, (612) 724-0322 (n).



**FOR SALE:** Radio tubes; repair and restoration of all vintage amateur and commercial radios, 25 years experience. Herbert Stark, 321 N. Thompson St., Hemet, CA 92543. (714) 658-3444

**WANTED:** Collins literature, manuals, catalogs, SM2, SM3, MM2 mic's, TD1, 647T dipole ant, 35C low pass filter, 55G1. Rick Coyne, KD6CPE, POB 2000-200, Mission Viejo, CA 92692. (714) 855-4689

**FOR SALE:** HP audio osc. 200 CD - $35; HP 400L AC voltmeter, rack mount - $35. Don, (503) 289-2326

**WANTED:** Tune-up instructions for DX-100. Tim, N6CC, 2608 Campeche Ct., San Ramon, CA 94583.

**WANTED:** TCS-12 xmtr and TCS-12 rcvr. Also command (ARC-5) and PRC-47 accessories. Vince Sposato, N2AXV, 410 Palisade Ave., Union City, NJ 07087. (201) 867-6311

**WANTED:** Collins 51S-1 pwr sply (AC) choke. David, 38A Parkers Rd., Parkdale, 3195, Victoria, Australia 03 587 1593.

**FOR SALE:** Johnson Ranger II - $195; Hallicrafters S20R - $85; RME 4350 - $125. Jim, (616) 229-4318

**WANTED:** Information on Thordarson T19M17 vintage mod xfmr. John Packer, 318 School St., Springdale, PA 15144. Collect (412) 274-4734

**WANTED:** Globe Scout 680; Gonset 6 meter Communicator and Walter Ashe novice rig. **FOR SALE:** HT-37 - $110 plus shpg. Tony Stalls, K4KYO, (703) 522-1568, FAX 243-8059

**FOR SALE:** Heath Apache TX-1, GC, pick-up - $150. **WANTED:** E.F. Johnson Viking Courier amp and Viking 500 xmtr. Bert, N8NN, 2150 Silentree Dr., Vienna, VA 22182. (703) 448-8016

**WANTED:** Heath TX-1 Apache xmtr. Ron Brewer, WA6ALM, 1394 Nissen Pl., Broomfield, CO 80020. (303) 469-4653

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

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

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**FOR SALE or TRADE:** SX-25; Ranger I; KW Matchbox. **WANTED:** NC-100; ACR-111; early Skyriders; tuning eye radios. Jim Dillon, 201 Seward St., Juneau, AK 99801. (907) 586-3223 10-6 PST

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**WANTED:** Manual for WRL SB-175 Meteor xmtr; Eico 722; Hallicrafters HA-5 or WRL VFO; 2-M converter. Al Norton, K7IEY, 1008 Liberty St., Lynden, WA 98204. (206) 354-4622

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**FOR SALE:** 100 vintage radios and other neat stuff; HRO-500, w/manual, nice - $750; plus much, much, more. Send SASE to Jerry Moore, KBØHHK, Rt 1, Box 370-5, Pleasent Hope, MO 65725.

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**FOR SALE:** Collins 312A-1 grills & lamp hoods; S-Line/St. James gray painting. Butch, KØBS, (507) 288-0044

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**WANTED:** Drake MS-4/MS-8 spkrs; NC-300 spkr. Thanks! Bill Colligan, N1DJR, 35 Quail Run, Hampstead, NH 03841. (603) 329-7879

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**FOR SALE:** Collins WE 75S-3, 516F-2, 32S-1, manuals, xtra set of tubes, EV 638 mic, all - $600. Rcvr and spkr/ps in exc. condx, xmtr in VG condx. Hammarlund 10"x10" spkr in exc. condx - $40; Heath SA-2550 antenna tuner, NIB, not yet assembled - $225; Heath SB-610 in exc. condx, w/manual copy - $110; Crosby 67A SSB converter, w/orig. manual in good condx - $40. Clyde Sakir, N7IOK, 4243 E. First St., Tucson, AZ 85711. (602) 323-1120

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**WANTED:** Collins KW-1. Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. (313) 453-8303

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**WANTED:** Collins mech. filters for S-Line F455FA-05-500 Hz, X455Q200-200 Hz, F455FA-31-3.1 kHz, F455FA-60-6.1 kHz. N5CET, (800) 776-4976 (d), (214) 271-0017

**Western Heritage Museum Omaha, Nebraska**
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***Leo Meyerson, WØGFQ, (founder of WRL) needs donations of gear and related materials for the amateur radio exhibit at Western Heritage Museum in Omaha, Nebr.***

***This permanent display is the only one of its kind in the country and is something that all hams can be proud of. We expect 50,000 visitors annually.***

***Your tax deductible donation will be permanently noted on a plaque that will be prominently displayed.***

***For more information contact Leo at (402) 392-1708, May-Nov.; 619) 321-1138, Nov.-May.***

**WANTED:** List, indexes or directories of WW II Navy tech. manuals or equipment. Willing to help to identify WW II Navy 5-digit type numbers. Send SASE. Ray, W6RIC, (805) 985-6048

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**WANTED:** Hammarlund HQ-140X and HQ-150. Call Hoover, (803) 726-5762

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**FOR SALE:** Tektronix Parts instruments. I am starting a parts instrument list with 29 of my own instruments. Send $1 & an SASE for my list. If you have Tektronix parts instruments of your own, send me your list and I will include it with mine, no charge to you. Stan griffiths, 18955 SW Blanton, Aloha, OR 97007. (503) 649-0837

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**FOR SALE:** Manual and design blue prints for Collins 32V-3 xmtr - $50; pair of F455Z SB 6545 Collins mech. filters on IF boards with xtals - $30. P.A. Orobko, VE7FY, 12347 Davison St., Maple Ridge, BC V2X 5N5 Canada. (604) 463-4904

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**WANTED:** Galaxy or Swan equipment. Anything! Hollow/solid-state, accessories, VFO's, 2-meter, parts...marginal? non-working? OK! Price and condx to: Eric Kutzli, KBØXP, Box 98, Stanton, IA 51573. (712) 829-2446

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**FOR SALE:** Vintage WW II airborne electronics. A.R.C. Type 12 VHF and UHF. (2) Freq. converter - xmtr CV-431A/AR (228-258 Mc); Receiver R-19 (118-148 Mc); Receiver R-13B (108-135 Mc) no dyn; VHF Transmitter (14V) T-11A w/mount (116-132 Mc). All units VG to exc. condx. Sell as one lot $100 plus shpg includes original manual. John Snow, W9MHS, 4539 N. Bartlett Ave., Shorewood, WI 53211. (414) 964-0194

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**FOR SALE:** We rebuild twist-loc, wet style, rectangular, can capacitors. Mail your can to us, typical in-shop time is 10 days. We custom build tubular & can capacitors & rebuild your capacitor. Inquire. Frontier Electronics/Everett Hoard, NØNVQ, Lehr, ND 58460. (701) 378-2341

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**WANTED:** Modulation meter Weston M-891 for General Radio 1931 AM modulation monitor, or a whole GR 1931A monitor with good modulation meter. Vern Jackson, WAØRCR, 2109 Ebert Ln., Wentzville, MO 63385. (314) 327-580

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**WANTED:** Hallicrafter HA-10 LF osc.; PS 150-120 AC sply; Valiant PTT relay (consider non-working unit). FOR SALE: 516F2 solid-state conversion kit - $28. Joe Hargis, WS0E, 2505 S. Aspen, Springfield, MO 65807-3103. (417) 882-3197

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**WANTED:** Details of xmtr and rcvr on cover of "How to Become a Radio Amateur". See catalog section of 1951-1955 Handbooks for cover picture. Harry, VE7AIJ, 847 Glencoe Dr., Port Moody, B.C. V3H 1G7.

