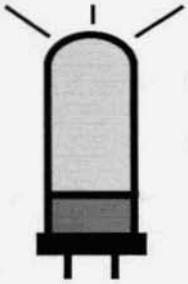
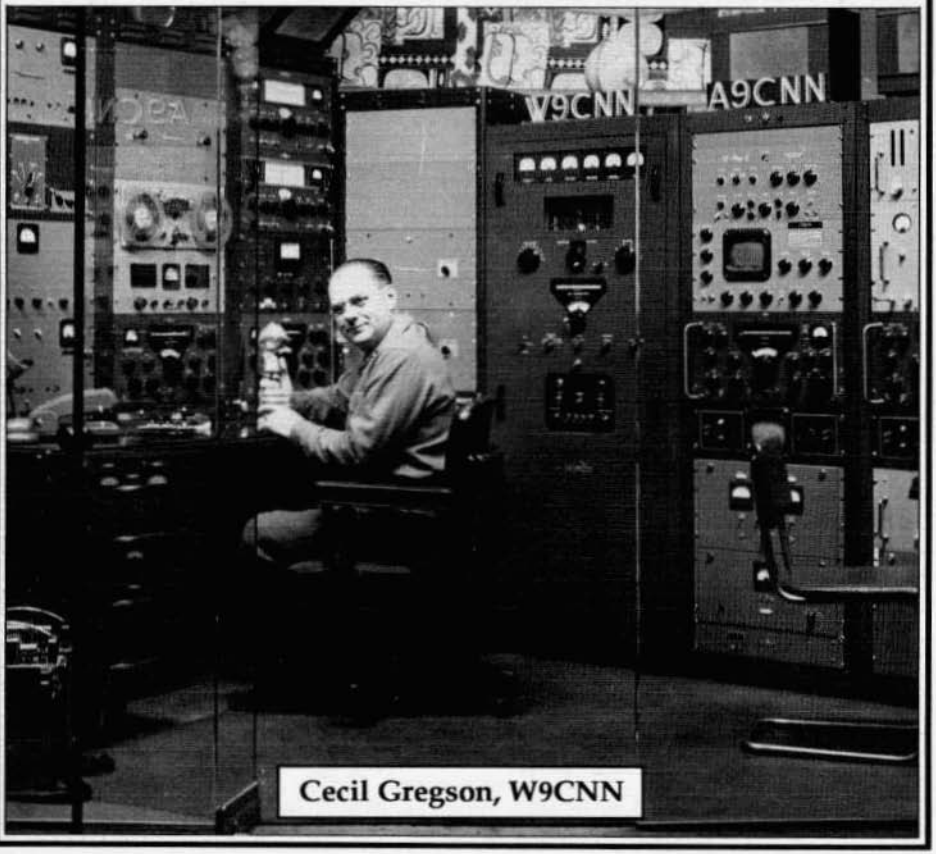
$2.50



ELECTRIC RADIO

celebrating a bygone era

Number 46 February 1993



Cecil Gregson, W9CNN

ELECTRIC RADIO

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REGULAR CONTRIBUTORS

WALT HUTCHENS,KJ4KV.....ELECTRIC RADIO IN UNIFORM
FRED HUNTLEY,W6RNC.....REFLECTIONS DOWN THE FEED-LINE
BILL KLERONOMOS, KDØHG.....VINTAGE PRODUCT REVIEWS
DALE GAGNON, KW1I..... AM REGULATION UPDATES

Electric Radio is published for amateur radio operators and others who appreciate the older tube type equipment. It is hoped that the magazine will stimulate the collecting of, and interest in, this type of equipment.The magazine will provide information regarding the modification,repair and building of equipment. We will also work to-wards a greater understanding of amplitude modulation and the problems this mode faces.

Electric Radio Solicits Material

We are constantly searching for good material for the magazine. We want articles on almost anything that pertains to the older amateur equipment or AM operation. From time to time we will also have articles and stories relevant to the CW operator and the SWL. Good photo's of ham shacks, home-brew equipment and AM operators (preferably in front of their equipment) are always needed. We also welcome suggestions for stories or information on unusual equipment. For additional information please write us or give us a call.

EDITOR'S COMMENTS Barry Wiseman, N6CSW/Ø

QST's article ("Classic Rigs and Amplitude Modulation: Friendly, Nostalgic Ham Radio Partners") by Paul Courson, WA3VJB, in their February issue, has been the best thing that has happened to AM/vintage operation in a long while. This article will be followed up another, similar article, by Jim Musgrove, K5BZH, and Marty Drift, WB2FOU/5 in the March issue. I think what's happening is absolutely great; finally we're being recognized as a legitimate part of amateur radio. We should all write *QST* and let the editor know that we appreciate what is happening. And Paul, WA3VJB, should be congratulated for producing such an excellent article.

The announcement of the formation of AM International by Dale, KW1I, has been received with great enthusiasm by all AM'ers. All the letters I've received here and that Dale has received at his QTH have been positive and encouraging. I think we'll have a fine organization in place within several months. The next step is for all of us to start thinking about directors and executives for this new organization. Suggestions and nominations should be sent to Dale at his QTH or to him here in care of *ER*. AM'ers in each region (and as yet these regions have yet to be carved out) should try to nominate a director that they feel will put some time into the position and be someone that they think will represent their best interests. It will be the directors that will shape this new organization, more than anyone else. As Dale mentions in his update (on page 3) this month, a number of people will be selected as interim directors and then a few months down the line we will have elections.

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Cover: Cecil Gregson, W9CNN, (the original CNN!) in his, glass fronted, air conditioned, deluxe ham shack which was located in his Chicago home. This photo was taken in the early '50's and shows his station equipped with the very best equipment of that era. He is now a Silent Key. In a forthcoming issue Ron Steinberg, K9IKZ, will have more photos and information on this outstanding ham.

Product Reviews

Jupiter Superknobs

A couple of years ago Joel Thurtell, K8PSV, ordered a 75A-4 through the mail and it arrived with a broken main tuning spinner knob. After many ads in the ham magazines he located another one; it cost him $125. It was as a result of this experience that he set about to have some replacements made. And not only were a lot of the originals being broken but the early 75A-4s did not come with the spinner knob.

He first investigated the possibility of having a duplicate made in plastic but this proved too expensive. He then learned of a process using computer technology (computer numerical control or CNC) whereby an exact duplicate could be machined from a solid block of metal. This information came from Ward Rehkopf, K8FD, who is now a partner in the venture. The first one made was aluminum. This knob was very attaractive and functional but he went on to have one machined from solid brass and then had one of the brass ones given a bronze finish. It is the latter two that he is now selling. See his ad on page 42 of this issue.

Joel sent me the knobs to try. I found them all to look very attractive mounted on the 75A-4. Because of the increased weight of the brass knobs however there is a change in the feel of the tuning. I think that I prefer the heavier feel that Joel's knobs provide.

The knobs are perfectly satisfactory in every way other than the fact that they are not original. But for those people who own early 75A-4s that came without the spinner knob or those whose knob has been broken, Joel's Jupiter Superknobs will more than adequately fill the bill. And maybe a number of years down the road they will be just as collectible as the 75A-4. **N6CSW/Ø**

Fine Tuning's Proceedings

"Fine Tuning's Proceedings" is an outgrowth of a newsletter called *"Fine Tuning"* that's aimed at those interested in shortwave broadcast DX. It's basically a collection of articles bound into a single book. Having not seen a copy of *"Fine Tuning"* I can't comment on it, but the copy of *"Proceedings"* I received recently is excellent throughout with lots of interesting stuff for the readers of *ER*. I might add that there were annual editions since 1988. The issue I have is combined for the years 1992 and '93. It is a very well done production. Soft bound and containing 200 pages, it is well laid out and organized. The editor is John H. Bryant.

The articles of interest to me were (as you would expect) those that related to vintage gear. Those were: "The Collins 51S-1: An 'S' Line Classic" by David Clark; "The Hallicrafters S-38" by Chuck Dachis, WD5EOG; "The Hallicrafters SX-28: The Classic Shortwave Receiver" by John Bryant, "The HRO: Portrait of a Classic" by Elton Byington, N2KXT and " A New Method of Recalibration of Receivers, BFO's, etc." by Bennett Basore, W5ZTN. Each of these articles listed above is exceptional. There are other good articles in the book that were of lesser interest to me on receiving antennas, propagation and modern receivers. The price of the book is $19.95 plus $4 S&H.

If you'd like to order a copy they can be ordered from Fine Tuning c/o John H. Bryant, RR #5, Box 14, Stillwater, OK 74074. For a LSASE John will send you a brochure that describes the contents of all the *Fine Tunings' Proceedings* that have been published to date. **N6CSW/Ø**

AM International Update

by Dale Gagnon, KW1I
9 Dean Ave.
Bow, NH 03304

Over the next few months articles will appear to keep the AM community informed of various aspects of the formation of AM International as it moves toward becoming a fully functional organization. The ideas put forth in these articles are not mine alone but a consensus of what most AM'ers I've talked to have put forth. This article covers the important position of AMI Regional Director.

The Regional Director will be by design the backbone of the newly proposed AM International organization. The directors will be responsible for essential tasks and optional activities to accomplish the goals of AMI in their regions. A regional focused organization is superior because the regional directors will be close to the AM activity in their geographies. The essential tasks are important, but need not be time consuming. Directors can, according to free time and interest, add optional activities.

Essential Tasks

1. Act as a member of the governing AMI Board of Directors. This will mean expressing an opinion by phone or letter on outstanding issues to other directors and ultimately casting a vote where board decisions are called for. This would probably amount to one call or letter per month.

2. Recruit AM'ers in each ARRL Division in your region to make appropriate introductions to ARRL Division Directors and Section Managers. Suggested materials and guidelines for this would be available from AMI headquarters. AMI regions may contain several ARRL Divisions so this may require development of 4-6 contact people. This task should be accomplished over a 6-to-12 month period.

3. In the event of a regulatory crisis, seek AMI representatives in the region with government contacts who can exert influence. AMI headquarters will provide position statements and letter formats, etc. A crisis requiring this kind of response occurs only once every several years, but it is wise to have contingency plans in place.

4. Disseminate AMI materials as required. Lend out tapes, slides and AMI signage. Keep supplies of AMI brochures and other related material on hand. AMI members requesting materials would be responsible for postage. This activity would amount to one or two occurrences per month on average.

Optional Activities

1. Develop a list of important amateur conventions and swap meets in the region as AMI promotion opportunities. Identify local AM operators and encourage them to promote AM and AMI at the event.

2. Develop operating events and get-togethers to stimulate regional AM activity.

3. Write up regional AMI activities for publishing in the AMI report in *Electric Radio* and the *AM/Press Exchange*. Innovative activity reports will stimulate a healthy competition between regions for who can have the most fun on AM!

4. AMI Net organization. Hopefully some AMI net activity will develop on its own, but Regional Directors may at their option specifically target some frequencies and times and reclaim "AM windows" in their geography. This activity would most likely be delegated to AM operators with appropriate locations, equipment and available time.

Action

Discuss with other AM operators in your area who would make a good Regional Director. Send me letters identifying these candidates so I can have a pool of people to contact as the AMI organization unfolds. Hopefully, an interim board can be put in place before mid-year to get the organization up and running. Open nominations and elections could then occur within 6-12 months. Please give this matter your earnest attention. ER

ELECTRIC RADIO IN UNIFORM

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

"Military Miscellany"

As happens from time to time, the box of odds and ends has overflowed so this month we will "sweep down all lower decks, ladders and passageways". No malingering now; we'll muster on stations when this duty is finished and the Master at Arms will be collecting names.

Even More On The MBF

From time to time I ask my father for memories of Navy radios he might have seen; last summer's visit with him brought pay dirt. In the summer of 1945 dad was Executive Officer of the USS Palawan, a repair ship assigned to 'mother' about 60 minesweepers as they cleared the mines from the approaches to Sasebo, Japan in preparation for the invasion planned for the winter of 1945-46. He remembered that they used radios made by Collins and after a discussion of shapes, sizes, and appearance we settled on the MBF as the ship-to-ship (60-80 Mcs) radio on the minesweeps.

The column which covered the MBF said that the set had been used on small ocean-going vessels but came to no conclusion about what kind. Dad's "minesweepers" was like switching on the light. Because some mines are designed to be set off by any disturbance in the Earth's magnetic field, minesweepers are built with an absolute minimum of magnetic material and equipment that generates magnetic fields such as electric motors, dynamotors and transformers. The hulls are of wood and all the fixtures and as much machinery as possible are made from nonmagnetic materials. Even the hand tools are of a non-iron alloy.

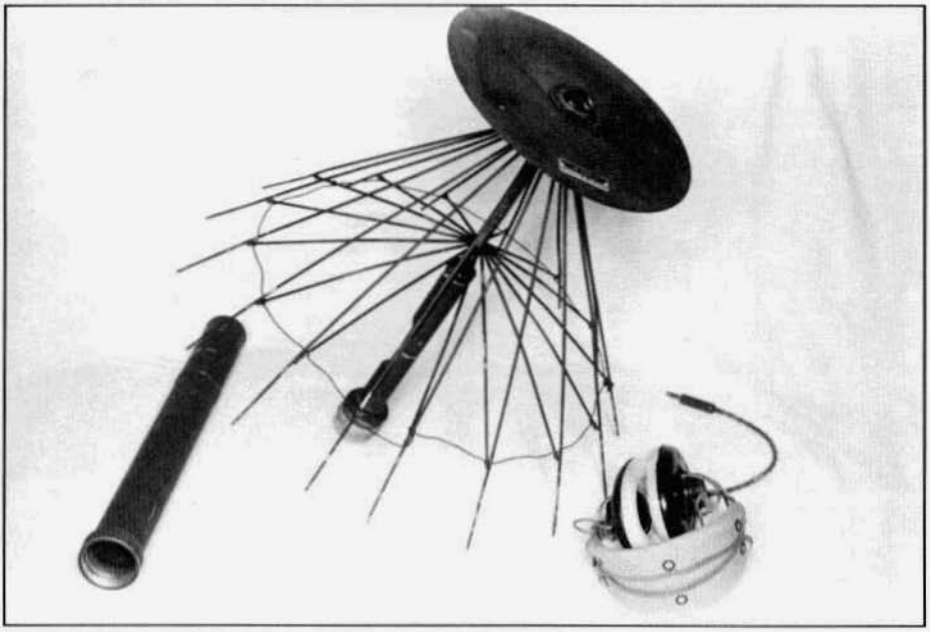
The MBF (covered in the August, 1991 issue of *ER*) is unique among military communications sets in being a transformerless (AC/DC) design. With no power transformer, no dynamotor and even an aluminum case it seems the perfect minesweep radio and that is almost surely the job for which it was built.

About 1947 the Navy (along with other services) switched to UHF (225 to 400 Mcs) for this type of communication. Most early shipboard UHF sets (TDZ and TED transmitters, RDZ and RED receivers) contain far too much iron and are too heavy for such a small vessel. RCA's MAR UHF transceiver (used mostly by the Marines) is a possibility as the minesweep set; does any reader know for sure?

More Mystery Radios

It doesn't happen that often, but when it does, collector Henry Engstrom, KD6XWH, is a frequent offender. Yep, Henry recently sent pages copied from a manual for yet another 'new' old military radio.

The Navy TCX covers 1.5 to 12 Mcs, 36 watts out on CW and 9 watts on phone, using a 1626, a 1625 and two 837's and weighing 41.5 pounds. The corresponding receiver, the RBD weighs 20 pounds and uses 4-12SK7's, a 12K8, a 6SR7, and a 6V6. Both transmitter and receiver can be continuously tuned or operated on any one of four crystal-controlled channels. Each unit has an associated dynamotor supply with both 12-and 24-volt models being available.



No, it isn't a folding umbrella that went through a hurricane, but the AS-408/U antenna does fold up. You just unscrew the plate on top, push up on the lower set of ribs near the center and then carefully compress the outer ribs (there's a spring on the center rod above the inner ribs, just as on a folding umbrella) until the whole thing will slide into the tube at the left. The plate stows on the transceiver case. The headphones (not those used with the set) are shown for size.

These are GE-made sets of about 1939 or 1940 design. The receiver is a near RAX-clone; the right side seems to have been stretched slightly, probably to accommodate the RAX's control box functions and the channel crystals. The transmitter doesn't look like anything else but check that loading coil dial -- it's the same as the one on the BC-191/375.

The TCX/RBD sounds a lot like another set, doesn't it? The Collins-designed TCS is almost identical in shape, size, and function and (though totally different in design) was built at about the same time. The manual says the TCX/RBD "is particularly designed for application to small boats where weight and power are of major importance". Could this be a minesweeper HF radio?

The TCS was built by the tens of thousands; common in surplus stocks after the war, it is still a frequent hamfest find. Has anyone out there ever seen a TCX or RBD?

AS-408/U

Writing about the May 1944 backpack UHF set, I noted the unique folding antenna -- which unfortunately had been lost from my set. At the time I had the feeling that these delicate items were likely to have been popular with the ham UHF gang and were probably rare today. Then came a package from Ed Alves, KD6EU, with a note: "Enclosed please find one AS-408/U discone for your May equipment. . ."

