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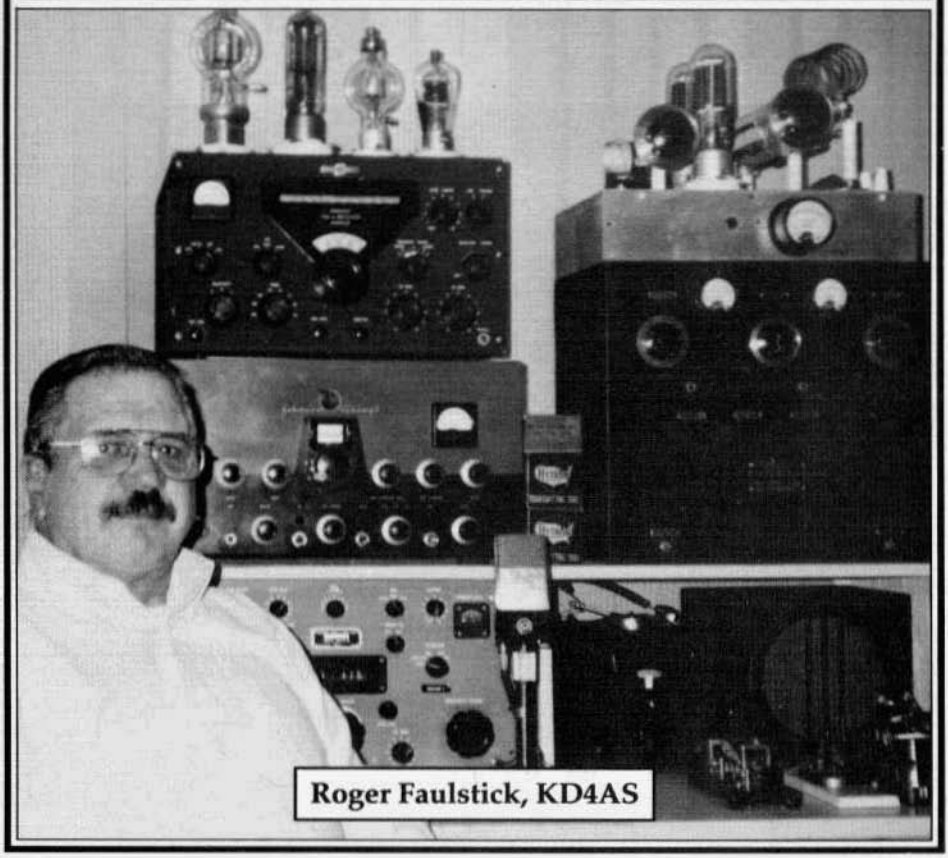
ELECTRIC RADIO

celebrating a bygone era

Number 55 November 1993



Roger Faulstick, KD4AS

ELECTRIC RADIO

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

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

Regular contributors include:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; 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

This month on page 19 I've listed the information on all the vintage nets that I'm aware of. I think we'll have this in the magazine monthly for a while and then at regular intervals. It should be helpful to newcomers and old-timers alike. If anyone has any information that would make this list more complete I'd be happy to receive it.

Again I'd like to draw everyone's attention to the Parts Unit Directory. As I've said several times in the past this is a tremendous resource for all us vintage enthusiasts; when our rigs fail this is where we go for parts. To keep the Directory viable we need more parts units. Please consider listing your parts rigs; "Your dead rig can bring another rig to life". And we also need to keep the list current. If you have put a rig on the list and it's been sold or stripped clean please call or write so I can delete it. For those who are unfamiliar with the Parts Unit Directory, here's how it works. I maintain a computer data base that consists of all the parts rigs listed alphabetically according to manufacturer and model. Opposite the rig is the owner's name, address and phone number. To acquire the list send $2 and a LSASE with $.52 postage. The list has around 250 units on it at present.

Another directory I may consider putting together will list all those hams involved in vintage homebrewing. This list would be useful in that it would make it easier to acquire and exchange parts and technical information. I'd like to hear from the homebrewers on this.

Finally, don't forget to participate in the AMI AM Jamboree coming up on Thanksgiving Weekend Nov. 25-28. Look for activity on 10,15 and 160 meters. It should be a fun weekend.

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DON'T BE SORRY! CONDITION THOSE TUBES

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

It's an increasingly common scenario - and a sad one. You put down a pile of hard earned dough for a set of output tubes for that vintage sideband rig or classic hi-fi amp. The tube tester indicates all is well with your purchase. You plunk the new tubes in the sockets and set the idling current with the bias control. Convinced all is well you commence a full carrier tune up or put on a record and sit back. All of a sudden - there's trouble in hollow state land: the plate current in your vintage rig starts creeping up, slowly at first, then with increasingly rapidity until within a matter of seconds, the tubes are red hot. If you're lucky, you've noticed in time and cut the power or the fuse blows. If you're not, you've just ruined what you thought was a perfectly good set of bottles. Your next move is giving a piece of your mind to the jerk that sold you what were purported to be good new tubes. So, what happened?

As the years go by, many of the glass power tubes made in past decades and stored unused are slowly becoming gassy. Not that there's any manufacturing defect, but molecule by molecule, air is entering the envelopes through minute gaps along the seals and other places. I doubt that the tube manufacturers of years past ever designed their products to maintain a vacuum for decades to start with! In any event, when the long dormant tubes described in the first paragraph were put under load and got seriously warm, gases were driven off the plate and other internal parts, and these free molecules caused various deleterious effects within the tube, including ionic back bombardment of the cathode and control grid. The net effect of all this was a large amount of reverse grid current flow, opposing the protective or operating bias applied to the tube and raising the plate current. The increasing plate current caused even more heating, liberating even more gas and on and on in an accelerating chain reaction, resulting in the eventual destruction of the tube. This is not a big problem in class C amplifiers with their extremely large amounts of applied bias, but it is in any class A, AB or B amplifier where a large resistance exists between control grid and cathode. The most suspected tubes appear to be bottles such as the 6146, 5894, 829B and various audio types such as the 6550 and 6L6GC. I have had this runaway occur even in a class C biased Johnson Ranger. The higher the plate voltage, the greater the danger.

So, what to do? Fortunately, the getter used in these tubes was designed to absorb stray gas molecules for the life of the tube and all one need to do is allow it to do its job. The following procedure has been recommended and I have used it with great success in activating new old stock tubes, salvaging some that read gassy in a tester, or those that have tendencies towards plate current runaway as described above.

Set up a test jig consisting of an appropriate socket, heater supply and adjustable source of B+. Connect a low value resistor between cathode and control grid, on the order of a thousand ohms or two. Tie screen and plate together and to B+. In the case of the above power tubes, use a value of B+ near 200 to 300 volts but do not exceed the screen voltage rating of the tube under any circumstances. Bias the tube with the use of a cathode resistor or zener diode so that the tube is idling at about 1/4 the rated plate dissipation rating. (Plate current x plate voltage = plate watts). This allows the tube to 'cook' in a safely controlled manner. Watch the plate current for a period of time to make sure

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AM International Update

by Dale Gagnon, KW1I
Interim President

AM Jamboree, November 25-28

Plan to operate the AM Jamboree on Thanksgiving Weekend from Thanksgiving Day through Sunday evening November 28. Look for Jamboree activity on 10, 15 and 160 meters. Exchange of contact numbers and AMI certificate numbers is optional. I encourage you to send in a report of your Jamboree experience.

Membership Hits 400

Membership at the end of October topped 400. Over 40 people signed up at the Hosstraders Tailgate Swapfest and Fleamarket on Oct. 15, 16. AMI Headquarters' new banner (1.5 ft. x 6 ft.) drew most of the new members in. Andy, WA4KCY, has sent in at least that many new members from hamfests in the Southeast in the last few months. Write if you need to use an AMI banner at your local radio event.

Nominations and Elections

Nominations for AMI Regional Directors, President and Treasurer are due in to AMI headquarters in November. To have a name entered in nomination for an office, the nominee must be an AMI member and must be willing to serve. You can nominate yourself if you are interested in serving. A slate and ballot information will be published in *ER* in December. Voting will occur at the end of December. Votes will be tallied independently and will be announced in January. **ER**

This handsome membership certificate (8 x 10, suitable for framing) is given to all new members. To join AMI send $2 to AMI, Box 1500, Merrimack, NH 03304-1500

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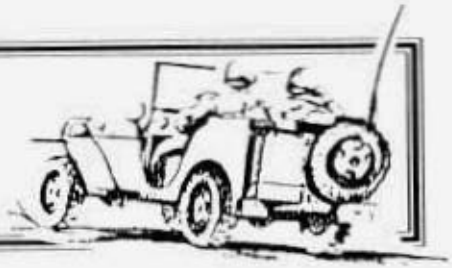


by Walt Hutchens, KJ4KV
3123 N. Military Rd.
Arlington, VA 22207

"The R-1051/URR Receiver"

When we studied the SRR-13 communications receiver (ER, July, 1991) bought by the Navy about 1952 we noted that it was pretty much a flop and was replaced in the short run by the Army's R-390. This month we'll look at the next receiver the Navy bought specifically for its needs.

Overview

The R-1051/URR is an HF communications receiver designed for ship and shore station use. It covers 2-30 Mcs in steps of 500 CPS (R-1051, the first model) or 100 CPS (R-1051B and later models) and can also be continuously tuned over a 1 kc range at each 1 kc setting. All frequencies used in the receiver are phase locked to a precision 5 Mcs reference oscillator; an external 5 Mcs source may also be used. Rated frequency stability is .01 CPS per megacycle per day and rated accuracy is 1/2 CPS at 5 Mcs.

The R-1051 can receive upper or lower sideband or both at the same time to separate output channels, a mode called independent sideband or ISB. It can also receive CW and AM. Bandwidths are 3.2 kcs in SSB modes and 7 kcs in AM and CW.

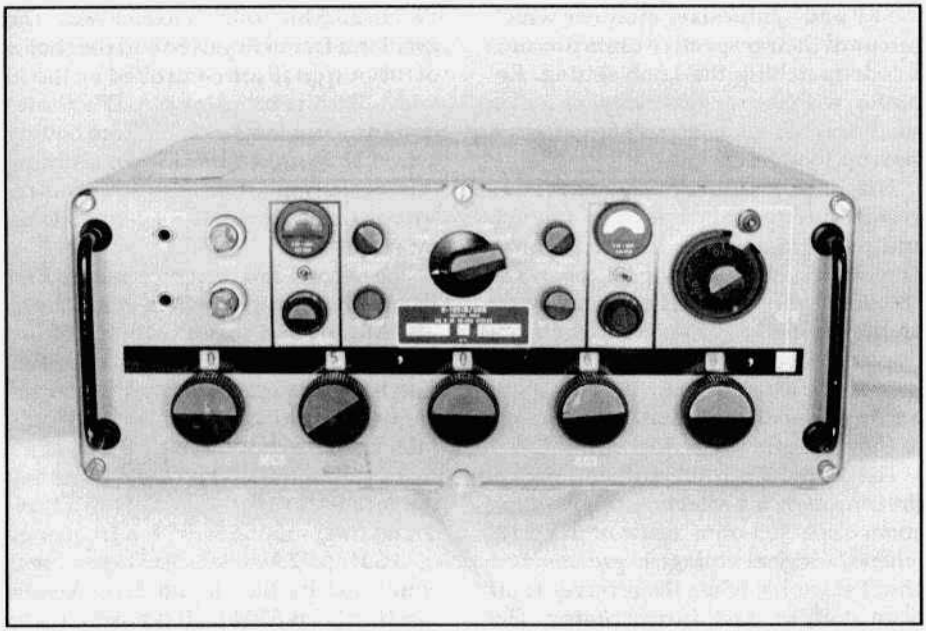
The R-1051 measures 7" x 17-1/2" x 19" (H x W x D) and weighs 70 pounds not counting the shock mount. It operates on 115 VAC, 48 to 450 CPS at 55 watts. The receiver cabinet is watertight.

History

I have only a little information on the history of this set. It is a Bendix design and was first procured by the Navy in 1960. It has been built in models R-1051, R-1051B, C, D and so on to at least H; the F model was being built by Stewart-Warner in 1981. Except for the size of the frequency steps the models are similar in function but the early ones use vacuum tubes in the RF amplifier with individual transistors in most other stages while the later models use integrated circuits. I believe that the latest models are still being bought; the early ones have been appearing in surplus for several years.

The R-1051 became the cornerstone of a whole group of Navy radios called the WRC-1 family. With minor chassis and panel changes and some different modules you get RT-618, a very low power SSB transceiver. An RT-618 with an AM-3007 is a URC-35 100-watt PEP SSB transceiver; one manual notes that this was the replacement for the TCS-series! If the receive function is left out, you get a T-827, which with an AM-3007 gives transmitter URT-24; adding an R-1051 receiver gives a WRC-1. A T-827 exciter with a higher power amplifier AM-3924 gives you a URT-23 which delivers 1 Kw PEP.

It is hard to guess the total production but the R-1051 has been a very successful radio. Perhaps 20,000?



The R-1051B/URR. Knobs across the bottom set tens of megacycles, megacycles, and hundreds, tens and kilocycles. The outer knob at the upper right sets 100 CPS or (in the R-1051) 500 CPS units; the inner knob controls continuous tuning of 1 kcs when the outer knob is in the 'V' position. The similarity to the SC-901 transceiver (ER, August 1991) is no accident; both sets are Bendix designs. This photo was taken before starting clean-up operations.

Design

This is a very complex radio; I count about 50 crystals and over 150 transistors plus two tubes and several integrated circuits.

Mechanically the R-1051 consists of a shallow aluminum chassis with a die cast front panel. The set is mounted on slides in a welded aluminum cabinet; when pulled out it can be pivoted up 90 degrees to service parts on the bottom. A cable runs from the rear of the chassis to the inside of the case; power, control, antenna, and 5 Mcs frequency standard connections are on the back of the case.

Most of the electronics is in six modules: the RF amplifier, synthesizer/frequency translator (local oscillators and mixers), mode selector (mechanical filters), two IF/audio sections (USB/AM and LSB) and frequency standard. These modules plug into the top of the chassis.

The synthesizer/translator is often called the 'six pack' because of its similarity in shape to the familiar fiber, aluminum and fluid equipment. The R-1051 unit is also similar in having six removable subassemblies.

The RF section and synthesizer/translator are controlled by the tuning knobs on the panel. One input is provided by three bicycle chain drives operated by the 100 kcs, 10 kcs, and 1 kcs knobs. These chains operate vertical shafts with disk and pin couplings which mate with the modules when they're installed. The other comes from two groups of five wires which are grounded or open in various combinations according to the settings of the 10 Mcs and 1 Mcs knobs. These wire groups control motors in

continued next page

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the RF and synthesizer modules which run until their respective units produce a code matching the knob setting. Retuning within a megacycle takes only a small fraction of a second; larger steps take up to about a second.

The 100 CPS tuning steps and 1 kcs vernier tuning are provided by a switch and potentiometer on the front panel. The switch has eleven positions: 000, 100, 200. . . CPS above the frequency set on the tuning knobs and 'V' to activate the vernier potentiometer. When in vernier mode a neon lamp flashes about once a second to warn that the frequency of the set is not phase locked.

The signal from the antenna passes first through a protective relay which connects a 100-ohm resistor in series when the signal voltage is greater than about six volts, when the receiver is off or in standby, and during tuning. The signal then goes through a two-stage RF amplifier using 6BZ6 and 6AN5 tubes. The 6BZ6 is a high-gain RF pentode; the 6AN5 is a beam-power tube probably because this module is also used in the RT-618 and T-827.

The RF amplifier uses four tuned circuits in an arrangement unlike anything I'd seen before.