**WANTED:** Intelligence museum wants German, Japanese, Italian, Russian and Chinese communication equipment and any British or U.S. spy radios. LTC William Howard, 219 Harborview Lane, Largo, FL 34640. (813) 585-7756

**TRADE:** One 5' tall 19 inch rack. Really strong. PU only. Marc Melucas, KBØJPQ, 201 North X st., Lompoc, CA 93436. (805) 734-8232, ext. 66579, daytime please.

**WANTED:** McIntosh and Thordarson amplifiers any condx. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803. (414) 545-5237

**WANTED:** Any technical manuals or schematics about Stoddard tubes; RiFi meters. Buy or swap. Many thanks. Alain Guiriec, Hopital Du Porzou, 29900 Concarneau. France.

**FOR SALE:** (5) E.F. Johnson 4-prong isolantite (ceramic) H.D. sockets, new. (For type 10 and similar tubes) $8 ea. Bill Riley, W7EXB, 863 W. 38th Ave., Eugene, OR 97405. (503) 345-2169

**FOR SALE:** NIB pwr xfmr for Globe Champion - BO; Gov't surplus Jonathan rack slides, 3-1/2 x 24 inch ext. - $25/pr; cable followers available; filament xfmr 115 pri, 10-V sec., 20 amp - BO. U-ship. Gary Reiss, WAØJRM, Rt 1, Box 141, Wilcox, NE 68982. (308) 263-3231



**FOR SALE:** USSR issue radio sets for collecting: (not to be operated): R-105M, R-105D, R109M, all exc. condx, w/accessories in transit cases - $280 ea., 3 for $750. Mike Murhpy, (609) 444-7717

**WANTED:** Waters rejection tuning kit for KWM-2A; Collins cabinets for S-Line, KWM-2A, 30L-1, etc. Will pay top $ for very clean cabinets. N5CET, (800) 776-4976 (d), (214) 271-0017 (n)

**FOR SALE:** Subscribe to "The Amateur Market Place". A Canadian newsletter, listing new/wanted Amateur/Computer equipment. 10 issues per year $16.50 US. Benefit from $ exchange. P.O. Box 8180, Ottawa, Canada K1G 3H7

**FOR SALE:** (11) Sangamo mica caps type GB3, .003 mFd at 1000 kcs; (21) 2722 type 408A caps; (39) Cornel Dublier .002 mFd. All are brand new - $9 for all or trade for ham gear. P.A. Orobko, VE7FY, 12347 Davison St., Maple Ridge, BC V2X 5N5. (604) 463-4904

## WANTED

***Collins promotional literature, catalogs and manuals for the period 1933-1983. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (805) 259-2011. FAX (805) 259-3830***

**FOR SALE:** Collins 75A-4 filters: 6 pole ceramic for high quality AM, 6 Khz - $83.50 ea.10% discount for two filters. Money back guarantee. Calif. residents please add sales tax. Vector Control Systems, 1655 No. Mountain, Ste. 104-45, Upland, CA 91786. (909) 985-6250

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**FOR SALE:** Precision CRT tester, model CR-30 - $25. **WANTED:** Manual for Heath IM102 digital multitester. R. Napoli, K2LGO, Box 158, Riverhead, NY 11901. (516) 722-5737

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**FOR SALE:** Vintage parts. Send stamp and request "Vintage Flyer". USA only. 40 years of mail order electronics. Bigelow Electronics, P.O. Box 125, Bluffton, OH 45817.

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**WANTED:** Hammarlund clock & plastic cover; BFO knob for SX-101A; T-195 xmtr & cables; HQ-180AC rcvr; meter for EFJ Viking I xmtr. Dennis, WAØWAB, (316) 225-3736 (d), 225-2961 (n)

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**FOR SALE:** 7 ft. rack cabinets on casters w/ lockdowns. These are beautiful enclosed units w/doors - $125. Panels available. Gary Gleicher, Box 427, Little Neck, NY 11363. (718) 423-1911 (n)

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**WANTED:** WW II radar equipment, the bigger the better; pre-1900 motors and generators also wanted. Allan H. Weiner, 14 Prospect Dr., Yonkers, NY 10705. (914) 423-6638

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**WANTED:** RBU or RBV panadapter; AN/SRR-12 rcvr; manual for GPR-90 RXD. Tom Brent, Box 1552, Sumas, WA 98295. (604) 826-4051

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**WANTED:** Manuals (copies OK) and modifications for Drake 2B,2BQ; Heath HR10, HG10; Echophone Commercial. Gary Lang, WN9U,5129 N. Elkhart Ave., Whitefish Bay, WI 53217. (414) 332-5872

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**FOR SALE:** Heath Electronic Design Experimenter, untested model ET-3100 - $30 + shpg; TV Field Strength meter - $15 + $7.50 shpg; Plus monitor scanner, no papers - $10 + $5 shpg; Heath QF-1 Q-multiplier - $25 + $5 shpg; ARC model R11A - $20 + $5 shpg. James Fred, R1, Box 41, Cutler, IN 46920.

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

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**WANTED:** U.S. Signal Corps buzzerphones EE-1 or EE-1-A or British Fullerphones from WW I to WW II era. J. Marshal Reber, 165 Berkeley St., Methuen, MA 01844. (508) 683-6540

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**FOR SALE:** Drake R4B, T4X, AC4 and MS4, elect. VG, mech. F, all - $280. Gary Stigall, WA7RGO, 3619 Pershing Ave., San Diego, CA 92104. (619) 294-7895

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**WANTED:** Johnson gear, all models, any condition. Also parts and literature. Please state condition and shipped price. Wen Turner, AD7Z, Box 451ER, Cal-Nev-Ari, NV 89039.

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

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**FOR SALE:** TBY xcvr - $30; R-19D/TRC-1 rcvr - $45; ABA-1 (BC-645) xcvr - $15; CDE TRA-4 rotor - $15; TBX parts rig - $20. U-ship. Parting out HA-10 amp; CJB-26003A "flameproof" keys NIB - $47 includes shpg. WA7HDL, (208) 756-4147

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**WANTED:** Hallicrafters HT-33B linear amp in exc. or mint condx, w/good tube. Also need mech. filters for 51J4. Tom, WA4FJQ, (910) 887-0705

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**WANTED:** Collins 312A1 spkr in any condx - will pay cash. Bruce Thompson, K9LOF, call collect (217) 834-3464.