Ed sent several pages of info on the AS-408. It is a lightweight collapsible broadband antenna for the military UHF band, which was then 225-390 Mcs. According to the info the antenna has an SWR of less than 1.5 to 1 over the frequency range. A

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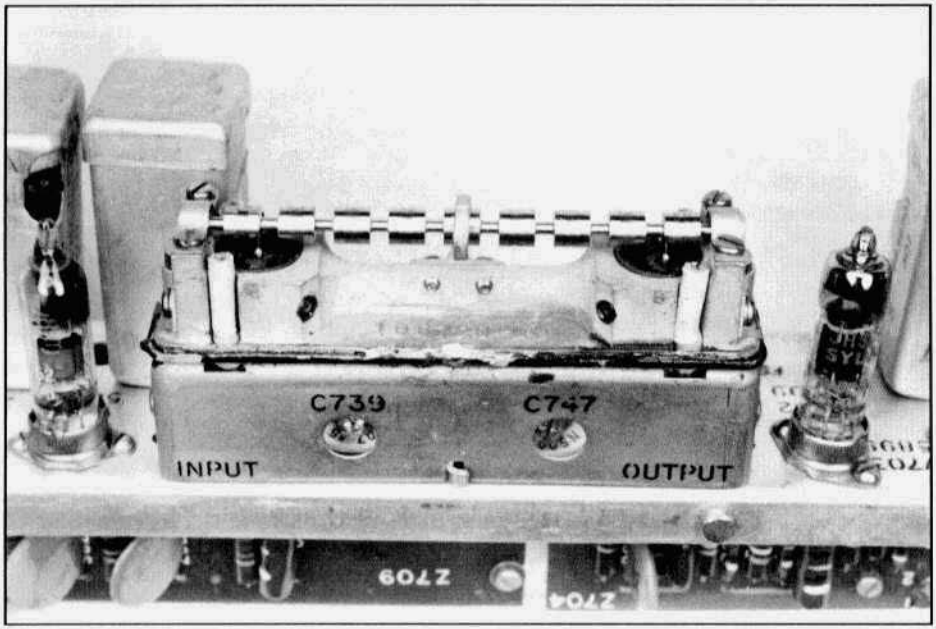

An RCA mechanical filter. Input and output transducers are located below the filter assembly at the ends. The loop around the resonators at the center prevents the rod from being bent in case of severe shock -- the ARC-65 was used in heavy bombers.

unique feature is the ability to fold up for storage inside a 2" tube. The storage tube clamps to the side of either the transceiver or the battery box. With the antenna screwed to the top of the tube you have a fully portable setup with higher gain than (though not as handy as) the short whip supplied with the set. Other possible discone mounting arrangements include being hung from a tree limb, placed directly on the ground, and mounting on a 3/4" pipe; the low end of the antenna has a female 3/4" pipe thread.

Under 'Procuring Service' there appears a tantalizing note: "USN, BuShips for special project". BuShips was the Bureau of Ships, then responsible for most kinds of USN ship and USMC gear. I wonder what the special project was?

Those RCA Mechanical Filters

Writing in connection with the 75A-3 (*ER*, December, 1992) Ray Osterwald left the impression that RCA never produced a workable mechanical filter. However at least two later RCA sets contained mechanical filters which -- since they are of very different design from the Collins units -- are probably RCA-made. The RCA SRR-13A communications receiver (and relatives, see *ER* for July, 1991) uses a pair of 250-kcs mechanical filters in the IF assembly on the 1 and 3 kcs selectivity settings. In addition the ARC-21 aircraft communications set and its SSB clone, the ARC-65, use a 4 kcs wide filter in their 300 kcs IF's. The SRR-13A (etc.) were produced during the mid-to-late 1950's and the ARC-21 dates from the same period; the ARC-65 is from the mid-1960's.

I don't have a spare SRR-13A filter, and even if I did, I wouldn't bust it open to find out what makes it tick; my bad experiences with this go back to age 6! Fortunately, however, I had a spare ARC-65 IF strip in which someone else had already pried the cover off of the mechanical filter.

At first glance the ARC-65 filter looks much like the Collins unit (*ER*, December, 1992, p. 13) but it is actually quite different.

The Collins filter disks vibrate as plates with the disk center and edges moving in one direction along the length of the filter assembly while a ring in between goes the other direction. Coupling between the disks is by three wires running from disk to disk along the edges.

The RCA filters used in the ARC-65, however, consist of a solid metal rod with grooves machined to leave eleven cylinders joined at their centers by small rods. The two end cylinders are clamped, leaving nine free. Each of the two cylinders nearest the clamped ends has two wires welded 180 degrees apart at the face nearest the center. These wires run down into coils. Below there you can't see much and I have no description but it would be reasonable to guess that these are magnetostrictive transducers like those used by Collins but arranged to turn rather than push and pull the cylinder edges. Coupling between the cylinders is provided by the rods at the centers.

There are a couple of possible modes of vibration; my guess is that the one used is the left end of each cylinder rotating clockwise while the right end is going counterclockwise. The filter appears to have been adjusted during production by grinding around the outside of the cylinders near the center; this would lower the frequency of this mode.

This design is probably a follow-on to the 1940's RCA design referred to by Mr. Osterwald. Certainly it isn't delicate as he described the earlier one. It should be easier to produce than those used by Collins. The twisting vibration of cylinders coupled by rods at their centers is simpler than the vibrations of a flat circular plate so there should be fewer spurious modes. For reasons too complicated for this small space, the Q's of the individual resonators are probably higher than those in the Collins design, meaning a filter with steeper sides. The thing definitely works: the SRR-13A filter in my SRR-13 is all you'd expect it to be. Does any reader know more about this interesting design?

More About Those Radioactive VR Tubes

Dave Metz wrote (ER Letters, November 1992) that TM11-649 warns of the dangers of radioactive VR tubes such as the 0A2 and 5651. Military radio collectors are especially likely to encounter these so we will explore the problem a bit further.

These are gas discharge voltage regulator tubes. When the applied voltage reaches a level called the 'striking voltage' of 156 volts (this and all the following numbers are for the 0A2) the gas inside (neon or xenon I believe) ionizes and current flows. In a circuit of the right resistance the voltage across the tube will fall to the 'maintaining voltage' of 108 volts and stay close to that value even though the current through the tube varies widely – the range is 5 to 30 mA for an 0A2.

All gas discharge devices are somewhat 'flaky'. The striking voltage of a VR tube is affected by temperature, light (particularly daylight or a fluorescent lamp) and RF energy to name a few; all of these help start ionization by providing a little extra energy to the gas molecules.

As the tube ages, the striking voltage often increases; unless the circuit provides ample voltage the tube may not strike until the set is warmed up, until the transmitter is keyed, or maybe even at all. If the VR tube does not strike, the voltage you thought was regulated may be thirty or forty volts high and unregulated.

If, however, you put just a bit of a radioactive substance inside the tube that 'extra energy' is always there and striking becomes much more reliable. There was a period (I will guess the late 1950's and the 1960's) when military VR tubes contained radioactive material.

The material in these tubes is a low level emitter; there is no danger in being around them or the equipment containing them as long as they are not broken. However if radioactive dust or particles from inside a broken tube got in a cut or was inhaled or swallowed and stayed in

continued next page

the body it would almost certainly cause cancer. I don't know if dust is a possibility (the radioactive material may be in a form which can't produce dust) but TM11-649 warns that you should see a doctor if you get cut by the broken glass. Considering the consequences one should assume the worst.

Perhaps ten years ago, military disposal sites started checking surplus materials for radioactivity. No such material should be getting out now but some radioactive tubes did escape; I have seen them in equipment and at hamfests. (Both the tube and box should be marked with the three-sectored radiation hazard symbol). As for those which were caught, you can bet that some of the low level radioactive waste our country still hasn't figured out how to dispose of is drums full of radioactive VR tubes.

I don't think that a very large fraction of the VR tubes which are in circulation are radioactive. When I pulled out the KJ4KV miniature tubes shoebox and checked the seven assorted 0A2's it held with a PDR-27 (Geiger counter), none of them was radioactive.

Radioactivity symbol

I suggest the following precautions:

(1) Never buy tubes marked with the radioactivity symbol. The small performance improvement isn't worth any risk at all. Also don't buy VR tubes with worn markings; look inside before buying fleamarket tubes which may have been reboxed.

(2) If you already have such tubes I'd be inclined to get rid of them since about half the tubes that go bad here either break or are broken while replacing them. Many cities now have programs for disposal of hazardous household wastes though you may have to pay for the service.

(3) If you break a radioactive tube or one you're not sure about, turn off the ventilation and put on a dust mask and gloves. Pick up and bag the large pieces; wipe the area with a wet cloth. Seal the pieces, cloth, mask and gloves in a plastic bag and dispose of as hazardous material.

Tubes were not the only radioactive parts to escape from the military supply system. The small meters shoebox holds 18 black face 1-3/4" square military meters; the PDR-27 says all but three have radioactive faces. None of them is marked to indicate radioactivity. Like tubes, these are no hazard as long as they're intact but most are easily opened, for example to readjust the zero. DON'T DO IT.

The main source of radioactive hazards to the military set collector remains the early WW II ground radios with radioactive paint on exposed dials and panel markings. Not only can these flake or wear away forming dust but the unwary collector might attempt to refinish the set; sanding will create dust. If you use paint remover, the remover residue, any wash water and the dust produced when the unit dries will be radioactive. Even if you just wipe one of these dials with a wet piece of cotton, you will have paint particles on the cotton and when it dries, the particles can get loose. . .

Some of the WW II radios are quite 'hot' as low level emitters go -- much more so than those meters pulled from the R-390's. The TBX and TBY are among the worst.

These hazards are no worse than others in ham radio -- 100-foot towers and 2000-volt power supplies for example -- but just as for the others you must take proper precautions. Much more information about radioactive sets including a list of sets known to have the problem appears in the June and August, 1990 issues.

Frequency Meter FR-149A/USM-159

Most hams are familiar with the U.S. Army's BC-221 and its Navy parent, the LM; frequency meters designed before WW II and much prized when they be-

came surplus after the war. While easily ten times as accurate and stable as other tunable oscillators most of us had in those days, these units are not directly calibrated in frequency – you must look up dial settings in a calibration book.

The FR-149 Frequency Meter set was the military's answer to these problems -- and it was improved in other areas as well. To begin with, this 1962 unit is fully transistorized so there's no significant heat production even if you run it on the built in AC supply. It can also be powered by six size 'D' cells which go in a drawer at the top of the front panel.

The BC-221 and LM have two bands: 125 to 250 kcs and 2.0 to 4.0 Mcs; harmonics allow use up to 20 Mcs or so. For higher frequencies, there were the BC-221-like TS-173, TS-174, and TS-175.

The FR-149 has three bands: 125-250 kcs, 2.5 to 5.0 Mcs, and 65 to 130 Mcs; the fundamental frequency is shown directly on a three-track film strip dial under a magnifying lens. With harmonics the unit covers 125 kcs to 1000 Mcs continuously; the harmonics are tabulated in a book mounted in a tray at the bottom of the panel. Operation of the FR-149 is similar to the best models of the parent sets: it can be checked against internal crystals, has a mixer and audio amp so you can check other signals by zero beating and has tone modulation for use as an alignment source.

Military use of the FR-149 seems to have ended a few years ago. While far fewer 149's were made than BC-221's and LM's (mine is s/n 987) they show up fairly regularly at flea markets. I have even seen a few 'new in box' units; these include a new pair of HS-33 headphones, spare calibration crystals, cables, and other goodies so they're worth a bit more than you might expect. If you get a used one, check to make sure that the film strip dial works okay as the film is fragile. There should be a negative for the dial film packed in a can under the chassis; get this printed if your dial strip is bad.

There's one essential modification to be made before trying to use the unit with modern batteries. Remove the battery drawer and note where the two rivets holding the jumper plate at the front of the drawer come through the phenolic insulator on the inside. Radio Shack and some other modern 'D' cells have a ridge on the negative end which will touch the end of the rivet on the right causing a short on that string of cells. Tape over this rivet; I did the other one also, though it is not likely to cause trouble. Also clean the raised battery contact on the right and build it up about 1/16" with solder to keep the battery away from the rivet.

This is a fine unit for general ham use and certainly authentic for servicing any post-war military set; the neon lighted film dial is a pleasure to use. The FR-149 is also one of the most nicely made late model military sets I have seen.

In Uniform Photos

From time to time someone asks how the photos which accompany these articles are taken. As you'd expect from someone who feeds his antenna with a twisted pair, the method is simple.

The background is a white flannel sheet draped over the seats and backs of a couple of straight chairs. Large sets sit on the part of the sheet which lies on the floor in front of the chairs; smaller sets or parts are placed on the chair seats. (The AS-408 photo is a floor shot; the RCA mechanical filter was done on the seat). In either case the sheet covers the entire field of view behind the item being photographed. Large wrinkles are smoothed out and the printing process 'washes out' the small ones.

I use a 1972 Nikon 'F' camera with the aperture at f/16 and the shutter on 'B' which allows opening and closing it manually. The standard 50 mm lens is used unless the subject requires a closer shot; in that case I screw on the necessary close-up adapters. The camera is mounted on a cheap tripod. The film is Kodak Plus-X.

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The Collins 75A-Series Receivers: A Legacy of High Quality

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

Part 5: The 75A-4 and the Single-Sideband Era

Why is it that a ham receiver first produced thirty-seven years ago, in terms of basic receiver performance, is still fully competitive with contemporary designs? What is there about the 75A-4 that makes it so intrinsically "radio" that their owners become very unwilling to change? Is it because the A-4 may be fixed with only a VTVM and a soldering iron? Is it the feel of the comfortably large and velvet-smooth vernier dial placed at exactly the right height on the panel? Maybe it could be a quiet moment in the shack, when the translucent kilocycle dial is illuminated in the warm glow of a type 47 lamp that we get attached to. Or, maybe it's the big Simpson S-meter we remember, as it kicks up sharply, announcing that the DX station you've stayed up so late for has finally arrived. It also might be the super-sharp selectivity that's available, as fellow net members are quickly separated from band noise. Surely it couldn't be the fact that the rig was made in Iowa, USA, could it? It is probably not one single thing so much as a combination of all its features that produces this devotion.

Designed to be a high-performance, single-sideband receiver, the 75A-4 did not neglect the other modes and operators, and offers equivalent high performance. Being totally new inside and outside, it was nearly 4 inches narrower than previous A-line receivers, and considerably lighter. It began the trend towards smaller and lighter radio equipment.

All of the unique circuitry in the receiver was developed in a special post-war engineering program which was set up and personally directed by Art Collins. By late 1953, this special team had begun to show some good results of the five or so years of work in new circuit concepts and hardware design. Their progress can be followed indirectly today by scanning the Collins ads which were entitled "SSB Engineering Notes" in the ham magazines of the period. Ernie Pappenfus, K6EZ, was a Collins engineering supervisor in Cedar Rapids at the time. His involvement came when, as he puts it, "Art Collins grabbed a bunch of my engineers and assigned them to a special project team that was headquartered in a little metal building behind the Collins main plant. The sideband circuits used in all of the later equipment came out of this group. We developed the product detector circuits, further improved the stability, reduced audio distortion, and did the other things that were required for good single sideband operation."

It should be pointed out that although Collins designed original circuitry and improved existing basic designs, we should remember that it was Edwin Howard Armstrong who gave us the principles of regeneration and heterodyne signal conversion, which are put to such fine use in the 75A-4.

Engineer Gene Senti, WØROW, took designs from the SSB project team and combined them with what had been learned to date with the existing 75A-series receivers, producing what we know today as the 75A-4. Introduced in March,

Collins 75A-4, S/N 5396. This receiver left final test at the factory 6-6-58, and was purchased 1-7-59 by Wendell Fletcher, K6KOJ, at dealer Gil Severns, Hemet, California.

1955, it was, along with the KWS-1 transmitter, the first Collins equipment designed expressly for single sideband service. QST reviewed the 75A-4 in the "Recent Equipment" column for April, 1955. Over the years, thousands of operators have come to develop a great respect for this receiver and for its capabilities.

Mr. Senti, as with all of the great engineers of his time, is relatively modest when it comes to talking about his life's work. He did mention that "When you're working on a receiver, you spend a lot of time in the screen room!" I asked him what the toughest obstacle was that he overcame during the 75A-4 design process: "Well, getting Mr. Collins' OK on it was the toughest! He was very active in the design. He knew what was going on with the project every day, and would be always looking over your shoulder. He would usually try the new equipment out at his house. He had a real nice ham shack out there with nice beam antennas, and I spent many an evening there, making changes that he wanted to suggest—' try this', or 'move that over there', or 'let's try these instead'. (It's obvious that the 75A-4 embodies whatever performance that Art Collins thought a good receiver should have.)"

"Generally, we'd build one or two of what we'd call an engineering breadboard, which was a pretty shaggy looking thing, with resistors pasted on resistors to get values zeroed in. Then we'd build maybe two engineering models, which had basically the same circuit as the breadboard, but were prettier to look at and nice enough to take some pictures of for advertising brochures and so forth. Right off we'd build a pilot run in the factory of maybe 20 to 50 units. Quite often these were sent out to various dealers and friends of Mr. Collins for evaluation. They'd use them for several weeks and

continued next page

75A-4 from previous page
make comments about them. Also any problems which showed up during that preproduction run would be taken care of. Then, generally we'd build a thousand units at a time on most of the ham gear. That was done in a little factory about 20 miles out of Cedar Rapids, a little farming community called Animosa. The ham gear was put together by farm gals, mostly. They knew how to give you a day's work for a day's pay. They were very good people and were very conscientious. The ham gear was built out at this place right until the 'bitter end'.

"As soon as Rockwell took us over, they figured out that ham equipment was just a loss leader and decided to drop it, and start making money on military contracts. So they dropped the ham gear just like a hot potato, but they kept the service department for a year or so, and then it was dropped too. I pity the poor guys out in the field who don't have any connections and have to scrounge parts. I see the prices of the parts in some of the magazines and catalogs and it is sometimes as much as the equipment cost new!"

In addition to being a new standard of comparison in communications receivers, the 75A-4 also made significant contributions to national defense and to the maintenance of world peace, something not much other ham gear can claim. Shortly after the introduction of the new amateur SSB line, the Collins Radio Company became involved in a very unusual project with the United States Air Force. Known as 'Project Birdcall', this was a joint effort between Art Collins and two Air Force generals, and convincingly demonstrated the effectiveness of single-sideband radio on world-wide communications circuits. Ernie Pappenfus and his engineering department was directly involved in this work. Here are his recollections:

"I went on several SAC (Strategic Air Command) flights all over the U.S., down to Texas, and to some other places testing single-sideband equipment for the Air Force. We operated all bands from a big old Air Force transport plane. On the plane, we had installed a brand new 75A-4 and a KWS-1, into which we had plugged special sets of Air Force crystals to get us on their command frequencies. Collins had set up a big communications station at the engineering building in Cedar Rapids, later called Communications Central. If the Air Force couldn't communicate with their network around the world for some reason, the Cedar Rapids station would jump in and assist them, as we had some high-power transmitters at the time, 50 kilowatt for sideband. The Collins station also assisted on some of the Presidential flights.