There's a separate coil for each megacycle 2 through 30. These are carried on a turret with an inside diameter of about six inches which is rotated by the RF section servomotor. Inside the turret with the tubes and other circuitry are switches operated by the 100 kcs and 10 kcs chain drives; these switches select fixed capacitors which are connected across each of the four selected coils. Each tuned circuit is made up of a megacycle coil and 100 and 10 kcs capacitors. You can think of the R-1051 front end as covering the 28 megacycle range in 2800 fix-tuned bands!

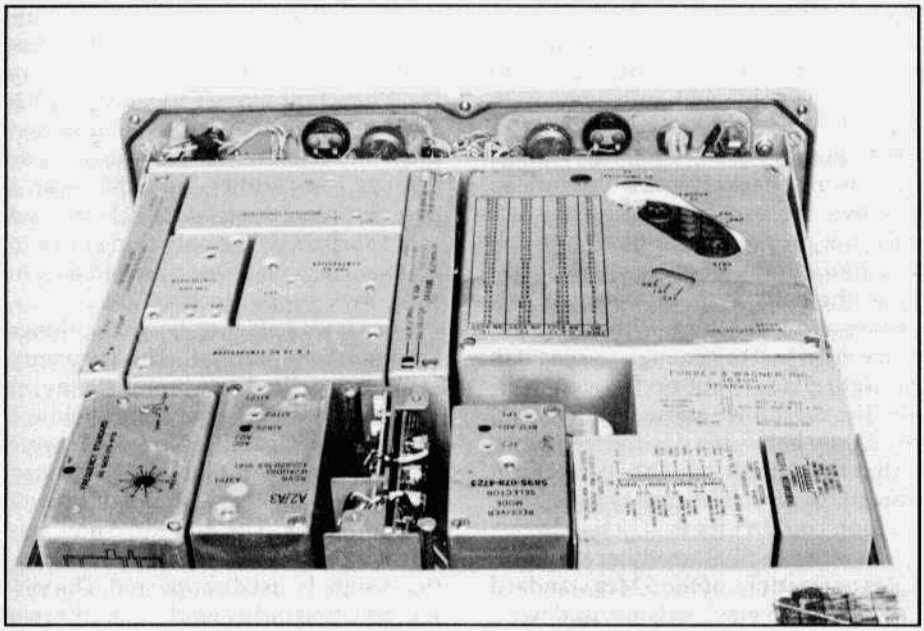
Over in the synthesizer/translator module the amplified signal is mixed first with a frequency between 2.5 and 23.5 Mcs to produce a first IF of either 19.5 to 20.5 Mcs or 29.5 to 30.5 Mcs. The oscillator frequency used and the choice of the output IF are controlled by the 10 and 1 Mcs knobs; using two IF's allows dodging problems coming from having a first IF within the receiver's tuning range and minimizes both spurious responses and the number of crystals required.

The second mixer combines the first IF with a frequency which goes 22.4 to 23.3 Mcs or 32.4 to 33.3 Mcs in 100 kcs steps according to the IF in use. This frequency is controlled by the 100 kcs knob and yields a second IF of 2.8 to 2.9 Mcs. It is also controlled by the 100 CPS step or vernier knob so the real tuning range is 1 kcs greater than given above.

The final mixing is with a frequency of 3.301 to 3.400 Mcs in 1 kcs steps controlled by the 10 and 1 kcs knobs. The third IF is 500 kcs. It is passed to the mode select module where diodes choose the proper mechanical filter for USB or AM/CW; the signal is also applied to the LSB filter. The USB or AM signal goes to the upper sideband IF/audio module and the LSB signal to the lower sideband module; the panel switch applies power to the unit for the selected mode.

The IF/audio modules also generate AVC voltages for the two RF stages and the solid state IF's.

The R-1051 megacycle oscillator is phase locked to the frequency standard. Phase locking controls an oscillator so it has a constant phase with respect to another signal; this is done when you have a stable signal which is too 'dirty' to use directly. The situation in the R-1051 is a good example: all harmonics of the 1 Mcs output of the frequency standard are present but a pure local oscillator signal is needed for the first mixer. It would be impractical (require too many tuned circuits) to filter the harmonic signal but if we use it to precisely control another oscillator the problem is solved.



Top view of the R-1051. Removable modules fill the set to the brim making extender cables essential for all but the simplest service operations. Across the front (left to right) are the synthesizer/translator and RF amplifier; at the rear are the frequency standard, two IF/audio units, the mode select module and the power supply).

The oscillator we're controlling is a conventional crystal-controlled Colpitts circuit except that there is a varactor diode in series with the crystal. A varactor diode is a voltage variable capacitor; by adjusting the bias on the diode the crystal frequency can be varied a kilocycle or two. Increasing the diode bias reduces the capacitance which increases the operating frequency.

The megacycle synthesizer selects one of 17 crystals according to the megacycle knob setting; let's use the 8.5 Mcs crystals (selected when the receiver is tuned to 11, 21 or 28 Mcs) in this example. Actually, this crystal is etched to operate at 8.499,320 Mcs for a reason we'll see shortly.

The crystal oscillator output is one input to a mixer; the other is the 1 Mc harmonic signal. The output of the mixer is tuned to 1.5 Mcs. Although the mixer produces all combinations of the many input frequencies, the only two which will get through the output tuned circuits are the beats between the crystal frequency and the second harmonic above and below it, namely 10 Mcs and 6 Mcs. Assuming the crystal oscillator is 680 CPS below 8.5 Mcs, these beat frequencies will be 1.500,680 and 1.499,320 Mcs, respectively. These signals will be amplified and then detected by a diode.

The diode output is the beat note between these or 1360 CPS. A DC amplifier rectifies this signal and turns it into an increase in the bias on the varicap, raising the crystal oscillator frequency.

This sounds like a circuit which could reduce the error in the crystal oscillator frequency to a small value but not to zero. However as the frequency error nears zero, the circuit behaves a bit dif-

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ferently. The output of a diode fed two equal AC signals of the same frequency is a DC voltage which varies from zero to twice the value with only one input, depending on the relative phase. After going though the DC amp, this voltage also has the effect of biasing the varicap to move the oscillator frequency up. With the proper choice of circuit values, the oscillator frequency slides right up to the halfway point between harmonics and locks there with a constant phase error just big enough to keep it in the right place -- but no frequency error. The reason we started with a crystal slightly below the desired frequency is that this circuit can only correct upward; if the crystal frequency were high, the loop couldn't fix it.

The other oscillators either use multiples or fractions of the 5 Mcs standard frequency or their signals are used twice in opposite directions so that any errors cancel out. The end result is that there can be an error in the frequency to which the R-1051 is tuned only if the frequency standard is off frequency. The standard is expected to be stable enough to require checking only once per quarter; it is to be adjusted only if it is off frequency by more than one cycle every twenty seconds!

Like most Navy shipboard sets, the R-1051's audio level is under 100 milliwatts and is intended for output to headphones or a remote speaker/amplifier.

Audio-derived 'hang' AVC is used; separate control voltages are provided for the two RF amps and transistorized IF stages.

On The Air With The R-1051

As a fairly modern set, the R-1051 fetches a good price -- depending on condition, upward of $800 from dealers and $200 or more at fleamarkets. That's a bit steep for this QTH, so my '1051 came along a bit at a time. I got a Bendix-built R-1051B missing a couple of modules for $50 at Gaithersburg '91. A couple of 'six packs' (with shipping documents saying they had been released to surplus by the White House communications center in March 1991!) turned up for $5 each at Howard County in '92. Finally, I got a mode select module and a set of manuals to copy in a trade arranged at Gaithersburg this year. I plugged everything into the chassis and -- big surprise -- the only thing I had to fix to get it to play was a broken wire in the power supply section!

Once it was playing, however, things became more 'normal'. The frequency standard drifted continuously by as much as 100 CPS above and below 5 Mcs. Signals received on USB were much louder than those on LSB; I had wondered why that LSB IF/audio unit had no cover. The 100 kcs knob was intermittent on the '9' position -- sometimes signals just disappeared. The vernier function didn't work at all (the rear end of the pot looked like it had been knocked loose with a hammer) and the 100 CPS steps worked 'sometimes'. The dial lamps were burnt out -- no small thing on this radio.

Worst of all, even when the frequency standard was on frequency the received frequency was off the knob settings by as much as a couple of kilocycles, depending on the setting of the megacycle knob. Sure enough, the megacycle synthesizer was not locked to the frequency standard; checking at a test point I found that the bias on the varactor diode that controlled the crystal oscillator was always at the minimum, meaning that the oscillator frequency was always at the low extreme. It looked like the White House comm. center knew what it was doing. . .

A scrap 'six pack' and a couple of hours work yielded an extender cable for the megacycle synthesizer subassembly and it took only a couple of minutes with a scope to discover that except for the crystal oscillator, not much was going on in there. Another two hours turned up a shorted bypass

cap in the section which generates the harmonics of the 1 Mc standard. Of course the stage that had the problem is located in the very center of the module where two layers of other parts and a soldered shield have to be peeled back before you can see it. The good news is that considerable thought has been given to making that as easy as possible to do.

With the cap replaced most megacycles locked up properly; the three exceptions seemed to be crystals which were so far below the right frequency that the loop couldn't pull them on. Sure enough, adding a 100 mmF cap in series with each of the bad crystals made those megacycles lock up; the varactor voltages are even near the center of the range so modest amounts of drift shouldn't cause a problem.

It took a couple of hours to shove the back onto the vernier frequency pot and resynchronize the resistance element with the wiper; that put the vernier function back in service.

Some of the other problems seem to have just faded away. The intermittent 900 kcs setting and 100 CPS switch have given no trouble for a couple of days. The drifting frequency standard has been fine since I closed the radio up; evidently the oven loop is unstable when it must supply lots of heat. The manual does tell you to let the radio run for three days before adjusting the standard.

The IMD dynamic range at a signal spacing of 20 kcs is 45 dB; that can be compared to my XYL's Collins 51S at 60 dB and the little R-8040 (ER, April 1993) at 80 dB. (*) The limit is probably the 2N3127 mixer stages.

I suspect my R-1051 is about average for used flea market units. I have forty hours work in it so far, and there's probably another 10 to go to fix the bad IF/audio module, replace the dial lamps, and finish cleaning the set up. There are separate audio jacks for USB/AM and LSB, meaning you must shift the headphones back and forth... this will require a mod.

The R-1051 could have a place in the shack of almost any military radio enthusiast. The dial accuracy is better than any frequency standard most of us have, the AM bandwidth of 7 kcs makes it sound better than most receivers and its stability makes set-and-forget operation possible on any band. The AVC is outstanding. The 5 Mcs output on the rear of the set is handy for calibrating frequency meters and other gear. However because of the stiff six-knob tuning you can't easily 'tune around' with an R-1051, the dynamic range is poor, troubleshooting is only for the true fanatic and the set has no S-meter. I like my '1051 a lot and it will likely always have a place here but all considered the R-390A is a better choice for general hamming.

* 'IMD dynamic range' is a ratio of two signals at a stated spacing and strong enough to produce a detectable spurious response one spacing over from either, to a signal which is just detectable. It tells you how weak a signal you'll be able to hear when there are many strong signals outside the normal bandwidth of the receiver.

Conclusions

Someone who was there told me that when his aircraft carrier got R-1051's, they took the SRR-13's to the rail and dropped them overboard! I think the SRR-13 is beautiful but as a military radio the '1051 is miles ahead -- stable, easy to use, reliable and clean sounding, all of which the SRR-13 is not. 'Local disposal in accordance with command-established procedures' was probably appropriate.

The R-1051B manual is outstanding -- the best radio technical manual I have ever used. Everything you want is there: simplified diagrams, pictures showing the locations of parts and test points, block diagrams, step by step troubleshooting procedures which actually make sense, complete schematics, a good high level explanation of the theory. The most remarkable feature is that the manual was written by someone who had actu-

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A Superhet for 160 & 80 Meters

by Bob Dennison, W2HBE
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Westmont, NJ 08108

Soon after building an AM transmitter, I began thinking about an old-time tube receiver to go with it. I had some old (circa 1932) Hammarlund IF transformers and a matching BFO coil and I figured these would give just about the right bandwidth for good AM reception on 160. After the receiver was used for a season, I made a list of its shortcomings:

1. Frequency stability of the BFO was poor.
2. SSB reception using the VFO was very difficult.
3. There was no AVC, S-Meter or noise limiter on CW/SSB.

The old pre-war design had to go. It was time to adopt some of the newer post-war ideas. During the breadboarding phase, tubes, components and clip-leads were hanging out of the bottom of the set in great profusion. When all this new stuff was working, it became necessary to squeeze in two 7-pin miniature tubes. The problem was compounded by the restriction that these had to be located near their associated circuits. One always hates to rework something that was carefully laid out but the results justified the effort.

Photos of the revised receiver are shown in Figs. 1-3. No digital dial here - only old fashioned, warm, full-vision analog dial. Here's the new list of features:

1. Stable product detector for CW/SSB reception.

Figure 1. The nine-tube, band-switching superhet tunes the 160 and 80 meter bands. All controls are marked with Dri-Transfer labels.

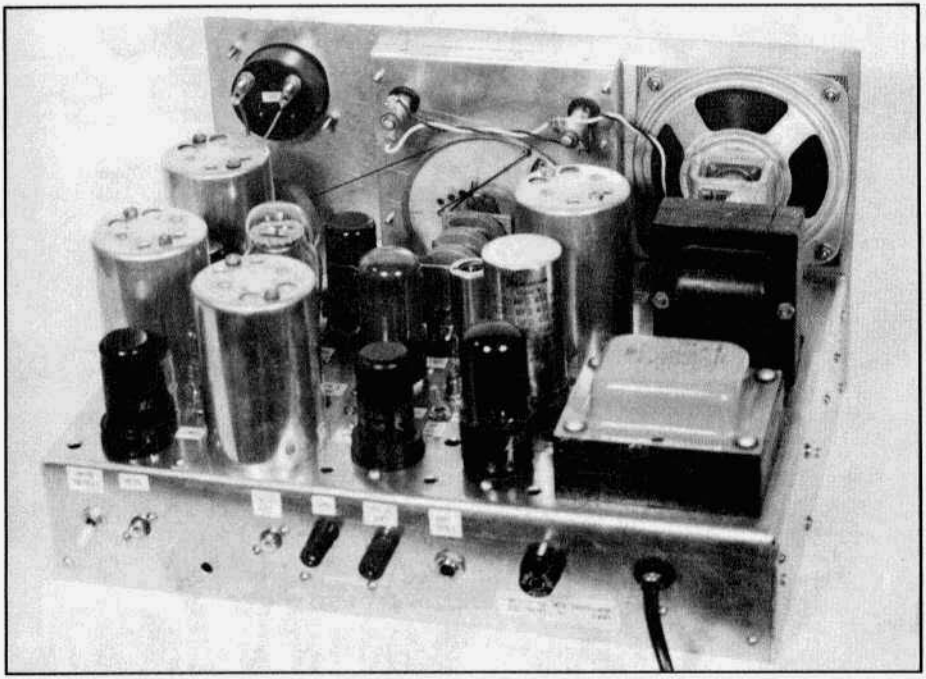

Figure 2. Rear view showing arrangement of parts and the home-made dial. The switch on the left defeats the mute circuit.

2. Crystal control of product detector eliminates need for a pitch control.

3. Superior noise limiter - works on AM, CW & SSB.

4. DAVC & S-Meter work in all modes.

Other features include provision for muting during transmission, antenna trimmer,tone control, 20 dB attenuation for very strong signals and a jack for an external hi-fi speaker.