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**WANTED:** Speaker for Collins 75A-4. David A. Clark, K5PHF, 9225 Lait Dr., El Paso, TX 79925. (915) 591-4184

## ELECTRIC RADIO PARTS UNIT DIRECTORY

**If you need a part for a vintage restoration send $2 and an SASE (.52 postage) for a 6 page list of parts units. If you have a parts unit, consider putting it on the list. Your dead unit can help bring others to life!**

**Repair & refurbishment of older tube-type amateur equipment. Fully FCC licensed; 35 years experience. Chuck Banta, N6FX, Claremont, Calif. (LA area) (909) 593-1861**

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

**FOR SALE:** Tubes: VT-49 (39/44), 1626, 1630, 7193, 832, 2E26 - $1 each; 836, 6080, 6336, 3E29 - $3 each; 4-64A, 872A, 804, 805 - $7 each; 100TH - $12; 861 - $25. U-ship. WA7HDL, (208) 756-4147

**FOR SALE:** Repair & restoration of all classic & vintage radio equipment, reasonable rates, prompt turn around, 25 yrs experience. Mike McKean, N3HJQ, 726 McClellan St., Philadelphia, PA 19148. (215) 336-6111

**FOR SALE:** Knight TR106 6-M AM xcvr w/ vfo, manuals, mic - $50 or trade for Eico 720 vfo. John, WB9OVV, 6921 Springside Ave., Downers Grove, IL 60516-3114. (708) 964-3020

**WANTED:** Eico 723; Drake 1A manual (Xerox OK); meter for Collins R-388/51J3/51J4; F455B08 mech. filter. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

**FOR SALE:** Ranger I - $135. **WANTED:** Heath HG-10B vfo; S-53A; R-48; R-47. Dan Baraszu, K89UGG, 9361 Baywood Dr., Plymouth, MI 48170. (313) 453-6891

**WANTED:** Vibroplex Presentation bug (the chrome and gold one); pre-WW II National xmtr. Niel Wiegand, WA5VLZ, 12105 Mustang Chase, Austin, TX 78727. (512) 219-8548

**WANTED:** Schematics/manuals for abused, poorly built Allied Knight R-55A rcvr, RCA WR-49B and Precision E200C sig. generators. Jack Bertholf, 8109 N.W. 58 Ct., Tamarac, FL 33321. (305) 721-2337

**FOR SALE:** SX-28A; Valiant; KWT-6/URC-32; Globe 755A VFO; S-40B. Mike, WØBVA, 305 N. Keith St., Scammon, KS 66773. (316) 479-2756

**FOR SALE:** Hallicrafters manuals. Copies $5 postpaid for most models. Some Johnson, Hammarlund and others. SASE for list. Miller Radio, 909 Walnut St., Erie, PA 16502.

**FOR SALE:** 6-M Gonset xcvr; HQ-120; ART-13. **WANTED:** Pr. of 811's; 28-V, 40-amp xfmr or generator that will do 28-V at 40 amp out. W7RBF, (602) 864-9987

**WANTED:** British and Canadian military radio equipment, WW II and later. Leroy E. Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123

**WANTED:** Tech manuals or repro for Navy rcvrs FRR59B/WRR2 and R1134B/WRR3B. Please note B versions. Wayne, N8MS, Rt 2, Box 1500, Fairmont, WV 26554.

**WANTED:** WW II SCR299 base station radio components to complete K51 vehicle restoration project. Need: BC-610ABC or D xmtr; BC-729 antenna tuning unit; MC-269-A table; BC-731 control box; T-17 mic; T-50 mic; T-30 (throat) mic; JB-49 or JB-69-A junction box; phone or spkr control panel; MP-47 mast base; PE95ABC or D generator; FT389-A and FT388-A mountings; SW-199-A (start-stop) switch; CH-88 chest; CH-89 (seat) chest; SCR-211 freq. meter; JB-60 junction box; DR-4 reel mounts; HS-30 headset w/cord CD-605; air ventilator for truck roof mount made by Keystone #52771 6-volt motor; ST-19-A antenna straps; various cords, CD-556, 558, 560, 562, 557, 559, 561, 563, 564, 565, 566, CO-316, 313, 314; TE-48 tool equipment. Any information would be gratefully appreciated. Bill Miller, RR 1, Box 35, Vincennes, IN 47591. (812) 882-2437 (h), 882-6690 (w)

**FOR SALE or TRADE:** National NC-240D rcvr and spkr, exc. condx, needs some work. Looking for Johnson KW Matchbox; Drake R4B. Offers? Dick WØDSW, (303) 945-1318

**WANTED:** The following rcvrs in excellent condx: Hallicrafters SX-28A, SX-88; Hammarlund SP-400X; RCA AR-88. Please write stating price etc. Theodoro Hirsch, Av. Lazaro Cardenas, No. 54-B, Mexico 1, D.F.

**FOR SALE:** 75S3B, RE, w/F455FD10, F455FA05, F455F821 filters, in exc. condx - $425; TR4, w/ NB, AC-4, MS4 - $300. U-ship. Gary Elliott, NO5H, 808 Clarice St., Delhi, LA 71232. (318) 878-8032

**FOR SALE:** Rider's Radio Manuals #5, 6, 8, 9 - $25 each; antique radio schematics, Sam's, Rider's, Beitman, Gernsback - $2.50 each. Postpaid USA. Joseph R. Forth, WA2TRT, 321 Long Vue Acres, Wheeling, WV 26003. (304) 277-3154

# Dovetron NB-1 Noise Blanker

## Back by popular demand!

The Dovetron NB-1 Noise Blanker is a small solid-state devise that plugs directly into J22, J23 and J24, which are located on the top of a Collins KWM-2/2A HF transceiver. The NB-1 may also be installed in all versions of the Collins 75S(*) receiver.

In addition to noise pulse blanking and random noise suppression, the level of the received signal may be amplified 15 dB or attenuated more than 20 dB. Specs upon request.


**P.O. Box 6160**
**Nogales, AZ 85628-6160**
**Telephone 602-281-1681**
**FAX 602-281-1684**

**WANTED:** Lafayette HE-10, HE-30; National NC-190; Hallicrafters SX-100. Excellent please. James B. Geer, WB5LXZ, 604 King Dr., Bedford, TX 76022-7124. (817) 268-1985

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**FOR SALE:** Moving. Yaesu FT-101EE, AM filter, mic, manual, exc. condx - $350; R-390A (Electronic Assistance Corp), new caps, product detector, checked, ultra clean - asking $250; Viking I xmtr, complete, good iron, w/122 VFO, fair - $90; Viking II, complete, works, fair - $115; Hallicrafters SX-24 rcvr, superb condx, carefully restored - asking $140; Hallicrafters SR-42 2-M AM with HA-26 VFO - $25; Lafayette HA-500 rcvr, orig. owner, absolutely mint - $80; Lafayette HA-90 VFO - $20; Tek 515 scope, retubed - $25. Most items pick-up only, Kingston, NY area. Steve, NW2F, POB 235, Tivoli, NY 12583. (914) 757-5800

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**WANTED:** Viking Thunderbolt or Viking Courier amp. Jeff, N9INW, (414) 962-6383

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**WANTED:** Copy of manual and schematic for Knight VFO. Jim Alexander, KØHIP, 1511 N. Jackson, Russellville, AR 72801. (501) 968-7270

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**FOR SALE:** National HFS VHF rcvr circa 1950, w/coils, wkg & in good condx - $125 firm. P.Jay Spivack, 177 Telegraph Rd., Bellingham, WA 98226. (206) 859-2680

**Please remember to count the words in your ad. If you are over 25 words, please send 15 cents for each extra word.**

**FOR SALE:** 75S1, 32S1, 516F2. **FOR TRADE:** HRO-50 coils, Type 697 ps. Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383

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**WANTED:** WW II Japanese military radio equipment of any kind; early radio amateur equipment like spark xmtrs and matching rcvrs; shortwave xmtr and rcvr built on bread board; portable and pocket radio with tubes; toy crystal radio and kit. Please send your offer with pictures. Takashi Doi: 1-21-4, Minamidai, Seyaku, Yokohama, Japan.