"The way these world-wide tests started was because General Curtis LeMay and General Butch Griswold were the Commander and Vice-Commander of SAC, and both of them were hams. They were familiar with the 75A-4 and the KWS-1 equipment, and one day they came over to the plant and talked to Arthur Collins about single sideband. A few weeks later, in the engineering lab, we made a special setup, which used a 75A-4 and a KWS-1 for single sideband service. Later, we did a permanent installation in a big C-97 Air Force plane. The equipment ran on 400 Hertz AC, and worked quite well there. There was no modification necessary to the power supplies to run at that line frequency. Eventually, SAC dispersed that plane all around the country, and then later to Turkey, Spain, and way out into the South Pacific to test single-sideband. They would have a radio roll call every hour to make sure they had communications, because at that time we had airplanes in the air with atomic bombs on them that had to be ready to go at any minute.

"On most of the test flights Art Collins was along with them, as he was a licensed pilot and interested in aviation. After two dead stick landings with his Bonanza, he decided that he wasn't going to be flying any more!

A 75A-4 and KWS-1 aboard an aircraft during the period when the airforce was evaluating SSB for military use. Photo courtesy of Harry Snyder, WØRN.

"The whole single sideband Air Force program started because of the 75A-4 and KWS-1 we installed on that SAC plane. We demonstrated the equipment, and they realized just how far they could talk with single sideband, compared with the old stuff they had. They decided that they really had to have it in order to have command and control of their airplanes while in the air. I think single sideband and the 75A-4 probably kept us out of a war.

"The Collins airborne installation was used for a couple of years, I think, starting around late 1955 or early 1956. After they saw how successful it was, the Air Force let a contract to Collins to develop the high power transmitters and the specialized communications equipment they needed, including the ARC-58, which was a single-sideband, multi-channel airborne set that we made thousands of.

"As far as I know, there were never any green 75A-4s for the military. As far as I can remember we never painted any a different color, and none of them was specially built under mil spec."

75A-4 CIRCUIT DESIGN

The 75A-4 is crammed full of circuit goodies originally developed out in that little tin building at Cedar Rapids. From Ed Andrade's product detector, to Gene Senti's passband tuning, the 75A-4 introduced circuit concepts still enjoyed in more modern equipment. It really represents an entirely new design philosophy from the rest of the A-line receivers.

The 75A-4 front-end represents a major design philosophy change from any other HF receiver of the period. The Collins SSB

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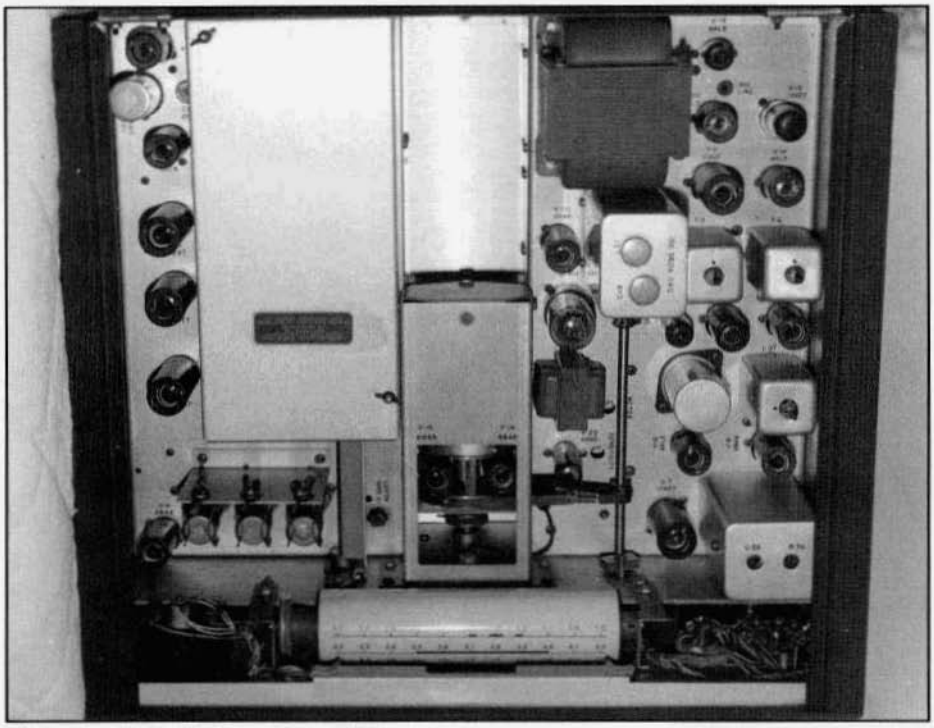
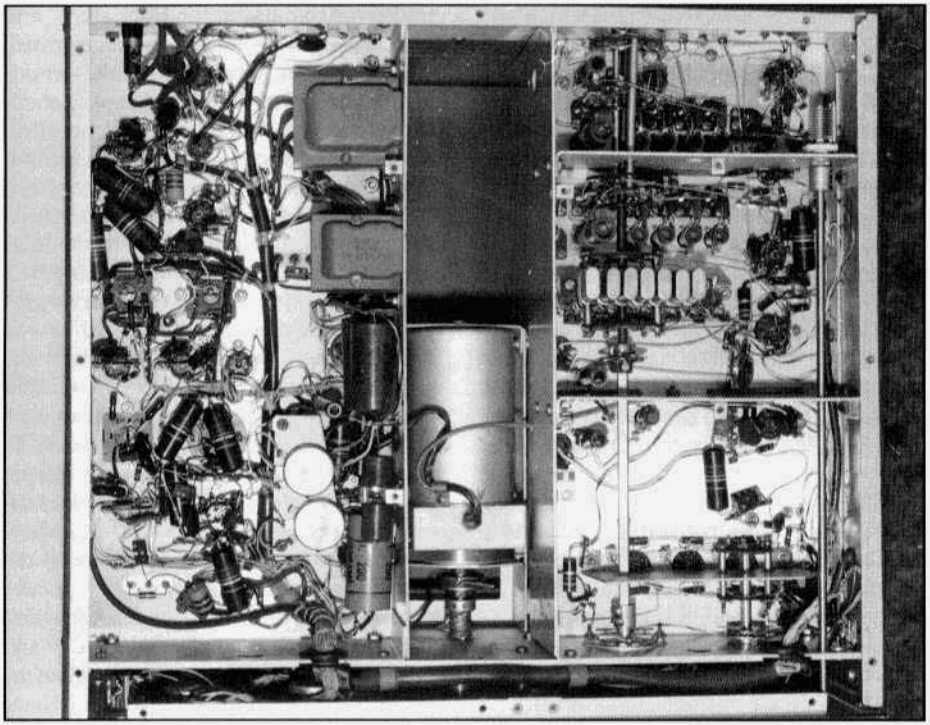


Underneath the 75A-4 cabinet lid.

project team recognized that given typical noise levels, a 7-to-10 dB receiver noise figure is perfectly adequate 90 percent of the time, even on 10 meters. Therefore, extreme sensitivity was traded off for the higher dynamic range figure needed in the increasingly crowded HF radio environment. This was accomplished with the 6DC6 pentode amplifier, the standard front-end tube for Collins until the S-line was discontinued. The remote cut-off 6DC6 was developed for television receiver front-ends, where similar problems with IMD were encountered. The 75A-4 is 14 dBm less sensitive than the 75A-3 or 75A-2, at -127 dBm. However, the dynamic range has improved significantly. My evaluation receiver, in factory stock configuration, measured a blocking dynamic range of 90.2 dB. The 2-tone, third-order dynamic range measured 88.3 dB. These numbers confirm what is already known, that the 75A-4 is in the "high-performance" class of receiver.

Another significant change is the inclusion of a built-in 100 Kc. calibrator, which uses a 6BA6 in a modified Pierce crystal-controlled oscillator. A Pierce oscillator operates in the parallel-mode for stability. The oscillator portion of this circuit is actually a Pierce "triode", in which the pentode screen serves as the equivalent triode "plate". The cathode and suppressor are bypassed to ground, forming an electron-coupled oscillator, which prevents changes in the plate load from pulling the oscillator frequency. This calibrator has good short-term stability. Although the crystal is mounted in a sealed can and uses a ceramic socket, long-term drift is a problem, and the calibrator must be frequently re-set. There have been some modifications published to increase the calibrator marker level on the 10 and 15 meter bands by directly substituting a 6BZ6, and this works well.

In order to have the same tuning rate



Bottom view of the 75A-4. The cabinet serial number reads 5396. Other records indicate a "factory serial number" of 5-396 and a "customer serial number" of 396. This might be part of the reason S/N's are not sequential.

on 10 meters as on the lower bands, an additional position on the bandswitch was added, giving a 10 meter "low" and a 10 meter "high" selection. The low portion tunes 28-29 Mc., and the high portion tunes 29-30 Mc. This requires an additional bandswitch deck in the RF amplifier plate circuit because of the added trimming capacity, and an extra crystal position was required for the 1st crystal oscillator grid and plate circuits. Also, the 10 and 11 meter bands were given their own antenna coils, to further increase image rejection.

In connection with the additional 10-meter switch position, the 1st variable IF bandpass is now 2.5 to 1.5 megacycles on all bands. 6BA7's are retained as the first and second mixers, and the double-tuned first mixer output is unchanged from the earlier receivers.

A newly-designed PTO, a type 70E-24, was used in the 75A-4. Its electrical design is similar to that of the others, but it is stronger mechanically, and critical component selection provides even higher stability than before. Its output range is 1.955 to 2.955 Mc., to produce a fixed 455 Kc. IF from the second mixer.

The 75A-4 design fully integrated mechanical filters into the IF amplifier strip, by allowing up to 3 of them to be plugged into chassis sockets, and to be selected from a front-panel switch. In contrast to the military receiver designs, there are no ceramic trimmers on the filter terminations in the 75A-4, probably a cost-saving measure. To make up for filter insertion losses, a 6BA6 pentode amplifier directly follows them.

Following the fixed selectivity provided by the mechanical filters is a variable

continued next page

notch filter, of a new design which replaced the venerable crystal notch of the 1930s. This new filter uses both halves of a 12AX7. The first half is a cathode follower which is used to feed a regenerative amplifier, the second half of the tube. The cathode follower serves to buffer the amplifier's input voltage. The regenerative amplifier has a variable bridged-T filter in its plate load, and being a series-tuned circuit, it provides a deep null at resonance.

Normally, a variable bridged-T filter won't provide a deep notch when used in IF circuits above 100 Kc. However, in the 75A-4 circuit, the effective Q of the plate filter coil (L26) is raised by means of the Q multiplication action in the regenerative amplifier. This gives an effect similar to a crystal notch, but avoids the distortion which is so typical of the IF response curve on either side of the crystal notch. The adjustment resistor, R36, gives the deepest null when set at 1/4 of the resonant impedance of the tuned circuit.

Unfortunately, due to short-term drift of the filter components, a careful alignment of the rejection filter circuit to provide the deepest notch usually doesn't last too long, and the long-term effective notch depth is less than what was available with the 75A-3's crystal notch. Hand-selection of C73 and C74 to provide the lowest possible temperature coefficient will help, but they are inside the filter can and are hard to get at.

As if a sharp rejection notch working against the steep skirts of a mechanical filter wasn't enough, Mr. Senti also gave us mechanical "passband tuning". This is a scheme where the rear of the PTO can is mounted in a bearing, and connected via a flexible metal strap to the shaft of the BFO tuning condenser. When the operator moves the passband tuning control, he can change the position of the interference relative to the fixed mechanical filter skirts, without changing the beat note or the dial frequency. There is no separate BFO pitch control. The effect is to "shove" interference outside the filter skirts, and it is extremely effective when the system is in proper alignment. Note that in this arrangement, in sharp contrast to modern passband tuning circuits, no additional RF conversion stage is required. With no additional mixing, there is no chance for additional distortion products to show up, and all we get are the benefits of the selectivity! Passband tuning was first used on the 75A-4. Its invention should be credited to Gene Senti.

There are two stages of conventional 455 kc. IF amplification. In many modification articles, it is advised to change the value of R46 to 47K, and R50 to 68K to increase IF gain. If this is done, be sure to change R47 to 1 Watt. Be aware that total receiver gain distribution will be affected.

Gene Senti provided deluxe dual detectors as well. Not only is there a tube diode for AM detection, but Ed Andrade's product detector is included for CW and SSB. Its interesting to note that in all of the modification schemes I've read, not once did anyone mention changing the product detector because it works so well as designed.

After the detectors is a dual-diode audio noise limiter, which is adjustable from the front panel and clips on positive and negative peaks. It is effective on AM, but unfortunately it is all but useless on CW and SSB. There were many "fixes" offered over the years, and it was even the subject of a multi-page Collins service bulletin. In short, what they said was that noise pulses are simply stretched out in the selectivity so much that by the time audio limiting is reached, limiting action is ineffective. After catching heat about this problem for several years, Collins released the type 136C-1 noise blanker for the 75A-4. Using a separate 40 Mc. receiver to convert noise impulses to IF blanker pulses, it works OK, but is nearly impossible to find. The blanker was reviewed in QST November, 1959, and was also used in the KWM-1 and KWM-2 rigs for ignition noise suppression in vehicles.

Amplified AGC is used in the receiver. A sample of the IF voltage is picked off after the second IF amplifier and fed to an IF AVC amplifier. Following the amplifier is a dual diode. A small DC bias voltage is placed on the detector half to provide delayed AGC action. The second half of the detector tube is used as an IF AGC noise limiter. By clipping the noise pulses before detection, they are prevented from charging the AGC line and reducing gain during the noise pulse duration. In spite of precautions, there are several problems with the AGC, and they will be discussed later.

Instead of the RF gain control being a simple voltage divider across the AGC bias line, a separate bias rectifier and a "gain gate" was added. In the previous designs, changes in the RF gain control setting would not only change the impedance of the AGC line, but also would change the gain distribution in the controlled stages. In the 75A-4, using a separate bias rectifier provides an isolated, low-impedance AGC line, which further minimizes blocking and distortion with strong signals. To visualize its action, a higher impedance line would form a longer time constant with the AGC bypass capacitors. This longer time constant would mean that a controlled stage might be driven into distortion before the AGC could respond to prevent it. The gain gate, the second half of the bias rectifier tube, decouples the RF gain control from the AGC line. This is done so that the receiver's gain distribution is not disturbed by changes in the RF gain adjustment. Gain distribution is critical in keeping all of the controlled stages operating in their linear regions. Changes such as these came directly from the SSB special projects team at Collins, and Gene Senti's insight into what Art Collins would approve of.

To top off the design of this completely new receiver, the audio section was redone. The 6AQ5 single-ended output stage was retained, but it is now driven from a two-stage triode preamp. Both halves of a 12AT7 are used to drive the output tube. To reduce distortion on signal peaks, the 6AQ5 grid bias is taken from a much more elaborate resistive voltage divider network. There is additional RF by-passing, and if all of this wasn't enough, negative feedback was added to further reduce distortion. A sample of the output transformer secondary is picked off, and applied via R71 to the cathode of the first audio preamp, giving roughly 15 dB of inverse feedback. This helps to smooth out the audio response, and to reduce the effect of DC core saturation on audio peaks, common with small audio output transformers. Some modification articles recommend changing R71 to 100K to reduce the feedback, and to load the audio gain pot with a 1 Megohm resistor to further linearize it. I've never found these to be too useful, but they are fun to try.

CONCLUSION

Due to space limitations, there will be one additional installment of this series which will deal with the many modifications published over the years. Hopefully this will serve as a guide to readers wishing to change their receivers.

The 75A-4 was produced until mid-1959, when it was discontinued in favor of the 75S-1. This brought the Collins A-line equipment to an end, in the natural progression of technical development. The intent of this series of articles has been to provide a clear picture of these receivers, and of the times they were produced in. Surely they will stand as some of the classic communications receivers of all time. **ER**

PTT Modification For the Johnson Viking Ranger

by Hank Scharfe, W6SKC
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Whoever devised the PTT modification for the Viking Ranger was confronted with a very complex OPERATE switch. A lot of switching functions are designed into that custom switch and it is not a simple task to add a conventional PTT mode.

Although the modification works very well, when the OPERATE switch is in the PHONE mode, the rig is really 50% PHONE and 50% STANDBY. When the PTT line is grounded thru the microphone's PTT switch, the rig is switched to 100% PHONE.

Unfortunately, it is hard to tell what is going on, because the RED Transmit light is always ON when the OPERATE switch is in PHONE (regardless of what the PTT is doing) and the front panel meter is not illuminated. Another inconvenience is that to generate a continuous carrier, the OPERATE switch must be in the CW mode, or in PHONE with PTT switched ON.

There are a couple of ways to smarten up the RED status light. One is to hang a 115 VAC relay across the external antenna connector (J4) and to route the lead to the RED light thru the relays contacts. The RED light will turn on only when the external antenna relay circuit is energized.

The other option is to add another set of contacts to the PTT circuit. If the EFJ modification has not yet been made, a Potter-Brumfield KA14DG-110 (3PDT) relay can be substituted for the EFJ recommended LM-11, which is only DPDT.

Before proceeding with any modification though, it is probably a good idea to review the modification procedure in the Ranger manual. It is included in both the Ranger I and Ranger II manual with the Ranger II version being superior.

To update the Ranger I procedure, add the following statement after the last line of Paragraph F.3.g at the top of page 21:

Connect a lead from terminal 6 of SW4A to the normally-closed (NC) contacts on the same side of the relay. Ref: Page 21 of the Viking Ranger II manual.

This additional modification disables the final amplifier during Standby, which in turn reduces the noise generated by the final while you are receiving.

If the EFJ-recommended LM-11 relay has already been installed, check that the above mini modification has been made.