A block diagram of the receiver is shown in Fig. 4. Nine tubes (including the voltage regulator) are used. The power supply uses a solid-state bridge rectifier and delivers 185 volts. The antenna transformer has a turns ratio of 1:3.16 and is wound on a small ferrite toroid. The attenuator (approx. 20 dB) is useful when listening to strong locals or monitoring your own rig. The converter uses a 6SA7 in a conventional circuit. AVC is not applied to this stage; instead, the signal grid is returned to ground through a 1.5 meg resistor. This limits grid current to a safe value when the transmitter is on.

Initially it was planned that the receiver would cover only 160 meters. But as the design progressed, it seemed like a good idea to add the 80 meter band. The bandswitch is a Centralab PA 2010, 2-section, 4-pole miniature with ceramic wafers. The coils are wound on 'poly' tubing obtained from a fish and pet supply store. Each coil form is cemented to a small block of lucite which is drilled and tapped for a 6-32 screw. Only two sections of the tuning condenser (Allstar C3) are used. The tuning condenser is mounted on 5/16 inch pillars so that the dial appears at the best location on the panel.

Two stages of IF amplification (6SK7) give lots of gain so it was necessary to decouple all plate, screen and grid circuits. A 6SQ7 is used for the AM detector and the first audio stage. A 1N914

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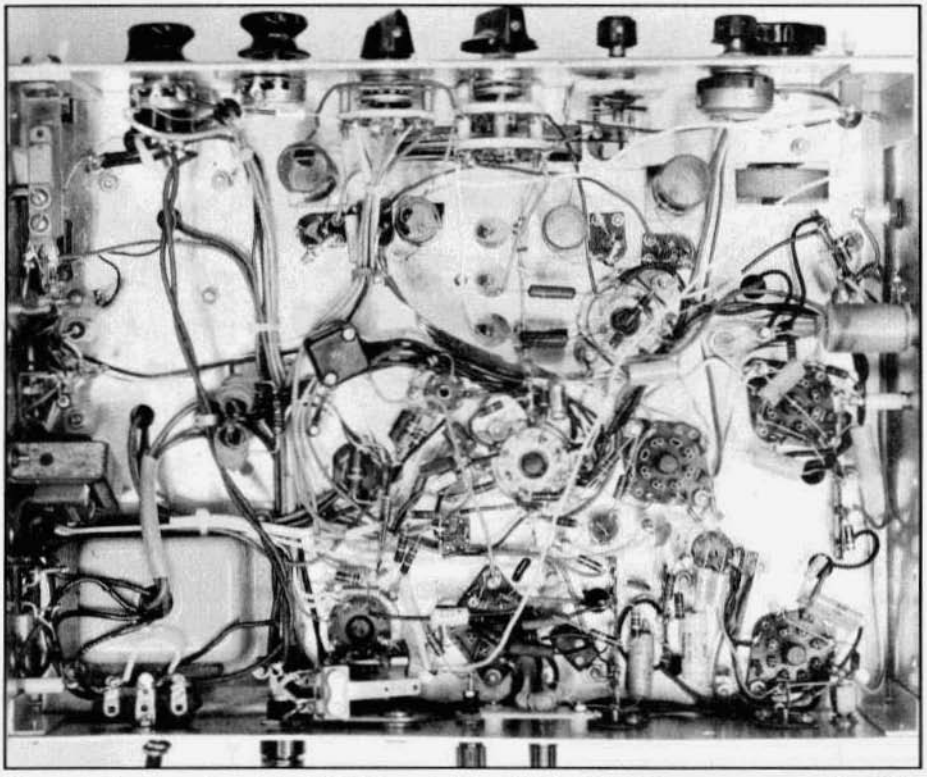


Figure 3. Bottom view. The 455 KC crystal is slightly left of the center - near the 6BE6 socket. Note cutout in chassis for flywheel. On the rear apron are the jack for the external speaker and the antenna transformer, T1.

provides delayed AVC in the AM mode. The output stage uses a 6V6-GT. The receiver contains a 5" PM speaker and there are jacks for headphones and an external hi-fi speaker.

Details of the product detector and the CW/SSB delayed AVC system are shown in Fig. 5. Here, Z1, is the old Hammarlund 455 kc BFO coil. The 455 kc crystal was donated by a friend. It makes tuning in a SSB signal almost as easy as AM. The AVC system uses V8-B to amplify the audio signal. Transformer T3 (Stancor A-53-C) delivers a push-pull signal to the full-wave rectifier (D2, D3) to which is applied a delay voltage of 4.3 volts. The AVC time constant in the CW/SSB mode is long enough to hold the receiver gain nearly constant between syllables and short pauses in speech. The other half of V8 is used for the S-meter amplifier and is conventional.

The chassis measures 12.75 x 9.5 x 2 1/2 inches and is made from a piece of semi-hard aluminum found at a flea market. It didn't want to bend easily so it was heated with a propane torch to anneal it. The corners are reinforced with angular members cut from aluminum angle stock which can be found in most hardware stores. The panel is .050 aluminum and is held in place by the various controls. A two-inch lead flywheel supported by a U-shaped steel bracket makes it easy to scan the band rapidly.

The dial well is made of .05 alumi-

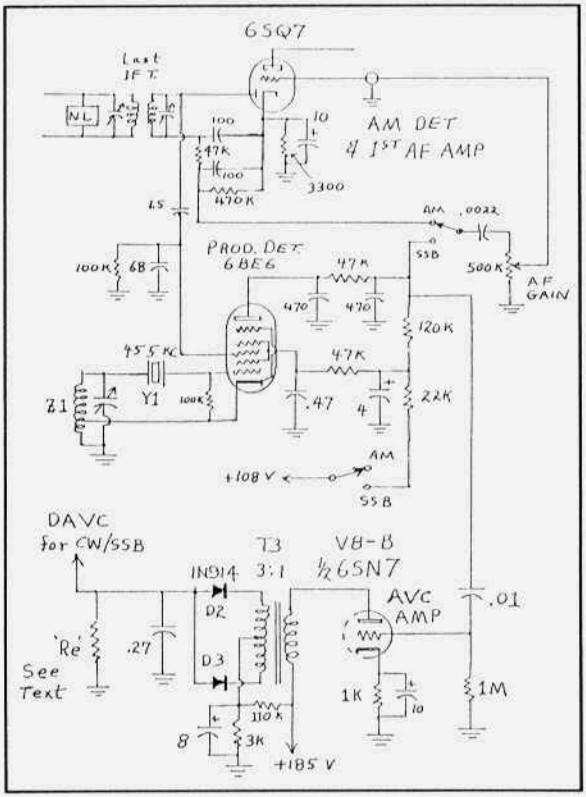


Figure 5. Details of SSB detector and AVC circuits.

num and bolts to the top of the chassis. The tuning condenser shaft projects into the well and is tapped for a 4-40 screw which secures the plastic dial pointer. Two #47 dial lamps provide illumination. The dial escutcheon is made of thin aluminum, painted black, and holds the glass dial cover. The dial drum is 3-1/2 inches in diameter so it was necessary to cut a clearance hole in the chassis. Another hole was made to clear the flywheel.

The original series-value noise limiter was replaced with a Bishop IF noise limiter which functions in all modes. I am very pleased with its performance - so much so that a separate article is in preparation which will give the theory and design of this simple but highly effective limiter.

The only thing I can think of to further improve operation would be to add a panoramic display to show band activity. **ER**

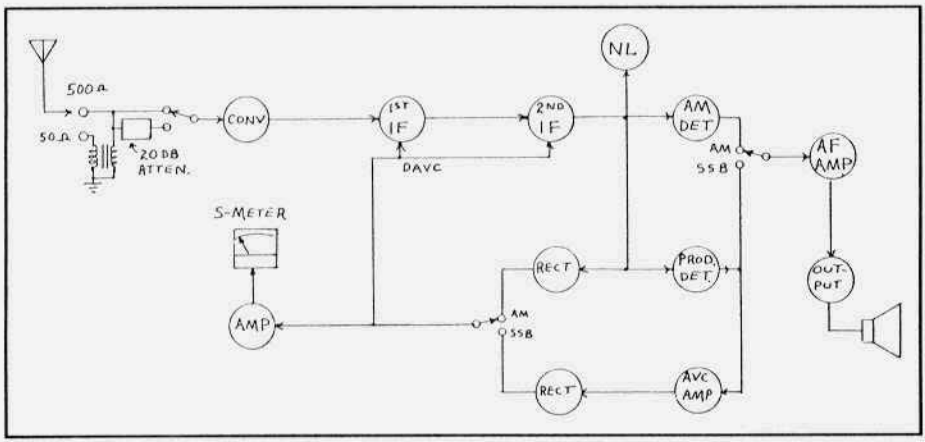


Figure 4. Block diagram of the 160/75 meter receiver.

LETTERS

Dear ER

I have a "Tech Tip" that worked very well for me. My Heath Apache developed a shorted .001 cap on the band switch. This short destroyed a switch contact on the ceramic switch. I cleaned off the remains of the switch and the little brass rivet that held it in. I removed a contact from a Radio Shack phenolic switch by drilling out the rivet with a PC board drill bit and my Dremel drill.

I took a ride to my local hobby shop. I purchased (2) 0-80 x 3/8 screws and nuts. They were part of a kit made for model airplanes. The kit is made by Rocket City Specialists, 103 Wholesale Ave., NE, Huntsville, AL. Stock #12D, $1.59. I am told that model railroaders use these types of tiny nuts and bolts. So I guess you could buy a package of 0-80 x 3/8 bolts and nuts if they have them or buy a small $1.50 kit and just use the hardware. Anyway I attached the new contact to the wafer with this bolt and used nail polish or lock tight to seal it in. The switch works great!! And I didn't have to change the whole thing.

Just make sure the screw doesn't short to ground.

So to make a long story short:

1. Clean wafer.
2. New contact from another switch.
3. Attach new contact with 0-80 x 3/8 nuts and bolts.
4. Solder wire to new contact.
5. Seal nut to bolt.

Al Persichino,WA2BMB

Dear ER

Thank you for the excellent article on page 14 of the October 1993 issue. Ray Osterwald gave me the explanation for the mechanics of "cathode interface" that I have been looking for since 1962! I have known the symptoms and the cure (replace the tubes) since 1962, but I have never really known the cause until now. I suspect there is no more obvious place to see the effects of cathode interface than in the vertical amplifier of an early Tektronic scope. Boy, I've seen it hundreds of times!

One thing that Ray did not mention was that the detrimental effects of cathode interface are noticeably worse when the filaments are not as hot as they might be, that is, when the line voltage is lower than normal. In a scope vertical amplifier, the way you verify that the spike you see on the leading edge of a fast-rising square wave is due to cathode interface is to vary the line voltage (and filament voltage with it) and watch the spike seem to get smaller at high line (125 VAC). Close inspection of the display will reveal that the rest of the square wave is actually getting larger. At low line (105 VAC), the spike seems to get larger, but actually the low frequency gain of the amplifier is getting lower. If you run this test with the square wave calibrator which is built into the scope, it will appear that the scope vertical gain is changing (which it is) with line voltage. No spike will appear on the leading edge since built-in square wave calibrator waveforms generally do not contain any fast rise or high frequency components.

Stan Griffiths, W7NI

Dear ER

I'm sorry to report that one of your subscribers has gone to that "Great Ham Shack" in the sky. My brother, Albert Morgan, N6BUP, passed away on October 7th after a lengthy illness (cancer). My brother really enjoyed your magazine and he read each issue cover to cover.

Albert's passing isn't all bad, as I'm now the possesser of his fine HQ-129-X that he bought (with his Dad's help) in

1946 when he was in high school. Now, that's a receiver with real personality!

Since so many of your readers are old-timers, and casualties from the rigors of life will tend to be high, maybe it would be nice to have a box in *ER* listing "Silent Mics" or similar. That way if we didn't hear someone for a long time we would know why.

Ken, KC5DW

Editor's Note:

Our policy has always been to note the passing of any radio pioneer/AM'er/vintage enthusiast, etc. However, we depend on our readers to keep us informed. Please let us know if you hear that someone has passed away.

Dear ER

The October '93 edition of Electric Radio in Uniform reminded me of my experiences with a covert radio. About 1950 or 1951 while I was a student at Purdue University, another ham showed me a transmitter that he said was used by US spies or the French underground (I don't remember which) during WWII. It was a small unit, about the size of the smallest tube type portable radios, and contained a crystal controlled CW transmitter using a 6L6. Another box about the same size held an AC power supply. I borrowed it from him, took it to one of the club stations, W9CLY, and fired it up. After many CQ's I finally contacted someone not very far away. I decided it was a dog, and returned it to the owner.

Later, I received a notice from the FCC, saying my 5th harmonic was heard in Idaho. I needed Idaho for my WAS, and friends said I should ask the FCC for a QSL.

Jim Hill, W6IVW

Dear ER

I really enjoyed 'browsing' thru the middle 2 years of back issues that I recently ordered. I will "in depth" read them on 'snowy-stormy nights' here in the Northeast Kingdom this winter.

I find your magazine very interesting vis-a-vis older 'hollow-state, 'glow-in-the-dark' gear. I still remember my Jr. and Sr. High days in the '60's working odd jobs (and never seeming to be able to save enough) to buy a "new" R-390A. Then Viet Nam service and 'real life' interrupted. Finally got one in late '70's, new, in crate with a 2 foot pile of manuals, spares, etc.!! The fullfillment of a 14 year old's dream!

Now it is good Bordeaux, good cigars, and 3-star restaurants in Montreal or Quebec City. How times change.

Doug, K1FKW

Dear ER

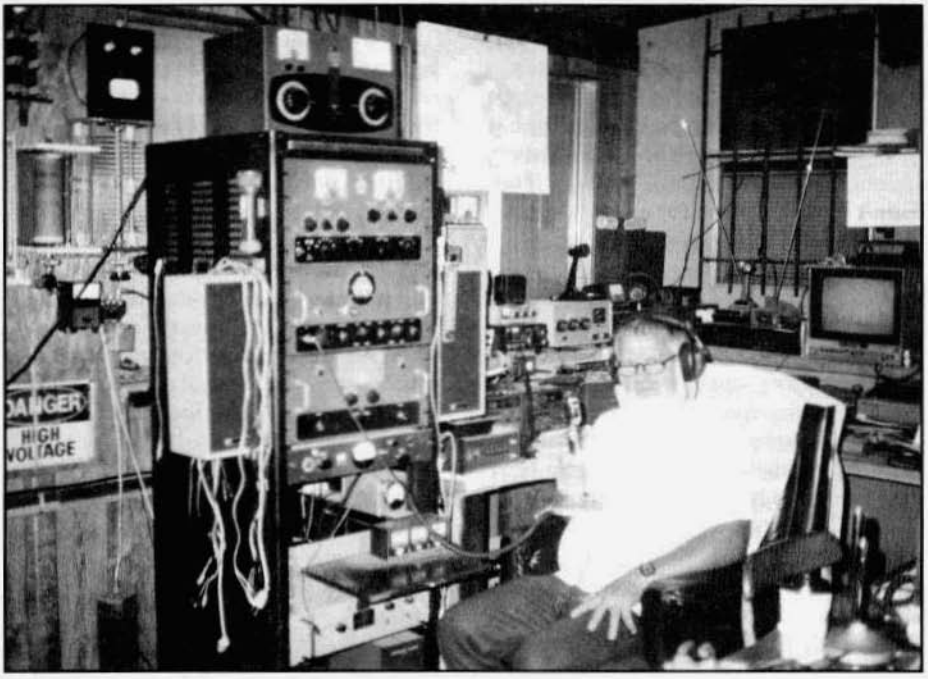
We here at EFJ Special Events Station 9ALD, which operated in June to celebrate the 70th year of E.F. Johnson's founding would like to thank all the stations who contacted us.