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**WANTED:** 51S1 with cabinet. Bud, W7IYG, (208) 466-2803 after 8 PM MST.

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**FOR SALE:** Collins RE 32S-3, 75S-3B, 312B-4, 516F-2 - $1400; Drake R4B, TX4B, MS-4, AC-4 - $450. All as new. Bill Jenkins, WA5MWJ, (501) 646-3859

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**FOR SALE:** Collins KWS-1 xmtr w/manual & updates, exc. condx, along with a Collins 75A-3, w/manual in exc. condx; Hallicrafters Skyrider type S-1 rcvr, 1934. We will have these items and more from a large estate in Calif. at our outdoor booth at the Dayton Hamfest. Our indoor booth is #206. New Wireless Pioneers, Box 398, Elma, NY 14059. (716) 681-3186

**ELECTRON TUBES:** All types - transmitting, receiving, obsolete, military--Large inventory. **Daily Electronics Corp.**, 10914 NE 39th St., B-6, Vancouver, WA 98682. (800) 346-6667, (206) 896-8856, FAX (206) 896-5476

**FOR SALE:** Restoration of vintage radios; 25 years experience. Phil Goodman, K4FXB, 217 Millbrook Farm Rd., Marietta, GA 30068. (404) 509-9493

**WANTED:** Band change, tuning and beat osc. knobs for Hammarlund SP-600; phasing knob for NC-183D. Thanks. It is difficult to find them here. Oscar Steila, Via Bardonecchia 83, 10139 Torino, Italy.

**FOR SALE:** Drake 1A rcvr, looks very good, works bad - $279; Heath Marine Radiolocation set, good - $59; RCA AR-8711 radiolocation set with 20" loop on top - $75; CE 20A, looks good, unworking, with BC-458A VFO - $79. Military - PRC-6 AT-249 DF loop antennas, new-in-box - $75; AN/GRM-55 TS-1755S PRC-25 test set, good - $47; ANB H-1 headsets, good - $18 each; T-30V carbon throat mics - $30 each; 1948 Surplus Conversion Manual, Volume I - $29. Books - CQ-DX Annual, 1948 - $23; ARRL Handbooks under $19: 1946, 1952, 1966, 1969; Radio Handbooks under $30: 1942, 1946, 1978. 2-stamp LSASE for big list. Don Merz, N3RHT, 47 Hazel Dr., Pittsburgh, PA 15228. (412) 234-8819 (wkdys)

**WANTED:** Drake MN2000 antenna tuner, speech processor for T4XC, L4B power amp, any condx. Bill Kirk, W6RQQ, 9020 Balboa Ave., San Diego, CA 92123. (619) 279-0411

**FOR SALE:** Disassembled Heath AT-1. All parts, chassis and cabinet cleaned but not refurbished. Some new parts. The AT-1 is ready to be reassembled w/orig. construction manual. Ted Bracco, Quincy University, 1800 College Ave., Quincy, IL 62301. (217) 228-5213



**WANTED:** WRL-70 xmtr; HB xmtrs for display, must be museum quality; thousands of QSL cards to paper walls of Amateur display. Call Leo, (402) 392-1708, Western Heritage Museum, Omaha.

**FOR SALE:** Vocom 2C-050-2, new never used, manual, 2-M 50-W pwr amp, 2 W to drive rated output - $98; Collins cabinets front leg elevators - $7 each; for S-Line rcvrs, electrolytic, triple 40 mFd 250-V, factory fresh - $20; RCA 813's, orig. boxes, never opened - $25 each; Aerovox 10 mFd 4000-V cap. w/brackets - $20. Ed, W3WDF, 8245 Garden Oaks Dr., San Antonio, TX 78266-1710. (210) 651-9348

**TRADE:** See page 37, Feb. issue. For new 6U5/6G5 & 42 tubes. A. Bruno, 24 Butternut Dr., New City, NY 10956. (914) 354-8899

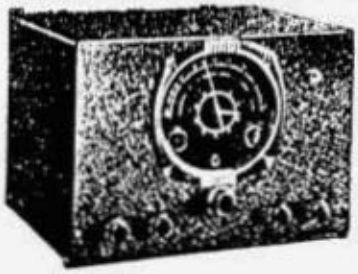
**WANTED:** Cosmophone 35 (Cosmos Industries, NY), any condx; Collins 32S, 75S, 30L, KWM, any condx. Dan Rupe, W7HBF, (206) 387-3558

**FOR SALE:** BC-223 w/pwr sply - $40; ATJ/ATK TV camera - $15; 6 ft. enclosed rack cabinet - $60. George Cumming, K7DU, 28725 Hwy. 287, Livermore, CO 80536. (303) 493-7539

**FOR SALE:** Hallicrafters HA-2 & HA-6, w/ps and HA-2 manual, good condx - $250 OBO. Bill, (303) 443-9944 (d) or 494-3682 (n).

**WANTED:** Premium Hallicrafters SX-100, SX-42 and Lafayette HE-10. James B. Geer, 604 King Dr., Bedford, TX 76022-7124. (817) 268-1985

**WANTED:** WW II & Korean mititary sets, xmtrs, rcvrs & test equipment. Send list of equipment along with price. Richard Mollberg, K6PWF, 2340 Almond Ave., Concord, CA 94520.



**WANTED: Any condition, Hallicrafters Sky Master and EP-132 as shown. Also want SX-46, S-48 and S-49. Chuck Dachis, 'The Hallicrafter Collector', 4500 Russell Dr., Austin, Texas 78745. (512) 443-5027**

**FOR SALE:** National manuals; BC-611 parts; military radios & manuals, LSASE for lists; DY-17A/ART-13 NOSB - $45; BA-38 - $42.50. Robert W. Downs, WA5CAB, 2027 Mapleton Dr., Houston, TX 77043. (713) 467-5614

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**FOR SALE:** Elmac AF-68, PMR-8 and pwr sply - $175. **WANTED:** Clegg Thor 6. Steve, K6PFW, 848 N. Silverwood, Upland, CA 91786. (909) 985-1062

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**FOR SALE:** W.J. Log Periodic Antennas. VHF to UHF, 26 elements, AZ-EL mount, like new - $125. Orig. cost $1650. S.T. Carter, II, W4NHC, POB 033177, Indialantic, FL 32903-0177. (407) 727-3015

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**WANTED:** R-390 pwr connector; HRO-60 coils, G, H and J; T-368F parts - top screws, mic connector, remote control box and BC-939B tuner; FRR59A parts and manuals. **FOR SALE or TRADE:** BC-1031C panadaptor - $125; Clegg Intercepter rcvr - $95; CV-1758 SSB converter - $225. Ward Remkopf, K8FD, 116 Fairway Dr., Belmond, IA 50421. (515) 444-4396

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**FOR SALE:** (2) Riders Vol. 14 or will trade for Vol 13 and up. Brian, POB 37, Brownville, NY 13615. (315) 788-2866

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**FOR SALE:** Vox 3 unit for Galaxy xcvrs, w/ manual - $16; HRO main tuning knob - $7. **WANTED:** GPR-90 cabinet & spkr. Bill, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

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**WANTED:** Hallicrafter S-38 & S-38C, prefer good shape but will take junkers for parts. John Henderson, NM3M, 524 Mill Rd., Goldsboro, NC 27534. (919) 751-0067