If a second relay (SPDT) is to be installed, its logical location is the platform right above the OPERATE switch that contains V13 and V14. Don't pay any attention to the fact that V13 and V14 do not agree with the tube designations on the main schematic. The error is strictly academic. One tube (6AL5) has 7 pins and the other (12AU7) has 9 pins and there is little risk of interchanging them.

I could say that I selected a Potter-Brumfield LM-5 with a 2500 ohm coil, but I really think it selected me. It has been lurking in my junk box for at least 25 years, but looks new. It is only 2.5 inches high and fits on the V13/V14 platform perfectly. Its mounting holes line up with unused holes that EFJ punched in the platform a long time ago. I put its 2500-ohm coil in series with the 10,000-ohm coil of the LM-11 and they both snap in together. The current thru the PTT switch is still 10 mils, which is a good current to keep the dry PTT switch contacts "alive". I did not notice any change in the relay speed of operation.

After accomplishing the EFJ modification (Version II) for the first two sets of contacts on the LM-11, connect the 3rd set of contacts for the LM-5 (SPDT) relay in the following manner:

1) Remove V13 and V14 from the platform located directly above the OPERATE SW.

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AM FREQUENCIES

2 Meters - 144.4, calling freq., activity in most cities; **6 meters** - 50.4 calling freq. **10 meters** - 29.0-29.2 operating window; **12 meters** - 24.985 calling freq.; **15 meters** - 21.400 - 21.450; **17 meters** - 18.150 calling freq.; **20 meters** - 14.286 for the nightly net starting at 5:00 CA time; **40 meters** - 7160, 7195, 7290 are the main freqs. Westcoast AM'ers net every Sunday afternoon, 4:00 PM on 7160; **80 meters** - 3870, 3880 and 3885 are the main freqs. Westcoast swap net Wednesdays nights, 9:00 PM on 3870. AM Swap net Thursday nights, 7:30 PM on 3885; **160 meters** - Gray Hair net every Tuesday at 8:00 PM EST on 1945. Mostly sporadic summertime activity, but during the winter signals can be heard anywhere on this band.

From the Editor:

The Christmas Weekend 160 and 10-Meter Contest

Although the level of participation was high for this contest relatively few logs have reached ER at this date. This indicates to me that the 'contest' was of less interest than just getting together.

Jerry, K1GUP, sent in a log with a total of 31 contacts; 28 on 10 and 3 on 160. He said he didn't do much on 160 because he was having difficulty getting his DX-100 fired up for that band. He also commented that he experienced some sporadic-E propagagation on 10.

Another log received recently was from Paul Maikranz, KB2MUQ, who worked a total of 33 stations, all on 160 except for 1 10 meter contact he made with Ian, GI3NUM, in Belfast, Ireland.

Next issue we'll announce the winners. If you haven't sent in your log yet, please do so in the next week or two.

AM Activity on 15 Meters

I've been hearing more and more AM signals on 15 meters. Recently I contacted Andy, N5JBT, (one of the stalwarts on that band) for a list of the more active AM stations there. Here's his list:

Ken, WA6BQX; Warren, K2LXW; Howie, W2NRM; Lloyd, W0SYH; Bob, K7SW; Bob, W7RSQ; Joe, KC4CFE; Frank, VE5NT; Norm, VE6NE; Jerry, K1GUT and Gene, W7MXM.

Andy says that there's always some activity on 15 except when 10 opens up, then there is a mass exodus to that band. He also added that towards evening he has been working VKs and ZLs from his QTH in Texas, with no difficulty at all. I think we're going to find increasing activity on 15 as 10 deteriorates.

I've been thinking about a 15-meter contest for late March. One idea I've had is to make it an "AM International" contest/jamboree. The object would be to see just how many DX stations in how many countries all of us AM'ers could cumulatively work. I'd like input from AM'ers on this next contest. I'd like to know how we could make the contests better and more interesting for everyone. **N6CSW/Ø**

The AT-1: Heath Gets on the Air

by Chuck Penson, WA7ZZE
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The year was 1951 and the Heath Company of Benton Harbor, Michigan was relaxing a bit on the handsome profits made from their ever-growing line of kit test equipment products. Heath was also beginning to look for other markets to explore. There were a variety of options, but in 1951 opportunity called CQ. The creation of the novice class license in July of that year was Heath's chance to get on the air, and they decided to test the water (or the ether, if you prefer) with something simple and inexpensive. A smartly designed, affordable, novice transmitter, Heath's engineers concluded, would be just the ticket.

A LITTLE BACKGROUND

In retrospect, it is easy to see why a rig like the Heath AT-1 would do so well. Browsing through a *QST* from 1952, it's clear that there wasn't very much to choose from in novice transmitters - and what there was left something to be desired.

The Elmac A-54, for example, was expensive - $140 without a power supply - and it used a VFO. Same with the Gonset Commander. Novices had to be rock bound. The Harvey Wells Bandmaster Senior was nice, if somewhat cumbersome. It was also a bit pricey for the novice - $110 without a power supply. The B&W model 504 was a spartan little rig, but you had to swap coils and it cost $85 without a power supply that was advertised as "available soon." The Lettine model 240 was about as nice and for the same $85, it included a power supply.

The Globe Scout, the Meissner 2-CW, and the Sonar SRT-120, were all decent rigs but missed the mark for various reasons.

Even when they had a good product, companies almost always missed on the price. Remember, we're talking about 1952 here - when 50 bucks was nearly a month's rent. The Eldico TR-75-TV for instance was an attractive kit and was intensely marketed to the novice - but it sold for $60. The WRL Trotter was certainly on the right track, but the kit was real steep at $90. Then there was the Philmore novice transmitter. Definitely not much to look at, it was a bare bones open chassis unit that used swapable coils and ran only two bands. But it was a kit, it had a power supply, and the $30 price tag may have compensated for its lack of aesthetics and features.

Heath looked carefully at these rigs and observed that while most would get you on the air, many were much too expensive and none was a marvel of engineering. In studying the competition, Heath realized that all of these rigs lacked at least one of four strategic factors needed to succeed: engineering, features, price, and aesthetics. With a combination of insight, creativity, and the uncommon common sense that would soon make it a household word (at least in the shack), Heath had figured out the equation for what we now refer to as "value". With this equation in hand, it was a simple matter to plug in the pieces of a best-selling transmitter.

Heath knew that the basic circuits for small transmitters could be had from any handbook, and that those circuits worked well. Engineering, they concluded, was not a problem. The features they needed to include could be derived as a composite of the best of the competition. And it didn't require a Ph.D. to design an aesthetically attractive rig. As for the price? Heath had purchased tons of war surplus electronic parts for pennies on the dollar. Enough said.

Introduced in 1951, carrying a $29.95 pricetag, the AT-1 became an instant hit and launched Heath into the amateur radio business.

And so, armed with the "value equation" (and tons of parts), Heath set out to build a novice transmitter - and a reputation in ham radio.

Work on the transmitter probably began early in 1951. It was designed by Roger Mace, who had been hired specifically to get the new amateur radio effort off the ground.

The result was the AT-1 - Heath's first serious venture into ham radio. It was released just in time for Christmas 1951, was an immediate success, and quickly began showing up in shack photographs on the pages of QST.

DRESSED FOR SUCCESS

With the AT-1 you got six-band operation, one knob band switching, full metering, plenty of power, and a built-in power supply. In addition Heath provided prewound coils, "rock bound" control with provisions for a VFO and a modulator, all wrapped up in a nice looking two-tone gray cabinet. (Heath's famous green color scheme was still a few years away.) And you got all this for only $29.50.

Heath had done its homework. Here at last was a rig designed not only for functionality but for form as well - a transmitter that worked well and was nice to look at. Indeed, the AT-1 was a rig with all the features needed to succeed.

While it was advertised and sold primarily as a transmitter for the novice, Heath knew better than to limit at AT-1's appeal. The AT-1's non-novice frequency coverage and VFO/modulator provisions made it attractive to the higher class license holder, while giving the novice a clear "upgrade path."

A CLOSER LOOK

Like all of Heath's other products, the AT-1 was offered only in kit form. (Assembled versions of Heath's products wouldn't show up for another 10 years.) The kit included prewound coils, single-knob band switching, key click filter, AC line filtering, and "profuse shielding". It

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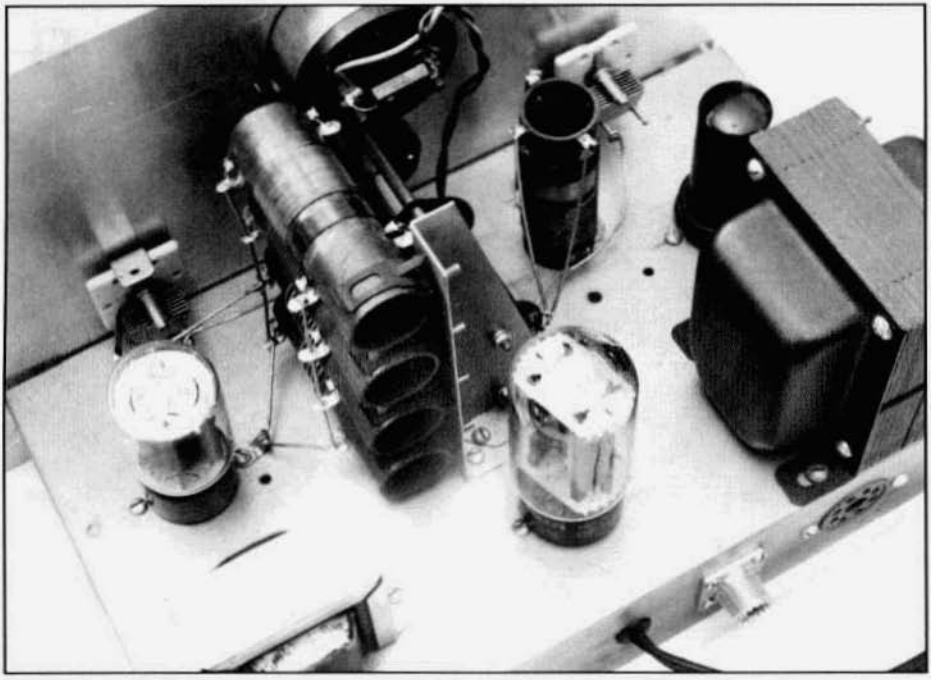


Top-side view of the chassis.

stood 8 1/2 inches high, 13 1/8 inches wide and 7 inches deep. The AT-1 weighed in at about 13 pounds and was built on a copper-plated chassis.

The front panel included driver and output controls, the band switch, plate on/standby switch, meter grid/plate switch, and main power switch. It also included the crystal socket, meter, and key jack. On the rear apron was the power cord, an SO-239 antenna connector, and two octal sockets. One of these supplied power for a VFO and the other was an input for a modulator, though Heath never made one for the AT-1.

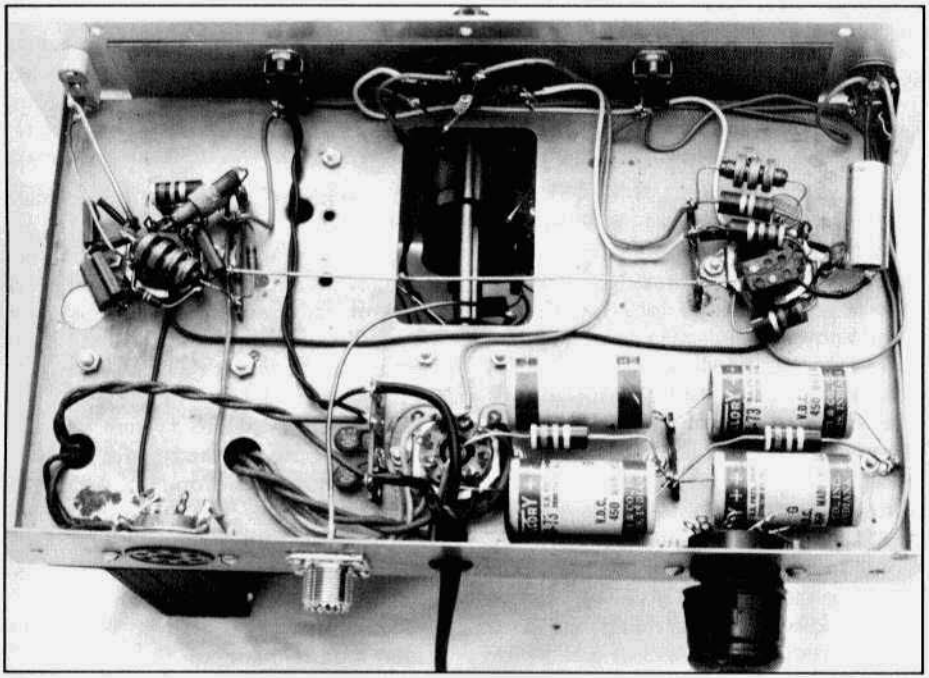
Early ads described the AT-1 as operating on 80, 40, 20, and 10 meters. Later ads added 15 and 11 meters, though the band switch never listed more than the original 4 bands.

The power supply ran around 400 volts at about 100 milliamps, enough to yield about 30 watts of input power (variously advertised as 25, 30, and 35 watts). A wobbly iron vane type panel meter provided PA plate and grid current readings - and made tuning a maddening task.

CIRCUIT DESIGN

Just looking at the AT-1, one is tempted to conclude that it was lifted from an ARRL handbook, but in fact the opposite may have been true. While the basic circuit elements were well-known, the small, simple, band switching transmitters of the AT-1 variety didn't start showing up in the handbooks until 1957, almost five years after the AT-1 hit the market.

Ads for the AT-1 referred to "time-proven circuits" that would "ensure years of trouble-free operation". Indeed, the AT-1's 6AG7 Colpitts oscillator and 6L6 power amplifier circuits were time-proven. Heath used these designs because they had been around for years and they worked well. Heath's engineers saw no need to reinvent the wheel, they needed only to give it a little spin. And spin it they did. To prevent coupling between the oscillator and amplifier coils, Heath



Underside of the chassis from the rear.

ran the oscillator untuned on 80 meters. On other bands, it was run as a tuned-plate amplifier or doubler stage. On the higher bands, the 6L6 ran as a doubler to minimize the possibility of parasitics. Operation on 15 and 11 meters was done on the 10 meter circuit. With a capacitor here, a resistor there, a big rotary switch and a handful of coils, Heath engineers coaxed the transmitter into stable operation over a six-band range. And they did it for under thirty bucks.

Though Heath advertised the AT-1 as its "latest addition to the ham radio field", it was in fact their first serious entry. Prior to the AT-1, Heath had only the IB-1 impedance bridge, and the AR-1 general coverage receiver in their "ham radio" product line - both released in 1950. While the IB-1 probably found its way into a few shacks, it is doubtful that anyone - even a novice - would have considered the AR-1 (or the later AR-2) as the receiver of choice even though the AR-2 was briefly advertised as the "perfect companion" for the AT-1. The AR series receivers were a six-tube superhet design suitable for casual SWLing. They had the selectivity of your great grandmother's earhorn and wouldn't stay put no matter how long they had been warming up. But I digress.

All things considered, the AT-1 was a reliable, affordable, feature-packed transmitter that by the standards of the day and produced a stable signal reasonably free of clicks, chirps, and hum. And what's more, it looked great.

To complement the AT-1, Heath released two companion products: the VF-1 VFO ($19.50), and the AC-1 antenna coupler ($14.50). The VF-1 used a Clapp oscillator (a modified Pierce circuit) built around a 6AU6 stabilized with an OA2. The AC-1 employed an "L" type tuning network with a neon indicator. It used a tapped inductor, an air variable, and a three-section low-pass filter with a 36mhz cutoff. It was designed for end fed random wires.

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Radio of Today and Tomorrow

by David Sarnoff, General Manager, Radio Corporation of America

Reprinted from the New York Sunday Herald, May 14, 1922

Part 2

Wave-Lengths

There are two main points in this process which appear confusing to the lay mind. The first is, how does the ship operator know when he is to be called? The answer is that he does not; he listens; maintains a "watch," during which time it is his duty to be on the alert for signals intended for his ship; hearing his call, he answers, and the message is then forwarded. The second question is: How is interference, confusion of messages, avoided when several stations are working at the same time? This is a matter of tuning and wavelength; that is, the radio waves are of definite length just as the ripples from a stone made on water are of different length measured from peak to peak. Transmitters are adjusted to radiate a specified length of electro-magnetic wave, and the receiving instruments are also made selective, so as to receive as nearly as possible only the desired wavelength. International regulations govern the length of wave on which the various classes of messages are sent. For example, ship to shore traffic is generally conducted on 600 meters; the call for a ship or coastal station is made on that wavelength. If the air is not congested at that moment the message is then transmitted on that wavelength; but if it happens that several ships are working in the vicinity, to avoid interference, the operators, by agreement, shift to a band between 300 meters and 450 meters or a band of wavelengths above 1800 meters, also designated for this class of message traffic.

A great number of messages thus can be transmitted through the air at one time without causing interference or confusion. The generally used wavelength bands run from 200 meters, used by the amateurs, up to 20,000 meters, employed by commercial trans-oceanic stations. Control of the length of the radiated wave came in the early stages of the development of radio communication and this feature obviously has contributed largely to the rapid expansion of the present day system.

Trans-Oceanic Radio

The vastness of this system today is little appreciated by the general public. A score of nations in Europe and Asia are in regular radio telegraph communication with America and millions of words are exchanged in a straight commercial message business operated day and night.

A great network of high-power stations is required to maintain the world-wide system of the Radio Corporation of America; powerful transmitters are located in Massachusetts, Long Island, New Jersey, California and Hawaii. South America, too, will soon be adequately provided for, and already America is conceded the foremost position in the matter of commercial radio communication. The correspondent stations abroad are located in the important communication centers of Europe, Hawaii and in Japan.

In the accomplishment of the reliable trans-ocean service which prevails today, radio telegraphy has made some wonderful strides in technical development. The old time "spark" station has made way for a newer type, transmitting signals carried on a continuous wave, through which speed and accuracy have been increased and interference reduced to a minimum. This great improvement is largely due to the development of the Alexanderson alternator, a radio frequency machine which gives an output of 200 kilowatts, and which is produced by the General Electric Company. More than a dozen of these machines have been installed in American Stations.