By the time this is published, all stations who QSL'd should have received their return cards and/or certificates. Any station who may not have is invited to write:

Marty Durham, WT1S
QSL Manager, Special Event Station
E.F. Johnson Co.
299 Johnson Ave.
Waseca, MN 56093

We have made an honest attempt to QSL every station wanting a QSL, but in the event we missed someone, please write. Thanks again to all stations who made this celebration an unqualified success!

Mark Allen, WJ7X
Chief Operator
E.F. Johnson Co.



Ralph Miller, KD6OS, well known west coast AM'er in his shack. The transmitter is a Globe King 500C.

Yoshio Koyanagi, JA1EIA, a Japanese AM'er active on 20 meters.

Jim Holt, WA6GBJ, at his vintage operating position. Photo by Bob Sitterley, K7POF.

Bob Kemp, WAØVRC, in his vintage shack. He's active on 75-M AM.

Collecting/Repair/Restoration Tips

by Andy Howard, WA4KCY
105 Sweet Bay Lane
Carrollton, GA 30117

Johnson Maroon Paint

To duplicate the maroon paint on Johnson cases which are very often scratched and chipped use 1985 Toyota deep maroon acrylic lacquer. Make sure it is not the type of lacquer that requires a clear coat on top to give it a shine. Mix enough black into the paint to darken it to match the case.

A dab touched onto an out-of-the-way place will confirm when you got it dark enough.

Sawing Aluminum Panels

A table saw with a fine-tooth carbide tipped blade makes a great way to cut one-eighth inch panels of aluminum and other stock. Lower the blade to about an inch high and cut slowly. A sabre saw makes a nice way to cut large holes if you use a guide to keep it straight.

Removing Scuffs And Scratches From Worked Chassis

A mixture of water and lye will etch aluminum to a satin dull finish that will cover most scuffs and scratches. 1/2 cup lye to 5 gallons of water.

Removing Old Paint From Cabinets

The easiest way to remove old paint for refinishing is to take the work to a tombstone maker and have him sand-blast it. They use a very fine grade of sand that will leave a good finish on the metal. For removing small scratches before repaint use 400-grit water proof sandpaper and water as a lubricant. Leaves a great finish.

Touch Up Paint Tips

Keep a can of white, light and dark gray, blue, brown and beige spray paint on the shelf. Mix in the plastic top of one of the cans starting with the color most like what you are trying to match. Then lighten of darken according to the color you are trying to match. compare to the original by dabbing on an out-of-the-way place. Use a very fine artists brush. You will want to add other colors as you progress.

Changing The Value of Variable Caps

Large transmitting variables can be changed in value by taking apart and putting additional space between plates using washers or other spacers. Just remember that if you change the rotor the stator has to be changed the same way. By the same token removing space between plates will give you more capacitance but less voltage handling ability.

Symmetrical Knob Layout On Panels

The liberal use of universal joints for quarter inch shafts will allow you to place the component in the place needed and still keep the knobs in the right place on the panel. A good idea is to buy a supply as you see them at hamfests.

Tips on Applying Wrinkle Finish Paint

When applying wrinkle finish paint make sure the surface is clean and smooth. Apply paint directly to bare metal - first with strokes one way and after waiting five minutes apply in the other direction. Carefully place in the hot sun or a 150 degree oven. The paint will wrinkle beautifully in a short time and be baked dry.

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.

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 Thursday at 8:00 PT.

Twenty Meter AM Net:1 This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:30 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.

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. It meets on 14.275 at 6 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.

The Hallicrafters DD-1 Receiver

Masterpiece or Mistake?

by Joel Levine WB2BMH
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Greenlawn, NY 11740

In 1938, the Hallicrafters company introduced a revolutionary new radio for the serious amateur operator and shortwave listener; the DD-1 Dual Diversity Radio Reception System. Within two years the DD-1 quietly faded from public view without leaving a legacy of dedicated users or determined imitators.

Was diversity reception a good idea for communications? Was the DD-1 a good idea poorly executed or was the DD-1 priced beyond the pocketbook of even the most affluent and dedicated operators? Was the DD-1 the Chrysler Airflow of communications; an innovative product that was ahead of its time. Or was the DD-1 an overpriced hunk of marketing hurumph in an Art Deco package?

This article will review the history of amateur dual diversity activity, report on the experience of the author using the DD-1 and provide a bibliography for the reader who requires the greater detail available in primary sources.

First, some history....

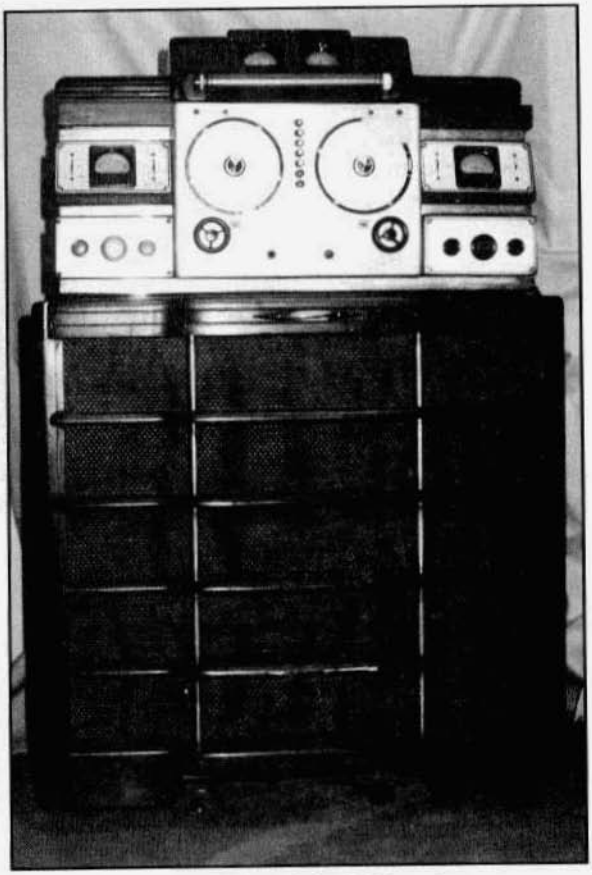
The 1930's was the decade in which the communications receiver as we know it evolved. By 1936, National, Hammarlund, Hallicrafters, RME, and others were producing essentially similar receivers with the following features;

- ....Superheterodyne design with an IF between 450 and 500 Khz.
- ....Crystal filtering in the IF for maximum selectivity.
- ....One or two stages of RF amplification.
- ....Sufficient audio output to drive a speaker.
- ....A single-dial control for frequency (the converter and RF tuning capacitors were ganged together).
- ....A BFO (beat frequency oscillator) for CW reception.
- ....Electrical or mechanical bandspread tuning.

This paradigm would remain the standard for another decade until the basic design was modified with the addition of double conversion, product detection and improved IF crystal filtering.

In the May 1936 issue of *QST*, McLaughlin and Lamb (1) reported on the construction of a radically different receiver custom-built for a zealously dedicated and equally wealthy American expatriate living in Mexico City. Dr. Hard, XE2G, already the owner of one of the most extensive antenna farms and ham shacks in the world, ordered the one-of-a-kind unit after consulting with McLaughlin and Lamb, the *QST* technical writers.

The custom-built receiver contained several significant features, but by far the most radical innovation was the application of diversity reception. On conventional shortwave receivers, fading and distortion are the result of the constantly changing sky wave randomly bouncing off the ionosphere and ground until the signal reaches the antenna. When several signals with slightly different sky wave paths arrive at the antenna at the same time, the product of the signals will decrease and distort if the signals are out of phase. If two antennas are separated by several wavelengths or are out of phase with one another, the diversity receiver compen-



The DD-1 was introduced in 1938 and about 200 units were manufactured. It cost $750 and weighed 225 pounds.

sates for the sky wave fading and distortion by selecting the stronger of the two sky wave products received. The AGC outputs are combined in both front ends with the signal amplified appropriately in the front end receiving the stronger signal while the IF amplifier in the front end receiving the weaker signal is biased to a very low level of amplification relative to the weaker signal received by that front end at that instant in time. As a result, the stronger signal dominates the input into the detector, effectively passing to the audio only one of the signals. At any instant in time, the diversity receiver is amplifying the signal which is stronger and least distorted and ignoring the weaker and more distorted signal product received by the other antenna.

Diversity reception itself was not new; the theory and practice were well known to commercial and military designers (2) and numerous applications were installed around the world. These units typically cost thousands of dollars and utilized either crystal controlled front ends or two separate receivers which had to be aligned to each other every time the frequency was changed. Dr. Hard's receiver achieved the breakthrough of single-dial tuning control by using a single oscillator with an output to each receiver and ganging the RF stages so that one dial actually tuned two electrically separate front ends. Properly aligned, this innovation offered the benefits of diversity reception with the ease of tuning associated with a conventional receiver.

The *QST* article reported that the receiver was a great success though the possibility of mass production seemed remote. In the December 1937 issue of *QST* (3), McLaughlin and Lamb described another diversity receiver sharing the essential design of Dr. Hard's masterpiece but reduced to table top size and a mere 26 tubes. This design was the prototype for a production model soon to be released by Hallicrafters.

The prototype of the production receiver to be built by Hallicrafters had several other innovations and there were a number of differences between

continued next page

Hallicrafters DD-1 from previous page

the prototype and the production model, especially in the complicated band switching arrangement. For a more complete description of the differences between the prototype and the production model, refer to John Nagle's 1980 article in *Ham Radio* (4).

To introduce the new receiver and brag about the important innovations, Hallicrafters purchased eight pages of the June 1938 issue of *QST*. The entire system consisted of five parts:

- . . .a 21-tube dual diversity tuner
- . . .a 4-tube audio amplifier
- . . .a power supply with one rectifier
- . . .a three foot high Jensen speaker console with room for the tuner on top and the amplifier and power supply inside
- . . .a dual S-meter headpiece sitting atop the tuner and providing a visual display of the havoc propagation would play with reception if you did not own a DD-1

The cabinet was styled in the best Hallicrafters art deco tradition with a brushed aluminum front panel and ribs of chrome on the power supply and audio amplifier panels. The later units, equipped with the optional Jensen speaker, looked more like the large console radios popular in the homes of millions of Americans during the 1930's. Total system weight was 225 pounds.

Available for the modest sum of $750, sales were less than brisk. Authoritative sales figures are not known to exist though Bill Halligan was reported to estimate a total production of 200 units. John Nagle reported that two were known to exist while Moore thought that there are three extant units (4 and 5). Max De Henseller reported that about a dozen are known to survive in private collections (6).

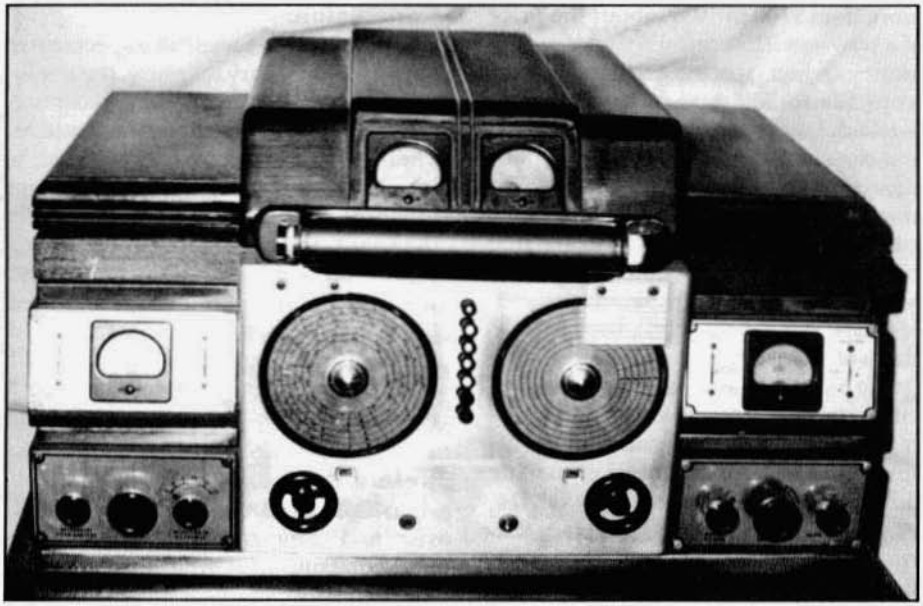
The catalog section of the ARRL handbook listed the DD-1 in the 1938 and 1939 issues but by the time the 1940 edition was released the DD-1 had quietly faded from view.

Is Diversity Reception A Good Idea For Communication?

John Nagel attempted to answer this question in his 1979 *Ham Radio* article. He presented a series of strip-chart recordings to prove that diversity reception reduces the fading effects of skywave transmission and achieves an average gain of 3 to 20 dB (7). However, John did not measure the effect of diversity reception on a live user. In other words, do the effects of fading, of the degree they are eliminated by diversity reception, significantly reduce the ability of the system to transmit data or is diversified reception more pleasant to listen to but not significantly better at transmitting information?

For the average ham operator, QSB (fading) is a nuisance which rarely terminates communications. Since the fading shifts randomly, it is common to repeat the message several times until, by chance, conditions improve. We consider this process part of the challenge of amateur communications. Commercial users on the other hand are paying for a service and value the increased reliability and convenience which result from a reduction of repetitions. For the military, timeliness and accuracy are essential and military users naturally place a high value on the quicker and more reliable communications provided by diversity reception. While diversity reception could improve the reliability of amateur communications, I believe that hams are more willing to tolerate intermittent reception than commercial users driven by market force considerations or military users motivated by the unique requirements of the battlefield.

A significant portion of ham radio activity is now in digital modes. On VHF, transmission speeds of 1200 baud are common because the channel is generally free of QRM, QRN and QSB. On HF, the standard transmission speed is 300 baud and users report intermittent



The dual S-meters provide a visual display of the havoc propagation can play with reception.

communications even at that low speed. Diversity reception could significantly contribute to improved data throughput on HF digital modes.

Despite John Nagel's article, few hams accepted the challenge and, to the best of my knowledge, none of the manufacturers of ham equipment offered a diversity option since his article was published fifteen years ago.

Cost alone cannot explain this because some of the modern high end HF transceivers cost $4000 to $5000 and offer many deluxe features including a CRT display, a built-in automatic antenna tuner and a computer interface.

Was The DD-1 A Good Idea Poorly Executed?

Raymond Moore published a monograph on the DD-1 several years ago and stated that the DD-1 suffered from a number of technical deficits including poor choice of tubes and an ineffective filtering system (5). His measure of success was the number of "big guns" in *QST* using the DD-1. A quick and unscientific perusal of *QST* confirms that National was the favored receiver for hams of means in the late 1930's with no reference to diversity reception known to the author after the *QST* articles of 1936 and 1937.

While Moore may be correct that the DD-1 failed to maximize every new technology, my own experience with reception of the DD-1 indicates that the receiver offers more than adequate AM selectivity, more than adequate sensitivity below 14 Mhz and delivers true diversity reception. When switched to either receiver individually, QSB follows the normal pattern with signal strength shifts of 20 dB or more in a few seconds. When I switch to the diversity mode, fading is decreased approximately 10 dB as measured on the unit's S-meter.

Was The DD-1 Priced Beyond The Means Of Even The Most Dedicated And Affluent Operators?

The DD-1 equipped with the Jensen speaker and diversity S-meters cost

continued next page

Hallicrafters DD-1 from previous page
more than $700 in 1939, about the price of a new car. That certainly was a lot of money when working class salaries were $25 to $50 per week, when you worked. I was born after the depression and can claim neither first hand experience nor solid historical research to answer this question. Conversations with family and friends indicate that even during the depression some people were wealthy (and conspicuous spenders) and the pages of *QST* support this claim with many photographs of extensively equipped shacks. Investments in kilowatt AM stations were often in excess of $700 so it is reasonable to assume that cost alone does not explain the markets indifference to the DD-1.