**FOR SALE:** Hallicrafters S-38E - $40; Heath VFO model HG-10B - $40; Heath final model DX-60B - $40; Hammarlund HX-50 exciter - $200; Professional tube tester, model 69 - $35; HP 410B VTVM - $40. Bob Mitchum, N9WEZ, (317) 783-5157

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**WANTED:** Tubes for Tube exchange bank. Receiving tubes, all American, new-in-box. Help us make this zero tube cost system work. SASE for info. Tube Exchange Bank, POB 806, Lake City, MI 49651

**WANTED:** Galaxy gear - bandswitch or parts unit GT-550, spkrs, pwr splys, accessories, xcvrs, wkg or parts units. Byron Tatum, WA5THJ, 1920 Maxwell, Alvin, TX 77511. (713) 331-2854

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**FOR TRADE:** Military items - BC-611F, BC-1306, PRC-6. **WANTED:** PRC-64 (Delco 5300), Delco 1600, 3200, TBY or TBX accessories, GRR-5 pwr sply, FRR-59A rcvr, others considered. **FOR SALE:** Signal Corps shock mount feet, 2" square - $3 each; National RAO-1 (NC-100 with extra RF stage) nice - $219; Wells-Gardner RBL-2 WW II VLF, great - $219; AN/SRR-13A, good, manual - $209; AN/SRR-11 VLF, good - $209; AN/URR-13A VHF/UHF, fine - $129; T-282DGR UHF 200-watt AM xmtr, fine - $49; R-48/TRC-8 rcvr, VHF/UHF FM, new-in-the-crate - $99; Hallicrafters S-36, exc. - $189; S-36A, exc. - $159; R-44/ARR-5, exc. - $179; small stuff - ANB H-1, T-17, R-14, H-79, T-30V, AN130A. Don, (412) 234-8819 (wkdys)

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**FOR SALE:** HF/KWM-380 digital keypads that are electrically and functionally identical to the original model AC 3805A keypad. These are newly manufactured units, packaged in a colormatched and weighted low profile enclosure. A small quantity will be built and I'm taking orders for these units. Price is $ 99.95, plus $5 S/H with a 30 day moneyback guarantee. Specs available with a SASE. Jerry Brouwer, AB8U, 3041 Rising Springs Ct., Bellbrook, OH 45305.

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**FOR SALE:** Hallicrafters manuals. Copies - $5 postpaid for most models. Some Johnson, Hammarlund, others. SASE for list. Miller Radio, 909 Walnut St., Erie, PA 16502.

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**WANTED:** Eico, Fisher, etc. tube-type audio amps. Franklin Albanese, 1610 Prince St., #7, Berkeley, CA 94703. (510) 845-2625

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**FOR SALE:** Dial calibration is easy with our Tri-Mark crystal calibrator. Uses 9-V battery or rectified filament voltage. Three outputs provide rock steady signals from broadcast to UHF. Great pocket signal source. Kit $17.95; assembled $24.95. $4 S&H, Visa/MC. We have a large selection of HV capacitors for tube circuits. $1 brings catalog and coupon. USA/Canada only. Two Fox Electrix Co. POB 235, Tivoli, NY 12583. (914) 757-5800

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**HEATHKIT FANS:** Don't mourn their passing; enjoy learning more about their past in historic pictures and personal insights from many company oldtimers in 124 page book - $9.95 pp. Heath Nostalgia, 4320 196th S.W., Suite B-111, Lynnwood, WA 98036-6754

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**FOR SALE:** Collins 30L-1; HB 572 (4) 2500 UPS; Bird wattmeter; Waters 334 load. John King, K5CDV, 14222 Shoredale, Dallas, TX 75234. (214) 241-8020

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**WANTED:** Manuals for PRC-36, PRC-68, LTV G-186B; HQ-215; RT-1113/PRC-68; BB-5588. Joseph Pinner, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

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**WANTED:** CVM-1 UTC 25W mod xfmr and carrier current xmtrs. Buddy Travis, Rt 4, Box 36-B, Louisa, VA 23093. (703) 894-0406

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**FOR SALE:** TV-7D/U tube tester - $150; capacitors; breakers; connectors; isolators; meters; relays; resistors; switches; xfmrs; HP's; more - SASE for list. M.D. Simpkins, 2030 Oak Grove Rd., Carrollton, GA 30117. (404) 854-8628

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**FOR SALE:** HB 75W, 80-10, AM/CW xmtr, needs work - BO; Navy RBL-3 rcvr - BO. PU only. **WANTED:** BC-610 xmtr; BC-375 shock mounts. Steve Davis, KD2NX, 705 13th Ave., Belmar, NJ 07719. (908) 280-9760 lve message

**FOR SALE:** Limited quantity of new blue with white stitching handles for Tektronix 545A etc. scopes, complete with new chrome mounting hardware - $7.50; also replacement rolls of special silver bearing solder (3 feet) for Tek scopes - $.50 each. Add $5 S&H. Stan Griffiths, W7NI, 18955 S.W. Blanton, Aloha, OR 97007. (503) 649-0837

**WANTED:** Kenwood T-599 xmtr; Radio Shack DX-400; Uniden CR 2021; Heath HG-10(B) VFO; RCA model CRM R6A; Heath SB-610 monitor scope; type 3RP1 CRTs. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459

**WANTED:** HQ-170 junker chassis; also Hallicrafters S20-R in exc. condx. Gerald Liccione, W2TPL, 118 Hiawatha Trail, Liverpool, NY 13088.

**FOR SALE:** Collins 51S-1, WE, rcvr, w/Collins rack mount adapter - $600; Collins R-391 w/meters & covers - $375; R-390 w/meters (for parts) - $100; Hammarlund SP-600JX-17 - $250. All plus UPS. Ron, KC6WTG, POB 783, Santa Rosa, CA 95402. (707) 539-8319



**WANTED:** Millen 90881 amp; 90810 pwr sply; Abbott TR-4; DK-3 radios; parts; pwr splys; manuals; anything; Instructograph code tapes; FT-171B xtals in the ham bands; 1930's issues of the RCA review. Don, (412) 234-8819 (wkdys)

**FOR SALE:** Vintage Vibroplex bugs - 3 Deluxe Originals (chrome base/red knobs, 2 exc. condx - $85 each, 1 NIB - $90); WW II Deluxe Original (gray/red, exc - $100); Presentation (gold/red, near mint in box - $125); 2 rare and beautiful Deluxe Blue Racers (chrome/red, exc. - $250 each); WW II Deluxe Lightning Bug (gray/red, exc - $100); Champion (blk/blk, fair - $60); Champion (gray/blk, vg - $65); Also Les Logan Speed-X 515 (blk/blk, g/vg - $75) and Lionel J-36 (blk/blk, base repainted, rest exc - $60). Shpg extra. Randy Cole, KN6W, 1216 Alvira St., Los Angeles, CA 90035. (213) 939-9847

**FOR SALE:** Collins 312-B4, RE - $135, WE - $115; KWT-6 modules - call; 75A-4 filters, 500 Hz, 1.5 Hz - $150 each; Knight Ocean Hopper w/coils - $95; Spacespanner & Spanmaster - $65 each; Lafayette Explorair - $60; Dak Mark 9 CB, w/Silver Eagle D-104 - $450; Johnson Ranger - $250; National HRO-500 series 140 - $900; Hallicrafters R-42 spkr - $150. Pick up only - Johnson Valiant - $425; Gonset GSB-101 linear - $350; HB KW, 6 ft. rack - $400; other stuff available. Most equipment exc. or like new. Jim Weil, 15915 Armada Center, Armada, MI 48005-2203. (810) 784-9860

WANTED: Millen 43xxx coils; Hallicrafters HT-17 coils; military TBY and TBX accessories. Don, (412) 234-8819 (weekdays).