Marked increase in the radiating efficiency of these transmitting stations has come, too, through improved design and application of the multiple tuned antenna. And of equal importance is the corresponding development of long-distance reception, whereby messages are now automatically transferred from the receiving station over land wires direct to a single office, located in the heart of New York's financial district, there to be recorded automatically at high speed in ink on paper tape by special recorders and transcribed on message blanks by operators.

By this method, elimination of the human relay at the receiving station has been effected, an obvious saving in time and an aid to accuracy. Of still more recent date is the new method devised by which two or more radio signals may simultaneously be transfered to the central operating office over a single wire, and the concurrent development of devices which make it possible to receive signals from four European stations on one receiving antenna without mutual interference.

Only a few "high spots" have been touched in the foregoing reference to the radio system existing at the present day; it includes, of course a commercial organization represented in principal cities by branch offices, and a messenger service adequate to take care of message traffic - a traffic which has grown within the past two years to something more than twenty per cent of the total business handled by seventeen cables connecting the old world with the new.

Radio Corporation of America

The Radio Corporation of America was formed as the result of an appeal from Government sources calling upon the patriotism and vision of the great electrical industries in the United States to establish an American-owned, operated, and controlled radio communication company, powerful enough to meet the competition of the radio interests of other nations and to develop the new art to the greatest possible service of the American people and the American Government.

The supreme inventive genius of the country, the greatest organizing ability, and the most powerful resources were placed at the service of the new art, with the result that radio has made greater strides in the past two years, than it had in the ten years previously. The Radio Corporation of America now enjoys the benefits of the highly developed manufacturing and research organizations of the General Electric Company, American Telephone & Telegraph Company, Western Electric Company, United Fruit Company, Wireless Specialty Apparatus Company and the Westinghouse Electric & Manufacturing Company together with its subsidiary, the International Radio Telegraph Company.

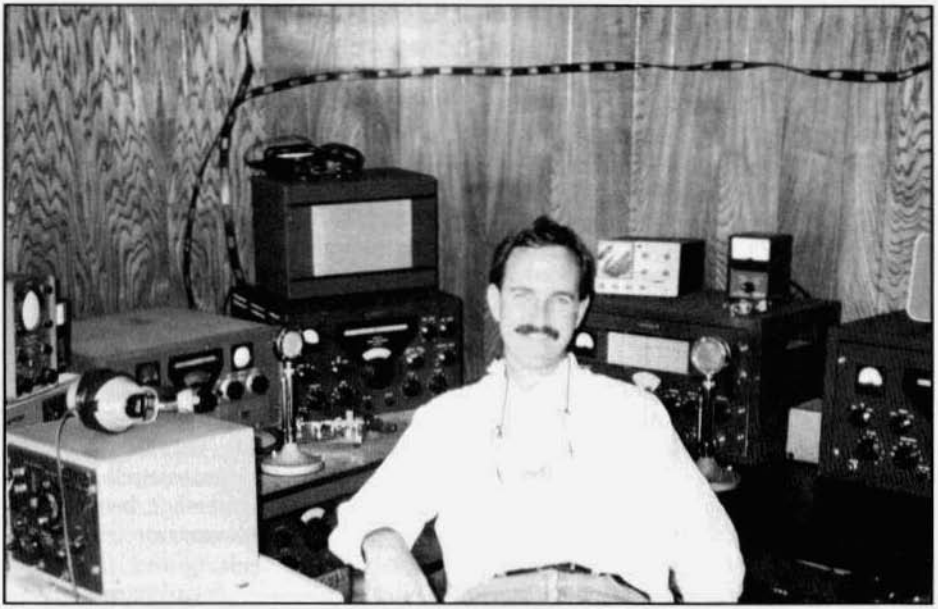
Broadcasting

The greatest feat of radio telegraph broadcasting, was the opening message sent from the Radio Central Station on Long Island, the super-power plant erected by the Radio Corporation of America. The station, the largest plant of its kind in the world, occupies about ten square miles of land, and when completed will cost about $10,000,000. It was built to send messages to a great many countries simultaneously. On November 5th last, it was officially opened to service by President Harding, who by pushing a button in Washington started the apparatus on Long Island and automatically sent out to the whole world a message of greeting from our nation's Chief Executive. That message was received simultaneously in twenty-eight different countries. It was received directly as far as New Zealand and Australia, Japan and in South America. It was a feat of broadcasting, that meant practically an instantaneous encircling of the globe with a single message. It was one of the crowning achievements of modern radio.

Turning to the discussion of the partially developed radio telephone, the basic principles are exactly the same as in

continued on page 32

Bill Shortz, KA9BZM, is shown in his vintage shack. He works for the Indiana State Police, Communications Division.



Jim Wilson, NU6H, at one of his several operating positions. He is a regular with the 3870 west coast AM group.

AM'ers at Flagstaff, July, 1992. Back row, left to right: Clyde, N7IOK; Don, KV7S; Russ, K7RLL; Art, KB7LOQ; Bill, K7VZP; Dana, K7OBB; Gary, WA7WOQ. Front row, left to right: Bob, K7POF; Larry, WØOGH; Dave, W7GZ; Barry, N6CSW/Ø

Al Feder, W1EOX. He has several operating positions, plus a large work area contained in a New England farmhouse that was built in 1840. He says that he's had to add extra supports for his shack in the form of steel columns and beams.

On the Trail of the Valiant Low-Output Problem

by Rob Brownstein, NS6V
3881 Winkle Ave.
Santa Cruz, CA 95065

The two topics of conversation one hears most about Valiants concern the "pinched" quality of the stock audio section and the poor efficiency of the final amplifier section. There are several solutions to the first problem, but the second has proven to be much more elusive.

With my Valiant connected to a 50-ohm dummy load and wattmeter, and properly adjusted, the output measured between 110 and 120 watts at a plate current reading of 450 mA on the panel meter. This was frustrating. At a nominal plate voltage of 600 volts, and a plate current of 450 mA, the input power is approximately 270 watts. At 120 watts output, the efficiency is a paltry 44 percent -- way short of the efficiency one expects from a class C RF amplifier!

Like others I have spoken with, I attacked the obvious first. Adjusting the grid bias to a higher voltage level had little effect. Increasing the grid drive level also had only a slight effect on the output power. I tried different 5763s, different 6146s, checked the values of all the passive components in the final amplifier and pi-network output circuits, even checked the power input line to see if low utility voltage might be at fault. It all proved futile.

Then one day I overheard Pat, WB9GKZ, talking to a W5 on 10 meters AM. They were discussing the Valiant efficiency problem. Pat, it turned out, had done all the same things I had done, and then did something I hadn't done. He verified the panel meter's reading. Or, at least, he tried to verify it.

With a precision milliammeter in the system, Pat compared readings. He found a wide disparity between the calibrated meter and the panel meter. When the panel meter read 450 mA, the calibrated meter read something like 340 mA. Pat went on to create a small chart equating panel meter readings to those measured by the calibrated meter, and pasted it onto his Valiant's front panel. When he adjusted his loading for a real 330 mA on AM, his output power was, of course, significantly higher than when he had relied solely on his panel meter's reading.

Stealing a page from Pat's book, I decided to investigate whether my Valiant's poor showing had the same underlying cause. Was my panel meter giving me erroneous data, too? I put the Valiant on the bench, connected the dummy load and wattmeter, and tuned for a 450 mA reading. Despite my urgings, the wattmeter rested at about 112 watts.

The 0.202 ohm shunt, R58, forms a current divider network with the meter's internal resistance when the meter switch is placed in the plate position. If the meter's readings are too high, that means the shunt's value is too high and too much current is being diverted through the meter. Or, perhaps the meter is no longer working properly. I decided to find out which it was, but I lacked a known-good ammeter of sufficient range. Instead, I innovated using the tools I had on hand.

I turned the rig off, made sure the high voltage had been bled off, and unsoldered the terminal-strip-connected end of R58. It looks like a short piece of wire located at the end of the 7-lug terminal strip nearest the 6146 XV5 socket. In the shunt's place, I wired in a 2.0 ohm resistor fashioned by wiring 5, 10 ohm (1/4-watt) resistors in parallel. (I verified the resistors combination's value with a digital

multimeter (DMM) on the 20-ohm range. It read 2.00 ohms!). One end of the resistor combination is soldered to the last lug on the terminal strip; the other end is connected to the ground lug nearby.

With the Valiant's settings unchanged, I turned it on, let it warm up a few minutes, turned on the B+ supply and keyed it. [IMPORTANT – before turning the Valiant on, and keying it, make sure the panel meter switch is NOT in the plate position, or you will severely overload the meter!] I read the voltage drop across the 2.0-ohm resistor with the DMM, and got a reading of 0.72 volts. That meant that the actual current flowing through that shunt was 360 mA (0.72 volts/2 ohms), not 450 mA. Like Pat's Valiant, my Valiant's panel meter was reading too high a value in the plate current mode. Was it also reading too high a value in the grid and modulator switch positions too?

In AM mode, and with the rig properly adjusted, I read the modulator bias current. It was reading 50 mA on the panel meter. Reading the voltage across the 0.404 ohm shunt, R59, I found 0.022 volts, or approximately 55 mA. That was close enough. Similarly, with the panel meter in grid position, and the drive and exciter controls set for a reading of 8 mA on the panel meter, the voltage drop across the 5.1 ohm shunt, R57, read 0.039 volts. This meant the grid current was actually about 7.7 mA. That was also close enough. In essence, the meter seemed to be working properly, and the problem was that shunt R58 had too much resistance.

To get my panel meter to read much closer to the actual plate (and screen) current, I measured the voltage drop across the 2.0 ohm shunt and adjusted the transmitter for a voltage reading of 0.90 volts (e.g. 450 mA x 2 ohms). Then, I turned off the Valiant and bled off the voltage. Next, I removed about 1/2-inch of insulation from the unsoldered end of the shunt, and bent the end back about 1/4 inch. I resoldered it to the lug at the bend, thus shortening the wire's effective length (and resistance) by 1/4 inch. I turned the Valiant back on, waited for it to warm up, keyed it, and read the panel meter. It now read 440 mA, and the wattmeter read 170 watts of output. That was certainly more like it. The moral of the story is don't take panel-meter readings on faith.

If your Valiant seems a bit short on the power end, there's a good chance your plate-current shunt is causing too high a reading, and you are not really fully loaded. Shortening the shunt's effective length will reduce its resistance and bring the panel meter's reading more in line with reality. You can do the job with a known-good ammeter. Simply sample the series current through the shunt and compare that with the panel meter's readings. Or you can do it using the approach I used. You may have to do the unsoldering-bending-resoldering routing a few times until you get a close-enough match between panel meter readings and actual current. But it is sure is nice to know that your Valiant isn't really only 44 percent efficient! Will we Valiant jockeys now run out of things to talk about? Somehow, I doubt it. **ER**

Footnote:

Several people who have done the audio mod that I described in the December issue of ER (#44) have brought to my attention that I inadvertently omitted the grid resistor on the 12AU7. Here's how to correct that omission.

Remove the 200-pF capacitor shunting the audio gain pot. Add a 470K resistor from the 12AU7 grid to ground. Alternative values for the input network are 0.1 pF coupling capacitor, 47K input resistor, 4.7 M grid resistor and 100 pF (grid resistor) bypass capacitor.

LETTERS

Dear ER

AM International was started on 20-meters by Fred Qwynn, W6QS; Bill Dunaway, WB6HTS; Alan Gamman, ZL2UD and Bob Burstall, VK2QR on 23 April, 1967. The initial meeting included Hugh McKee, K6YA; Laszlo Kiss, WB6ILN and Margot Gwynn, XYL of W6QS. The last AMI bulletin was August-September, 1967 due to the death of Secretary Margot Gwynn.

The new AM International might consider the following as a prelude to the by-laws:

1. Our basic aim is to promote national and international goodwill through amateur radio communication with the harmonious cooperation of amateurs using all modes of transmission.

2. AMI is dedicated to bringing about the good fellowship and friendly cooperation enjoyed by all amateurs during the early days of amateur service.

3. AMI is our representative, the unifying body within the AM fraternity, dedicated to bringing about and maintaining the rightful place of AM operation on the amateur bands.

4. To stimulate interest in experimental design and construction of communications equipment ultimately providing a reservoir of technically competent personnel trained to improvise in the event of national emergencies.

5. It is our intention, through the persuasion and cooperation of AM operators, to seek out sections of each phone band to establish regular AM operations in these segments.

Vestal R. Lester, K6HQI

Dear ER

I own one of the largest Collins collections in Europe, but I also have other equipment like Central Electronics and Hammarlund; strictly American made. I would like very much to have a regular AM QSO on a weekly or even daily basis.

AM in Europe is slowing growing up. Most of the AM'ers are English or Russian. I believe I am one of the very few Italian AM stations.

If I could be of some help for your most valuable project, please don't hesitate and let me know what I can do for 'AMI Europe' (Sounds great doesn't it?)

Alberto Sannazzaro, IK1CXJ

Dear ER

Bravo WA3VJB! What a wonderful article in QST magazine. What a coup for AM and vintage operation. Paul is certainly to be congratulated for this fine article. It has been said that if you are trying to create a good impression you want to put your best foot forward. We have really put our best foot forward when we expose AM through the efforts of Paul Courson. Paul is certainly the epitome of what we that have been on the bands for a long time expect to hear from an AM operator. He is a gentleman, a knowledgeable ham, and has a great sounding signal from the Annapolis area.

It might appear that we have finally gone over the top with this recognition by the ARRL and QST magazine. First we are acknowledged to exist by being listed in the considerate operators guide. Then, we have this fine article by Paul touting the virtues of AM and vintage operations. I have always been of the opinion that one reason we AM'ers have such a tough time with interference is that the ARRL did not recognize AM as a legitimate mode and this feeling was merely taken up by some that would deny AM a place on the bands.

Again, congratulations to Paul and also to the ARRL whom I have supported for years with my membership and subscription to QST. It looks as though my loyalty has finally been rewarded.

Andy Howard, WA4KCY

Dear ER

There is an error in the circuit diagram on page 21 of the Jan.,'93 issue: The + terminal of the power supply is shown connected to the (common) ground bus. The + terminal lead should stop about 0.5 inch sooner. If this change is made the B+ will be applied to the proper terminal of the output transformer, the 50 K plate decoupling resistor of V2A and one terminal of the SEND/RECEIVE switch. The way it is drawn, the 22 K filter resistance following the 7 henry choke, or even the 6X5 will likely be destroyed[1] as there is a "crow bar" across the power supply output.

Please don't consider this a "gottcha". Reading the article, looking at the neat construction, and seeing the tubed circuit diagram were just delightful. Made me recall, almost with a pain, the long-ago winding of the coils on a cardboard sleeve of an Eveready D cell using #30 enamelled wire with one end anchored to a doorknob. It was used in a one-tube, battery powered, regenerative set with a 1Q5GT. It was built in part to get a Radio Merit Badge as a Boy Scout when I was 12 years old!

[1] Some manufacturers of the 6X5 apparently allowed so little spacing between the collinear positioned anodes that arcing would occur between them, next to the continuous cathode surface at only moderately over specification currents. There may still be a few that have experienced this malfunction in my junk box (along with the 27's, 6C6's, 30's, 45's, 46's'!).

Jerry O'Halloran, W8EGD

Horst Geipel's response:

Dear ER

This is in response to a letter which was sent to you by Jerry O'Halloran, W8EGD. As this letter contains a correction to a grave error I made when I drew the schematic for the WAØNUH receiver published in the Jan/93 (#45) issue of ER, I hope that you plan to publish it.

It is so easy to overlook a glaring mistake after proofreading. As a technical consultant before my retirement I wrote hundreds of reports and published many articles. It never failed to amaze me how many errors remained undetected by my own repeated proofreading. Yet when I gave my manuscript to someone else for proofreading, they were spotted immediately.

In the case of the error detected by Jerry, all I can say is that my Rapidograph pen obviously went that 1/2-inch farther that I intended it to go. I hope nobody burns up a precious 6X5 because of this error.

Speaking of the 6X5, I had no idea that that tube was so touchy before I received that interesting bit of information from Jerry.

On the other hand, I recently found a tube which seems to be virtually indestructible. It is a 2E26 by an unknown Canadian manufacturer, which I am using in the companion transmitter [an article on that rig will appear in the March issue. Ed.] to my regenerative receiver. In that transmitter, when the key is unplugged the cathode of the final is automatically connected to ground by the switch contact of the key jack. Twice so far (that shows how flaky I'm getting in my old age) I turned the transmitter on to let it warm up and left the room not realizing the key was not plugged in. When I returned the room about 30 minutes later in both cases, the strong odor of baking paint immediately told me what had happened. The transmitter was running without a load that whole time. The plate current meter was pegged, the transmitter cabinet and the power transformer were too hot to touch and the plate of the 2E26 was glowing bright red. Yet in both cases, after I plugged in the key and connected the antenna, the wattmeter showed normal power output! Some tube! As I mentioned earlier, I don't know who the manufacturer is. The only markings on the tube are: 'Canada 2E26.

Horst Geipel, WAØNUH

Radio of Today and Tomorrow from page 25

radio telegraphy. With the radio telephone the voice control of the electro-magnetic wave is substituted for the telegraphic signal control; vacuum tubes replace the old time coil and coherer; but everything else remains the same in principle, except that in telephony, as stated, the wave is modulated or changed in accordance with the vibrations of the human voice, exactly as is the case with ordinary currents for wire telephoning.

Transmission of speech or music has been made possible almost entirely by development of that marvelous device, the vacuum tube. In physical appearance it resembles an ordinary electric light, but inside the glass bulb are three metallic elements, a plate, a filament, and a grid. A single one of these vacuum tubes, of fair size, can deliver as much high frequency power as would run an ordinary fan motor, or about one-sixteenth horse power. There are tubes now being made which generate a power of twenty kilowatts, or nearly thirty horse power.