Was The DD-1 The Chrysler Airflow Of Communications; An Innovative Product That Was Ahead Of Its Time?

John Nagel suggested that the DD-1 was an electronic Chrysler Airflow, an infamous market failure of the 1930's which introduced a number of technical innovations., While streamlining and other features of the Airflow were eventually built into later automobiles, diversity reception was never copied by any other manufacturer of amateur and SWL equipment.

Was The DD-1 An Overpriced Hunk Of Marketing Hurumph In An Art Deco Package?

While the DD-1 did not deliver on all of its promises, the receiver did provide genuine diversity reception. If diversity reception was valued by the amateur radio market (as it was by the commercial and military market), Hallicrafters would have refined the receiver or other manufacturers would have copied the diversity reception concept. Both National and Hammarlund manufactured diversity receivers for the military during and after World War Two but neither of these receivers was marketed to the amateur community (8).

Conclusion:

While the DD-1 was not a spectacular performer by every measure, it successfully delivered dual diversity reception with single-dial frequency control. Though Hallicrafters provided a technically elegant solution to the problem of fading, few hams seem interested in the result. The failure of other manufacturers to copy and refine the concept while they simultaneously provided diversity options for commercial and military users suggests that the DD-1 was more of a market failure than a technical failure. **ER**

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1. McLaughlin and Lamb, "Dual Diversity Phone Reception With Single Control Tuning", *QST*, May 1936, Vol XX, No. 5, pp 39-43.

2. Beverage and Peterson, "Diversity Receiving System of RCA Communications, Inc.", *Proceedings of the IRE*, April, 1931, Vol. 19, No. 4, pp 531-561.

3. McLaughlin and Miles, "An Improved Dual-diversity Receiver for High-Quality 'Phone Reception", *QST*, December 1937, Vol. XXI, No. 12, pp 17-21.

4. Nagle, "High-Frequency Diversity Receiver From the 1930's", *Ham Radio*, April 1980, pp 34-43.

5. Moore, Hallicrafters Skyrider Diversity DD1, Fact Sheet, *RSM Communications*, 1990.

6. De Henseller, *The Hallicrafters Story* 1933-1975, 1991, p 59.

7. Nagle, "Diversity Reception: An Answer to High Frequency Signal Fading", *Ham Radio*, November 1979, pp 48-55.

8. Moore, "*Communications Receivers, the Vacuum Tube Era*: 1932-1981, 2nd edition", Raymond Moore, RSM Communications, 1991, pps 62 and 95.

HOMEBREWED GLASS DIELECTRIC CAPACITORS

by Al Roehm, W2OBJ
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Cranford, NJ 07016

Finding large value, high-voltage, variable capacitors can be difficult, especially for use in transmitters and antenna tuners. Finding them at reasonable prices can be nearly impossible. Here is one area where the ham tradition of homebrewing can still pay off. In this article I will describe one design approach using two flat metal plates and a piece of ordinary window glass to make a capacitor. The recommended plate material is copper although aluminum or other conducting materials can be used.

When transmitting type variable capacitors are mentioned, we invariably envision a rotary design with widely spaced multiple plates using air as the insulation or dielectric. A few fortunate hams enjoy the luxury of using vacuum variables with their high-voltage ratings and very low minimum capacitances. By contrast, the home-made sliding capacitor design is compact, easily able to withstand 12KV to 18KV peak voltages, and capacitance values of 350pF to 500pF, or higher. And, the minimum capacitance can be less than in a vacuum capacitor. If all this sounds too good to be true, read on.

Every capacitor stores energy from the electric field in the dielectric material separating its plates. The two major qualities of interest in any dielectric are the breakdown rating (volts/mil of thickness), and the relative ability to store energy between the oppositely charged plates (dielectric constant). The formula for calculating the capacitance of a two plate capacitor is:

$$CpF = \frac{0.224 \times A \times k}{d}$$

Where:
C = capacitance, in pF
A = plate or dielectric area, in sq. inches
k = dielectric constant (air = 1 and glass = 8)
d = plate spacing or thickness of dielectric, in inches

Making a suitably large value capacitor is easy. For example, I used just two 3" x 6" flat copper plates (plate thickness is not important) separated by ordinary window glass. Since the dielectric constant of glass is 8, the resulting capacitance will be eight times larger than when the dielectric is air. I have measured many samples of single weight window glass and found the thickness to fall within the range of 0.088" to 0.093". Assuming an average thickness of 0.090",

$$CpF = \frac{0.244 \times (3" \times 6") \times 8}{0.090} = 358.4pF$$

I have found picture frame glass measuring 0.075" in thickness (C = 430pF), and many samples as low as 0.059" to 0.063" thick. Using 0.060" as an average thickness for thin picture frame glass, the capacitance becomes 537.6pF. So you can see how easy it is to arrive at adequately large values of capacitance. Alternatively, the area of the plates can be increased instead of reducing the spacing between them. Since an unavoidable thin layer of air gets between the glass and each plate, it reduces the total effectiveness of the higher dielectric material. You should, therefore, oversize the plate area if the maximum

continued next page

value of capacitance is critical in your application. By the way, the breakdown voltage of air is about 20 volts/mil while that of glass is at least 200 volts/mil. therefore, a capacitor using 0.060" thick glass is good for 12KV and the 0.090" thickness reaches a rating of 18KV. Not bad for a bucks worth of glass!

Building the Capacitor

As any homebrewer knows, there are many ways of reaching a goal. The sliding capacitor is no exception, but let me show you one way that is as easy on ingenuity as it is on the pocketbook. Start with two flat plates sized to satisfy the area requirement of the capacitance formula. I will use the 3" x 6" (18 square inches) plates for this example. One plate is fixed in place and the other one will slide across the glass that separates the plates. Recall that the breakdown voltage of glass is ten times that of air. Therefore, a look at the edge conditions in Figures 1A and 1B illustrates why the glass needs to be larger than the conducting plates to avoid arc-over. A very conservative design approach lets the glass extend beyond the plates by 4.5 times the thickness of the glass (4.5 + 1 + 4.5 = 10). In my design example, the glass was trimmed to a minimum size of 6-5/8" x 6-5/8". These dimensions allow the sliding plate to move 5/16" away from the fixed plate and contributes to the low value of minimum capacitance. See Figure 2. The finished capacitor should exhibit a stray capacitance of under 10pF, a favorable value found in many vacuum capacitor designs.

Before assembling the capacitor be sure you thoroughly clean the copper plates and the glass. Place both plates on a flat surface and apply a small drop of glue near each corner OF ONLY ONE PLATE. Use one of the modern super glues containing cyanoacrylate. Quickly, but accurately, lower the glass plate onto the glued copper plate. The glue cures in seconds so don't try to

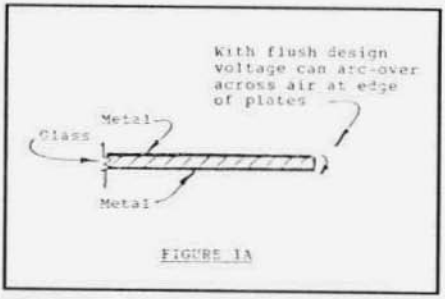

FIGURE 1A

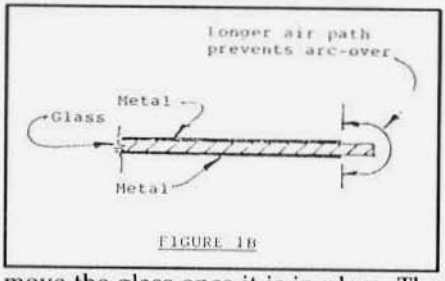

FIGURE 1B

move the glass once it is in place. The capacitor is completed by installing the loose (sliding) plate on the other side of the glass. See Figure 3.

Every sliding capacitor I have read about uses insulated side plates as guides for the movable plate and additional strips along the top to hold it in contact with the glass. I use a greatly simplified method which combines the functions of movement, guidance, and contact to the dielectric. I use a suitable length of 1/4" diameter, 20 TPI threaded brass or aluminum rod. The rod is supported by bearings installed in the front and rear panels of the cabinet or capacitor frame. Any size of threaded rod can be used but the 1/4" size fits commonly available knobs and bearings. The rod goes through two nuts which are glued to insulated spacers which, in turn, are glued to the top of the moving capacitor plate. Figure 3 illustrates this method of construction. One word of caution. . . .be sure to run BOTH nuts onto the rod before gluing them to the spacers. This step is important in order to synchronize the threads for smooth operation.

Making The Panel Bearings

In keeping with the theme of low-

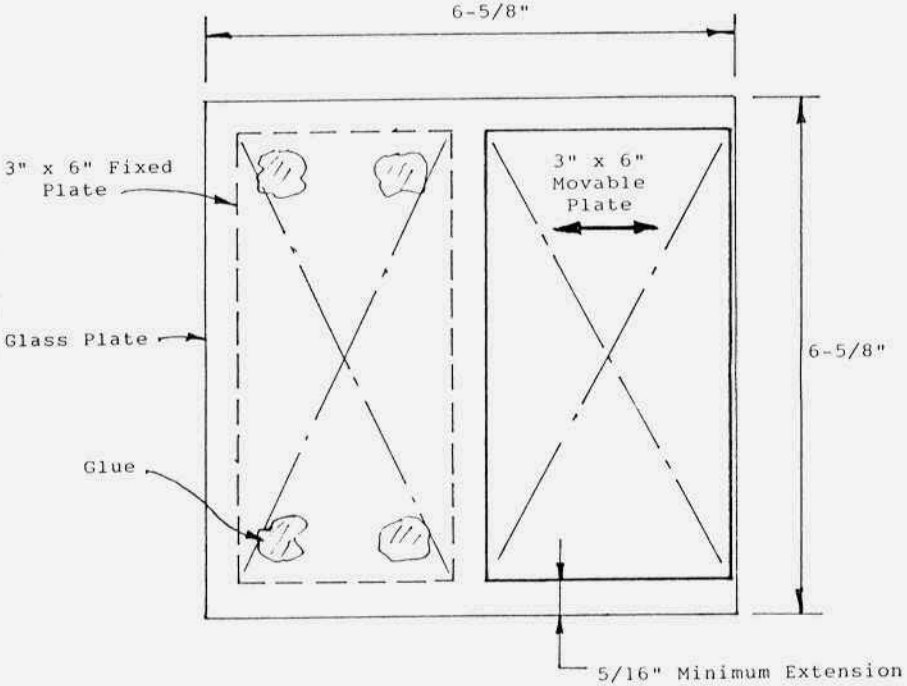

FIGURE 2

cost construction, I salvage the panel bearings from the shanks of discarded radio or TV set potentiometers. Look for a pot with a 1/4" diameter shaft. Either a brass or aluminum shank is fine. Straighten the tabs holding the rear cover to the body of the pot and remove the cover. Pry off the "C" washer holding the shaft in place. This step is easy to do if a special spanner wrench is available. Without the wrench, I can usually get the washer off with a miniature jeweler's screwdriver. As a last resort, the shaft can be cut with a hacksaw. Make the cut as close to the washer as possible. Once this step is completed, the shaft and wiper arm can be removed. Now all that remains to be done is to cut away the resistance wire and molded body (phenolic or plastic) from the metal shank.

Closing Remarks

I have made single and differential capacitors, both balanced and unbalanced versions, as described above. They were used in various experimental antenna tuners and performed admirably. They are stable and easy to adjust. It's nice to know that they won't breakdown or arc over.

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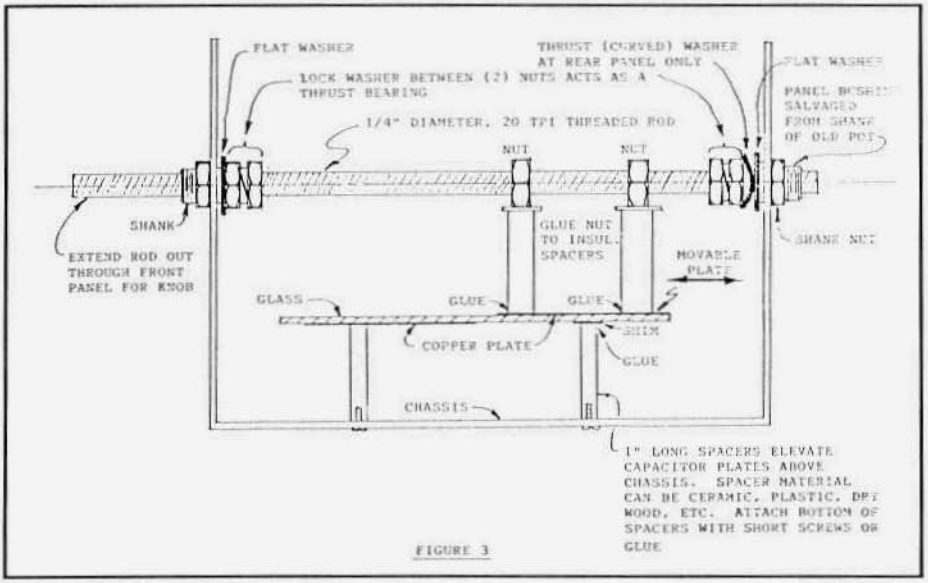


FIGURE 3

The shape of the plates determines the tuning rate. Square plates are compact. A rectangular shape with a 2 to 1 aspect ratio will probably suit most applications best. Sliding the plates across the short dimension will provide a fast tuning rate. Turning the plates 90 degrees and sliding them lengthwise will be very slow and not recommended. Enterprising hams can develop, as I did, a rotary cam system that allows the capacitance to change as quickly as conventional rotary designs.

I hope this article inspires some readers to experiment with the sliding, glass dielectric type capacitor. You won't be disappointed. **ER**

Creed McKinley, W4TZ, Inventor of the D-104 SK

Creed McKinley Chorpening, W4TZ, 96, a pioneer in the radio industry, died of infirmities Oct. 13 .

Mr. Chorpening was born Sept.14,1897, in Brandonville, W. VA. He attended Brandonville schools and the Marconi Institute in New York City. His lifelong interest was radio and related fields.

He was involved in broadcasting before licenses were issued and was associated with WKBN radio when it went on the air. He was a founder of Astatic Corp. and once was its vice-president in charge of research and development. The company moved to Conneaut, Ohio in 1944.

During World War II, a microphone that Mr. Chorpening developed was used by the military.

He organized amateur radio clubs in Conneaut and Vero Beach and, while in Youngstown, was head of the Mahoning Valley A.R.A.

In 1984, he was recognized with the United Nations Peace Medal for his assistance in the Mexico earthquake disaster.

Mr. Chorpening was a member of the American Relay League Inc., Radio Old Timers, and Quarter Century Wireless Association. He was part of the Treasure Coast Network.

There are no calling hours. The family requests that material tributes take the form of contributions of local libraries for the purchase of books on radios.

Editor's Note: Thanks to James Viele,N8IRL, for sending us this newspaper obituary.

ER in Uniform from page 9

ally worked on the radios! Unlike those manuals that tell you the obvious, the R-1051B manual tells you things like there is an internal spurious signal at 22.5 Mcs in many receivers which can be used for a quick check of performance.

As noteworthy as what is in the 'Technical Manual -- Maintenance Instructions' is what isn't there: detailed theory and troubleshooting information below the module level. Servicing aboard ship is limited to repair of the simpler modules; the complex and delicate ones are replaced with a spare and returned to the depot for repair. There is another manual for the complex modules: "Repair Book for AN/WRC-1B and R-1051B 2N Modules" and the depot has yet another.