**FOR SALE:** Repair! All makes and models, homebrew, maximum labor per unit - $96. Dan Rupe, W7HBF, Telo Technology, 1302 S. Uplands, Camano, WA 98292. (206) 387-3558

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**WANTED:** HRO-7, w/pwr sply, matching spkr and coils; power xfmr for HT-32. Clark, WØBT, 2546 SE Peck Rd., Topeka, KS 66605. (913) 235-2721

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**WANTED:** Collins 312B-5 station consoles, need 1 WE and 2 RE units, need 2 qty 75S-3A rcvrs, 30S-1 (RE), 32S-3A (RE), 32S-3 (RE), 312B-4 (RE), 312B-3 (RE), 136B-2, DL-1 for personal station. N5CET, (800) 776-4976 (d) (214) 271-0017 (n)

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**WANTED:** Other Hallicrafters SR-2000 owners to exchange information on repair, modifications, etc. Thanks! Dick Bean, WV1U, 422 Everett St., Westwood, MA 02090. (617) 461-0101

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**FOR SALE:** ART-13 w/xtal osc., used - $125; PRC-75, complete, used, exc. - $400, PRC-47 set, used - $150; PRC-47 accessories, used, whip - $15, H-233 headset - $15, "Y" cord - $7.50, DC or AC cables - $8, wire ant. - $12, legs - $8, FSK adapter - $5, chest - $35; parts radio - $45; PRC-25 modules - $8; AT-271 - $8; NOS - $10; LS-166 NOS - $20; AS-2851 30-76 MHz Hi-Gain log-periodic, NOS - $115; C-7673 120V sply for PRC-25/77, used - $30; "Power-Up!" Dave Strom's book on military battery adapters - $15 ppd; Sig. generators - scratch & dent, URM-25D - $25, 2 or more - $20; HP-608C - $45, 2 or more - $40; Polarad 1108A no output - $50, 2 or more - $40 each; HP cabinets from HP-606 type equip. 19x10-1/2 panel, 13" deep chassis, side handles, used - $25; URM-120 wattmeter - $120; VT-4C boxed - $32. Add shpg. (UPS now 150 lbs.) Tartan Electronics, Inc., POB 36841, Tucson, AZ 85740-6841. (602) 577-1022

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**WANTED:** Manual/schematic (copy OK) for Heath AV-2 audio voltmeter. Charles Hett, KØTHN, 12414 W. 101st Terrace, Lenexa, KS 66215. (913) 492-9165

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**FOR SALE:** Johnson Viking Valiant - $325, PU only. Message: Fellow from Montana who called about the BC-348, trade for your 1926 battery radio. Bob Bakinowski, 1524 Saint Tropaz, Tucson, AZ 85713. (602) 624-8029

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**WANTED:** National FBXA or SW-3 w/pwr sply. Milt Kessie, 16820 Hubbard, Livonia, MI 48154-6101. (313) 425-6477

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**FOR SALE:** Knight T-60, fine - $89; Conar Novice rcvr, looks near mint, unworking - $69; National HFS, 5886 doghouse, coils, good - $149; E.H. Scott SLR-M, near mint - $399; Globe (World Radio Labs) LA-1 linear amp, modified for 160, good - $189. Don, (412) 234-8819 (wkdys).

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**WANTED:** Heath Apache TX-1 with bright chrome knobs and matching Mohawk RX-1 rcvr; also Johnson Viking Ranger II. Will pay top dollar for clean equipment. N5CET, (800) 776-4976 (d) (214) 271-0017 (n)

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**FOR SALE:** Hallicrafters T-54 television (1948), correctly restored in good operating condx - $300 firm, PU only. Jim Hagerty, 64 Nonquit Lane, Tiverton, RI 02878. (401) 624-4739

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**WANTED:** Hallicrafters DD1 Skyrider Diversity, only in VG condx. Jose Cangas, EA4JL. Contact in the States Kurt Keller, (203) 431-6850

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**FOR SALE:** T-20/ARC-5 Command xmtr, 4-5.3 MHz, never used, in orig. box, orig. tubes - BO. John Kessel, W4IL, POB 1855, Lenoir, NC 28645.

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**WANTED:** Geiger and scintillation counters, esp. models Lucky Strike, Professional and models 111 by Precision Radiation Instruments Inc. Also ore samples and calibration sources. Thanks. Buddy Herring, 1310 Andover Rd., Charlotte, NC 28211. (704) 366-6600

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**FOR SALE:** RME 4350 - $75; Collins R-390A - $250. **WANTED:** Non-working DB22A. Doug DeWeese, 502 East 80th St., Tacoma, WA 98404. (206) 472-3478

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**TRADE:** Will trade TMC GPR-110 rcvr, w/ orig. manual for 30's com. rcvrs, keys or mics. John Kelly, N3GVF, 17510 Sir Galahad Way, Ashton, MD 20861. (301) 774-8186

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FOR SALE: NC-57, average - $55; SX-101A, VGC - $150; SX-62, fair - $85; SX-96, good - $95; BC-314F, w/110V army internal ps - $75; 2 ea AN/ARC2A, no DM's - $40 ea; lot only various Sams, under #600 - $125. All wrkg plus shpg. Dave Metz, 1016 Ridgemont Dr., Staunton, VA 24401. (703) 885-7914 7-10PM EST please

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**FOR SALE:** HRO coils G,H, J in wood coil rack. Fit HRO-5 or earlier HRO rcvrs - $125. KØOCC, (404) 396-1312

**WANTED:** Waters Rejection tuning kit for KWM-2A; Collins cabinets S-Line, KWM-2A, 30L-1, etc. Will pay top dollar for very clean cabinets. N5CET, (800) 776-4976 (d) (214) 271-0017 (n)

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**WANTED:** Receivers - Guthman U17; Meissner Scout; Traffic Master; Silver 802; Repairable? Henry Mohr, W3NCX, 1005 Wyoming St., Allentown, PA 18103.

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

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**FOR SALE:** Meissner Utility PA tuner model 10-1119, w/manual, good condx - $50. Buyer pays shpg and handling. Jim Barrows, W7BCT, 15121 41st Ave., S.E., Bothell, WA 98012-6113. (206) 337-4880

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**WANTED:** Blue Turner SSB+2 mic. Michael Murray, KE2LH, POB 5141, Hemstead, NY 11550. (516) 489-4094, anytime

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**WANTED:** Collecting early Heathkit gear, accessories and literature. Any condx or parts units. Thanks. Byron Tatum, WA5THJ, 1920 Maxwell, Alvin, TX 77511. (713) 331-2854

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**FOR SALE:** Very good photo copies of manual and schematics for AT-1, VF1, DX-60A, Navigator, Viking II, CE-20A, BC-458, 1A, R4B, National 270, BC-348Q - $10 each. HQ-170 - $15. Write Craig, KB6XV, 14 Governors Ct., Sacramento, CA 95817. Call (916) 736-1133 between 6 & 9 PM PT