What are the possibilities of radio telephony when the art will have developed to the approximate perfection of wireless telegraphy? It is difficult to keep one's feet on the ground in contemplating the subject. It staggers the imagination. Think of radio telephony as a means of better understanding between man and man, creed and creed, and even nation and nation.

On a recent Sunday, while I was at home, I listened to a sermon delivered by radio by Dr. Foster of Newark; it was a sermon on religion. His opening remarks, ran somewhat as follows: "I cannot address you as citizens of Newark, because my voice is being heard beyond the limits of the city. I cannot address you as fellow Americans, because my voice is being heard perhaps in Cuba, in Canada, and in Central America. I cannot address you as brethren of my faith, because only a very insignificant part of the great number who are listening to me are of my own faith. And therefore, I must address you as fellow human beings."

He struck a chord which, I am sure, was answered by every intelligent man or woman within the hearing of his voice, regardless of religious affiliation, regardless of nationality.

Consider that the great difference between man and animals is the fact that man can express himself, and that human beings have the ability to make others of their kind understand what they think and what they would like them to know. With the coming of the telegraph, man learned to transfer that power of expression to a telegraph operator, and thence to the wire. With the wire telephone, he found that he could himself send his message to a given point. And now with radio broadcasting he can radiate not only his message but his very personality; and that power is a very wonderful one.

To be concluded next issue.

Editor's Comments from page 1

My hope is that AM International becomes all that we want it to be and that it will endure for years to come. As I mentioned in a previous issue, I see the organization's most important role as a protector of AM; a group that can respond quickly and effectively to any FCC petition that might be threatening to AM.

But there are other roles a good organization could play as well. One would be to educate the rest of the amateur population regarding AM and to change the way AM'ers are perceived by the rest of the ham population. Brochures, slide shows and demonstrations at club meetings and hamfests would be very effective ways to do this.

AMI will have a continued presence in *ER*. I'll always have space for minutes of meetings, financial reports and bulletins to members. In the near future, when directors and executives have been nominated, I'll print the ballots in the magazine. I'm going to give all of my support to AMI. I think this organization is vital to the future of AM. **N6CSW/Ø**

Heath AT-1 from page 23

VARIATIONS

In its four-year production life the basic circuit never changed. There were, however, a number of subtle changes and variations to the AT-1.

The most obvious of these are the knobs. Early units were supplied with black Collins-like knobs while later versions used the "modern" looking gray knobs used by the companion VF-1 VFO and later on the DX series transmitters. This probably revolved around Heath having a stockpile of the black knobs they needed to use up. Why they didn't also use these knobs on the VF-1 VFO is not as easy to explain. All available ad photos show the AT-1 with black knobs.

Another curiosity is the key jack. Early units used a standard 1/4 inch phone jack while later ones were fitted with the single contact microphone jack used later (as the mic connector) on the DX-60 and the Lunch Box series, among others. Since the later DX-20, 35, 40, and 60 all used the 1/4 inch phone jack for the key, about the only explanation for the use of the single contact connector on late model AT-1s is that it was an experiment that didn't work out. As with the knobs, all available advertising photographs show the AT-1 with a 1/4 inch key jack.

The crystal socket also changed over time. Early units used a phenolic socket that stood out from the front panel. Later units used a flush mounted porcelain socket.

Internal parts changed constantly (if not in value then certainly in manufacture) because of the vagaries of the surplus market, from which most parts where acquired. Regardless of the source Heath never sacrificed quality for availability. From the beginning, Heath engineers insisted on, and used, high quality parts. In later years, disputes between Heath's engineers and accountants over what parts to buy would begin to cause problems - but that's material for a future article.

The AT-1 was on the market only four years - in production through 1956. Unfortunately, all the records from Heath's early years have been thrown out so it is impossible to say how many AT-1s were made. To further complicate matters, AT-1s did not have serial numbers. It is likely that the total number sold was only a few thousand. As a rule of thumb, Heath needed an annual volume of around 1000 of any given product to get any kind of return on their investment. We can guess that the AT-1 was successful enough though, since Heath officials gave the go ahead for additional amateur products.

Indeed, the AT-1 set the stage for one of the most remarkable stories in ham radio, and laid the groundwork for what may have been the most extensive amateur radio product line ever offered by a single company - more than 200 kit products, not counting their test equipment.

To be sure, the AT-1 was not a marvel of engineering. It was, however, very much a marvel of insight, creativity, and uncommon common sense - qualities that would become the Heath Company's stock in trade.

I think Heath found these qualities in those boxcars of surplus parts. Heath's engineers had to learn early on to innovate and to find creative solutions to the various design challenges that they faced. In the "lemonade from lemons" school of business, the AT-1 was just the first lesson. Heath was was a quick study and the lessons they learned served them well.

The year was 1951 and for the Heath Company of Benton Harbor, Michigan, the marvels of engineering - and a new chapter in amateur radio - lay just around the corner. **ER**

Editor's Note

Chuck will be contributing other articles on the Heath company, hopefully on a regular basis. He has been collecting Heath equipment and researching the company for several years.

PTT Modification for Viking Rangers from page 18

2) Remove V11 (5R4) and V12 (6AX5), if they are going to be in the way.

3) Remove the three screws that secure the platform to the three standoffs. Swing the platform "over the side" and out of the way.

4) Locate the rear deck of the OPERATE switch, which is SW4B.

5) Remove and discard the black jumper between SW4B-3 and SW4B-5.

6) Do not remove the RED (1-4) lamp lead from SW4B-4, probably a green wire. SW4B-5 is below SW4B-4 and SW4B-3 is directly above SW4B-4.

7) Move the 6.3 VAC (Z) lead from SE4B-5 up to SW4B-3. At this point, the RED lamp will light only when the OPERATE switch is in the CW position.

8) Connect the now empty SW4B-5 to the normally open (NO) contact of the 3rd pole of the 3PDT relay or to the only NO pole of the SPDT (LM-5) relay.

9) Connect the wiper of the above relay to the most convenient source of 6.3 VAC, which may be:

A) SW4B-3 of the OPERATE switch (EF] designates 6.3 VAC as "Z"),

B) 6.3 VAC lug on the terminal strip mounted on the VFO enclosure, or

C) Hot side of the GREEN (1-3) front panel lamp.

The RED (1-4) front panel Transmit lamp will now light when the OPERATE switch is in PHONE and the PTT line is grounded.

It will not light when the final is disabled in the TUNE and STANDBY modes.

It will light when the OPERATE switch is in the CW mode.

This is probably the best that can be achieved without converting the STANDBY mode to a PTT mode, and it appears to be very adequate PTT scheme.

The big negative feature of this PTT modification is that a PTT microphone must be used. No provision has been made to force the Ranger I/II into Transmit other than by grounding the PTT line.

To overcome this shortcoming without drilling an extra switch hole, etc., I installed a 1-megohm pot (with a "pull" switch mounted on the back) in place of the original Audio Gain Control R21.

By just pulling "out" the Audio Gain knob, the RED light comes ON indicating that the Ranger is in Transmit. You may find this to be a more convenient way of keying the PTT line with some broadcast-type microphones. **ER**

ER In Uniform from page 9

I darken the room and place a watch with a sweep second hand just out of camera view on the floor. A 60-watt frosted bulb in a 6" bowl reflector gives the light. I point the light away from the equipment and open the shutter. Then I note the position of the second hand and begin to 'paint' the set with the light, moving it in large arcs around the camera but always keeping it pointed at the subject. This fills in the shadows and gives a minimum of reflections and bright highlights – exactly what you want for documentary photos.

When the time is up, I turn the light away and close the shutter. Typically each photo is shot six or seven times with exposures of 5, 10, 20, and 40 seconds; for close shots I shoot two of the short exposures and for longer ones the long exposures get the extras.

I write the final caption after the photo is taken but before the setup is changed. The exposed film is mailed with the article; the Electric Radio printer picks the best shot of each group.

This method (not my idea; I have heard it from several sources over the years) is almost foolproof; in thirty-some articles we have never had a picture fail to come out. Any camera with an f/16 stop and a time setting which allows manual operation of the shutter will work; at f/16 the quality of the lens does not matter. The camera must not move so you need a solid floor and must not be too vigorous in moving the light. I hit the camera once in a while but the extra exposures take care of that. **ER**

CLASSIFIEDS

Advertising Information

Subscribers receive 1 free - 25 word- ad per month. **Extra words are .15.** Here's how to count the words in your ad: the heading - For Sale, Wanted, etc count as **1 word**. Your name, call, address and telephone number count as **6 words**. Hyphenated words count as **2 words**. **Please count the words in your ad and if you're over 25 words send payment for the extra words.**

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VINTAGE EQUIPMENT ONLY

ER
P.O. Box 57
Hesperus, CO 81326 **Phone/FAX 303-247-4935**

DEADLINE FOR THE MARCH ISSUE: MARCH 3

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

FOR SALE: KA2VUE estate: NC-300 rcvr, w/ matching spkr, xtal calibrator, VHF converters, manual, good cond. - $250; Knightkit T-60 AM/CW xmtr, w/manual, VG cond. - $30; Heath Sixer, VG cond. - $25. Howard Weinstein, K3HW, 15 Lakeside Dr., Marlton, NJ 08053-2704. (908) 271-6484 (d), (609) 596-3304 (n)

FOR SALE: Johnson Viking 500, on the air - $600 (PU only); Collins R-388/51J-3, rack mounted - $200; Heath Apache - $80 (PU only); Hallicrafters Skyrider 5-10, no cabinet - $20; TCE (CAY-47153) "range E" tuning unit; BC-610 6.35 - 10.8 MHz tuning unit. **WANTED:** Lafayette HE-10 (KT-200) rcvr. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (708) 852-4704

FOR SALE: Knight RF gen. - $35; (2) boxed Eimac 3XC100A5's - $35 each. **WANTED:** E.F. Johnson power reducer. Bernie Doermann, WA6HDY, 300 James Way, Arroyo Grande, CA 93420. (805) 481-6558

FOR SALE: Collins S-Line aluminum knob inlays: small (exciter/PA tuning) - $1; 30L-1 - $2; spinner/plain (main tuning) - $3. Charlie, K3ICH, 13192 Pinnacle Lane, Leesburg, VA 22075. (703) 822-5643

WANTED: Top and bottom covers and original cabinet for R-390A; data on Cetron UXCVII triodes; manual for HP 606B. Clark Hatch, WØBT, 2546 SE Peck Rd., Topeka, KS 66605. (913) 235-2721

FOR SALE: New list of 1000's of tubes! Includes new, used, antique, collectible, Majestic and Western Electric types. Send SASE to Jim Cross, 2817 Parklawn Dr., Dayton, OH 45440-1538. (513) 298-5827

FOR SALE: Custom made vinyl covers to keep the dust out of your priceless vintage gear; Collins 75S-3B & 32S-3, both exc.; CE 200V, exc., no dirt - $350; Ham IV rotor, used 1 yr. - $150. Donald, (317) 788-4337

WANTED: Early Globe Champ, rack mounted, 150-175-watt model, circa 1949-50; also a Knight T-150 xmtr. Bill Smitherman, KD4AF, Rt 4, Box 79, East Bend, NC 27018. (919) 699-8699

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

FOR SALE: Collins 515-1 RE, w/rackmount & manual, 73XX serial - $975; Amphenol 9-pin 'octal' type plugs, male & female, cable or chassis mount (fits E.F. Johnson equip.) - 10 for $15; RCA "Ham Tips" 1946-1950, 11 issues - $20; Heath HO-10 monitor scope, mint, w/manual - $60; Heath HO-13 panadaptor, mint, w/manual - $60. All plus shpg. Ron, KC6WTC, POB 783, Santa Rosa, CA 95402. (707) 539-8319 noon - 9 PM Pacific time

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

FOR SALE: (2) BC-696's - BO. **WANTED:** National Select-O-Ject and NFM-83; Sylvania 6JB6's. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459

WANTED: Hi-Fi audio amp, about 10 watts; 8 ohm to 15k ohm, 10 + watts, Hi-Fi output xfmr. Tom Mackie, WB2ILA, 807A Bristol Ferry Rd., Portsmouth, RI 02871. (401) 683-9504.

FOR SALE: Several ARRL Handbooks, plus old radio books - LSASE for list, Hallicrafters S-38abcde's - $55 includes sckmt, shpg; parting BC-610, B&W 5100 & SSB, S-40, S-38's and NC-33. **WANTED:** ARRL Handbooks: 1st, 5th, 16th editions. Bob Schafer, WA7IHN, POB 442, Aumsville, OR 97325. (503) 749-1149

FOR SALE: Lafayette radio operating and service manuals, schematics etc. If I don't have it,they never printed it. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

FOR SALE: Rackmount SX-28A, w/manual, working cond. - $125 plus shpg or PU. Bud Santoro, 3715 Bower Rd., Roanoke, VA 24018. (703) 774-9153

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

WANTED: Good cond. Collins 516F-1 (pay $100-$150); 516F-2 (pay $100-$120); SM-3 mic (up to $150) and 515-1. Mimi, 2212 Rockefeller Ln., Redondo Beach, CA 90278. (310) 379-6052 or FAX 379-5543

FOR SALE: Johnson Viking II - $200; Hallicrafters SX-42 - $175; SP44 panadaptor - $125; SX-28A - $200; Clegg Zeus 185 watt 2/6 xmtr, w/pwr sply - $250; HQ-129X - $165; Empire NF105 14 kHz - 1 GHz plug-ins, w/manuals - $285; BK 1076 analyzer - $40; older test equipment, HP, Tektronix, manuals-SASE. Can ship some of above UPS, others cash pickup. S.T. Carter II, W4NHC, POB 033177, Indialantic, FL 32903-0177. (407) 727-3015

WANTED: Electro-Voice model 419 desk stand for model 664 microphone. Jerry Brouwer, AB8U, 3041 Rising Springs Ct., Bellbrook, OH 45305.

FOR SALE: R-390A service, module repair to complete remanufacture, cosmetic restoration, 20 years experience, expert service, 1 week turnaround, very reasonable, any cond. accepted. Rick Mish, (419) 726-2249

FOR SALE or TRADE: Collins 351D-2 mobile mount & 351E mounting plates - $35. **WANTED:** Johnson Viking KW Matchbox, mint. Al Sturko, RR 1, S7A C13, Peachland, BC V0H 1X0, Canada. (604) 767-6447

WANTED: Chicago CMS-2 mod. xfmr and pair of U.S. built 810s; restoring a KW-1. Jerry, W8EGD, 7065 South Gray Ct., Littleton, CO 80123. (303) 979-2323

WANTED: Collins 32V-3. Paul Berkowitz, N3HUL, 3715 Woodley Rd., NW, Washington, DC 20016. (202) 226-7536 (d), 363-8593 (n)

FOR SALE: TRF Tunaverter, a converter that converts a standard car radio to cover the 3.8-4 MHz phone band for AM, CW and SSB reception, solid-state, new - $20 ppd. Bill Riley, 863 W. 38th Ave., Eugene, OR 97405

WANTED: Schematic for DX-150A rcvr. J.L. McDonald, W6SDM, 24 Glenbrook, Camarillo, CA 93010. (805) 484-1307

WANTED: SX-62A aluminum front dial cover; 7" TV, working; SX-133. Steve Sauer, WA9ASZ, R3, Box 413, Bloomfield, IN 47424. (812) 863-2088 eves. after 7 PM EST

FOR SALE: Galaxy V, w/pwr sply; Eico 753, w/pwr sply; crystal deck with 5 CB xtals for Collins S-line. Joel Levine, WB2BMH, 67 Derby Ave., Greenlawn, NY 11740. (516) 757-7641

WANTED: Dial scale for Hallicrafters SX-62, part no. 22D215. Doug Burskey, 732 Pulver-List Rd., Mansfield, OH 44905. (419) 522-5669

FOR SALE: Hallicrafters SX-18, w/spkr - $125; Hallicrafters S-10 - $75. Buyer pays shpg and handling. James H. Barrows, W7BCT, 15121 41st Ave., S.E., Bothell, WA 98012. (206) 337-4880

FOR SALE: Battery radio, 1920's, wood and bakelite tabletop; USN flameproof keys, NOS, 1955 package. $1 + SASE list of telegraph, etc. J.H. Jacobs, 60 Seaview Terrace, Northport, NY 11768

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

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

FOR SALE: 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: Information on commercially built and kit transmitters 1930-1980 for new book along lines of "Communications Receivers". Ideas and comments welcome. Ray Moore, c/o RSM Communications, POB 1046, Key Largo, FL 33037-1046. (305) 853-0184

FOR SALE: Fair cond. NC-100XA (RAO 2), circa 1945 - $75; Drake R4, exc. cond. - $135; TCS II, w/matching AC sply - $125. Cliff Fleury, AI7Y, 64174 Tumalo Rim Dr., Bend, OR 97701. (503) 382-9162

WANTED: HQ-100 rcvr. Jerry Boles, N5KYE, 14857 Redbud Ln., Piedmont, OK 73078. (405) 373-2228

FOR SALE: Collins filters - F-455-FA-21 and F-455-FC-60 - $50 each. Evan Haydon, 4308 N.15, Lincoln, NE 68521. (402) 435-4083

WANTED: Info/manual for field intensity meter 101C, manufactured by Federal Telephone and Radio Corp. Newark, NJ, copy OK. John Hollowell, General Delivery, Port Republic, MD 20676. (410) 586-0545

WANTED: Copies of manuals for Precision model 960 transistor/diode tester and Lafayette KT-208 sig. gen. Don Hudson, KA1TZR, 97 Southwood Dr., New Canaan, CT 06840. (203) 966-2859

WANTED: Very early Hallicrafters and Hallicrafters/Silver Marshall equipment including Skyriders with entire front panel dull aluminum color, S-30 radio compass, S-33 Skytrainer, S-35 panadaptor, wood console speakers - R-8 & R-12, HT-2, HT-3, BC-939 antenna tuner, parts, advertising signs, paper memorabilia of Hallicrafters. Also want RCA model AVR-11 airport tower receiver. Chuck Dachis, WD5EOC, "The Hallicrafters Collector", 4500 Russell Dr., Austin, TX 78745. (512) 443-5027

FOR SALE: URM-25F sig. gen., w/acc. - $70; National RBL-5 - $80; used 4-400A - $20. **WANTED:** RBB rcvr; MN-28 control box for MN-26 radio compass; manual for RBA; knobs for R-274 (SX-71); R-388A rcvr. Tom Brent, Box 1552, Sumas, WA 98295. (604) 826-4051

FOR SALE: New list of over 400 vintage radios and accessories; also list of 500 vintage manuals available. SASE please. Mike Horvat, KA7ASF, 112 E. Burnett St., Stayton, OR 97383.