As usual, there are minor glitches. To change a dial lamp you must pull the radio from the case, remove one of the two front modules and reach under other parts on the panel to unscrew the small knurled top of the lamp. It's a job for a technician with small fingers and the disposition of a cow -- and totally unnecessary; the set could have been designed with lamps going in from the front of the panel. The RF amplifier drum will be demolished if its thin aluminum cover gets a 1/8" deep dent at the level of those ceramic coil forms; there are no warning about the need for very careful handling. A 45 dB IMD dynamic range is lousy by modern standards but probably it wasn't possible to do better than this with two stages of RF amplification and 1960's transistors.

Some of the R-1051 modules contain extra circuitry not used in the receiver so that they can also be used in the various exciter configurations. The Navy evidently decided that it was cheaper to pay more for each module so that one spare could cover both transmitters and receivers. That was surely the right decision; not only do you cut the number of high-cost spare modules by half (on smaller ships which would have only one of each unique type) but the weight and volume for parts storage is also reduced.

One of the ongoing themes of this column has been that many of our older military radios really weren't that good. Another has been that we bought too many kinds of radios. The R-1051 was a milestone, first for doing its job really well and second for being the foundation for a family of sets with many common parts. This is a fine, fine military radio. **ER**

Condition Those Tubes from page 2

it is stable and if all is well, let the tube idle in the test jig overnight. This conditioning period will drive gas molecules off the internal parts of the tube and allow the getter to do its job in a controlled manner.

At the end of the conditioning period, carefully observe the edges of the silver getter deposits on the glass. If the getter has turned whitish, tan or brown along the edges, a large amount of gas was present and the tube should be used with caution. Otherwise expect little or no discoloration to be seen. (By the same token, use caution when buying hamfest tubes where the getter is discolored in the same manner!). Most of the time this conditioning process does a great job in reducing reverse grid current.

Along the same lines, it has been recommended that tubes in long-term storage be periodically used in rotation in powered equipment to prevent a build-up of gas in the first place. This is not always a practical proposition but the emphasis is on not allowing tubes to sit idle for years where they can deteriorate. So save yourself some grief and money and pre-condition those power tubes before sending them to the salt mine.

References:

Radiotron Designer's Handbook, 4th edition, 1965 - Chapter1, Section 1.

"Heath DX-20"

by Dave Ishmael, WA6VVL
1118 Paularino Ave.
Costa Mesa, CA 92626

In spite of my recent "infatuation" with Heath's AT-1 xmtr (ER#50), Heath's DX-20 was the first kit-type xmtr that I used as a Novice in 1960. I used Alan Burgstahler/WA6AWD's DX-20 for literally hundreds of my Novice and Conditional QSOs. I spent many a weekend at Alan's house in Desert Hot Springs, Calif., using his DX-20 and HQ-100 into the early morning hours, occasionally waking him up to copy code that was too fast for me to copy. After building several so-so homebrew xmtrs, I looked forward to using Alan's DX-20 on the weekends. I will always have fond memories of the Heath DX-20.

The DX-20 is a 50-W input, xtal controlled, CW xmtr w/single-knob bandswitching on 80-10M. The pi-network will accommodate output impedances in the range of 50-1000 ohms. I have often referred to the DX-20 as a 2nd generation AT-1. While the DX-20 was the replacement for the AT-1, it was NOT an "improved" AT-1. The DX-20's design was brand-new, both mechanically and electrically. The DX-20 sold for $35.95 when it was introduced around Christmas of 1956. The DX-20 uses a 6CL6 Colpitts oscillator, 6DQ6A final amplifier, and 5U4GB rectifier. The power supply uses a choke input filter that delivers >500-V key-down @ 100 mA. To further improve regulation, the filter choke is tuned with a 0.1 uF capacitor which limits the surge voltage under key-up conditions. Since the 6CL6 and 6DQ6A are mounted on shields and brackets above the chassis, most of the oscillator and amplifier wiring is above the chassis. The under-chassis wiring has been kept to a minimum. The 6DQ6A is horizontally mounted.

Although this is a very simple and straight-forward CW xmtr to operate, I have a few minor (?) criticisms:

• Changing the xtal is through a hole-plug on the left side of the xmtr. The xtal location is (probably) OK if you have only one xtal, but if you have several and change bands frequently, it's a nuisance which precludes mounting the DX-20 under a shelf to the right of the rcvr. In addition, placing the xtal inside the DX-20 will cause a short-term frequency drift of several hundred Hz as the xtal heats to the DX-20's internal temperature. I personally prefer the front-panel mounted xtal sockets a la Heath AT-1, Johnson Adventurer, Drake 2N-T, etc.

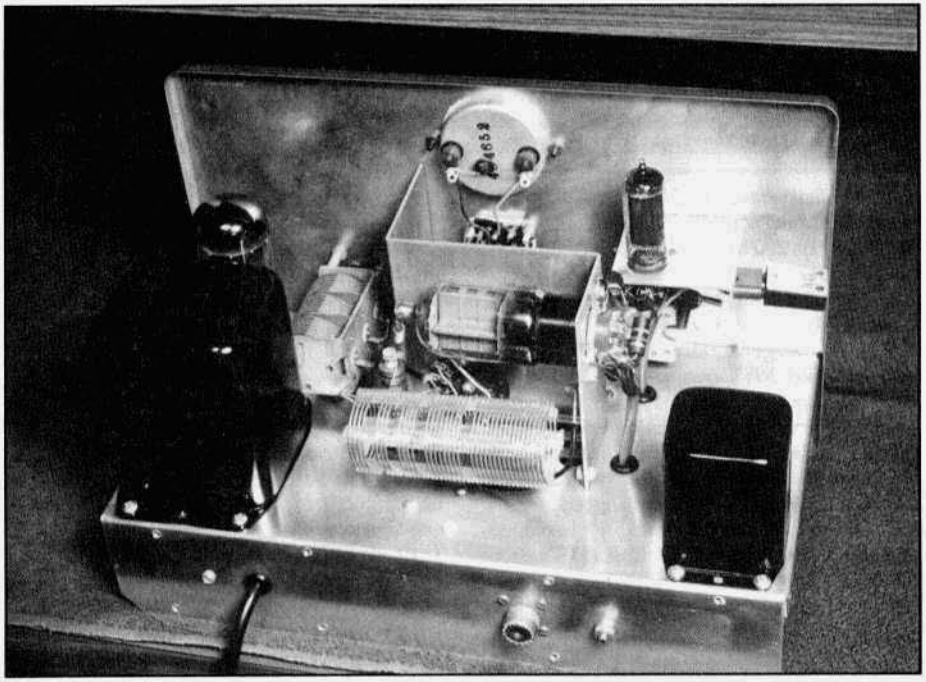
• The meter is the same undamped type found in the AT-1 and DX-35 which makes tune-up a real "chore". Unlike the AT-1, the DX-20's meter switch has no mid-position that switches out the meter. Like the AT-1, I'm always afraid that the meter is going to "beat itself to death"/"self-destruct" (although I can't remember ever worrying about that when I used Alan's DX-20 thirty years ago!).

• The DX-20's power xfmr doesn't appear to be very reliable. My DX-20's power xfmr failed several months after I bought it - the HV secondary shorted. I replaced the xfmr from a DX-20 "parts unit" whose xfmr had been replaced by Heath. I have also seen several DX-20s at TRW sans xfmrs.

I bought my DX-20 from Bill Albrant/K7JYE 2-1/2 years ago. It was in very good condition and didn't need any major work aside from filter caps and line cord. It is now a somewhat composite unit, having the best parts from three separate units. It is a "permanent" part of my collection that I occasionally use with my SX-100.

For additional reading, try Donald L. Stoner/W6TNS's DX-20 review in the April, 1957 *CQ*, pgs. 60-61, 96. Send me a LSASE and I will send you the schematic and a copy of W6TNS's article. ER

The Heath DX-20. It was introduced around Christmas of 1956 and sold for $39.95



Rear view of the DX-20. Most of the wiring was above the chassis.

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FOR SALE: Illustrated 50 page catalog of WW IImilitary radio sets & aviation items - $2 US, $5 foreign, refundable. Sam Hevener, W8KBF, "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286-9723. (216) 659-3244

WANTED: Coils for HRO-50, AB, AC, F; Hammarlund SPC-10 SSB converter; SP-300 spkr; Collins 55G-1 preselector; CC1 TK-1 digital readout. Dan Mason, R.RT. 1, Box 204 F, Santa Fe, NM 87501. (505) 455-3416

FOR SALE: Manuals: NC-66, BW 6100, Viking Messenger, RF gen. Logimetrics 921A, Marconi TF1246, HP 330B/C/D, HP525A, HP606A, Measurements 79B, 84, WRL VFO 755, Heath GD 19, Eico 221 - $10ea postpaid. Equipment - Ameco TX62 w/VFO 621 - $100; Johnson 6N2 w/VFO - $100; Zenith Transoceanic H500 - $70; Knight T60, working - $50. Van, W2OQI, 17 Inwood Rd., Center Moriches, NY 11934.

WANTED: Collins R-388/51J revrs; BC-348. Joel Thurtell, K8PSV, 11803 Priscilla, Plymouth, MI 48170. (313) 453-8303

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"a magnificent home for your equipment"

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.

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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.

FOR SALE: Collins kHz dials for 75A-1, 75A-2, 75A-3, 32V-1, 32V-2, 32V-3, KW-1, KWS-1 - $30 per dial or $35 exchange. Butch, KØBS, (507) 288-0044

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

FOR SALE: Two B&W dip meters w/one set of coils - $45 & 1 ship. Roland Matson, K1OKO, RFD #1, Box 2943, Kennebunk, ME 04043. (207) 985-3751

FOR SALE/TRADE: SX-62 or 62A w/R46, SX25, HA-230, DX150. **WANTED:** Tuning eye rcvrs: SX-11, S-14, NC100X, RCA ACR111, home allwaves. Jim Dillon, 201 Seward St.,Juneau, AK 99801. (907) 586-3223, 10-6 PST

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

FOR SALE: Getting rid of my working Drake and Collins as I get ready for a heart transplant. VG TR4 w/NB, AC-3, MS4 - $350; exc. T4X, R4A, AC-4, MS-4 - $350; exc. to mint 75S3B RE, 3 filters, 32S3 WE, 516F-2 WE - $850; exc. Heath HD-15 phone patch - $25. U-ship. Gary Elliott, NO5H, 808 Clarice St., Delhi, LA 71232. (318) 878-8032

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

FOR SALE: Bird VHF wattmeter 40/400W Ham-mate model 4352 - $50; Etek digital HF wattmeter 200/2000W - $35; Philmore HF SWR meter - $10; Parting Viking II, 122 VFO - $45. All + shpg. **WANTED:** Bird 2-30 10W, 100W, 250W, 1000W slugs; 100Kc octal socket xtal; fused AC plug for Valiant. Tom Marcellino, W3BYM, 13806 Parkland Dr., Rockville, MD 20853. (301) 871-7463

FOR SALE: Complete 160-10 meter AM, SSB, CW, FM station consisting of Central Electronics 20A exciter, Lakeshore Bandhopper VFO & Central Electronics 600L broadband amplifier, exc. condx, manuals - $600; Collins WE 30L1 linear amplifier, new tubes, new filter caps, exc. condx, manual - $600; Collins KWM-380, all factory mods, all filters, Kiron 100 memory, keypad, manuals, service bulletins, mic, exc. condx - $2500; ZM 11 L/C/R bridge, exc, partial manual - $75, U ship. Howard, W3HM, (304) 876-6483, after 7PM EST

FOR SALE: Collins KWM-1, KWM2A, 75A4, Drake TR4-C. Joel Levine, WB2BMH, 67 Derby Ave., Greenlawn, NY 11740. (516) 757-7641

WANTED: Johnson 500. Must be in perfect condx. Top dollar paid for the right one. Tom, (716) 634-2545 10 - 4 EST, 741-9574 after 5

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

WANTED: McIntosh and Thordarson amplifiers; poor to junk Collins 75A-2, 3 and 51J series rcvrs; poor to junk Hallicrafters louvered spkr. Serious sellers only! Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803. (414) 545-5237 (24 hrs) collect.

FOR SALE: Navy type CJB-26003A "Flameproof" keys, new in orig boxes - $47, shpd Conus. Trade for wrkg IC-22A, TCS, or ?? WA7HDL, (208) 756-4147

WANTED: Following British military wireless sets: W.S., No. 62, No. 21, No.22, No.46, also Canadian sets: W.S. 19 MK3, W.S.29. L. Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707. (714) 540-8123

FOR SALE: HW-16, HG-10B vfo. Vern Snyder, 3712 Amber Trail, Duluth, GA 30136. (404) 381-6636

FOR SALE: EAC R-390A (1967) complete, near mint. **WANTED:** Ampex 300 or 350 series tape deck, half track prefered. Mike Nowlen, WB4UKB, POB 1941, Herndon, VA 22070. (703) 481-9614

Photofacts and Parts for Collectors
Electrolytics, high voltage capacitors, power resistors, plugs, switches and more. Free catalog. **A.G. Tannenbaum, WA2BTB, P.O.Box 110, East Rockaway, NY 11518. (516) 887-0057, FAX 599-6523**

MESSAGE: McElroy is here. W1IMQ's biography of T.R. McElroy, World's Champion Radio Telegrapher.150 pages; every Mac Key. Limited hardcover edition (if available) $39.95. Softcover $19.95. Add $2 shpg. per order. Artifax Books, Box 88-E, Maynard, MA 01754.

WANTED: Ameco AC-1 80/40 xmtr; to correspond w/Johnson Challenger user; St. address for Jim/W6WQJ from '59/'60 callbook; 1957 Allied catalog; E.F. Johnson Viking Courier amp; current meter for Heath IP-32 p/s; orig. Viking I manual. **FOR SALE:** VG Collins WE 75S-1 w/500Hz filter - $275; VG WE 32S-1 & 516F-2 - $375; Vector Control Systems 455A4-CW filter - $50. Dave, WA6VVL, 1118 Paularino Ave., Costa Mesa, CA 92626. (714) 979-5858

FOR SALE: Westinghouse H204 - $50; Philco PT44 - $75; Truetone D2919 - $25; Bulova 350 - $30; Bulova CR 190 - $20; NRI kit $40; RCA 2X62 - $40; Zenith 6D030E - $40; Silvertone 2421 - $50; Lafayette HE51 - $50; Marshall 638 - $125; Polaroids $1 + SASE. Bud Santoro, 3715 Bower Rd., Roanoke, VA 24018. (703) 774-9153

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. 3 bandwidths available: 4, 6, or 9 Khz - $83.50 ea.; single pole CW crystal filters - $88 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. (714) 985-6250

FOR SALE: Vintage parts. Send stamp and request "Vintage Flyer". USA only. Copies of some obsolete Readrite/Triplett equipment manuals. Bigelow Electronics, P.O. Box 125, Bluffton, OH 45817.

FOR SALE/TRADE/WANTED: Vintage tube CB's, all makes/models available; old radio books. LSASE for lists (specify). Charles Zafonte, RFD #1, Box 75, Fort Kent, ME 04743. (207) 834-6273 eves.

WANTED: Info to convert HA-2 to 222 MHz or trade for microwave modules 220/? Don Moth, POB 73, Chittenango, NY 13037-0073

FOR SALE: Echophone EC-1; Hallicrafters S41G; Hallicrafters S119; Eico GD meter 710 - $30ea, shpg xtra. Henry Mohr, W3NCX, 1005 Wyoming, Allentown, PA 18130. (215) 435-3276

WANTED: Maas Carillon organ amp, model 500. Victor Gregowski, 3635 Orvall Dr., Fort Gratiot, MI 48059. (313) 385-9479

FOR SALE: Hallicrafter's Manuals-Most - $5 ppd, photocopies only, some Hammarlund, Johnson, WRL, Harvey Wells, SASE for list. Miller Radio, 909 Walnut St., Erie, PA 16502.