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**FOR SALE:** HP 410B VTVM - $40. Equipment, parts, tubes, manuals, books, magazines, Collins, military, avionics, radioastronomy, lists - $1 (indicate interests). Joe Orgnero, Box 32, Site 7, SS1, Calgary, AB T2M 4N3 Canada. (403) 239-0489

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**WANTED:** Atlas 350 XL, not working preferably. Bob Kemp, 304 S. Washington, Lake City, MN 55041. (612) 345-5345 (d)

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**FOR SALE:** Drake TR4C, w/AC4, exc. - $250; Collins 353C-14 (75A-1 1.4 kc filter adapter) - $65. **WANTED:** McMurdo Silver 701, 702, 801, 802. John Hurst, KU6X, 2512 Euclid Cres., East, Upland, CA 91784. (909) 981-6759

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**WANTED:** Schematic/any tech. info re: Teleequipment Lt., 32AR Oscilloscope of London, England. J. Thomas, 1130 Pleasant View Lane, RR 3, Colorado Springs, CO 80921-2234. (719) 481-4564

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**WANTED:** Buy and sell all types of electron tubes. Harold Bramstedt, C&N Electronics, 6104 Egg Lake Rd., Hugo, MN 55038. (800) 421-9397, FAX (612) 429-0292

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**FOR SALE:** B&W 5100B xmtr, on the air, w/manual - $250; WANTED: 32V-3/75A-4. Bill, W2WXJ, (914) 356-6553

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**FOR SALE:** Collins URC32, WRT2, URR13A, National R1230/FLR, 01187/FLR, 0928/FLR, SRC502A, RDFs, antenna tuners, R1051 parts. SASE for list. Dave Morgan, WO4S, 117 West Hall Ave., Ste. 701, Norfolk, VA 23510. (804) 552-8626

**FOR SALE:** 50 page illustrated catalog of WW II military radio sets - $2 US, $5 foreign. Sam Hevener, W8KBF, "The Signal Corps" 3583 Everett Rd., Richfield, OH 44286-9723. (216) 659-3244

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**FOR SALE:** Vintage mobile - Multi-Elmac AF-67 xmtrs - $75 - $119; PMR-7 rcvr, NIB - $209; another PMR-7, very good - $99; PMR-6A rcvr, good - $79; another PMR-6A, poor - $39; PSR-612 sply, NIB - $89; (2) PSR6 splys, good - $35 each; M-1070 AC/DC splys, good - $99 each; Harvey-Wells T/90-R9A station, exc. - $209; Gonset Superceiver, poor - $29; Stancor ST-203A, poor - $10. Don, (412) 234-8819 (wkdys).

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**WANTED:** Straight keys, Mac keys (bugs),empty key boxes, Chart of Codes and other McElroy artifacts. Tom French, W1IMQ, "The McElroy Collector", 120 Great Rd., Maynard, MA 01754.

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**FOR SALE:** Five volumes Beitman Radio Diagrams, 1939-1942 plus 1950 - $30 ppd. **WANTED:** Heath HW-8 or HW-9. Ros Hawks, WB0GKL, 355 Animosa, Durango, CO 81301. (303) 259-0785

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**WANTED:** WW II Japanese three-tube RX for companion model 94-5 TX now on 1811 kHz and 3740 kHz CW and similar equipment. Ken Lakin, KD6B, Box 310 Redmond, OR 97756. (503) 923-1013

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**FOR SALE:** Eldico SSB-100 - $100; Globe King 400 - $300; National 183, Select-O-Ject - $125; odd Collins xtals - $5 each, SASE. All pick-up. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, NY 11758. (516) 798-1230

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**FOR SALE/TRADE/WANTED:** Vintage tube CB's, list - SASE. **WANTED:** Fisher tube rcvrs, Fisher K-10 Spacexpander, electric guitar tube amplifiers. Charles Zafonte, RFD 1, Box 75, Fort Kent, ME 04743. (207) 834-6273 (n)

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**WANTED:** Pwr sply /modulator for Clegg Zeus 6-M xmtr. Jim, (616) 229-4318 EST.

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**WANTED:** Collins mics SM-1, SM-2, SM-3, MM-1, MM-2 also Electrovoice 664 with deskstand. N5CET, 800-776-4976 (d), (214) 271-0017

**FOR SALE:** Collins 32S1, working, heavy duty HB sply - $295; 6146A/B, 6LQ6, used and new; Philmore Crystal Radio - $40; BC-457, nice - $30; BC-453, average - $20; Echophone Commercial - $25; Zenith 5H40, very nice - $68. G. Stevens, WØATA, Box 704, Longmont, CO 80502-0704. (303) 776-9036

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**FOR SALE or TRADE:** AN/GRC-10, vg condx, w/manual, PU only. **WANTED:** Top cover for Mouse key and good HF rcvr. Marvin C. Fortune, WA4TOJ, 2957 Gaffney Rd., Richmond, VA 23237-3551. (804) 275-1252

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**FOR SALE:** SB-301; SB-401; SB-400; SB-600; NW-12; GT-550, VFO, ps/spkr; Galaxy V, MK 3, ps/spkr; 101A, 32S-1, w/ps; HW-7's; WRL Duo-Bander 84, w/ps. Don, W6TVW, (702) 475-0211 (d,n)

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**Message:** Sagacious key collectors read the Vail Correspondent. Informative articles, free ads. Published quarterly. $10/yr. USA. Sample, $2. TVC, Box 88-E, Maynard, MA 01754.

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**WANTED:** Very good NC-190 w/manual. Harry Greulich, WA6IWZ, 442 S. Alpine Rd., Orange, CA 92668. (714) 978-3121

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**WANTED:** Manual, schematic and/or service/operating instructions for Dumont AN/USM-281D (preferred) or 281E scope. Will pay printing. Mike Dinolfo, N4MWP, 4027 Barbour Dr., Fairfax, VA 22030. (703) 591-7717

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**FOR SALE:** SX-25 - $100; BC-348R - $35; S-40 - $50; DX-20 - $50; DX-60A - $65; VF-1 - $25; HG-10B - $35; HR-10 - $50; SB-10 - $35. Ron Follmar, 1409 W. Willis, Alvin, TX 77511. (713) 331-1074

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**WANTED:** Elmac PMR7A rcvr. Rich Smith, 1122 Via La Cuesta, Escondido, CA 92029. (619) 739-1835

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**FOR SALE:** NIB 455 kHz CW xtal filters, 250 Hz BW, made by Trio of Japan but will work on Collins, Kenwood, Yaesu, etc. - $40. Ed Fong, 1163 Quince Ave., Sunnyvale, CA 94087. (408) 245-8210

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**WANTED:** Globe 680-A xmtr. Please call Wes, WV5I, (903) 838-0568

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**FOR SALE:** Eddystone 770R, VHF rcvr - $125. Dan Mason, RR 1, Box 204F, Sante Fe, NM 87501. (505) 455-3416

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**FOR SALE:** NC-173, Collins 75S3 and R-392, w/new ps and manual. Richard, (919) 637-6724

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**FOR SALE:** Catalog of Naval Radio Equipment, catalog SHIPS275. A 228 page publication incorporating over 100 photographs and details of Navy gear used in WW II-1944. This is a quality reprint, bound with plastic spiral. Price is $22 ppd. Also: "The High Frequency War" - A survey of German electronic development during WW II by Lt. E.S. Hessing, June 1946. 184 pages with photographs. A quality reprint, bound with plastic spiral. Price is $22 ppd. Order from: New Wireless Pioneers, Box 398, Elma, NY 14059. phone/FAX (716) 681-3186

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**WANTED:** KWM-2 wired-in relays. VP2MC is QRT without them. K8SJ, 749 E. Prospect, Girard, OH 44420. (216) 545-9632

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**WANTED:** Galaxy R-530 parts unit or working. To restore mine if possible. Pat Hildreth, 81 Lincoln Pk., Longmeadow, MA 01106. (413) 567-6663

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**FOR SALE:** Johnson Desk KW RF deck, minor mods - BO >$450; Gates Dynamote, no ps - $60. Gary, WA9MZU, 1751 Michon Dr., San Jose, CA 95724. (408) 266-2218

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**WANTED:** For FRR59A/WRR2A - manual, spare parts or complete unit. FOR SALE: RAK-6 + AC - $100. Ward Remkopf, K8FD, 116 Fairway Dr., Belmond, IA 50421. (515) 444-4396

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**FOR SALE:** Air Force Manual 100-14 "Communications-Electronics Equipment Directory" dated 1 March 1971. Describes communications and electronics equipment used and supported by the Air Force. Covers ARC-5, GRC-9, R-390, etc. 168 page repro. - $25 plus postage. **WANTED:** Connectors for TCS-12 & ART-13. James Owens, 1363 Tipperary St., Boulder, CO 80303. (303) 673-9019

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**WANTED:** Military TCS rcvrs, xmtrs, tuners and manuals. Also looking for Drake 2A rcvr and MS-4 spkr. Thanks! Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062. (713) 376-3436

**FOR SALE:** Place free ads and articles in my meter and vintage electronics newsletter. Newest issue - $2. **WANTED:** HRO-5 S-meter, good or parts unit. Chris Cross, POB 94, McConnell, IL 61050.

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**FOR SALE:** National NC-155 rcvr, manual, fair - $45; Eico 720 xmtr, manual, fair - $45; Eico 324 sig. gen., fair - $15; Knight CB-2 TX tester/analyzer, good - $25; Knight engine analyzer, un-assembled, exc. - $65. Wayne, WX8E, (810) 254-2236, 9-2 EST.

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**FOR SALE:** Tektronix and HP test equipment manuals, originals, no copies, SASE with needs. **WANTED:** Amateur related manuals, no Sams. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

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**FOR SALE:** Available this spring, Hallicrafters SX-88 rcvr, w/R46 spkr; Collins 75A-4 rcvr (S/N 5XXX); Collins 75A-4/KWS-1 combination, w/spkr; Johnson Viking II xmtr & 122 VFO; Drake WV-4 VHF wattmeter. Complete information on all via #10 SASE only to Michael J. Scanlan, WAØkEPW/6, 13428 Maxella Ave., #347, Marina del Rey, CA 90292.

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**WANTED:** Collins broadcast catalogs, 26-U compressors or other Collins broadcast compressors. R. Robinson, 868 South Main St., Plantsville, CT 06479. (203) 621-7445



**FOR SALE:** Plate and choke for Globe King 500B, 120-V to 4400-VCT - $65; choke - $20. Jim, (616) 229-4318

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**FOR SALE:** Tested tubes w/warranty! Xmit and Rec tubes: Recent acquisition has increased my stock. Buy those spare tubes for your tube radio, audio and electronic gear. Prices are about 35% of new for tubes with a warranty. I have bunches of octal, older, 7 and 9-pin tubes. All tested on TV/7 tester and boxed. I give a 30 day warranty. Send wants or SASE with two stamps for list. Daniel Nelson, 1025 E. Desert Lane, Phoenix, AZ 85040. (602) 243-7421

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**WANTED:** 6550 and 8005 tubes. George Schwarz, 18504 Arrowhead, Cleveland, OH 44119. (216) 486-6489

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**FOR SALE:** CE 200V, mint - $400; Henry 2K w/3-500Z's - $550. Pick up. Chuck Banta, N6FX, see my ad for telephone # here in ER.

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**FOR SALE:** RT-6 xmtr - $100; Heath SB-100 mobile mount - $15; HP-13 sply - $35; 1661 spkr - $20. All above w/manuals. Eico 950-B - $13; T-20 & BC-458 xmtrs NIB - $35; BC-611-F on 3885, exc. +, w/canvas case (zipper needs wrk) - $95; SST-1-D xmtr, rcvr & SSP-1-D pwr sply, some rust, restorable, not modified - $375; misc WW II military radio set manuals, components, accessories - list available. **WANTED:** TM11-617 (RT-53/TRC-7); AS-110/TRC-7 antenna; AB-37/TRC-7 base; cord CD-125 for BC-474 (SCR-288). Henry Engstrom, KD6KWH, POB 5846, Santa Rosa, CA 95402. (707) 523-9268

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**FOR SALE:** Dynamotor ??35-D 12V/625V - $20; Sprague computer grade electrolytics, 600 mFd/400VDC - ten for $20; Dowkey coax relay, BNC, 24VDC - $20; antique SWL rcvr ('30's) - $10. **WANTED:** Johnson 250-39 TR swtich; Heath TX-1/RX-1 combo. Dave, W1DWZ, (508) 378-3619

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**FOR SALE:** General Radio Model 1607 impedance bridge. Steve, KD2ED, (609) 795-9250

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**FOR SALE:** New tubes, 4CX250R, Amperex - $150/pr., 4CX250B, Amperex - $120/pr.; GL5550, GE - $150/pr. All for $375. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (201) 728-2454

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**FOR SALE:** T-368 xmtr; RAS-5 rcvr. SASE for much more. Gene Schraut, NG7A, 103 N. 3880 W 317-6, Hurricane, UT 84737.

# Uncle Dave's Wireless World

27665 Forbes Rd., Ste. 102, Laguna Niguel, CA 92677
Tel: (714) 367-1012 FAX (714) 367-1009

**What is Wireless World and what's it all about?**

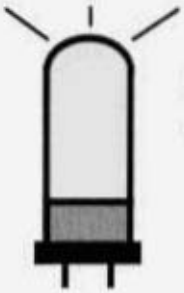
Wireless World is a store specializing in 'Radios That Glow in the Dark'. We cater to the ham who appreciates the warm, soft, glow of vacuum tubes, the 'twang' of a relay closing as the plate receives its voltage and the smooth broadcast sound of well-modulated AM. Of course, we have things for the SSB generation too. There are Collins S-lines scattered throughout the store, Nationals, Hammarlunds and others are in evidence as you take a trip back to your early days of hamming. Look at the keys and bugs from 1935, sort through our large tube selection or just ragchew with the guys (and a few gals) that hang out in Wireless World.

We accept good clean rigs for consignment. Please call or write for details before sending rigs. We can assist you in locating those hard-to-find parts for homebrewing. We have a large selection of parts on hand for HB'ers; variable capacitors, transformers, ceramic sockets, old tubes, National dials,etc. Call or write us with your needs.

As of press time we have the following: HP 606A signal generators; National NC-100XA; HRO-500, with low frequency preamp, outboard speaker, in cabinet; Collins 30S-1; Collins 62S-1; Hallicrafters SX-100; Hallicrafters SX-140/HT-40 combo; Hammarlund SP-600JX-26, in cabinet. If we don't have it, perhaps we can help you find it Why not give us a call today.

**Hours: 8:30 to 5 PM -Pacific Time Monday thru Friday - Noon to 5 on Saturday and Noon to 4 Sunday**

Uncle Dave's Wireless World



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