FOR SALE: Eico 720 - $65; DX-35 - $75; HC-10B - $45; new Eimac 4CX-300's & 4E27's - $50 & $40 a pair. Don Winfield, K5DUT, 6080 Anahuac Ave., Fort Worth, TX 76114. (817) 732-3976

WANTED: Converted ART-13 xmtr and SX-88. Both must be in mint/exc. condition. Tom, WB2IIS, 5913 Main St., Williamsville, NY 14221. (716) 634-2545 (d)

FOR SALE: NIB 1942 Coast Guard 30-40 Mc FM xmtr and rcvr, w/control head, mic, spkr and handset - BO by 1 March, '93. **WANTED:** 4X250B tubes; P102 15 contact connector and DC antenna relay from KWS-1; Collins 75A-3, 32V-3. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

FOR SALE or TRADE: DX-60; HT-37; SX-101A; SX-71; SB-104A; HP-1144; SB-644A; SB-630; HFT-9A; NC-60; CRX-3. Ray, (314) 428-1963

FOR SALE: Viking II, w/122 VFO - $100. Bud Gross, WØBYG, 11040 70th St., So., Cottage Grove, MN 55016. (612) 459-3233

Western Heritage Museum Omaha, Nebraska
"a magnificent home for your equipment"

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

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

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

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

FOR SALE: Heath Nostalgia - 124 page paperback covers Heath history in pictures and stories. $9.95 postpaid (plus tax in WA). Heath Nostalgia, 4320 - 196th SW., Suite B-111, Lynnwood, WA 98036.

FOR SALE or TRADE: Navy shipboard xmtr AN/SRT-14, 0.3 to 26 Mcs, AM and CW, 4-400A in final, 120-V AC pwr sply, w/manuals, many spares and accessories. PU only. Ted Bracco, Quincy College, 1800 College Ave., Quincy, IL 62301. (217) 228-5213

WANTED: Ceramic plate caps, homebrew rack mounted AM xmtr; Uniden Tempo 2020; NC-183DTS; broadcast mics; Globe King, vfo for Ameco TX-62; junk box parts; Drake model 4-NB; Harvey UHX-10 xmtr; 1.5 KW ant. tuner, w/SWR bridge. Will swap a Millen Type 90061, serial number D002, Grid Dip, w/full set of coils for tuner. Please, local only. Donald R. Boland, 28 Faulkner St., Malden, MA 02148. (617) 324-5362

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: Non working Collins equipment !!! Also other makes. Write with model and make. Dan Rupe, W7HBF, 1302 S. Uplands Dr., Camano, WA 98292

WANTED: B&W 100-W 160BVL coil and 3-inch round 300 mA DC meter. V. Gildersleeve, K5CF, 206 Michelle Dr., Poteau, OK 74953. (918) 647-9044

WANTED: Espionage equipment. Historian purchases spy radios, code and cipher machines and any equipment, devises or manuals pertaining to the world's intelligence organizations. Keith Melton, Box 5755, Bossier City, LA 71171. (318) 747-9616

FOR SALE: TRC-136 Collins 1 KW HF radio set in walk-in shelter. Late '60's vintage autotune URG-1 series equipment. Uses 60 Hz power, can run full duplex four sideband mode, has telephone and teletype hookups & modems, air conditioner, etc. - $1800 each. Dave, KA6EPI, (408) 984-1929

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.

WANTED: Coil sets A,B,C,D (bandspread) for HRO-5, buy or trade against same coils for HRO-7. HB9AQS, POB 209, CH-3780 Gstaad, Switzerland.

WANTED: Collins 51J-4 rcvr, w/case, spkr and manual. Barry Nadel, Box 29303, San Francisco, CA 94129. (415) 346-3825

WANTED: Clean, unaltered and operational Collins 310-B1; RME-69; RME-99. With manuals. Martin Piepenburg, W9OLD, RR1, Box 56B, Monterey, IN 46960. (219) 542-2591

WANTED: National LF-10 low freq. preselector and TF spkr for HRO-500. Dan Mason, R. Rt 1, Box 204F, Sante Fe, NM 87501. (505) 455-3416

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

FOR SALE: B&W 5100B xmtr in VG cond. - $175; Viking I xmtr in VG cond. - $125; RME Pre-Selector DB-20 and spkr in good cond. - $95 pair; Johnson crystal desk mikes, NIB - $20 each; National NC-2-40D, w/spkr, in VG cond. - $300; SB-620 panoramic display in VG cond. - $50. All with manuals. Clyde Sakir, 4243 E. First St., Tucson, AZ 85711. (602) 323-1120

FOR SALE: Military favorites: R-390As, R-388s, SP-600s, R-1051s, WRR3s and other HF and LF rcvrs, modules and parts available. LSASE for new list. AFS-E, 107 Fayton Ave., Norfolk, VA 23505.

WANTED: 11-meter crystal (29 Mc) for Collins 75A-4. George Hamner, 3659 N. Gleaner Rd., Freeland, MI 48623. (517) 797-2605 (days)

WANTED: I'm still looking for McIntosh tube amplifiers. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803. (414) 545-5237

WANTED: WW II rcvrs RAL and Radiomarine 8510 (R215). W. Britton, 225 S. 17th St., St. Helens, OR 97051.

FOR SALE: Dial calibration is easy with our crystal controlled receiver dial marker. Uses 9V battery or rectified filament voltage. Three WWV referenced outputs provide rock steady signals from broadcast to UHF. Great pocket signal source. $17.95 kit; $24.95 assembled. $4 S&H, Visa/MC. USA/Canada only. $1 brings catalog and coupon. Two Fox Electrix, POB 721, Pawling, NY 12564. (914) 855-1829

FOR SALE: Hallicrafters PM-23 spkr - $60; S20R junker - $20; HRO-60 tuning assembly - $50; new 6146B's - $15; S-line cabinet. G. Stevens, WØATA, POB 704, Longmont, CO 80502-0704. (303) 776-9036

FOR SALE: New Collins parts: 30L-1 blower motors - $35; 51S-1 PTO osc., 70K-7, P/N 522-2918-000 - $200; silver plated 30S-1 tank coils - $7. Dennis Brothers, WAØCBK, HC 84, Box 1, Potter, NE 69156. (308) 879-4552

WANTED: Hallicrafters SR-150 w/120-V pwr sply or pwr sply only; also Shure 51 mic. Terry Knapp, KC7ZD, 1937 Valley Dr., Los Vegas, NV 89108. (702) 647-5729

FOR SALE: Plug in replacements now available for UX 199 tubes - $20 ea. ppd; also for WD-11 tubes. James Fred, R1, Cutler, IN 46920.

FOR SALE: R4A rcvr, exc. cond., w/I.B. and xtra xtals - $175 shpd. Cliff, W3LVC, Elkridge, MD. (410) 796-1070

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: R-390A squelch modication: small external add-on module, super sensitive, works great on AM and SSB, 15 minute installation, instructions included - $25. Rick Mish, (419) 726-2249

FOR SALE: New 1993 catalog now ready. Send $2 for the Add-A-Page, color, plastic protected, illustrated catalog. Laboratory and Hobby test equipment, tubes, plug-in coil forms, reprint books and literature. Antique Radio Labs., R 1, Cutler, IN 46920.

WANTED: Schematic and/or manual for Hallicrafters S-40-B. Copy OK. B. Lee Cornwell, KD3KD, HCR #1, Box 95, Mt. Pocono, PA 18344. (717) 839-2710

FOR SALE: Parting out Viking I, II and Ranger I; manuals for vintage equipment - see our ad this issue. Gary, W7FC, (918) 333-7893

FOR SALE: Heathkit SB-500 140-W, 2-meter transverter - $155; SB-10 SSB adapter - $45; Drake AC4 - $60. **WANTED:** GPR-90 cabinet and spkr. Bill, KE7KK, 6712 Lake Dr., Grand Forks, ND 58201. (701) 772-6531

WANTED: Manuals for Hunter Bandit 2000B and station control, Heathkit Warrior HA-10, Collins 51J-3. Originals preferred, copies OK. Jerry Kethcart, WB9YMT, 16620 Robinhood Dr., Orlando Park, IL 60462. (708) 532-9245

FOR SALE: PPS-4 radar set, complete but rusty - $300. **WANTED:** Pre-war clear glass CRTs; WW II ATK, AXT, ATD television equip. Allan Weiner, 14 Prospect Dr., Yonkers, NY 10705. (914) 423-6638

FOR SALE: Transmitting/Receiving tubes, new and used. LSASE for list. I also collect old and unique tubes of any type. Looking for Taylor and Heintz-Kaufman types and large tubes and sockets from the old Eimac line; 250T through 2000T for display. Maybe you have something to trade? John H. Walker Jr., 16112 W. 125th St., Olathe, KS 66062. (913) 782-6455

FOR SALE: Hammarlund HQ-170, w/clock, manual and factory IF noise blanker ("noise silencer"), exc. - $95. Bill Gode, KB9IY, 1540 Kaywood Ln., Glenview, IL 60025. (708) 998-0974

FOR SALE: WW II radio sets: vehicle, aircraft, ground - catalog $2 or stamps. Sam Hevener, W8KBF, "The Signal Corps", 3583 Everett Rd., Richfield, OH 44286-9723. (216) 659-3244

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: Hallicrafters SX-122A revr; National LF-10 preselector/HCU xtal calibrator; old radio/electronic books. Alan Johnson, N4LUS, 6001 Goldsboro Rd., Bethesda, MD 20817. (301) 229-7069 before 10PM Eastern

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FOR SALE: Collins 'meatball' logo replica in the form of a lapel pin. Stamped metal, baked enamel finish, may be used to replace a missing logo on the S-line, KWM-2, etc. - $5.95 plus $.75 S&H. George Pugsley, 1362 Via Rancho Prky, Escondido, CA 92029.

WANTED: PM-23 spkr or any Hallicrafters spkr from '30's or '40's preferably with the 'H' logo on front grill. Pat Keogh, WB9CKZ, 3767 Fairview Rd., Greenbay, WI 54313. (414) 434-9016

ELECTRIC RADIO PARTS UNIT DIRECTORY

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

WANTED: Machine shop work. Knobs shafts bushings, etc. made to your sample or drawing. Reasonable. Jim Dill, Box 5044, Greeley, CO 80631. (303) 353-8561 evenings.

FOR SALE: 75S3, orig. carton, manual; McMurdo Silver wavemeter - $20; Heath sig. gen. Q-multiplier - $20 each; tubes - 6GJ5 (NCX finals), 866 - $5 each; Turner 454 mike - $15. **FOR TRADE:** 75A-4 spkr for 75A-1 spkr. Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383

FOR SALE: Repair & refurbishment of older tube-type amateur equipment. Fully FCC licensed; 35 years experience. Chuck Banta, N6FX, Claremont, Calif. (LA area) (714) 593-1861

FOR SALE: Military surplus rcvrs, Command sets, test equipment, vintage xmtr parts, misc. radio junque. SASE for list. Geoff Fors, WB6NVH, POB 342, Monterey, CA 93942.

WANTED: SSB adapter for RME-4350 rcvr; the following for parts - Precision EV-20, Howard 490, Drake T4X. Greg Richardson, WA8JPC, POB 405 Gallipolis Ferry, WV 25515.

WANTED: Will buy Collins 6 kHz filter for 75A-4 or prefer to swap an F455FA0B 800 Hz S-line filter. John Peterman, AB9C, 3024 N. 86th St., Milwaukee, WI 53222. (414) 444-1444

FOR SALE: 810 sockets, new - $2.50 each; aluminum plate caps (for 810s, 872s, etc), new - $1 each; 866 bridge filament xfmr, new - $10; all kinds of meters, new and surplus - BO. Joe, (916) 731-8261

WANTED: Copy of schematic & alignment information for Heath AR-1 rcvr. Doug Jorgensen, K9PFA, 601 N. Main, Mt. Pleasant, IA 52641. (319) 385-6330

WANTED: National NC-200 rcvr, state cond. James T. Schliestett, W4UMQ, POB 93, Cedartown, GA 30125. tel/fax (404) 748-5968

FOR SALE: Heath HW20 Pawnee 2-meter AM/CW xcvr, w/manual - $100; HX20 SSB/CW xmtr, w/manual - $75; HP23 pwr sply - $50; DX-60 AM/CW xmtr - $50; Globe Scout 65A AM/CW xmtr - $25; Motorola 6-meter xtal controlled FM xmtr - $20, rcvr - $20. Franklin S.H. Young, KH6CDO, 2816 Poelua St., Honolulu, HI 96822. (808) 988-7474

FOR SALE: RIT for KWM-2 and S-Line. No modifications for KWM-2; 75S- needs one wire - $59.95. SASE for info. John Webb, W1ETC, Box 747, Amherst, NH 03031.

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

FOR SALE: We have a large selection of HV capacitors for tube circuits. FT-243 crystals and other military types. Check out our Mike-Mate mike preamp. Goodies, at prices you'll like. VISA/MC. $1 brings latest catalog and coupon. USA/CANADA only. Steve, NW2F, Two Fox Electrix Co., POB 721, Pawling, NY 12564. (914) 855-1829

FOR SALE: Johnson Viking Adventurer, like new, w/orig. box - $90. **WANTED:** Squires-Sanders FM Alert, tunable VHF monitor rcvr. Gene Peroni, KA6NNR, POB 58003, Philadelphia, PA 19102. (215) 665-6182

WANTED: Orig. manual for RAX rcvr, USM-390, RBZ rcvr and USM-32 scope; schematic for Globe Scout 65A; bottom plates for RAX and ARC-5 rcvrs; tube compartment cover for ARC-5. Mel Stoller, K2AOQ, 100 Stockton Lanes, Rochester, NY 14625. (716) 671-0776

WANTED: S-meter for Hallicrafters SX-42 or information on same. Rick Blank, K1SSL, 2223 Blanco Rd., San Antonio, TX 78212. (210) 733-1211

FOR SALE: Teletype Model 33TU, w/floor stand. 2 availabe for PU in Baltimore/DC area, price negotiable. Steve Fick, N3TE, POB 178, Wash. Grove, MD 20880. (301) 869-1748

WANTED: Tuning knob for ARC-5 rcvr, ARC part # 6748. J.J. DeSousa, Jr., 29 Whiting St., Plymouth, MA 02360. (508) 746-6533

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

FOR SALE: SAMS Photofacts and parts for collectors. Electrolytics, high voltage capacitors, power resistors, plugs, switches and more. Free catalog. A.G. Tannenbaum, WA2BTB, POB 110, East Rockaway, NY 11518. (516) 887-0057, FAX 599-6523

FOR SALE: Military monitoring antennas: broadband V/UHF/U/UHF discones, biconical types, 30 - 1000 Mcs, shipboard construction, 'N' connectors, preamps, antenna multi-couplers, cables and accessories. Rick Mish, (419) 726-2249

WANTED: Home video of your station. Write for details of upcoming promotional tape for broadcast and amateur distribution. Paul Courson, WA3VJB, Box 73, W. Friendship, MD 21794-0073. Many thanks!

FOR SALE: Restoration of vintage radios; 25 years experience. Phil Goodman, K4FXB, 4112 Commodore Dr., Atlanta, GA 30341. (404) 457-4195

FOR SALE: RT-556/APX-46 IFF radar transceiver - $35 ($25 S&H); AN/PDR-27F radiation detector, w/all accessories - $45 ($20 S&H); more, list - $1. Joe Orgnero, VE6RST, Box 32, Site 7, SS 1, Calgary, AB T2M 4N3. Canada (403) 239-0489

WANTED: Information on how to get the Hammarlund HX-50 xmtr working on 160. Marc Chicoine, WC1X, 2121 W. Main Rd., Apt. 809, Portsmouth, RI 02871.

Message: Collect Keys? Subscribe to the Vail Correspondent, your quarterly journal. Informative articles, free ads. USA, $10/yr. Sample $2. TVC, Box 88-E, Maynard, MA 01754.

FOR SALE: Sam Photofacts (76) 1009-2040 - $115; (4) TS183BU battery tester - $25 each; Jennings 10-150 uuF, 23 kV vac. variable - $50; Westinghouse CL2 "tube in tube" - $12; Motorola T1034C FM gen. - $80; ZM14A/PSM2 hand crank megometer - $25; HP 5328A 500 MHz universal counter - $75; Boonton 91CA RF voltmeter - $40; HP 211A square wave gen. - $40; General Radio 1450TB decade attenuator - $45; TSI 361R universal counter - $40; Burroughs duty cycle meter - $15; Fluke Kelvin Varley voltage divider - $50; ESI 240 resistance bridge - $80; AN/USM 341 digital multimeter - $60; HP 500C frequency meter - $45; (4) IMC 4.5-inch 115-V muffin fans - $4.50 each. Plus shpg. **WANTED:** CRL 851 100 pF, 7500-V xmit cap. Bob, (919) 444-1660 after 5PM.

WANTED: Any of following, complete or parts units - R-390, R-392, Heathkit SB-series, Mohawk, SB-500, SB-310, SB-313, single banders, etc. Byron, WA5TIJ, 1920 Maxwell, Alvin, TX 77511. (713) 331-2854

FOR SALE: Thousands of vintage radio parts, catalog #0692, 40 pages - $2. Gary B. Schneider, Play Things Of Past, 9511-23 Sunrise Blvd., North Royalton, OH 44133.

FOR SALE or TRADE: Heath VF-1; OS-8E/U scope, w/case and maual. **WANTED:** Hallicrafter R-44 spkr. R. Chenez, RFD 2, Box 437-J, Plymouth, NH 03264.