WANTED: WW II & Korean military sets, xmtrs, rcvrs & test equipment. Send list of equipment along with price. Richard Mollberg, K6PWF, 2340 Almond Ave., Concord, CA 94520. (510) 283-6786 eves

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WANTED: Very good Swan 500C & Swan 700C w/ps & spkr. Gene, W7MXM, (208) 522-5854

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

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.

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

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

WANTED: Clean Collins 51J4, prefer cabinet & filters; 75A4, prefer serial #4200 or higher. Jim, (616) 229-4318 after 5 PM EST.

FOR SALE: RCA Senior voltohmyst, 25-1S, model WV-98C - $25+ $5 shpg; Precision E-200C sig.l gen. w/manual - $40 + $7.50 shpg; Johnson Messenger, 223, no mic, as is - $20 + $7.50 shpg; Patrolman Pro 2, Realistic VHF monitor rcvr, as is - $20 + $7.50 shpg; Lafayette Comstat 19, no mic or xtals, as is - $15 + $7.50 shpg; Johnson Viking Messenger, w/mic, one knob gone, unchecked - $20 + $7.50 shpg; Regency MR-33 monitoradio, 30-50 mc, unchecked - $25 + $7.50 shpg; Delco Electronics CBD-10 solid state CB radio, w/mic, unchecked - $25 + $7.50 shpg. James Fred, R1, Box 41, Cutler, IN 46920 (317) 268-2214.

WANTED: T-368 xmtr and schematics for an RME 79/DK4 2-10 meter rcvr. Vince, N2WXF, 864-B Nevada Oval, Plattsburgh, NY 12901-3902. (518) 562-8911

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FOR SALE: Narrow bandwidth (600 Hz) mech. filters for CW reception with Collins 51J-type rcvrs - $45 each. Limited supply. Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. (313) 453-8303

WANTED: Drake 4NB, 34PNB, 7075 mic, HRO-5 coils, ps; Systron Donner #114 counter inst. man. Jim Leathem, K7BTB, Box 50355, Parks, AZ 86018. (602) 635-2117

FOR SALE: Have you received your 1993 catalog of coil forms, literature, tubes and other radio parts? If not send $2 to Antique Radio Labs, R1, Box 41, Cutler, IN 46920 for your copy.

FOR SALE: TBY xcvr - $40; VHF Command rcvr R19 - $30; xmtr T23 - $35; MD-7 (less dynamotor) - $50; BC-455 40-M Command rcvr - $35; SPR-4 rcvr - $75. All exc. SCR-284 (restorable or for parts) - $35; orig TDZ manual - $20; DY-17 (ARC3) - $15. Dale Gagnon, KW1I, (603) 228-8721

WANTED: Hallicrafters S29 or S39, any condx. Bill Gustavson, 1819 Green Tree Ln., Duncanville, TX 75137. (214) 296-7275, lve message on recorder.

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: Drake T4X - $100; Hallicrafters SX-130, exc.+ - $120; Drake 2m/6m rcv convertor - $80; R-388/51J-3 - $175; Hallicrafters R45/ARR-7 (unmodified), matching ac sply - $140; R-390A w/SSB converter - $225; +UPS. Pick-up only, National RAL5 VLF rcvr, shock mount, primo - $150. WA7ZYQ, (208) 245-2070

TRADE: Drake C line exc. condx for Collins S line/KWM2A; **FOR SALE/TRADE:** Heath SB-102 w/ps, almost mint; Weston model #537 ac/dc radio tester set, circa 1927 w/data on 40 or 50 old radios; Crosley, Atwater, etc; Fisher tube amp, vacuum relay, misc meters, relays, tubes, sockets, xfmrs, inductors, coil forms (4&5 pin), send SASE for list. Joe Perratto, K2QPR, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-7362

WANTED: Orig manual for RAX rcvr, will pay reasonable price; manual/schematic for Sonar MR-3 mobile rcvr. Mel Stoller, K2AOQ, 100 Stockton Ln., Rochester, NY 14625. (716) 671-0776.

WANTED: S-Line RE - 32S3A, 75S3C, 312B-5 & 516F-2; RE KWM-2A, w/516F-2; RE 312B-4, 312B-5 & 516F-2; KWM-380 & SM-2/3 mics; vernier tuning knob for 75A-4. Mimi Kobayaski, KD6WVC, 2212 Rockefeller Ln., Redondo Beach, CA 90278. (310) 379-6052

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

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.

WANTED: HV xfmr for B&W L1000A (T101), PN T 1205, 115V/3000 VAC. Jack Alley, 2100 Miscindy Pl., Orlando, FL 32806. (407) 851-6258

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

WANTED: 2 ea. 10 Hy or 1 ea. 20 Hy choke, 500 mA, 5 KV. Fred, KC4MOP, 6922 Furness Ave., Oxon Hill, MD 20745. (301) 567-2012 eves.

WANTED: CV-116/URR freq. shift converter; pwr cable CX-1358/U for R-390/URR; rcvr control C-975/URR; TM for AN/MRR-4. Bill Neill, 1231 Crescendo Dr., Roseville, CA 95678.

WANTED: Heath SB-650 freq. display unit to complete the restoration of my vintage Heath station. Ron Eisenbrey, KC5DFX, 115 First St., Sugar Land, TX 77478. (713) 491-7823

WANTED: Altec 250 SU tube mixer. Will pay $800-$1000 depending on condx. Also seeking tube limiters by RCA, Collins, GE, others. Mark, (718) 387-2620 eves.

FOR SALE: Heathkits- SB-401 - $90; DX-60B - $50; HG-10 - $45, all VG to exc. condx. Cal, N6KYR, 330 Pico St., Morro Bay, CA 93442. (805) 772-4366

WANTED: Collins 212A-1 console or similar. Bob, NØNFI, (719) 846-6265

WANTED: Vibroplex vibro-keyer. Trade my extra parts, tubes, cash? Bill, KDØHG, (303) 823-6438

WANTED: Repairable or parts units tube-type SSB/CW gear, accessories or power supplies-Heath, Drake, etc. Byron Tatum, WA5THJ, 1920 Maxwell, Alvin, TX 77511. (713) 331-2854

FOR SALE: 51S1 W/E - $750; 75S3 - $350; 32S1 &516F2 - $325; WW II Navy RDZ belt radio complete w/all accessories - $100; Heath SSB single bander, spkr & 12V p/s, 80 meter - $100; Knight R-195 rcvr - $30; Lafayette HA-90VFO - $30; RME 2-11 radio AM-FM-CW - $50; BC-553-B 190-550 KH w/p/s - $25; SX-71 dials good, fair overall, works - $60; Drake PS-4 - $225; sweep generator 15-400 MHz SC-241 TRM-3 w/manual, works - $175; Eico audio generator model 377, looks new, works good - $30; I-177 tube tester - $55; Hallicrafter HA-26 VFO - $25; WW II sound pwr telephone set unmodified - $25; Teleplex 1930's model & 1950's model - $35; Rider's volume X & XII - $12ea; Allied catalog 1968, Allied Industrial 65, 68, Lafayette 74 & Newark 64, all VG condx - $40; **WANTED:** Pre-war HRO's & coils, any condx. John Orahood, N5SPQ, 5819 Miller Valley, Houston, TX 77066. (713) 440-5598 after 5 PM CT.

FOR SALE: Gates 250GY, AM broadcast xmtr, complete, wrkg condx - $900. John, WAØNEV, (303)482-9254

WANTED: Collins 8R-1 calibrator for 75A-2/3; Johnson TR switch; Johnson KW Matchbox; Johnson 500 or KW; Globe King 500; BC-348. Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. (313) 453-8303

FOR TRADE: Heathkit AT-1 xmtr; 1938 Meissner Traffic Master 14 tube communications rcvr, for telegraph keys. Rick Ferranti, WA6NCX, 254 Florence Ave., Arlington, MA 02174-7248. (617) 646-6343

FOR SALE: Magnavox R3, model B, base for horn spkr, mint condx. Marty, (817) 497-6023

WANTED: RC73-BC-709-B intephone amp, must work; good output xfmr for same. E. Renstrom, 2105 E. Maple St., Crete, IL 60417

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WANTED: Manual, copy OK, for HQ-180A & RME DB-23 preselector; cabinet for SP-600 & R-390A; megacycles & rejection tuning knobs for Collins 51S-1 rcvr. John Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

FOR SALE: EAC made R-390A, unchecked, has mil. meters - $175; T-416/GR, unchecked, has only wire-pin tubes - $20; Messenger 10 parts units, one w/tubes - $25 both; 1962 Gates mod.monitor, few tubes, supposedly wrks - $75; Radiola 17 pwr sply "good" tubes, bad paint job - $35; Lear R-10E 108-126 Mhz AM RX, unchecked w/tubes, poor/fair condx - $10; Zenith 5L41 battery/AC portable, wrks FB xcept scratchy spkr, missing battery bx - $45; some +2k used tubes: 4037A - $35; 710/6011 - $50; 6146's - $10; 2E26's - $5; 803's - $20; 5AR4-5AS4-5R4-5V4-5U4's - $5; 4-1000A w/socket - $115; asst. manuals & repo's: Swan 240, 260; Tempo One; Knight T-150; Allied SX-190; Regency HR-2B; Heath: HW-29A, IT-11, CO-1015, IO-17, HO-10, V-7A, IM-10, DX-100, GR-121, AA-151; all repo's $ .20 per pg, all prices include shpg. Eric Jones, N4TGC, Rt 11, Box 492-J, Florence, AL 35630. (205) 764-0675

WANTED: Collins KWM-1, w/516F1; 51S-1;KWM-380 and etc. Masahiro Nada, #503 1942-2 Murakami Yachiyo Chiba, 276 Japan. FAX 011-81-474-86-7085

WANTED: Pre WW II radio magazines, books, photos of stations, QSL cards, broadcast and ham collections bought. C. MacNeill Book Dealer, WA8ZNX, 3165 12 Mile, Berkley, MI 48072. (313) 543-1177 days

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FOR SALE: Collins winged-emblem S-line; 75S-3, 32S-1 & 516F-2 in VG to exc. condx w/manuals, cables, mic (Turner S95-D) & spare set of tubes - $750 + UPS; Gonset Comm III 6 meter xcvr in VG condx w/manual - $95 + UPS; SRT-14/ANN Navy shipboard xmtr by Federal Telegraph & Radio in good condx w/manual - $350, delivered within approx. 500 miles, many other items. Please request 2 pg list, no SASE needed, all prices negotiable. Clyde Sakir, N7IOK, 4243 E. First St., Tucson, AZ 85711.

WANTED: Collins 32V3, 75A3 (75A2 OK) Collins mechanical filters; Collins spkr; McElroy bug; **TRADE:** Amperite RBM mic. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

FOR SALE/TRADE: Globe King 400-C VG condx on the air - $400; serial #1923; Drake TR-3/AC-3/RV-3 looks good / TR-3, needs wrk - $150; HT-37/SX-111 good condx on the air - $250; SB-303 w/6 Kc AM VG - $225; Johnson directional coupler w/indicator - $50; Jones Micro Match like new - $75; Heath VX1, QF-1 - $50ea. Wayne Medley, N4VMV, Rt 3, Box 90E, McMinnville, TN 37110. (615) 668-9301

FOR SALE: Military tech manual listings, largest stock in the world, over 50K - $5 refundable with first order. SASE for inquiries. Lee Frank, POB 60011, Harrisburg, PA 17106-0011.

WANTED: SB-620 or HO-13; RAX-1; CU-1280 (multicoupler); PRR-9 crystal set; URA-17. Joseph Pinner, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

WANTED: ARRL book "Understanding Amateur Radio" from 1960's. Gerald Morris, WA6NAR, 46 Montell St., Oakland, CA 94611. (510) 654-4876

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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

WANTED: Military TM's for communication equipment. Have several to trade. Send list of what you can offer. Bill Neill, 1231 Crescendo Dr., Roseville, CA 95678.

FOR SALE: 2 Valiants - $200, both; HT-32 - $100; SB-10 - $45. **WANTED:** RF cage for 32V-3 and bottom plate for 75A-1. Mike, W1JZ, (508) 529-4427, B4 8 PM.

WANTED: RF module for radio receiver R 1051B/URR. Jack Meyers, 2656 N. Halleck, Portland, OR 97217. (503) 283-0821

WANTED: Farnsworth radios. Herman Zeps, WD9JKQ, 319S. Williams St., POB 282, Bluffton, IN 46714.

FOR SALE: First user friendly circuit on early BC-348's. Send $2 + (3) 29 cent stamps. Ray Larson, 12241-1/2 Gorman, W. Los Angeles, CA 90049-5214

FOR SALE: Hammarlund HQ-170A, ex. condx, w/orig. manual - $150. **WANTED:** Telegraph keys. Pete, WB2BYQ, (201) 818-4311

WANTED: WW II Japanese, German military radio equipment and literature; Toy Crystal radio kit. Takashi doi, 1-21-4, Minamidai Seyaku, Yokohama, Japan

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WANTED: Dimensions RCA Double Doublet antenna. Any info concerning Autovox TRF car radio using 39/44s RF, 42 output. John McDonald, W6SDM, 24 Glenbrook, Camarillo, CA 93010. (805) 484-1307

FOR SALE: Synchronous detector for 455 kHz IF rcvrs. Dramatically improves AM: Reduces fading distortion, selectable sideband cuts interference. Kit: $139. Built/tested: $199. Info: $3. Steve Johnston, POB 3420, York, PA 17402-0420.

FOR SALE: EAC R-390A, sn 6123 - $300. **WANTED:** To borrow pages 1 thru 1000 of MIL-HDBK - 161 of 1959. Walter Chambers, K5OP, POB 241371, Memphis, TN 38124-1371. (901) 761-9381

WANTED: TM 11487; Collins F500 Z10 filters for PRC-47; also PRC-47 radio & acc. in good condx. Fred Weymouth II, 13471 Hensley Rd., Midlothian, VA 23112. (804) 739-2471

FOR SALE: EFJ KW Matchbox, w/SWR and manual - $195; Heath AT-1, w/manual - $75; Galaxy V MK II, AC-4, spkr - $140; Collins WE 312B-4 - $125; Collins WE 312B-5, w/orig. manual - $325; Collins WE PM-2, w/manual - $65; EV 664 desk mics and 419 stands - $125 each. John Peterman, AB9G, 3024 N. 86th St., Milwaukee, WI 53222. (414) 444-1444

FOR TRADE: R390A, w/manual and cabinet for Hammarlund SP-600VLF. Dave Sampson, 117 Briarcliffe Rd., Dewitt, NY 13214. (315) 446-1258

WANTED: R-390A rcvr, mint condx, no mods, preferably in case. State price & shpg. L. Heaton, K7BIN, 1915 W. 15th Ln., Apache Junction, AZ 85220. (602) 982-1856

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Collins, Drake, Globe, Hallicrafters, Hammarlund, Heathkit, Johnson,National, Swan, etc., etc.

FOR SALE: Heath KL-1 Chippewa amplifier and pwr sply, uses 4-400 finals, w/orig. manuals - $395. John Peterman, AB9G, 3024 N. 86th St., Milwaukee, WI 53222. (414) 444-1444

WANTED: Low voltage pwr xfmr for DX-100, will take junker DX-100 if local and reasonable. Norm Roscoe, W1CIX, POB 402, West Bridgewater, MA 02379.

WANTED: Hallicrafters S-38, S-38A, D and E; R-46B spkr; Viking Adventurer. Bob, WA6KER, 6634 Navel Ct., Riverside, CA 92506. (909) 682-5084

FOR SALE: Marconi (Canada) AM monitoring equip. including mod monitor, freq. monitor, freq. standard and meter panel, primitive, late '20's, early '30's; 7' RCA rack containing BW-11 freq. monitor, BW-66 mod monitor and 3 line input mixer panel; Patterson PR-15, PR-16. Best swap offers. Hammarlund HQ-180, needs minor mech. TLC - $150; Collins 51S1 in LMB cabinet - $550; Heath SB-200 - $275; CA-1632 speech limiter (built for CAA) - $60. **WANTED:** WE or Machlett 279A/379A or 251A/351A "milk bottle" xmting tubes. Can trade 212Es, 810s, 833s, 152TLs, 250THs, etc. toward good tube; ribbon mics; Navy TCM-2 info. Gary, WA9MZU, 1751 Michon Dr., San Jose, CA 95124. (408) 266-2218

FOR SALE: Hallicrafters S-85 rcvr; Hy-Gain antenna CLR2, model 473, new; Delco auto radio, 1949 Pontiac. Also trade for keys. R. Chenez, RFD 2, Box 437-J, Plymouth, NH 03264. (603) 536-1017

WANTED: Hammarlund clock w/cover; SX-42 S-Meter; tubes - 6AG5, 300, 301A, 326. See our ad this page. Manuals for vintage equipment. W7FG, (918) 333-7893

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

FOR SALE: Hammarlund HQ-170AC - $110; SP-400/BC-779 - $50; HT-37 - $110. **FOR TRADE:** HRO-5A1 coils. Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383

WANTED: Rcvr control box C-2275/ARN, part of the AN/ARN-59 direction finder set. Alan Schreier, WA5DJU, 12805 Powderhorn St., Austin, TX 78727. (512) 835-2056

WANTED: Collins mech. filter model F455B60 for the 75A-3. Bill Edwards, K4BWC, 4209 Live Oak Rd., Raleigh, NC 27604. (919) 231-2829 collect after 6 PM EDT

FOR SALE: Hammarlund HQ-110C - $80; Hallicrafters S-47 - $100; Millen 90800 RF deck, w/coils - $50; Gonset GSB-201 - $250; new Johnson Messengers models 250, 323A and 4175 - $35 each; McElroy bug with broken spring. **WANTED:** Cabinet for NC-400; manual for Hickock 800A. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (708) 852-4704

TRADE: Johnson Thunderbolt and GPR-90 rcvr, both VG to exc. **WANTED:** Same condx Johnson 500. A. Santangelo, 252 Arnold Ave., Thornhill, Ont. L4J 1C2, Canada. (905) 731-7274

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

FOR SALE: Military GRC 109 rcvr, 3-24 MHz, sealed box - $50; Collins 30L-1, RE, plastic insert - $650; MPI - $85; 180S1 - $175. Send SASE for list. U-ship. Bob, WB2FOF, 129 Marly Dr., Syracuse, NY 13219. (315) 468-2691 eves.

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: NOS tubes - 4-65A - $40; 35T - $40; 100TH - $30; 250TL - $150; 304TL - $90; 572B - $100; TZ-40 - $50. Many more! Ed Billeci, 2310 SE 113th, Portland, OR 97216. (503) 281-4734

FOR SALE: Heathkit amateur radio repair by RTO Electronics, 4166 Maple St., Berrien Springs, MI 49103. (616) 473-3201

WANTED: SX-101 w/160; Radio Shack DX-400; Uniden CR 2021; TMC GPR-90/92; RCA model CRM R6A; Heath SB-610 monitor scope; 3 RPI CRTs. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459

WANTED: WW II German equipment and tubes, manuals and other parts. Bob Graham, 2105 N.W. 30th, Oklahoma City, OK 73112. (405) 525-3376

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

FOR SALE: Drake 2B rcvr, 2AC calibrator, 2AQ Q-multiplier, clean, looks great, works great - $195; 872A tubes (7), NIB - $85. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480. (201) 728-2454

WANTED: Teletype Crypto gear, as built by Crypto AG., Ericsson, IBM, Kleinschmidt, NSA, Siemens & Halske, Teletype Corp., etc. Dave Ross, KA6EPI, (206) 465-2117

FOR SALE: Code keys, telegraph items, parts radio quack, meters, etc., 9 page list - $1 plus LSASE. J.H. Jacobs, 60 Seaview Terrace, Northport, NY 11768.

FOR SALE: 250 watt RCA mod xfmr, 1:1 ratio with another small winding for feedback (?) - $40 plus shpg. Evan Haydon, NØGMR, 4308 N. 15, Lincoln, NE 68521. (402) 435-4083

WANTED: CVM-5 or similar 500 watt, multi-match mod xfmr. Marc, VE3GIX, (519) 969-5620

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

WANTED: Lafayette HE-10; KT-135; Knight Space Spanner; Ten Tec RX-10, 509, 515; McMurdo Silver 802; Meissner T3BK. James Geer, WB5LXZ, 604 King Dr., Bedford, TX 76022-7124. (817) 268-1985

FOR SALE: Viking 6N2 - $60; Viking I - $130; CSB-100 - $130; DX-100 - $130; Viking II - $130; Ranger - $175; Harvey-Wells TBS-50C - $60; HT-40 - $50; Millen GDO - $60. All F.O.B. Jon, KA4RLV, (615) 337-9317

WANTED: 1939, '40 or '41 Allied Radio catalog. Phil Barnhart, POB 983, Cody, WY 82414. (307) 587-6496

FOR SALE: HRO-50 spkr - $65; magazine "R9", 1934-'36 - $5 each; "Radio", 1936-'38 - $4 each; Hallicrafters R42 spkr - $50. Merle, W7YOZ, 12411 86th Pl., N.E., Kirkland, WA 98034. (206) 823-8139

WANTED: Manual for MITE TT-299B/UG compact teletype machine; 5867 or AX 9901 tubes. Geoff Fors, WB6NVH, POB 342, Monterey, CA 93942. (408) 373-7636, FAX 373-2345

FOR SALE: R-392/URR with instruction book - $200; Ameco TX-62 - $20. Earl, K6GPB, POB 255, Rio Dell, CA 95562. (707) 764-3141

WANTED: To make patch cord for R-390A - plug P112 and mate J512 on I.F. module. Aloha from sunny Hawaii. Itsuo Yano, 80 Lehua St., Kahului, HI 96732.

WANTED: Purchase or borrow manual and/or schematic for RACAL RA6337 low freq. adaptor; purchase clean RA6366 Panoramic Display Unit, w/manual. Art Hogrefe, 10549 Martellini Dr., Laurel, MD 20723-1127. (301) 776-6320

FOR SALE: ARRL Handbooks - '52, '53, '57, '63, '64 - $10 each; Sky Buddy - $25; Ameco 6-M converter - $10; NC-183D - $145; w/spkr - $170; SPDT coax relay, 110 VAC - $13; Echophone 1 - $30; Silver Voamax VTVM - $20; Whipload 6 - $16; Honeywell transistor DCPS - $20; DX-100, VGC - $115; RCP tube tester, w/'40's chart - $20; NC-190 & spkr in orig. box - $110; Space Spanner - BO. Joe Sloss, K7MKS, (206) 747-5349

FOR SALE: HQ-170 - $150 shpd; HW-101, SB-600, sply, exc., needs TLC - $125 shpd; HX-1681, HR-1680, HP-23C, exc. - $150 shpd. Richard Lucchesi, WA2RQY, 898 N. Broadway, North Massapequa, NY 11758. phone/FAX (516) 795-9371

FOR SALE: Hallicrafters SX-62A general coverage rcvr, AM, FM, CW, R46B spkr - $185; Heathkit HX-20 xmtr, near collector quality, professionally built homebrew sply, mic - $135; Heathkit HP-23A/SP-600 - $55; Vibroplex standard but - $60; Heathkit IM-25 vom - $45. Lane, KM3G, (505) 526-0910

WANTED: Zenith 7000-1 (Taiwan) Trans-Oceanic radio; Panadaptor, SP-44 or Hallicrafters PCA-2; BC455 types, racks, dynamotors; need clean BC-348-Q. Mike Neidich, K2ENN, 145 E. 15 St., Ste. 6A, New York, NY 10003. (212) 777-1332

FOR SALE: Heathkit SB-620 monitor, mint condx - $170; **WANTED:** R-390A table top cabinet & CV-157 SSB demodulator. Victor, (805) 583-5317 or 581-5317

FOR SALE: Hammarlund HQ-160 - $100; Atwater Kent, 10B - offers; **WANTED:** Hammarlund S100 spkr; tuning & bandspread knobs for HQ-200; Drake MS4 spkr. Doug Deweese, 502 E. 80th St., Tacoma, WA 98404-1014. (206) 472-3478

WANTED: Hallicrafters SX-28A, VG+ condx only. Will pick up anywhere in CA or OR. Will pay reasonable price. Bruce Bacon, 47 Windmill Ct., Brentwood, CA 94513. (510) 634-0739

FOR SALE: Military keys, telegraph, parts, radio, quack, meters, etc. Lge list - $1 + 2 stamp SASE. J.H. Jacobs, 60 Seaview Terrace, Northport, NY 11768.

WANTED: Hammarlund HC-10 SSB converter. J.A. Thomas, RR3, 1130 Pleasant View Lane, Colorado Springs, CO 80921. (719) 481-4564 (4th ring machine)

WANTED: Collins 51J4 or R-390A rcvr, exc. or better condx, late SN if possible. For my personal use. Terry Neal, 1127 Salvador St., Costa Mesa, CA 92626. (714) 546-9602

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 $199.95, 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.

FOR SALE: Meter glass - $1.50+s; free list books, tubes - $.95; testers, radios, meters, WW II aviation; **WANTED:** Meters. Chris Cross, POB 94, McConnell, IL 61050.

FOR SALE: Jennings Vac cap, new condx, 302 max-min 9/20KV - $50; buck or boost xfmr 120/240V 2KVA 12 or 16-24 or 32V - $90. Joe, W6CAS, (916) 731-8261

FOR SALE: 1955 Collins 212B-2 broadcast mic mixer console (similar to picture in Oct. ER) - $799; 1940 Meissner 150B 200-W AM xmtr, w/Signal Shifter, coils - BO or interesting trade, PU only. **TRADE ITEMS:** NC-240 pewter feet (4); 1933 ARRL Handbook; Thordarson 125-W mod xfmr. **WANTED:** Long case bolt for Johnson Invader; Motorola R-390A name plate; Navy TBY-4 accessories; GRC-9, w/acc.; Navy TBX-6, w/acc.; any Millen equip. List: Old radio mags, books, gear - 2-stamp LSASE. Don Merz, 47 Hazel Dr., Pittsburgh, PA 15228. (412) 234-8819 (weekdays)

WANTED: Diagram of military VOM AN/PSM-6 or ME 70/PSM-6. Trade for my spare meter movement. K6UU, Box 687, Ashland, OR 97520.

WANTED: Manuals, copies OK, for Eico 324 sig. gen., Sprague TO-6 cap. analyzer, Triplett 2590 transistor tester. Mack, KC5AQO, (501) 921-5874

FOR SALE: Heath SB-220, prof. modified by W5LAJ, all documented, works great and looks mint - $650; Heath HP-23A ps, w/SP-600 spkr - $55; HX-20 xmtr, w/ps, mint - $135; IM-25 VOM, w/leads - $45; parts radios - Superpro - $45, BC-348 - $60. Lane, KM3G, (505) 526-0910

FOR SALE: HF sig. generators - HP 606A, VG condx - $150, URM-25F - $89; HP 100E freq. standard, mint - $75; USM-159 freq. meter; accessories, exc. - $39; HP 5255A 12.4 Gig plug-in - $125; TV-7 tube tester - $65; new 6SS7 metal tubes - $3. Joe Bunyard, 1601 Lexington St., Waco, TX 76711-1701. (817) 753-1605

WANTED/FOR SALE: Vintage tube CB's. Send card or call with models you have for sale. LSASE for list. Steve White, WB5UGT, Box 1086, Clute, TX 77531-3814. (800) 374-6477 (9008) leave message.

FOR SALE: Exchange or donate - hard to get units, parts, tubes, tech. info or anything pertaining to radio. SASE. Cdr. Glenn W. Ritchey, USN Ret., W7SAB, 219 Naval Ave., Bremerton, WA 98310. (206) 373-9631

FOR SALE: Drake T4X - $100; Hallicrafters SX-130, exc.+ - $120; Drake 2M/6M rcvr converter - $80; R-388/51J-3 - $175; Hallicrafters R45/ARR-7 (unmodified), matching AC sply - $140; R-390A, w/SSB converter - $225. Add UPS. PU only: National RAL5 VLF rcvr, shock mount, primo - $150. WA7ZYQ, (208) 245-2070

FOR SALE: (Collectors): BC-221AK exclusively used in Hallicrafters labs after WW II (with Hallicrafters Labs plates, info and ID). J.M. Cannon, W9TLU, 618 North First Ave., Maywood, IL 60153. (708) 345-2929

FOR SALE: Knight V44 VFO - $35; Span Master - $25; Johnson Personel Messenger (2) - $100 pr. John Vercellino, WB9OVV, 6921 Springside Ave., Downers Grove, IL 60516-3114. (708) 964-3020

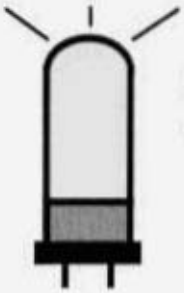
WANTED: 455 Kc coils for Heath SB-620 'Scanalyzer'. Dennis, KØEOO, (408) 997-9835

WANTED: Ceramic wafer from DX-40 or DX-60 bandswitch; copy of DX-60A manual or circuit diagram. Harry Davey, VE7AIJ, 847 Glencoe Dr., Port Moody, BC V3H 1G7. Canada (604) 936-5428

FOR SALE: Electronic Assistance R-390A, late production, AF overhauled, clean, w/manual - $220; R-390A front panel, w/knobs and chassis (no modules), clean - $70; R-390A IF chassis, w/all filters, good condx - $60; R-390A IF chassis, w/all filters, fair - $40; Hallicrafters SX-24, good condx, w/manual - $95; Hallicrafters S36A VHF rcvr, works - $65; desk rack cabinet, black wrinkle 19w x 9-3/4 x 14d, good condx - $35; desk rack cabinet, black wrinkle 19w x 9-3/4 x 15d - $25; Meissner Signal Shifter, w/coils and manual - $65; National FB7 coil set 28 MHz - $35; VHF AM xmtr T-363A - $20; Marine Corp MAP (MAW-1) field VHF AM TR/RX - $20; Mirage MP1 AV/peak reading SWR meter, w/manual - $75; Sherwood Eng. 75SP signal processor for Drake TR7 (new condx) - $75; Sprague Telomike cap analyzer, w/manual - $35; Heath IG52 sweep/marker gen. - $25; Johnson 813 sockets - $10; new 829B tubes - $8. Roger Faulstick, KD4AS, 210 Mariah Ct., Merritt Island, FL 32953. (407) 453-3312, FAX 453-2258

FOR SALE: National 5897 (doghouse) pwr sply - $30; more items, list - $1. **WANTED:** Small S-Line cabinet (S.C., P.S. size). Joe Orgnero, VE6RST, Box 32, Site 7, SS 1, Calgary, AB T2M 4N3, Canada. Phone/FAX (403) 239-0489

FOR SALE: SP-600-JX-1, poor-fair - $60. Keith Matheny, POB 119, Bath, OH 44210-0119



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