WANTED: Military sets. MAY-1; PPN-1; PPN-2; BC-966; British military radios; Bell Laboratories "Record" magazine, 1920's & '30's. Leroy E. Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707.

WANTED: E.H. Scott military RBO, RDO, SLR-12A/B/H. Also need manuals on all Scott military. Thanks! Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062. (713) 260-5842 (w)

FOR SALE: AM station. Viking Valiant, HQ-170AC, S-200, D-104, Dowkey, spare tubes. All exc. and unmodified - $475. No shpg. Dan Radcliffe, KF9BP, 8201 Plainview Pkwy, Sussex, WI 53089 (414) 255-9165

FOR SALE: Collins 75A-4 filters: F455J-60, 6 kHz - $130; F455J-05, 500 Hz - $125; 51J-3 to 51J-4 mech. filter conversion kit (no filter or shafts) - $60; 75A-11 4 kHz mech. filter plug-in adapter - $90; Gross Radio Eagle, 3-tube rcvr (see QST Jan. 1933) - $175. John Hurst, KU6X, 2512 Euclid Crescent East, Upland, CA 91786. (909) 981-6759

WANTED: Top $ for WRL Q-Multiplier, SS-1 (1965). Gary, K3OMI, 11124 Oak Hollow Rd., Knoxville, TN 37932. (615) 690-4217, days M-F

WANTED: Globe 400 or 500; National SW-54; Hallicrafters S-53; RCA AR-88. Pete, WB2BYQ, 75 Church St., Ramsey, NJ 07446. Call collect (201) 818-4311

FOR SALE: Collins R-392 audio modules, NOS, sealed boxes, w/tubes - $25 shpd. Send SASE for Collins equipment and misc. keys books, etc. Bob WB2FOF, 129 Marly Dr., Syracuse, NY 13219. (315) 468-2691

WANTED: Collins 270G-3 or 312A-1 spkr; excutcheon and F-455J-60 filter for 75A-4. David A. Clark, K5PHF, 9225 Lait Dr., El Paso, TX 79925. (915) 591-4184

FOR SALE: Gonset Super 6 - $7; 6N2 converter - $20; Morrow 5BR-1 - $15; Elmac PSR-12 - $14; PSR-6-12 - $18; BC-455B - $17; R-23 - $20; ARC 6-9.1 rcvr - $17; (2) ARC-5 3-7 xmtrs - $10 each; TCA shockmount - $15; SX-11 - $145; KWS-1 - $900, PU only. Parting NC-57 and TCS xmtr. Joe Sloss, K7MKS, (206) 747-5349

WANTED: Collins 32V-2 manual (or copy). Also need Collins 32V-3 xmtr. Fenton Wood, KB5VQ, 109 Shoreline SH, Malakoff, TX 75148. (903) 489-0204

FOR SALE: Racal HF communications rcvr RA117E - $500; matching xmtr drive unit MA79 - $500. Both w/manuals and in VG condition. Original operator and technical manuals for the Collins radio set AN/GRC-19, rcvr R-392, xmtr T-195, complete set - $50. Nigel, KC4TLV, (404) 949-1097 (h), 994-3900 (w)

FOR SALE: (2) BC-610s, w/BC-614 amp - $500; NC-303 - $100; R-174 - $85; SX-100 - $100; DX-60, not wrkg - $50; homebrew 813 xmtr - $100. Michael Nichols, 10010 W. 59th Pl., #4, Arvada, CO 80004. (303) 431-7298

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: Original manuals for BC-348, BC-610, AN/URC11, SCR245. Glantzmann, 22bis avenue gros-malhon, Rennes, 35000, France.

FOR SALE: Geloso G-209 rcvr - $80; (2) 805's, w/sockets - $35; Heathkit HX-11 - $50; Knightkit signal tracer, w/book - $20. U-ship. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, NY 11758. (516) 798-1230

WANTED: Hammarlund HQ-100A, w/clock; HQ-129X tuning knobs; NIB 7027A tubes; SP-600 cabinet; long bolts for Johnson Ranger cabinet. Al Coil, KC9S, 607 Countryside Lane, Hudson, WI 54016. (715) 386-5284

FOR SALE: Hallicrafters HT-18 - $100. **WANTED:** XCU-300 xtal calibrator. F.W. Nicholas, POB 37094, Phoenix, AZ 85069. (602) 864-9987

WANTED: GRC-19; T-195 xmtr, TT-98*/FG teletype, MT-791/U, MT-851/GRC-19, MT-925/GRC-19, MT-856/GRC-19. Philip Lindstrom, 4016 Rochester Rd., Royal Oak, MI 48073. (313) 585-2427

WANTED: Heath HG-10 vfo. Frank Vardeman, N4SUY, 4612 Eddy Dr., Tampa, FL 33603. (813) 871-2134

WANTED: Manuals or schematics for National NTX exciter, Pierson KP81, RME 99, Bretting 9; also need a vfo shield can from a HT-32. John Hurst, KU6X, 2512 Euclid Crescent East, Upland, CA 91786. (909) 981-6759

WANTED: E.H. Scott Special communications rcvr in any condition; any rcvr manufactured by E.H. Scott, McMurdo Silver, Lincoln, Leutz, Norden Hauck, Mathews, Breting, Patterson, Pierson-Delane, Sargent, Tobe and other lesser known manufacturers. Also looking for all the various radio trade magazines, radio catalogs and literature of the 1920's and '30's- "Radio Retailing", "Radio News", "The McMurdo Silver Times", "The Scott News", etc. Michael Feldt, 12035 Somerset Way E., Carmel, IN 46033. (317) 844-0635

FOR SALE: Yaesu xcvr FT-DX570 (1972) SSB/CW, w/mic and Landliner phone patch - $250 shpd. Clem, W8VO, (313) 795-4670

FOR SALE: Collins KWM-2A - $499; 312-B4 station control - $99. Also have Collins parts. Ray, (301) 953-7884, FAX 490-6141

FOR SALE: Nice NC-300 - $150; rare matching 6,2,1-1/4 meter transverters - $110. **WANTED:** Any Collins broadcast equipment literature; Globe King 500; RCA CR-88/91. Gary, KE6MS, (310) 696-0177

FOR SALE: Clegg Zeus VHF AM xmtr - $200 plus shpg. Steve Barnes, K6PFW, 848 N. Silverwood, Upland, CA 91786

FOR SALE: B&W 850. **WANTED:** Carrier level meter for R274/FRR (SX-73) or any 50 ua, 2-1/2-inch round meter; also manual for AN/GRR 26D. Andy Howard, WA4KCY, 105 Sweet Bay Lane, Carrollton, GA30117. (404) 832-0202

WANTED: Dynaco stereo 70 amplifier, pre-amp, tuner; also RCA 10K/13K or any console with magic voice & magic brain. J.L. Myers, 1010 Graybar, Nashville, TN 37204. (615) 297-5886

FOR SALE: Heathkit GR81 regen. AM/SW tube rcvr, exc. - $45 OBO. Jim Riff, K9JSC, 81 N. Ela Rd., Barrington, IL 60010. (708) 480-3526

WANTED: Tube type equipment for parts. Will pay $25 for any tube-type CB radio in good condition, working or not. Frank, WA7SPR, (206) 485-9000

WANTED: Metal identification nameplates for TCS xmtr and rcvr. Tim, N6CC, (510) 830-9474

FOR SALE: Thor 6 - $75; Knight T-60 - $30. **WANTED:** I will pay top dollar for a Heathkit Sixer. Kevin Reeves, (214) 946-1606

WANTED: Desperately! Connection sheets for modulation xfmrs: Merit A-4007 and Thordarson 21M65. Ken, WB9OZR, 362 Echo Valley Lane, Kinnelon, NJ 07405. (201) 492-9319 (n), (212) 512-1866 (d), FAX (201) 492-8958

WANTED: Johnson Desk KW, good or better cond. Mike Ferraro, K6ZSR, 743 Lilac Dr., Montecito, CA 93108. (805) 969-5095

AN-08-10-112 Handbook of Maintainance Instruction, Radio Receiver BC-348-J-N-Q (repro); also **TM-11-854** Radio Receiver R-388/URR (Repro). $15 each plus postage.Lee Frank, P.O. Box 60011,Harrisburg, PA 17106-0011

FOR SALE: Eico 720 and 722, VG cond. and operating - $85. U-ship. Gary Elliott, NO6H, 808 Clarice St., Delhi, LA 71232. (318) 878-8032

WANTED: Empty cabinet for SX-28A or will buy junker. Bud Santoro, 3715 Bower Rd., Roanoke, VA 24018. (703) 774-9153

FOR SALE: Late Drake TR-4C, 2-CS pwr sply/spkr; TR-6. Both good, w/manuals - $600 plus shpg. Fred Clinger, WA8KJJ, 417 Beechwood Dr., Galion, OH 44833. (419) 468-6117 after 6 PM

WANTED: My first station (nostalgia calls) - Heath DX-20 and Knight Space Spanner. Also a Hammarlund spkr, any condition. Jack, K4MZW, (404) 920-0440

FOR SALE: Two and Six-meter AM gear, plus a whole bunch of other good stuff. SASE for 3 page list. Tim Walker, N2GIC, 19 Woodside Ave., Westport, CT 06880.

WANTED: Kenwood 599D twins; Zenith 7000 Trans-Oceanic; Hallicrafters SX-100. Excellent condition please. James B. Geer, WB5LXZ, 604 King Dr., Bedford, TX 76022-7124. (817) 268-1985

FOR SALE: Real audio for your R-390A. Send me your audio chassis (no junkers please) and I'll ship you a ready-to-play chassis. If you're not happy (for any reason) return the chassis (within 30 days) for a full refund. Specs will equal or exceed those specified in ER #42 article - $119 shpg prepaid. Allow 30 days for delivery. Bill Kleronomos, KD0HG, DBA Longmont Labs, 224 Main St., POB 1456, Lyons, CO 80540. (303) 823-6438

FOR SALE: TMC GPR-90 rcvr, MS4, BSP6B, TAC-1 ant. tuner; National NBS-1 rcvr, NC-173R rcvr (GR finish), NCX-3 (w/pwr sply), NC-2-40-C rcvr; Gonset G-63 rcvr; Swan 700CX (w/pwr sply); Hallicrafters HT-20; Boonton 260; GR 1931A mod monitor; HP 606A gen.; HP 608D gen.; Hickock 539A tube tester; Elenc 9500 SG (w/counter); Measurements 800 S6, 140 DM, 760 FM. Bruce E. Walther, W9QAH, 3000 McCulloch St., Stevens Point, WI 54481. (715) 344-9099

WANTED: For Hammarlund HQ-145 rcvr - Telechron clock assembly; plug-in xtal calibrator assembly (XC100P); knobs - 1-inch dia. John B. Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

FOR SALE: Western Electric transmitting tubes, 701-A in orig. packaging - 6 available. Fred Linn, 5608 Edgewater Dr., Cedarburg, WI 53012. (414) 377-3280

FOR SALE: Heath HW-12A, w/AC-DC sply - BO. **WANTED:** BC-375 shock mnts; DX-100 manual; high voltage choke and audio driver xfmr for DX-100. Steve Davis, KD2NX, 705 13th Ave., Belmar, NJ 07719. (908) 280-9760

WANTED: Manual or copy for Ameco 6N2 xmtr and vfo; also manual for Gonset Communicator III, 6-M. Jeff Duntemann, KG7JF, 8105 E. Paraiso Dr., Scottsdale, AZ 85255. (602) 483-0192 days

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FOR SALE: R-392 rcvr, w/pwr sply and spkr, exc. - $250; HP 606A, 50 kHz - 60 MHz, lab quality sig. gen., w/manuals, exc. - $250; Stoddart NM-10A/URM-6B R.F.I. rcvr, 10-250 kHz, w/matching, numbered pwr sply, some acc., exc. - $200; HP 100E freq standard, mint - $175; Counters: HP 5327A, 550 MHz, high quality timebase - $150; Systron Donner 6150, 70 MHz, exc. - $49; Oscilloscopes: USM 281A/HP180A - $200; USM281A mainframe only - $100; TEK RM17, 10 MHz, rackmount, exc. great for station monitor - $75; Signal Generators: TS510A/HP608D, 10-420 MHz - $89; URM 25F HF, VG - $89; URM 25J, military reconditioned, exc. - $120. Large weather balloons - $10; AT197GR, 200-400 MHz, discone antenna - $70; roller inductor - $30; R-390A parts - write; Hal DS2000 KSR, w/manual - $60; L.T.V. G175J mainframe, w/S.D.U. parts (no tuners) - $40. U-ship. Joe Bunyard, 1601 Lexington St., Waco, TX 76711-1701. (817) 753-1605

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.

FOR TRADE: M-209 cipher machine, OSS/SOE "Spy" radios, and other espionage devises available for trade. Keith Melton, (318) 747-9616

WANTED: Teletype Model 28 ASR equipped with the dual-headed LCXD tape reader (fixed and climbing head); Operations and Organizational Technical Maintenance manual for CV-1758/URR converter, SSB - for General Radio Use; Operations and Organizational Maintenance Technical manual on Navy model no. TDZ Radio Transmitter; also interested in pwr sply for Westinghouse MW-Z xmtr. George Musgrave, K4MRJ, 5533 Crestview Dr., Hixson, TN 37343. (615) 877-7807

WANTED: ARC-5 xmtr and rcvr, preferably w/pwr sply; FT-243 xtals for ham bands; meter for Knight T-60. Bob Braeger, WA6KER, 6634 Navel Ct., Riverside, CA 92506. (909) 682-5084

FOR SALE: Electronics suite from U.S. aircraft carrier. MF-UHF rcvrs, xmtrs, radars, PPI displays, RTTY cnvters, terminals. Much more. Bob Mantell, W6VQT, 3135 N. Ellington Dr., Los Angeles, CA 90068. (213) 851-2786

FOR SALE: National HRO-50T, narrow band FM, xtal calibrator, coils A-B-C-D-E-F-AA, spkr and manual - $300. Jack Dubbs, (719) 392-2043 after 7PM MST

FOR SALE: BC-1335 & charger; RBM dynamotor sply; TBX vibrator unit; RAX 1.5-9 rcvr (modified); GRR-5 cover; TA-12 mounts; TCS dynamotor sply; GRC/VRC items; manuals; connectors; much misc. Write (include want list). Henry Engstrom, KD6KWH, POB 5846, Santa Rosa, CA 95402.

WANTED: Chicago CMS-2 modulation xfmr and pair of US built 810s; restoring a KW-1. Jerry, W8EGD, 7065 South Gray Ct., Littleton, CO 80123. (303) 979-2323

WANTED: Restoring Patterson all wave/PR-10 and would like to talk to someone familiar with this rcvr. Also need HRO's and I-10, also coils, any cond. John Orahood, 5819 Miller Valley, Houston, TX 77066. (713) 440-5598

FOR SALE: ART-13, BC-348, MN-26 - $100 each; SX-25 - $125; CU-24, CU-26, RU-18, RU-19 - $50 each; ARR-15 for parts - $25. Gary, W8MFL, (612) 698-4851

WANTED: Knight-kit Spanmaster; Johnson 122 VFO; QSL card from WN9HDY (1963-'64). WB9AZA ex WN9HDY, (608) 838-8779

FOR SALE/TRADE/WANTED: Vintage tube CB's - Browning, Tram, Demco, Dak, CPI, Lafayette, Johnson. LSASE for list. Charles Zafonte, N1FRX, RR 1, Box 75, Fort Kent, ME 04743. (207) 834-6273 eves

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WANTED: Documents for Knight 50-watt CW xmtr or matching vfo. Copy and postage fees paid. Jim Dillon, NØKWA/5, Rt 6, Box 303C, New Orleans, LA 70129

FOR TRADE: Will trade (4) HRO-50 coil sets, A,C,D and AD for coils E and F (broadcast band). Jim Cross, 2817 Parklawn Dr., Dayton, OH 45440-1538. (513) 298-5827

WANTED: Coil pack and turret assem. for 6010 Radcom/Westrex radio rcvr. Can anyone help? Edward J. White, WA3BZT, 809 Seymour Rd., Bear, DE 19701-1121. (302) 322-1313

WANTED: Need manual (copy OK) for B&W 51SB SSB generator for 5100 xmtr. Gary Reiss, WAØJRM, Rt 1, Box 141, Wilcox, NE 68982. (308) 263-3231

FOR TRADE: I have (2) Collins CW filters for 75A-4. Looking for nice HQ-150 or 160 rcvrs. Jerry Boles, N5KYE, (405) 373-2228

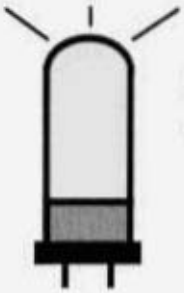
FOR SALE: Hallicrafters S-76 - $125; SX-100 - $135; SX-43, R-44 - $100; SX-71 - $100; Hammarlund HQ-160 - $150. KØOCC, Atlanta, (404) 396-1312

WANTED: Tube audio amplifiers, Western Electric, RCA, Heathkit, Fisher, etc., any cond., literature, parts. Need: WEKS-19602, Heath W-5M. Mike Nowlen, WB4UKB, 12911 New Parkland Dr., Herndon, VA 22071. (703) 481-9614

FOR SALE or TRADE: RME 4350, w/spkr & manual; RME HF 152 10/15/20 converter; Johnson Viking Matchbox. **WANTED:** TBS-50 & VFO; Drake B or C-Line. Gene, W7MXM, 508 S. B500 E, Idaho Falls, ID 83406. (208) 522-5854

FOR SALE: 51J-4 filters - used 3.1 - $75; unused 6.0 - $100 shpd. **WANTED:** Collins F455FD29 526-9693-010. Dallas Lankford, 903 Sherwood Dr., Ruston, LA 71270-2157. (318) 251-2716

WANTED: In any cond. - plug-in coils for National ACS or FB7; also want National SW-3. Thanks. Dale Knotts, WB8RZQ, (216) 644-1661 after 6PM EST



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TO: