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ELECTRIC RADIO

celebrating a bygone era

Number 86 June 1996

Mike Shaw, K2LRE

ELECTRIC RADIO

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

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

Regular contributors include:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; John Staples, W6BM; Dave Ishmael, WA6VVL; Jim Hanlon, W8KGI; Chuck Penson, WA7ZZE; Jim Musgrove, K5BZH; Dennis Petrich, KØEOO; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Rob Brownstein, NS6V; Dick Houston, WØPK; Andy Howard, WA4KCY; Skip Green, K7YOO; Albert Roehm, W2OBJ; Steve Thomason, WB4IJN; Don Meadows, N6DM; Bob Sitterley, K7POF (photos) and others.

EDITOR'S COMMENTS

For some time I've been trying to drum up AM activity on 20 meters. Since Les, K6HQI - the founder and mainstay of the 20-meter AM net - became a silent key, 20 meter activity has fallen off drastically. Andy, WA4KCY, sent me the following e-mail recently. I hope it provides encouragement to all AM'ers to get on 20. N6CSW

Subject: Contacts on 20 meter AM
Date: 03 Jun 96 21:37:18 EDT
From: Andy Howard WA4KCY <102452.362@CompuServe.COM>
To: Electric Radio N6CSW+ <er@frontier.net>
Hi Barry:

Made a couple of solid AM contacts on 20 meters this afternoon about 5:30 EDT. Called CQ on 14.286 and a fellow in Kansas (Jim, KDØSY) came back to me on a Yaesu that sounded very good. When the QSO ended with him a station called me from Dallas (John, W5ETK) that was running an Elmac AF-67. He had a remarkable signal considering the power (about 30 watts).

I think that if we can set up an earlier time for everyone to look for 20 meter activity it will become active again. Both of these stations knew that 14.286 was the AM calling frequency although neither was an AM-er.

The first station had never worked AM and the second had not been on AM in two years. It was good to be back on 20 meters. Now if we can get VE4BX on with us it will be somewhat like old times.

Regards,
Andy, WA4KCY, AMI #9

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Cover: Mike Shaw, K2LRE, in his hamshack with some of his vintage equipment.

Amplitude Modulation International - June Update

by President, Dale Gagnon, KW1I

Dayton Hamvention

My brother Dean, KK1K and I rolled in to a rainy Dayton on Thursday evening, May 16, after spending several hours at Fair Radio Sales in Lima, Ohio. We didn't even bother checking out our flea market spot at Hara Arena in the inclement weather. Don, K4KYV arrived at our motel room late Thursday evening.

To our great surprise, Friday turned into a beautiful day and the good weather continued for the rest of the weekend.

AM gear was plentiful and high priced. Many pieces of Collins gear were for sale in the flea market. Prices may be higher at Dayton due to the number of international visitors from countries where American-made vintage equipment is rare and the exchange rate for the dollar has been favorable.

As is customary for us, we made a few acquisitions that needed attention back in the motel room in the evening. If we had known that our troubleshooting was going to turn out badly we would have never asked for a nonsmoking room. Our room's maid probably wonders what we were smoking, having not smelled the sweet combination of rosin core solder, fried resistors and outgassing capacitors before!

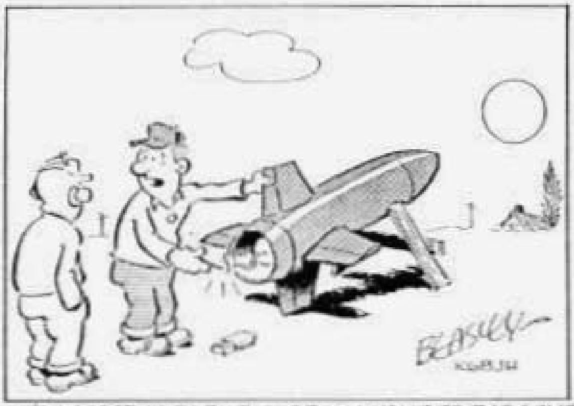
The Saturday AM Forum was in jeopardy just a week or so earlier. One of our presenters could not attend because of an illness in the family. Tim Smith, WA1HLR, graciously agreed to fill in.

The Forum was packed again with over 100 attending. A fairly good number of attendees had gathered in the meeting room 20 or so minutes before the Forum began. John, W6BM, visiting all the way from Berkeley, California, brought transparencies of his Collins broadcast transmitter and operating position and these were sequenced on the overhead projector while video from the 1994 and 1995 Gaithersburg hamfests played on monitors to the right and to the left of the center screen. At 12:15 PM I welcomed the audience and began with a quick update of AM International.

Next, Tim presented slides and story on the installation of a 50KW AM shortwave station at WJCR. This was very enjoyable because most of us had never seen radio components that large before. Tim explained the factory equipment modifications and the transmitter installation issues in the same manner that he would describe Ranger mods, even though the weight and power comparisons were separated by three orders of magnitude! Tim also had some pictures of his modification of Tom, WB2IIS's, Collins broadcast transmitter that was installed at Tom's Buffalo QTH in the last year.

Next on the program, Verne Jackson, WAØRCR, gave us the latest on his 160 Meter Gateway Net and Bulletin Service. The slides of his operating positions, his equipment, his antenna and his volunteer staff make WAØRCR look more like a professional operation than amateur. Verne is committed to using AM on these bulletins. He invited AM operators within his substantial "center of the country" coverage area to submit information on AM happenings for broadcast on the bulletin service and to check into the 1860 kHz Gateway Net.

I presented slides covering the acquisition and restoration of my Collins TDO. I also had taken pictures on a recent trip to the Baltimore area and



IT'S LOADED WITH BUCKSHOT --- I WANT TO PUT SOME SPOTS ON OL' SOL SO I CAN WORK DX ON 15 AGAIN

showed a great photo of Dennis, WA3YXN and his SRT-14 and Norm, N3RZU and his radio active Hum Vee (sp?).

The meeting ended with directions to the pizza party later that evening. About 30 showed up for several hours of visiting and picture swapping.

Unfortunately, Saturday was also the Armed Forces Day operating event. I was on the air for a brief period from the rear of my van with a URC-35 and actually talked to several stations of military significance, the most notable being a submarine in Baltimore harbor.

Sunday was another great day and we departed the flea market midday for the return trip to New England. We kept in 75 meter phone contact with my son Philip, N1HHG, in New Hampshire and with Dennis, WA3YXN/mobile, on his trip back to Baltimore. Dennis signed off at midnight having just arrived. We reached Vermont at 5 AM Monday and New Hampshire at 7:30 AM in time to see the kids off to school and get ready for work!

The Hamvention weekend was terrific fun. Start thinking about 1997.

WRC-99

Tony Stalls, K4KYO has forwarded AMI Headquarters a number of documents covering preparations for the 1999 World Radio communication Conference (WRC-99). The Future of the Amateur Service Committee (FASC) of the International Amateur Radio Union (IARU) has released a 20 page discussion paper this last April (available on the World Wide Web http://www.arrl.org/iaru/). Interested parties are invited to read the document and to send comments by the end of June.

One of the issues for which opinion is being sought is on the retention of testing for Morse code ability for certain amateur licenses as a treaty obligation.

We should all be familiar with the logic contained in Don Chester, K4KYV's August 1994 AM Press Exchange article. Briefly stated, a no-code HF license would likely produce an unprecedented influx of amateurs into the HF bands. Even in the absence of conflict with AM operators it would only be a matter of time before AM bandwidth became an issue. As Don stated, "It does not take a genius to figure out that "bandwidth" and "spectrum space" will once again become popular buzzwords as the HF bands become further congested.

Tony has been following the WRC-99 preparations and is especially encouraging amateur radio organizations to respond to the FASC committee. AMI, representing a membership of over 900 amateurs, will be sending in comments this month. ER

To join AMI send $2 to:
AMI
Box 1500
Merrimack, NH 03054

The Collins R-389/URR Receiver

Low Frequency Specialist

Part 2: Electrical Design

by Ray Osterwald, NØDMS
PO Box 582
Pine, CO 80470

Anyone who has seen or worked on an R-389 knows that it is a very complicated piece of equipment. While similar in layout and appearance to the R-390, it is quite different electrically. Although the R-389 is a superheterodyne similar in design to the 51J receiver, it can't really be said that it is conventional. The mixing stage is unique, and the story of its front-end design will be the focus of this part of the article.

Briefly, the electrical layout uses two RF amplifier stages, a double-conversion IF with a fixed crystal oscillator and a variable PTO, and a final IF at 455 kc. A frequency-locked loop is used to cancel drift, and the use of balanced mixers in the loop reduces noise and spurious response to levels that had not previously been possible. The IF, audio, and power supply subchassis are interchangeable with R-390 modules. There are 6 IF amplifier stages. The PTO can be tuned manually, or with a motor drive. This is a real help as the 70H-1 PTO is 50 turns! There are two tuning ranges selectable on the front panel, but actual bandswitching is handled by a switching motor.

The core of the R-389's performance, and the reason it was so difficult to design, is the mixing scheme. The mixers used are actually the fifth design, and the story of the steps involved in getting to the final version is fascinating reading for anyone interested in high-performance receiver history.

Before any serious frequency scheme planning could start, the Collins engineers had to determine the spurious response of various tubes when used as mixers. This turned out to be quite time consuming. They evaluated every available tube at all possible operating levels and compared all of the results. The best compromise formula turned out to be a remote-cutoff triode with balance in the plate output circuit to reject the local oscillator frequency. This produced a low mixer noise figure and reasonably good spurious rejection. For the R-389, a 12AT7 first mixer was chosen. The R-390 got a 6C4, which gave a 60 dB rejection to a fifth order.

Even though the tubes they would use had been determined by experiment, arriving at a final working schematic was a very difficult process involving many months of work. The design was dictated by the specifications, of course, and these strict requirements caused Collins engineers to push the state of the art in mixer design.

The Collins engineering report states: "Before any actual numbers for the signal ranges and injection frequencies could be decided upon, several design points had to be carefully considered. The most important of these were (1) spurious signals, (2) circuit complications, and (3) mechanical problems." The Signal Corps specification called out a maximum spurious level of 80 dB, so that is what they originally designed for. The Corps didn't put limits on mechanical complexity, but Collins knew that reliability and ease of maintenance would be very important to the Army. So, realizing that the mechanical linkages necessary to switch and tune a system that would meet the 80 dB limit would rapidly get out of hand, mechanical simplification was given top priority in all aspects of the planning process. You wouldn't know it to look at the finished receiver, though!

During the early stages of planning, frequency schemes were devised that would allow no spurious response below the 7th order. This is what the Signal Corps wanted, but when the mechanical systems didn't fit within their space limitations, the limit was dropped to 5th order. As anyone who has built high-performance receivers can testify, 5th order spurious response from tube circuitry is still very tough to achieve.

The decision to allow a 5th order spurious limit meant that the Signal Corps also had to give up the 80 dB total spurious specification. Engineering calculated that a 60 dB limit could be reached, and after some negotiation the Signal Corps agreed, and that became the design goal. At the time of the agreement, the engineers at Collins came to realize that there was no standard method to measure spurious response. Accurate spectrum analyzers and computer modeling tools which are taken for granted in 1996 had yet to be invented in 1950. They did have good signal generators and very accurate RF and audio voltmeters, so a procedure was agreed upon which used standard signal levels to measure an audio output response ratio. This method was accepted by the Signal Corps.

Originally, Collins considered only two types of spurious response in their design. The first response was the case of an IF frequency which was higher than the signal frequency, and the design would be such that signal harmonics got directly into the IF. The second spurious gremlin was when the signal, or its harmonics, beat with the injection oscillators, or their harmonics, and directly produced the IF frequency. A mixing scheme was cooked up on paper which held both of these possibilities to 5th order or below, and a breadboard version was built.

Why was the R-389 first IF selected to be 10 Mc and not some other frequency? The most obvious spurious response everyone learns about in radio theory class is when signal harmonics occur directly at the IF frequency. These must be greatly attenuated if you don't want to detect them. Past receiver work at Collins had shown that this response should not be lower than 6th or 7th order, which neatly coincided with the design goals. Simple arithmetic shows that if the highest signal frequency was 1500 kc, 7 X 1500 comes out at 10,500 kc. So, by using a 10 Mc IF, the lowest order harmonic would occur at 1428.6 kc.

Now that the 1st IF was selected, they were able to select the LO injection frequencies. This again is by arithmetic, the first LO being 8.5 to 9.985 Mc, and the second was 10.455 to produce the final 455 kc IF. The use of 455 kc at the second IF was called out in the Signal Corps specification.

Everyone looked good until one of the team members, probably Newmire, found a third and more serious type of spurious response which meant a total physical redesign of the mixers. This third type was an internally generated signal caused by the beating and mixing action of the various oscillators in the receiver. No external input was required to produce them. Once again, there was no standard for measurement of internal spurious levels. The procedure they designed compared the internal spurious level to an equivalent external signal and expressed the result in microvolts. The Collins designers wanted no internally generated spur to be greater than one microvolt, but found it extremely difficult to meet their own goal. Consider for a moment how tough this must have been. The R-389 tunes through its own IF frequency!

One may wonder why the R-389 uses two RF amplifiers, when one should be enough to meet any possible signal-to-noise requirements at VLF, especially when using low-noise triode mixers. The reason is, again, the tough 60 dB spurious level requirement. The mixer research performed earlier found it necessary to limit the maximum RF voltage at the first mixer grid so that the tube would not be

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R-389 from previous page

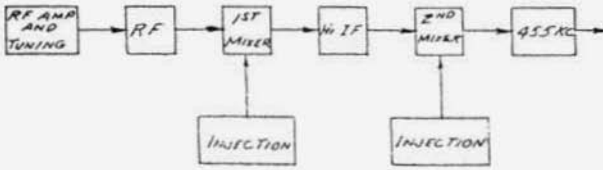

Figure 1

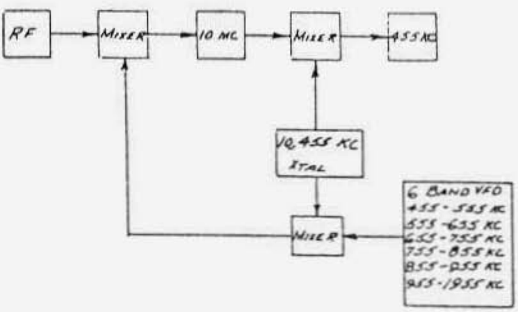

Figure 2

front panel "frequency change" knob.

Finally, all the details were worked out from a numerical standpoint. Now, they had to get some working circuits with performance which would meet the numbers. Although the spurious levels could now be met on paper, the use of oscillator frequencies which were several times higher than the signal frequencies meant that the stability requirements could not be met using current technology. For example, if a VFO were designed to run directly at the first LO of 8.5 to 9.985 Mc, neither the stability or calibration accuracy requirements would be in tolerance. In addition, the second LO, even with the best available crystals and ovens, would have "marginal stability".

driven into distortion on strong signals. So, two AGC-controlled RF stages were used to do the required voltage limiting.

Nothing occurs without affecting something else. The decision to use two RF amplifiers meant the front end became more complicated. Since wide RF passbands were required in the Signal Corps specification, lots of RF selectivity is just what they didn't need. Due to the low frequencies involved and due to specifications, the front end of the R-389 was designed for a passband response. This set the number of RF coils at 4. A double-tuned circuit was used at the second RF amplifier plate because it was necessary to reduce the amplitude of harmonics generated in the tube, which were being directly coupled into the first mixer. The low end of the R-389s tuning range, 15 kc, is in the high audio range! All four of these coils, the antenna coil, the first RF plate, and the second RF grid and plate circuits are ganged and tuned via the

Originally, Collins wanted to uses slide rule dial for the R-389, similar to other current production receivers. The thinking was that 5 band segments of 100 kc each up to 500 kc, and one band for broadcast would be a nice frequency presentation.

Figure 1 is the first mixing design submitted for approval, and was taken from the engineering report. This original circuit had the first LO running from 10 Mc to 8.4 Mc, which meant an RF input range of 0 to 1600 kc. They built a breadboard version and tested it. The low fundamental crystal used in the LO caused so much trouble with spurious response that the design had to be ditched. So, the team went back to the library to research the problem and found some help in the 3rd edition of Reference Data for Radio Engineers. Still desiring to retain the slide-

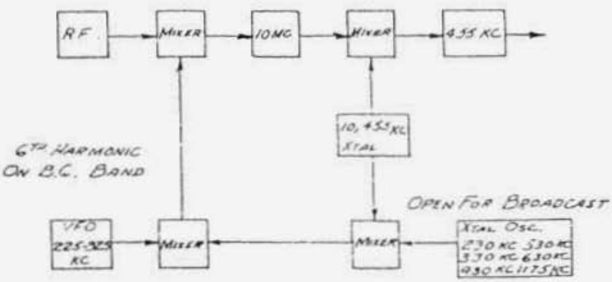

Figure 3

idea was scrapped.

Figure 3 is the third trial circuit design. Not much is mentioned about this particular design. They were still trying to retain the slide-rule dial, but not the 6-band VFO. Instead, this circuit called for two crystal oscillators. The high frequency crystal was still inside the loop, but was mixed with a low-frequency, bandswitched 3-crystal oscillator arrangement. The VFO was outside the loop, but since it was only necessary to run it at 225 to 325 kc, high stability could be maintained. While the report does not say so, I'm assuming this plan was scrapped because it didn't meet the internal spurious specification.

rule dial, the configuration of Figure 2 was tested.

The spurious response requirements meant that the originally determined oscillator injection frequencies could not change by more than a few percent. So, in order to maintain the required overall stability, it was decided to build the mixer chain as a frequency-locked loop. This would also allow the VFO to run nearer the signal frequency, further reducing drift.

Figure 2 shows ring mixer design number one. This setup used a six-band VFO, a crystal oscillator, and a loop mixer. By mixing the crystal frequency with the VFO inside the loop, crystal drift in one direction was cancelled by the mixing action at the other end of the loop, and the effect was constant second IF frequency. The circuit was built on a breadboard, and by using a signal generator for the VFO, many measurements were made. The spurious response results were "very encouraging". A request was presented to the oscillator department for the 6-band VFO system, which would have been necessary if the slide-rule dial were to be retained. The oscillator specialists evaluated the requirements and decided that it could probably be built and would maintain stability, but that it would be bulky. The space for the VFO, by this time, was predetermined. In view of the time required to built this new oscillator, and the space restrictions, the 6-band VFO

The mixing scheme used with the original 6-band oscillator performed so well that they had to retain it, if possible. With reluctance, the slide-rule dial was dropped in favor of a continuous tuning system and a counter dial. (Veeder-Root to the rescue!) This gives an input tuning range of 15 kc to 500 kc in one sweep, and by using the VFO's second harmonic, the broadcast band could be tuned with another sweep. Figure 4 is the outline of the final design.

At long last, Collins had a front end for the R-389 which met all of the specifications. The oscillator department went to work and developed the 70H-1 PTO, with a final tuning range of 469 to 980 kc.

Figure 5 is a detailed block diagram of the final mixing design actually used in production. The first mixer is single-balanced in the plate circuit. This is done to cancel the first LO frequency at the first mixer output, and to preserve the signal-to-noise ratio when tuning below 100 kc. This is necessary because, as the input frequency lowers below 100 kc, the injec-

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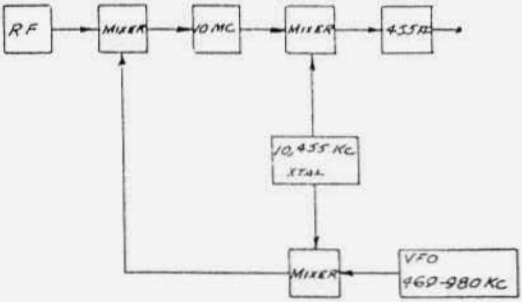


Figure 4

tion frequency approaches the 10 Mc 1st IF. Then, sideband energy from the oscillator then gets into the IF, causing phase noise at the detector.

The design was further refined by making the injection mixer double balanced, using two 6BE6s working into tracking, tuned output stages. This cancels the 10,455 kc LO signal, and is necessary to get rid of a spurious response at 455 kc, if the 10.455 Mc signal reaches the first mixer. The VFO "phase inverter" provides push-pull VFO drive to the 6BE6 mixers.

Balanced high-frequency tube mixers aren't stable no matter how hard one tries. An m-derived low-pass filter, having a cutoff of 50 dB at 10.455 kc, was included in the mixing loop. It further reduces the second LO voltage level into the first mixer. Its impedances are matched by a cathode follower on the input and a grounded-grid amplifier on the output. These are called "couplers".

The 1st mixer "driver" is a 6BH6 pentode, connected as a cathode follower. It provides the low impedance drive required by the cathode-injected 1st mixer.

Now that the front-end design was essentially complete, Collins had produced circuitry and test procedures which hadn't been used in this kind of receiver before, and had significantly advanced performance in several key areas.

Next month, electrical design continues with part three of the R-389 story. **ER**

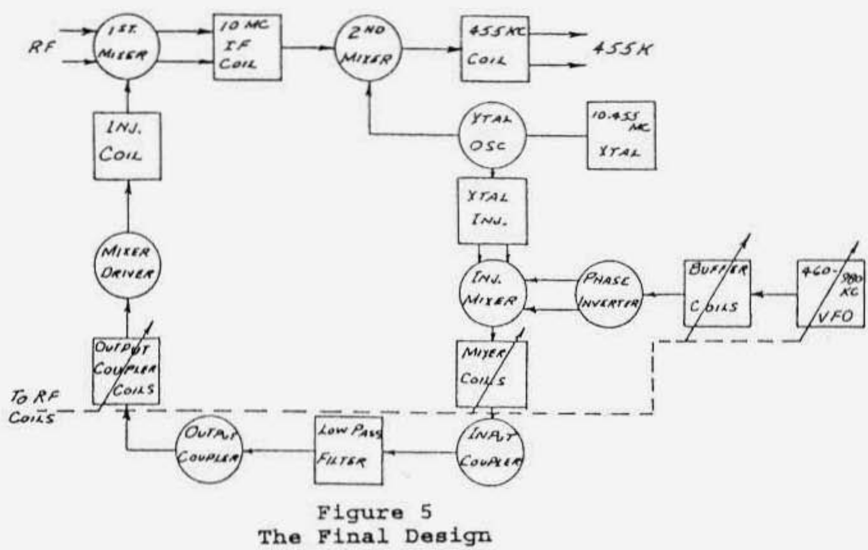


Figure 5
The Final Design

R388 IF Filter And Problems

by Bill Mottes, W1CKI
4 Boldgett Road
Stafford Springs, CT 06076

Chuck Teeter, W4MEW's 500 kc IF filter mod ["A Mechanical Filter for the R-388 and 75A-1", ER #83] is a great idea but I found it did not work as well as I anticipated. With the filter switched in position 1, I found several peaks and nulls as I tuned across a signal and selectivity positions 2 and 3 were ineffective.

The operation of the receiver is returned to normal by switching the filter out of circuit completely when using position 0 and 2, 3 and 4, and switching the crystal out of the circuit when using the 3.5 kc filter.

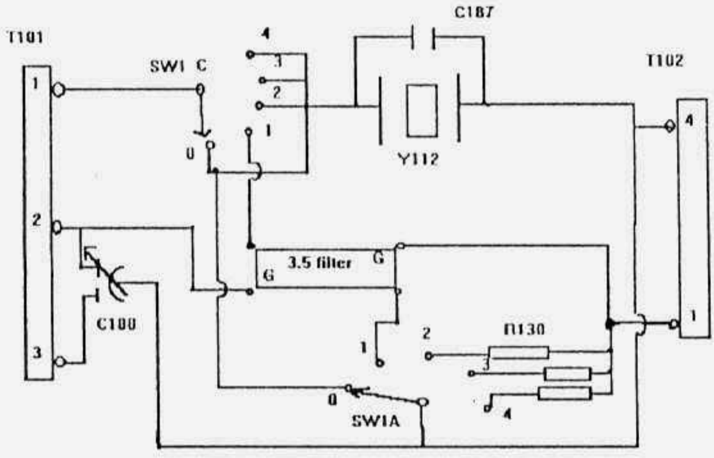
This is done by changing switch S114 to a 2 pole 6 position (5 positions used) switch from Mouser Electronics (part No. 10WA325) at $2.57 each, no minimum order. This switch will fit into the small space that is available and the shaft is the correct length. It is a make-before-break switch. The number of positions is adjustable, so set for 5 positions before using.

Before mounting the switch connect 2" pigtails to SW A lug 2, lug A and lug C. Use bare wire #20, also with #20 bare wire connect lug 1 of SW A to lug 7, 9, 10 and 11 of SW C. Connect the resistors to the switch before mounting. Lug 3 is R130, lug 4 is R131 and lug 5 is R132. By prewiring most of the switch you will save yourselves a lot of work in a small space.

Mount the switch in the crystal compartment with the resistors in the 6 to 8 o'clock position, align left stop with 0 position on front panel.

Align T101 as per manual (0 position) then set selectivity to position 2 and signal generator to 501.5 kc and adjust T102 for peak, phase control at half mesh or on center line. When phase control is turned left of center signal will peak and when turned right of center signal will null out. I also noticed a progressive increase in S meter reading when switching from 0 to 1 and peak in position 2.

Many thanks to Chuck for finding this filter (I found two on the IF board). It is very good addition to a great receiver. **ER**



sw1 is a 2 pole 6 pos switch.....Mouser pt no. 10WA325

The Coherer Detector

Part 1. History and Theory

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

Introduction

The coherer was the first practical radio-wave detector. Its most common form was a glass tube containing metallic filings. A coherer exhibits a drop in electrical resistance when acted upon by an electric wave. Early wireless (1896-1906) depended on the coherer for detection of the signals. It was succeeded by more sensitive and reliable detectors such as the electrolyic detector, magnetic detector, the crystal diode, Fleming valve, deForest audion, high-vacuum radio tubes, transistors and integrated circuits.

Early History

James Clerk Maxwell developed the mathematical theory of electromagnetic waves (1863-1873) and showed that their velocity was the same as that of light. About a year before Maxwell died (he died in 1879), David E. Hughes of London, a music professor, while experimenting with a carbon microphone, discovered something remarkable. He had connected in series with a telephone a glass tube filled with filings of zinc and silver. He noticed that a nearby spark discharge caused a change in the electrical resistance of the column of filings. Later, he built a clockwork-keyed spark transmitter and found he could detect a signal at distances up to 500 yards. An associate, Professor Stokes, said it could simply be explained by electromagnetic induction and the matter was soon forgotten.

A few years later (1884), Professor T. Calzecchi-Onesti of Italy also discovered that certain metallic powders showed a decrease in electrical resistance in the presence of strong electrical activity. See Figure 1-A. Again, no one paid any attention.

In 1887, Heinrich Hertz, a professor at the technical college of Karlsruhe, proved the existence of electromagnetic waves by showing that he could generate and detect them. He demonstrated that they followed the same laws of reflection, refraction and polarization as light. All of this is a rather remarkable accomplishment considering that his detector was simply a loop of wire with a miniature spark gap at its open end, see Figure 1-B. Sometimes a piece of black paper was held behind the spark gap so that the spark could more easily be seen.

The First Coherers 1, 2, 3

In 1890, Edouard Branly, a doctor of medicine and a part-time professor of physics at the Catholic University of Paris, after extensive research, produced a working coherer and gave it its most common form - namely a tube filled with metallic filings loosely packed between metal electrodes - see Figure 1-C. Later he also developed a coherer consisting of six hard steel balls, similar to those used in bicycle wheels, touching each other in a glass tube - see Figure 1-D. The resistance would drop form 2000 ohms to 100 ohms when a 1.5 mm spark occurred at a distance of about ten yards. He noted that a tap or slight blow to the tube would restore it to its high resis-

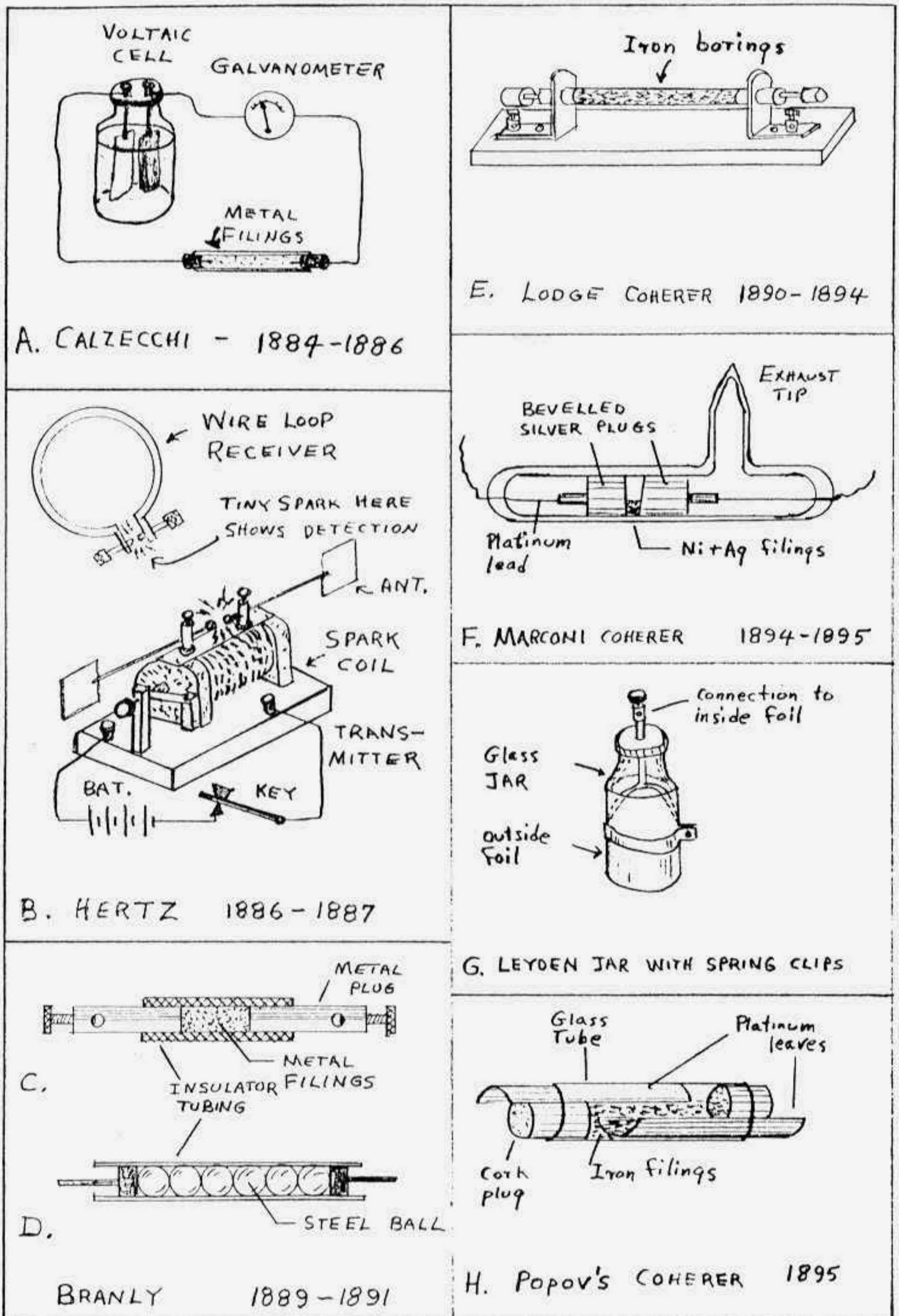


Figure 1. Some steps in the early history of wireless.

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The Coherer Detector from previous page
tance state. Thus was born a new, more sensitive detector of electric waves. According to Fleming (1), only a few scientists at that time clearly recognized that it was the electric wave sent out by the spark that caused the coherer to respond.

A few years later, in 1894, Oliver J. Lodge gave a lecture in which he demonstrated an instrument which he named the 'coherer'. It consisted of a glass tube about 7 cm long, about 1 cm in diameter, loosely filled with coarse iron chips (lathe borings) and having a metal plug at each end - see Figure 1-E. Lodge noted that the device was somewhat tricky to adjust and its sensitivity and resistance would often abruptly change for no apparent reason. In 1897 he published a book entitled "Signalling Across Space Without Wires". While Lodge was able to transmit Morse code over a short distance with his equipment, he did not foresee its commercial application and thus it was left to the young Italian, Guglielmo Marconi, to 'invent' wireless telegraphy. However, to Lodge we must give credit for being the first to realize that the transmitter and receiver should be 'tuned' to the same frequency, a principal which he called 'syntony' (3) and we now term resonance.

The Marconi Coherer

Marconi was born April 25, 1874 in Bologna, Italy. He grew up at his father's estate, the Villa Griffone, near Bologna (4, 5). It was here he began his first wireless experiments. He had only a little formal training - some at a college in Florence when he was 14, then some at Leghorn Technical Institute where he pursued physics and chemistry. Later he audited Professor Righi's lectures at the University of Bologna. Here he learned about electromagnetic waves and decided to concentrate his work in that field. Righi allowed Marconi to use the equipment in his lab for his early research.

During some experiments at this father's estate, Marconi conceived the idea of using an elevated antenna and a solid ground connection. This markedly increased the distance he could transmit and led the way to ever larger and more massive antenna systems. Meanwhile, he worked on his coherer, gradually improving it to make it more sensitive, more reliable and more readily adjustable. In its final form (see Figure 1-F) it was about 5.5 cm long and 5 mm in diameter. He made the end plugs out of silver and coated them with a thin layer of mercury. These electrodes were given a slight bevel so that by rotating the tube on its axis, its sensitivity could be varied. Marconi experimented with various combinations of filings and discovered that a mixture consisting of 95% nickel and 5% silver gave the best results. He evacuated the tube and sealed it to keep out air and moisture. He also developed a magnetic tapper to restore the coherer after each signal was received. This was called the 'decoherer'. Incidentally, the Germans called the coherer a 'fritter' and the decoherer a 'klopfer'. Marconi's decoherer was similar to the mechanism of an electric bell with a brass ball as a hammer. It was arranged so as to strike the coherer from below to minimize 'packing' of the granules. His filings were much finer than those used by Lodge and he carefully screened them to eliminate the coarser particles.

Marconi arranged for his coherer to operate a sensitive relay which in turn controlled the tapper or decoherer, which took much more current than the coherer could safely handle. He discovered that the sparking at the contacts in the decoherer interfered by causing the coherer to switch 'ON' again after each tap. He cured this by adding choke coils (RF chokes) in the tapper wiring. Marconi filed for a patent on his coherer in June 1896 - just 100 years ago!

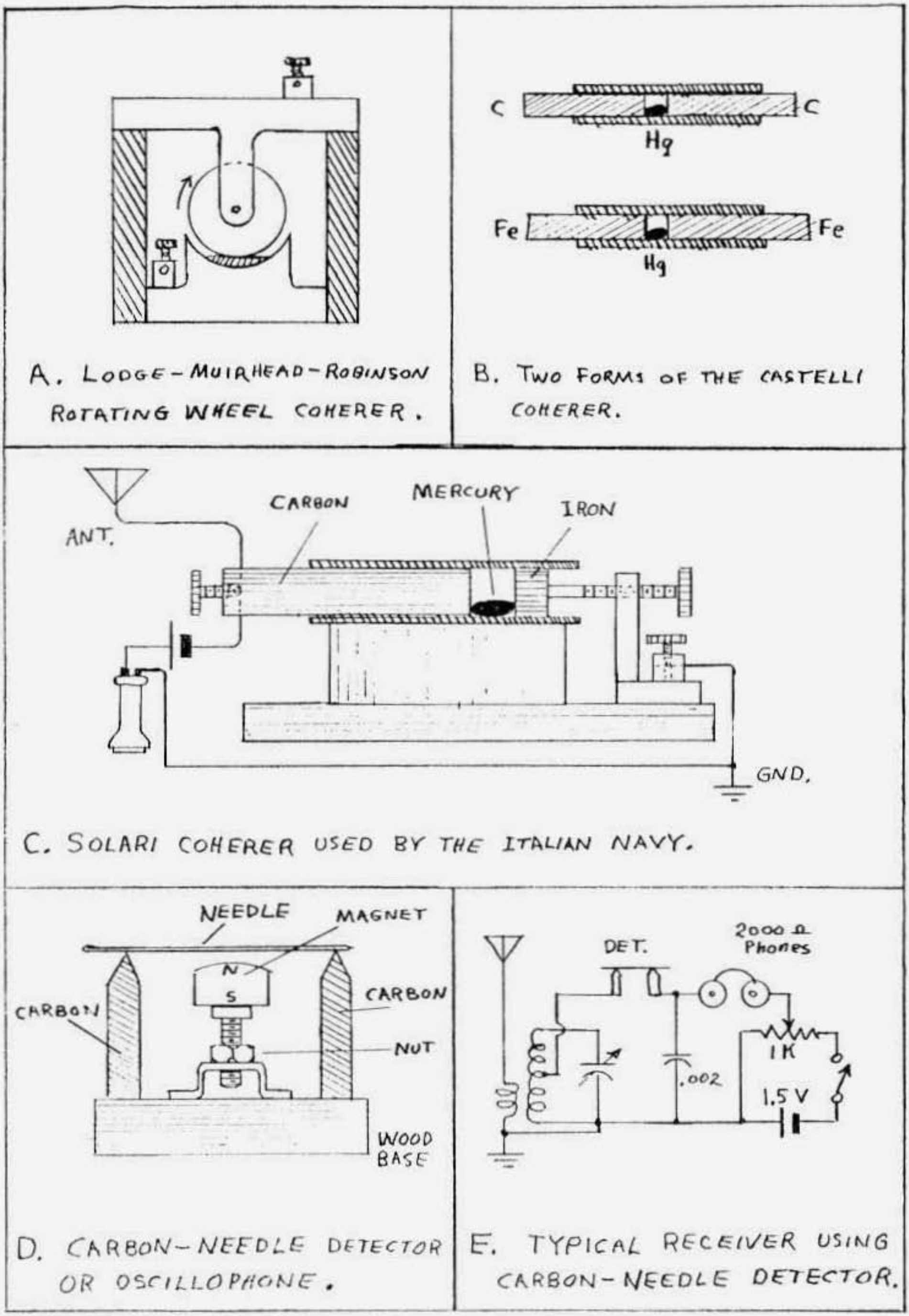

Figure 2. Several self-restoring coherers.

continued next page

Other Workers

After the coherer was discovered, many scientists began to study it in the hope of either improving it or getting around some patent. During this research, they discovered that way back in 1835, Munk af Rosenschold of Sweden mentioned that the conductivity of a mixture of filings of tin, carbon and other metals increased after a nearby Leyden jar was discharged. Note: A Leyden jar (see Fig. 1-G) is a condenser consisting of a glass jar with inner and outer coatings of tin foil. It received its name from the city in Holland where it was invented.

In 1856, S.A. Varley noticed that the resistance of a mass of metallic powders decreased during a lightning storm. He later invented a lightning arrester for use on telegraph lines, which was based on this phenomenon except that it used finely divided carbon.

A Russian professor, Count Popov, in 1896, made use of a coherer (see Figure 1-H) connected to an outdoor antenna and a ground wire to detect the approach of electrical storms. He also made use of an electric bell to tap and thereby reset the coherer after each flash was registered.

References 1 and 2 give details on more than three dozen coherers. Some of these are mind-boggling in their intricacy or cleverness. A study of this work can't help but imbue the reader with a feel for the excitement caused by the discovery of wireless communication. It must have been similar to the excitement caused by the discovery of gold in California or of oil in Oklahoma and Texas.

Self-Restoring Coherers

An interesting form of coherer is the 'wheel coherer' (see Figure 2-A) developed by Sir Oliver Lodge, Dr. Muirhead and Mr. Robertson, circa 1902. Here a small, slowly rotating wheel is arranged to barely touch the surface of a pool of mercury. The surface of the mercury is covered by a thin film of mineral oil. The electric signal punctures the thin film and a click is heard in the telephone receiver. Due to the rotation of the wheel, the detector is self-restoring and always ready for the next signal. A piece of felt is often arranged to wipe the wheel clean after it emerges from the pool of mercury. This coherer requires a bias of about 0.3 volt which is usually obtained from a potentiometer connected across a voltaic cell. It should be pointed out that coherers are essentially ON-OFF switches and thus not suitable for demodulating AM signals. But many metallic oxides; e.g. mercury, copper, zinc, do exhibit the properties of semiconductors and have been used as AM detectors. It's possible that some early self-restoring coherers may have actually been forerunners of the diode detector, (7).

A signalman in the Italian navy, P. Castelli, also developed a self-restoring 'coherer' about 1900. Figure 2-B shows two forms of his detector. The glass tube is about 3 mm ID and the electrodes are either iron or carbon. A single drop of clean mercury is placed between them. This detector also requires a bias voltage - usually provided by a single cell connected in series with a telephone receiver. In 1902, the Marquis Luigi Solari also of the Italian navy invented a similar coherer (see Figure 2-C) where one electrode was iron and the other carbon. It was used extensively by the Italian navy. This is the type of detector Marconi used in his 1901 transatlantic test (described later).

Loose Contact Detectors

Branly also discovered that two slightly oxidized steel or copper wires laid across each other with light pressure would act as a sensitive coherer. He observed the resistance to change from thousands of ohms to just a few ohms with sparks many yards distant. Maybe this is what led to the Massie Wireless Company's detector which

Marconi at Signal Hill, 1901.

they called the 'Oscillophone'. Two different forms are known. In one, two carbon V-shaped blocks support a steel needle (see Figure 2-D). An adjustable magnet under the needle varies the pressure that the needle exerts on the carbon. In another form, two single-edge razor blades support a carbon rod which may be a piece of pencil lead or the carbon anode from a small flashlight cell. The latter construction is said to have been used as an emergency 'foxhole' receiver by GI's during WW II. Since these were able to demodulate AM signals, they probably operated as diodes rather than as coherers.

Dr. J.C. Bose, a resident of Calcutta, filed for a patent on a 'coherer' September 30, 1901 which used galena elements. While he referred to it as a coherer, it seems likely that it really was a diode detector. He noted that his detector was sensitive, had quick response and didn't require tapping. It's possible that he came very close to being the inventor of the crystal detector.

Coherer Physics

Fleming (1) lists over a dozen names of those who have investigated the properties of coherers. Several of them proposed the theory that the particles are welded together to produce the 'ON' stage. In one experiment, iron filings were laid on a glass plate between two electrodes. After a nearby spark occurred, the filings adhered to each other to form chains from one electrode to the other. The loose or unconnected filings were then removed with a weak magnet exposing the cohered chains to view. Other researchers have pointed out that some materials such as carbon, arsenic, lead peroxide and a few others show an increase in resistance after the spark occurs. Furthermore, they say it's unlikely that carbon would be heated sufficiently to weld.

Research done at the Siemens Works (6) in Berlin during the 1930s and early 40s generally supports the theory that the metallic particles in a coherer are each enveloped by a thin film of tarnish (usually a monomolecular layer of oxygen having a thickness of 10 to 30 Å). It is this layer of tarnish that insulates the metallic particles from each other and gives the coherer its high resistance in the 'OFF' state. As the voltage across the coherer increases, it reaches a value sufficient to puncture the microthin tarnish film. The puncturing proceeds from particle to particle with great speed until the bridges are built from end to end. Then the resistance falls dramatically. At this point, the current rises and causes sufficient heating of the very minute sharp edges of these particles to melt them and cause fusing to occur. Now the resistance drops and the heating effect (due to I^2R) decreases just as suddenly so there is no runaway meltdown. Just the sharp edges of the tiny particles fuse. Only a light tap is required to break the threads (decohering

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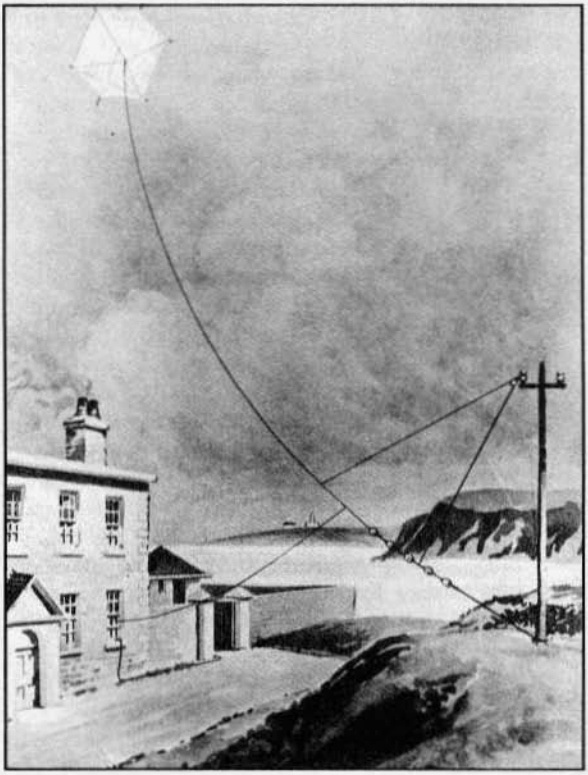

The kite antenna Marconi used at Signal Hill.

action). R. Holm (6) has suggested that the observed increase in resistance seen with certain materials after the influence of an electric spark might be explained by the concept that the bridges are annihilated by the electric shocks.

Modern Application

A modern application of the coherer was its use by a toy manufacturer in a radio-controlled toy bus. The hand-held transmitter used an induction coil and spark gap. The receiver employed a shock-mounted coherer, a relay and two motors - one for driving and one for steering. The control sequence was "Off-Left-Center-Right-Off". The range of reliable operation was about ten feet. One of the motors drove a 'whacker' to constantly reset the coherer.

Conclusion

On December 12, 1901, Marconi received the letter S, three dots, sent across the Atlantic Ocean from his high power station in Poldhu, England (4,5). His receiving station (see photo) was at Signal Hill, a high point on the coast of Newfoundland. The distance covered was about 2000 miles. His receiver used a Solari type coherer and the antenna was a long wire held about 400 feet aloft by means of a large kite (see photo). After Marconi heard the signal a few times, he handed the receiver to his friend Mr. Kemp who also heard it. Many people have expressed doubts about this story, but we must remember that there were no nearby transmitter, no trolley cars and no arc light to cause interference, very large antennas were involved and it's possible that good propagation conditions occurred that day. ER Next month part two.

Acknowledgements

The author wishes to thank Bruce Kelley, curator of the Antique Wireless Museum, Lucas Bazin, Ludwell Sibley and Robert Stapleford for their kind support.

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23. "Early Detector" Linc Cundall, W2LC, OTB, p. 16, Vol. 22, No. 4, March 1982. Shows example of Massie Wireless Oscillaphone, carbon block-needle detector.
24. "Popov's Detector", Pete Gummet, OTB, p. 20, Vol. 23, No. 2, Sept. 1982. Shows detector using two Gem razor blades and carbon rod.
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A 10-Meter Mystery - Solved

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If you want answers to any antique radio question, just ask ER. I have been amazed at the response to my May article concerning the Siltronix Comanche 1011D and the 8950 tube. I have received at least ten e-mail letters, several mail letters and several phone calls.

One of the most helpful contacts was from Dick Stout, KE7RD, who was, at one time, a major distributor for Siltronix and who purchased the residual stock when they quit business. Most of the following history is courtesy of Dick.

In the 1974-5 time period, Swan, a division of Cubic Corp. decided to cash in on the illegal CB business. They took their Swan 500C as a basis and changed it into a single band rig. In an attempt to keep out of trouble, the unit was designed to cover 28.5-29.0 MHz SSB with 300 watts input, USB. The unit also covered 26.830-27.830 "receive only". A single jumper would put it in transceive mode on the CB band.

Needless to say, the hams and the FCC were upset. Several of the ham magazines refused to accept advertising for this "amateur radio equipment" and apparently informed Swan that they would not accept any of their advertising if they actually delivered any of these rigs.

A new corporation was instantly born, Siltronix, to "build" and market the rig, which sold well to the CBers, even at the very high price. The antecedents of the rig are unmistakable, case and paint pattern, vernier dial, panel layout, VFO etc. are pure Swan. They delivered many of these rigs up until they stopped production in late 1977.

Another similarity was the use of a brand new tube in the final. Apparently GE had modified a sweep tube by shortening up some of the internal leads and other minor changes. Swan latched on to this tube in their ongoing attempts to increase the output of their amateur rigs, and designed the new tube into the Comanche. I want to thank George Watson, WØLOB, for sending me tube data, and Gary Caire for info on the substitution of a 6LF6/6MH6 tube (not a direct substitute as the 8950 is a 12 volt tube and the 6LF6 is a 6.3 volt tube. Gary uses an external filament transformer). Swan used the 8950 in their 700 series transmitters, but the tube apparently never went into full production and a new one now costs upwards of $50 if you can find one. 300 watts into a single tube indicates that it was rugged, although many were ruined by excessive periods in the tune-up mode.

The calibration on the transmitter was not extremely accurate, and Siltronix brought out a digital readout unit which plugged into the 1011D and is quite accurate once it is set up. Since my previous article, I have gotten another mint 1011D with this readout. The two pieces along with a new D-104 mic and grip-to-talk stand cost $100 at the Decatur, Ill hamfest. Compare that to the over $800 (1975 dollars) original cost, and the attraction of the unit to a tightwad ham becomes obvious.

I wish I could mention all the people who contacted me with information, but, lacking space, just let me say how much I enjoyed and appreciated the e-mail, letters and calls. Thanks guys.

Keep your eyes peeled at the summer hamfests and maybe you can also find a good, inexpensive rig for local rag chews away from the repeaters, and be all set up for the return of the spotted sun. HAVE FUN! **ER**

VINTAGE NETS

Westcoast AM Net: Meets informally, nightly on 3870 at 9:30 PT. Wednesday at 9:00 PM PT they have their formal AM net which includes a swap session. Net control rotates.

California Early Bird Net: Saturday mornings at 8 AM PST on 3835.

California Vintage SSB Net: Sunday mornings at 8 AM PST on 3835.

Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.

Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.

Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.

K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control varies with propagation.

Arizona AM Net: Meets Sundays at 3 PM MT on 3855. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.

Colorado Morning Net: An informal group of AM'ers get together on 3808 Monday, Wednesday and Friday mornings at 7AM MT.

DX-60 Net: This net meets on 7290 at 2 PM ET, Sundays. Net control is Jim, N8LUV. This net is all about entry-level AM rigs like the Heath DX-60.

Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is usually Walt, KJ4KV, but sometimes it rotates to other ops. It starts at 5 AM ET Saturday mornings on 3885.

Westcoast Military Radio Collectors Net: Meets Fri. at 2200 local on 3990 and Sat. at 0800 local on 3990 + or - QRM. Net control is Tom, WA6OPE or Andy, KD6TKX.

Grey Hair Net: The oldest (or one of the oldest) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:30 PM EST & EDST.

Vintage CW Net: For CW ops who enjoy using vintage equipment. This is not a traffic net; speed is not important. The net meets on 14.050, Saturdays at 1 PM PT. Net control is Tracy, WB6TMY.

Vintage SSB Net: Net control is Chuck, N5SWO. The group meets on 14.293 at 1 PM CT, Sunday afternoons.

Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet at 0100Z Tuesday nights on 3805 and on Thursday nights on 3875.

Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.

Heath Users Net: A new net started by Marty, WB2FOU/5. Net control is shared by Fred, AA5LW. It meets on 14.275 at 4 PM CT Sundays. Check in on either AM or SSB.

Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.

Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.

K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.

JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.

Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.

Southern California Sunday Night 6 Meter AM Net: 8 PM Sundays on 50.4. Net controls are Dan, KV6I and Scott, K6PYP. Informal, supports restoring old gear and using it on the air. Loan gear available for those wanting to join in.

Westcoast 40-Meter Sunday Net: Net control varies. The group meets on 7160 starting at 4PM PT.

Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.

Old Buzzards Net: Meets daily at 10 PM EST on 1945. This is an informal net in the New England area.

Hail to the Chief

Globe, that is

by Jim Hanlon, W8KGI
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It isn't often, when you are a collector of inexpensive - better yet, free - old boatanchors, that you are able to find one that has never been used and that has yet to make its first QSO. But such I think was the case with the first of my two Globe Chief 90's which came to me third hand from my Albuquerque friend, Les Lines, K5SDF. Les picked up the Chief several years ago, and when he tried to fire it up the 807's proceeded to vie with one another to suck every last milliampere out of the power supply. The reason for this, Les found when he looked inside, was that the crystal oscillator had been miswired, probably since day one, so that it wouldn't work; and the key was shorting the final control grid to ground whenever it was closed. The 5U4 rectifier was tougher than the 807's by the way, so the latter were being destroyed several times more often than the former. Les passed the Chief along to me before he'd had a chance to correct the error and I was the one to set it straight. So I had the honor and privilege of putting this 35 year old Globe Chief on the air for its very first QSO! Not quite the same as finding it in unbuilt kit form, but still no small thrill.

The Globe Chief is, of course, a World Radio Labs offering from Leo Meyerson. Leo and Al McMillian, a long time WRL stalwart and now Mr. HI Manuals, both remember it as being designed around 1954. But Ray Moore (1) reports that it was first offered for sale in 1956, and I don't find it listed in WRL ads in 1955 or early 1956 in the limited number of QST's and CQ's I have from that era. Leo thinks it was designed by Ed Shulman, also the designer of the Globe Champion (2). But Al remembers that it was designed by Sam Fidone, then WØQAB, and that Ed didn't join WRL until 1963. From the outside you might think that it's just a Globe Scout without a modulator since they come in the same cabinet and look very much alike, but such is not the case. The 60 watt Scout used the then new and quite popular 6146 for its final amplifier, a tube that could well have run the 90 watts for which the Chief is rated had it been paired with a 750 volt, 120 mil power supply. But according to both Leo and Al, WRL found a bunch of 807's on the surplus market for quite a bit less than the pricey new 6146 (it sold for about $4.80 in those days as I recall from buying one in the summer of '52 to replace the 2E26 in my novice transmitter). So the Chief came out with a pair of tried-and-true, two decade old 807's in its final amp. A pair of 807's running full bore from a 750 volt power supply are rated to handle 150 watts. But the Chief's power supply, with transformer, choke and filter borrowed from the Scout to keep costs down, put out only 475 volts, and thus the lower 90 watt power rating. Looking at some of the other parts in the Chief, it's pretty clear that this design was the most cost effective way to get to 90 watts. In addition to the power supply, the Chief also used the same 365 mmFd "broadcast band variable" final amp tuning and loading capacitors as the Scout and numerous smaller components as well.

The Globe Chief 90 wound up with a 6AG7 Colpitts crystal oscillator driving

Globe Chief s/n JG 6938K, the newer model

a pair of 807's in parallel and with a 5U4GB full wave rectifier in the power supply. (Those of you who know your 807's will note that I'm running a pair of 807W's in my Chief. They fit better into the cabinet, the original 807's just barely make it in and even then I have to pull the top of the cabinet up a little bit to get them to clear the panel mounting flange.) Like the Scout it is bandswitching, but it covers 160 through 10 meters instead of the 80 to 6 meter coverage of the Scout 680. The crystal oscillator is capable of driving the final running either straight through, doubling, or tripling. So the Chief is set up with the final amplifier running straight through on all bands except for 10 meters where it works as a doubler with the oscillator using 40 meter crystals. The manual says that it has "generous overlap" beyond the amateur bands. While this is so, 17 meters is the only WARC band that the Chief will cover (on the 20 or 15 meter ranges) with its original set of coil taps. An interested user with a grid dip meter could certainly modify the Chief to cover several more WARC bands. But I tend to leave well enough alone on classics like this one.

One curiosity is the 15 meter position on the bandswitch. It's there, but it isn't wired to anything either as shown on the manual schematic or as found in both of my transmitters! The 20 meter oscillator coil tunes from 13 to 23.6 MHz, so it isn't changed for 15. And there is no 15 meter tap on the final plate tank; instead the 20 meter tap which tunes from 7.5 to 22.1 MHz is used. So you can work both 20 and 15 with the bandswitch set to either position! I mentioned this to Leo, and he was as surprised as I was.

The final amp in the Chief uses the Pi-match network that was found in virtually all the rigs of that era, in this case with an additional "L" network coil between the loading capacitor and one of the two antenna connectors that can be used on 160 or 80 to match lower impedance loads. The other antenna terminal connects directly to the loading capacitor, allowing a choice of either the straight Pi-match or of the "Pi-L

continued next page

Hail to the Chief from previous page

WRL label on the back of Chief JG 6938K

match" with the additional inductor. The good news about the Pi-match, in contrast to a plug-in coil, parallel tuned, link coupled tank, is that it will bandswitch easily by shorting out appropriate sections of a tapped coil and that loading can be adjusted over a wide range without swinging a mechanical link. This allows everything in a rig like the Chief (including the meter whose rear end is covered by a metal "can") to be enclosed inside of a TVI tight box that never has to be opened except for servicing. The Pi-match really made convenient, inexpensive, multiband, TVI proof rigs practical in the 1950's. But the bad news about the Pi-match is that there are some rather substantial losses associated with circulating currents in the shorted section of the final amplifier tank coil, and the net power output from a tapped coil Pi-match is somewhat less than had an untapped coil been used. For example, the final amplifier efficiency for my newer Chief is in the mid 50% range on 40, 20 and 15 meters, dropping to about 42% on ten when it is doubling. On 80 and 160 where I use the added "L-match" coil to load into 50 ohms, the efficiency drops to around 40%! This is in contrast to nearly 80% efficiency in the plug-in coil final of my Globe King 275. Fortunately, very few of us had power meters in the 50's so we either didn't realize or didn't care that the Pi-match was somewhat inefficient. We were just happy to have transmitters that kept the peace with our 'television watching neighbors and families', and that got out well on the ham bands. A dB or two less power output we couldn't care less about.

In practice, my two Chiefs are good but not perfect when it comes to TVI. I can use either of them followed by a low-pass filter and antenna tuner on all bands at my QTH near Albuquerque, where the local VHF TV channels in use include 2, 4, 5, 7, 11 and 13, and not bother the family TV several rooms away. But when I take a small portable TV to the shack and tune up the Chief on 20 meters, I find that a signal from the crystal oscillator alone, with the final switched to "tune", does anything from change the color saturation to wipe out the entire picture on channel 4, depending on how close the TV is to the transmitter. The Chief with the metal backed meter is less of a problem. But the one with a plastic cased meter and thus a relatively large, unshielded hole in the front panel is worse, and the meter hole is a "hot-spot" for TVI when I sniff around the case with a short wire antenna on the TV set. So you can guess which of the two I prefer to use on the air.

The keying circuit in the Chief is not complicated but it is a little unusual. Most simple rigs of its day, including the Globe Scout, keyed a lead common to the cathode of the crystal oscillator and final amplifier. In the Chief, blocking bias which keeps the óscillator cut off and the final throttled back to 20 mils of idling current is obtained across a resistor in series with the B-power supply lead. What the manual calls "Modified Block Grid Keying" is used, with the key shorting out that bias source. The manual assures me that the voltage across my key is held to a safe value, less than 75 volts. Makes me glad that my station is set up to key the Chief with a relay! In any event, the keying

An inside view of JG 69388K. Note the metal back on the meter and the two output terminals for the PI-L match. The final tubes are 807W's.

envelope of the Chief is sufficiently well shaped so that keying is crisp and yet has no on-the-air clicks.

There is a front panel, "tune-transmit" switch that keeps the grid block bias on the final while I'm tuning up the oscillator or spotting the signal on my receiver. It definitely makes life easier on the 807's and on my ears. It also offers an opportunity to try out some QRP operation, since the Chief's output on "tune" runs in the 1 to 2 watt range on most bands. That's only about 16 dB below full output, and it just might well be enough for quite a few of the 579 and above QSO's that I make with full power.

The Chief, like its Scout cousin, requires a "hot" VFO to drive it. The WRL model 755 VFO (3) was well suited to the task since it had a 6CB6 buffer stage following its 6AU6 Clapp oscillator, and was well temperature compensated and really quite stable, according to Leo, in an era when most outboard VFOs were known to be pretty drifty (wish I had one). My Knight VFO provides adequate drive for operation on 80 and 40 meters where the Chief oscillator is going straight through, but there is somewhat less output from the final on 20, 15 and 10 when the VFO is driving the oscillator as compared to its operating crystal controlled. The manual has instructions on how to remove the fedback capacitors in the crystal oscillator when driving it with a VFO. I've found that it doesn't make much difference, perhaps because the crystal stage is block grid keyed and doesn't parasitic on its own when it's driven by another signal. And it's more convenient to be able to plug in either a crystal or the VFO without having to make internal changes. Keying is chirpy with the Knight Kit VFO, clean with a crystal. Oh well, it's kinda fun to have a "distinctive" signal on the

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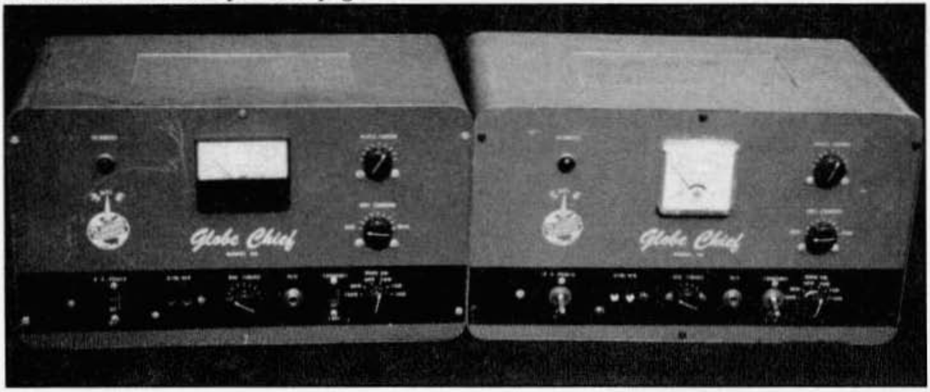
Hail to the Chief from previous page



Side-by-side Chiefs, FG 1879W on the left (the older version) and JG 6938K on the right (the newer version).

bands, especially in these days where all of the 'Yaecomwoods' sound so much the same.

The Globe Chief Instruction Manual is quite reminiscent of a Heathkit manual of its era. It contains step-by-step instructions, pictorial diagrams, tune up instructions, and a schematic. It even suggests using a 60 watt light bulb for a dummy load, a "bright idea" since it lets the new owner learn by visually observing the effects of his tuning adjustments. Al McMillan wrote the WRL manuals starting with the Scout 40 and going through the Globe King 400, including of course the Chief 90. He looks back on them now and says, "Did I write that?" But he certainly appears to have done a good job in my estimate.

I found out from Al that my first Globe Chief, serial number FG 1897W, is the older of the two and that it also is a factory wired model. The first letter of the serial number being "lower in the alphabet" is the tipoff to its age. The "W" indicates that it was factory wired, and it also has rivets securing the tube sockets and grounding lugs to the chassis, which is characteristic of factory wiring. It is rather interesting that this is the unit with the miswired keying circuit!

My second Globe Chief, serial number JG 6938K, was a gift just last year from another Albuquerque amateur who has since unfortunately died from cancer. I promised him that I would take good care of it. This JG Chief is the newer of the two, and the "K" means it was a kit. It was built using bat-handled toggle switches which Al assures me were never supplied with the Chief, and the oscillator and rectifier tube and crystal sockets have been upgraded from the fiber wafer sockets found on the older transmitter and shown in the manual to be plastic molded sockets for the tubes and a ceramic socket for the crystal. Perhaps its original owner substituted the better switches and sockets when he put it together. This also is the rig with the metal-cased, plastic front, iron vane meter. Al said that only the early Chief 90's came with an iron vane meter and that the later ones used a plastic cased, D'Arsonval movement meter. Indeed, Ray Moore's new book on transmitters (1) shows a Chief 90 with a black metal-cased, iron vane meter. On the other hand Ray's picture of the Chief 90A shows the same meter that's in my JG Chief, as does my manual which is for the later Chief 90A. Perhaps the JG Chief 90 was sufficiently late to have picked up the meter that wound up in the "new" Chief 90A in 1958. And since I've brought up the 90A, the only things different about it were the new "shadow cabinet" whose top extended out beyond the panel a short way and whose sides tapered back to flush with the panel at the bottom and also the panel logo which was moved from the center under the meter to the left side and changed from the older globe and radio tower to a newer circled WRL followed by a script "Electronics."

My Chiefs also show several other differences. JG 6938K has light and dark green painted features on its grey panel, black screws holding the panel to the cabinet, and a fiber based fuse block. FG 1879W has white and black features on a grey panel, unpainted steel screws in the panel, and a plastic based fuse block. The oscillator tuning capacitors are different, the JG one being a modified version of the broadcast variable used in the Pi-match while the FG one is a single bearing, ceramic insulated unit. The L-match coils are both pieces of B&W miniductor, but the coil in the JG Chief is longer and has fewer turns per inch, perhaps yet another "upgrade" made by its original builder. And the JG Chief has a yellow label with black lettering on the back of its cabinet that says, "WRL Electronics Inc, Broadway at 34th, Council Bluffs, Iowa, Mfgrs. of the world famous 'Globe' series transmitters". Al McMillan thinks this sticker may indicate that this Chief was sold by one of the distributors other than WRL who were also carrying the Globe line for several years about then.

Although the Chief was a CW-only rig, WRL's $32.50 UM-1 Plate Modulator kit could be combined with it via an accessory socket on the rear of the chassis to yield a 90 watt, high level modulated AM transmitter. WRL also offered the SM-90 screen modulator kit for $11.95. Considering that the Globe Chief 90 kit sold for $54.95 and the plate modulator would bring the total price up to $87.45, the pair were a good value when compared to the Heising modulated Globe Scout 680 which was going for $89.95 at the same time (QST, September, 1957). Yet, according to Leo, the Scouts were WRL's biggest seller with a total volume across all models greater than 52 thousand! The Chiefs were not as popular, but still sold a very respectable 20 thousand units. Competitors for the Scout and the Chief were Heath's DX-20 (50 watts CW, $35.95) and DX-35 (65 watts CW, 50 watts controlled carrier phone, $56.95), Knight's T-50 (SX-255, 50 watts CW, $42.50), and the Viking Adventurer (50 watts CW, $54.95). Even though the Chief was a bit more expensive than most of the other CW-only rigs, Leo thinks that its 90 watt power gave it a marketing advantage and made it a popular choice.

It is interesting too that in the 1950's there was so much competition for simple, economical, entry level transmitters compared to today. One sometimes wonders if a new offering of a 6146 or 1625 (12 volt filament 807) kit transmitter wouldn't fill a present day market niche.

And finally, I have to say that it's nice having a transmitter that has a name rather than just a number. Once upon a time, ham gear had character. Receivers were Super Pros, Skyriders and Sky Buddies, Ocean Hoppers, Mohawks, Traffic Masters, World Masters and All Stars. Transmitters were (Globe) Kings, Champions, Scouts, Chiefs or Trotters, Vikings, Rangers, Bandmasters, Marauders and Apaches. Even transceivers were Cyclones and Hurricanes. Gear like that you can have a relationship with. But who can love something called FT-101-ZD? Those were indeed the golden days. . . . **ER**

References

1. Transmitters, Exciters & Power Amplifiers, 1930-1980, Raymond S. Moore, page 140.

2. WRL Globe Champion Series 300, 300-A, 350, by Capt. Larry Rau, KF6W, Electric Radio, March 1996, page 4ff.

3. The WRL Model 755 VFO, Recent Equipment, QST, March 1956, page 42.

The Johnson 6N2 Transmit Converter

by Herman Cone III, WB4DBB
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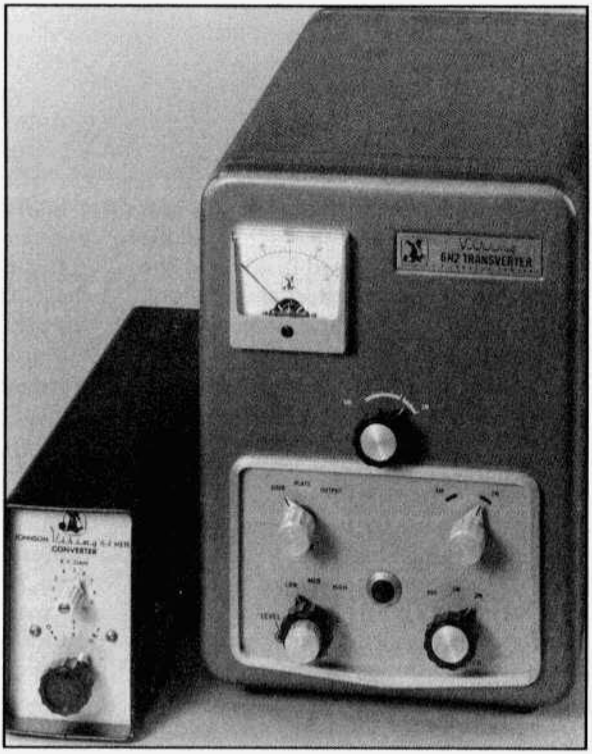
Photos by Joe Veras, N4QB

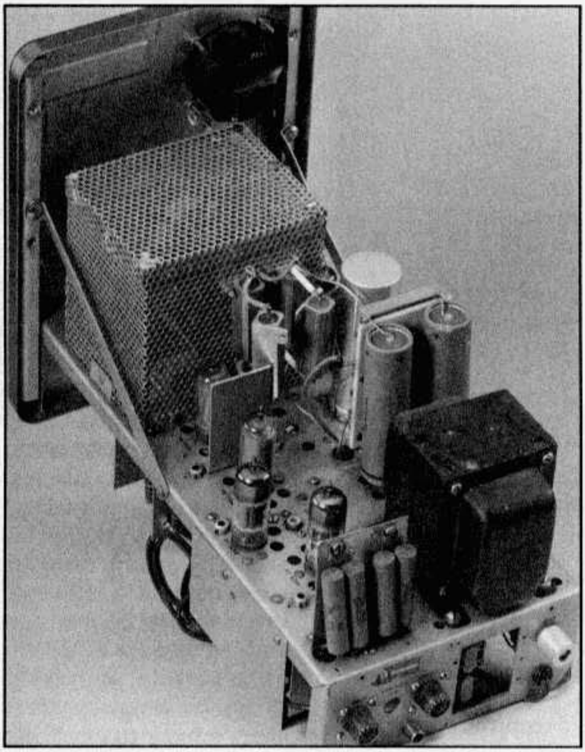
Although I have enjoyed collecting and operating vintage gear for the past twenty years, no other single item has intrigued me as much as this rare piece.

The events which led up to my obtaining this transverter actually began in the late 1960's, during my earliest days on six meters SSB. I remember having a QSO with a "WØ" station (in Minnesota, probably) who indicated that his rig was a Johnson "6N2" transverter. I had never known such a box to exist and figured he had probably modified the relatively popular "6N2" transmitter to act as a transmit converter. Not being a collector then (I believe I had a Swan 250 on six, a Twoer on two, and a Heathkit "SB" series pair on 80-10), I gave this no more thought until almost two years ago when Nick, KD4CPL, (I believe he collects Heathkits, among other things) called and said that he knew where a Johnson 6N2 transverter was. As it turned out, Dave, W2YV, had obtained one at a hamfest many years ago and was using it. He was also nice enough to send me some photographs and other information. I asked that he please keep me in mind if he were to sell it. He was true to his word when he said he would; at the Charlotte hamfest this past March, he said that he would sell it to me. Several days later, it was in my shack.



Front view with receive converter on left. Knob in center is PA tuning. Next row, left to right are metering and transmit load controls. The two controls at lower left are the crystal selector (low-med-high) and drive control. The switch in the lower right corner selects the VHF bands and turns the unit off and on.

Other than that 6 meter QSO almost 30 years ago, I had no other reason to believe that the model 240-202-2 "6N2" transverter existed. It is in none of my old Johnson catalogs, and I cannot find any mention of it in any old magazines. The information that Dave got (from the gear's previous owner) was that Johnson made a few prototypes (prob-



Top view chassis. The four large resistors just above the SO-239's are input swamping resistors. The large perforated box houses the PA stage.

There is a group of holes punched in the top of the rear of the cabinet; apparently it was planned to incorporate the Johnson Viking receive converter, allowing a complete transceive system to exist in one cabinet. The manual, which also covers the receive converter, refers to an installation kit, which allows this to happen, with a mechanical linkage that will allow the transverter's bandswitch to also take care of the receiver converter. Unfortunately, I have neither this kit nor the instructions; the transverter manual gives no information. My transverter actually came with a metal plate that covers the holes from the inside of the cabinet. Apparently, the receive converter mounts in such a way that its RF gain control projects out the back. Also, there were some intentions of disabling the crystal oscillator in the receive section, and injecting LO from the transmitter's oscillator, but, again there are no specific details in the manual. Being that my transmitter converter is set up for an IF of 28-30 MHz and the receiver is crystalled for use with a 20 meter IF, I think that I will keep them separate.

ably only a dozen or so) and gave them to some of their amateur employees to take home and try out. My guess is that this occurred in mid to late 1963, the dates printed in the manual (yes, I also got a manual!). For whatever reason the project probably stopped here, and within a couple of years, Johnson was out of ham radio altogether.

It appears that a minimal amount of cost was incurred in the transverter's mechanical design. It was built in the same cabinet as was used for the SSB adapter (that matched the Valiant II), although the front panel is nicely silk-screened and a nice nameplate is used. Other than a few simple sheet metal pieces and the output stage shield, all mechanical items appear to be "borrowed" from other Johnson products.

Electrically there are no real surprises. A built-in supply powers all circuits, including the PA. There is a large swamping circuit at the transmit IF input allowing use with exciters with up to 50 watts of output (the manual suggests the Invader), with additional external padding if more drive is anticipated. The "level" pot on the front panel actually is a voltage divider that "picks off" the desired RF available at the re-

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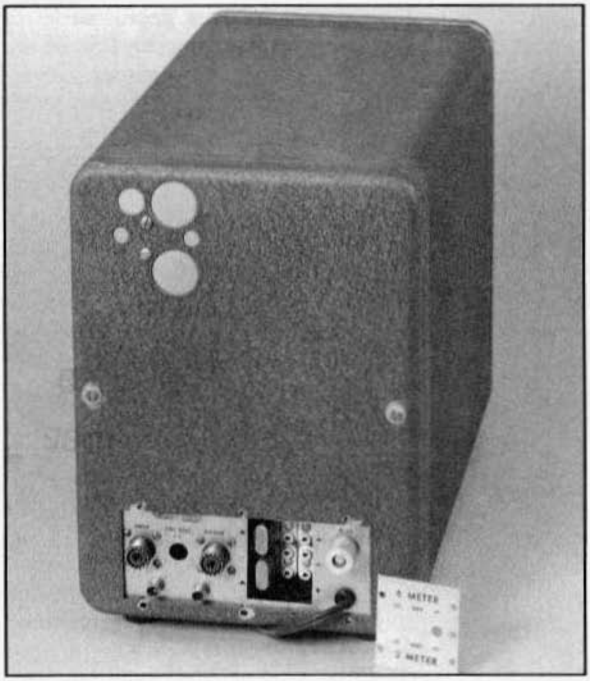

Rear view with crystal access plate removed. All interconnection jacks, as well as the bias control, are located here. See text for explanation of the holes at the top.

sistive load at the input. There are 3 crystal "slots" per band (one per band included), selectable from the front panel; the crystals are easily changed upon removing a small plate on the back panel. The triode section of a 6CX8 tube is used as the crystal oscillator; the pentode section is a "times 3" multiplier when 2 meters is selected. The triode section of another 6CX8 is a buffer amplifier, used to supply LO to the receive converter, if used. The pentode section of this tube serves as the mixer. Following this there are two 7558's which are low level linear amplifiers. Broadband circuits are used in these driver stages; no "peaking" or driver control is used. The final amplifier is a 6146; power input is rated at 75 watts on 6 meters, and 60 watts on 2. An external T/R relay (such as a Dow-key "60" series) is needed, although turning the bandswitch to "off" allows the HF exciter to be fed through without re-cabling. There are only two SO-239 connectors on the back, input from the IF exciter, and output (all bands) with the owner deciding how to route to the various antennas (HF and VHF) used.

Metering is quite complete, positions for PA grid and plate current as well as relative power output are provided.

The power supply is solid state; two diodes provide B+ and a third is in the bias supply. Additionally, there are three VR tubes.

Looking inside, there appear to be quite a few modifications. It is unclear how many were done at the factory, as part of a "fine tuning" process on a new product. Others appear to have been made by subsequent users. The most notable change is the bank of four large resistors which replaced a single larger one in the power supply. These are seen just behind the perforated PA compartment. The manual, although quite complete, has a schematic which does not quite agree with the actual hardware. It is rubber-stamped "obsolete" which may mean that they were working on a new version. At any rate, I consider having such a complete manual a real bonus, considering the transverter was not ever put into production.

I am looking forward to trying the transverter out someday. Hopefully, there are a few more of them out there somewhere. I would gladly share a copy of the manual if anyone needs one.

I owe a special thanks to W2YV and KD4CPL for making it possible for me to own this item. Also, many thanks to Joe Veras, N4QB, who did the excellent photography work. **ER**

LETTERS

Dear ER

It was great to see the article on the Globe Champion 300/350 series in the March issue of ER. The Champion is an interesting rig that deserves more "publicity". I have been using a 300 for the past five years.

However, Mr. Rau was a little optimistic in his assessment of the conservative design of the Champion and Globe products in general. There was a good reason why most World Radio Labs products cost less than their competitors: WRL used cheaper (less conservatively rated) components. It's not a coincidence that a Collins 32V weighs more than a Globe Champion. In many cases, these cheaper components were still good enough.

But, not always. Here's a few examples from the Globe Champion 300. The bandswitch for the final is undersized. The one used is no larger than one in a DX-100, even though the final plate voltage is up to 400 volts higher and the power output is almost twice as much in the 300. Consequently, the 10, 11 and 15 meter contacts were vaporized on my 300 when I acquired it. The same is true for the final plate tuning capacitor. This capacitor is identical to those in Viking I's, II's, Valiants, and DX-100s. The spacing is fine for a final plate voltage of 600 or 700 found in the aforementioned transmitters. But, with 1000 volts on the final of the Champion, arc overs do occur.

As far as the modulator tubes are concerned, there is no advantage to using 811A's or 572B's in place of the stock 809's except that 811As (and 572B's which are more expensive) are generally much easier to find. The small amount of extra audio obtained with these tubes cannot be utilized unless negative peak limiting is employed. Even with negative peak limiting, the increased audio power will cause the modulation transformer to saturate (creating distortion) due to its small size. Finally, if one does want to use 811A's as modulators, remember, the filament current requirement is several amperes greater than the 809's. This may stress the filament windings for the modulator tubes which are incorporated in the low voltage transformer. A separate filament transformer is recommended.

The AX9909 finals were a good choice at the time the Champion was produced. As late as the early 60's the 9909's were $10-15 apiece. Compare this to $5-7 for 6146s and as much as $25 for a 5894. The tubes were rated at 45 watts plate dissipation in SSB service with a maximum plate voltage and current of 1000 volts and 210 milliamps respectively. In class AB1 operation, up to 74 watts per tube is possible (single-tone power output) and up to 97 watts in class AB2. Very little driving power is required in AB2. If you plan to use the 300 for SSB, use a scope to check for flat-topping. Believe me, I've tried it!

The finals are mounted on a separate subchassis above the main chassis. This makes a nondestructive modification using almost any tube possible if one wants to remove the existing subchassis, make a new one (metal work required!) and install it. If this still sounds like too much work, the existing subchassis and sockets can be used.

An excellent replacement for the 9909's (that can use the existing sockets) is a single 7094. Although this tube is somewhat uncommon, it is far easier to find than the 9909's and is generally less expensive than a single 9909 new, let alone a pair. (I found two brand new 7094's without looking very hard and shelled out only $40). Since the 7094 uses the same socket as the 9909, the modification is simple. The socket must be rewired and 6.3 volts at 3.2 amps supplied for the filament. To obtain full

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Radio Frequency Oscillator 0-152/URA-13

by George Rancourt, K1ANX
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About ten years ago I came across the manual for the Collins-built URA-13. I thought the set was very, very interesting so I kept the manual hoping that someday I might find the radio. This year at the Hosstraders Hamfest in Rochester, New Hampshire I found one in a pile of other gear brought in from an estate. I got it for $10.

I don't think that Collins built very many URA-13s.. My set is serial number 10.

I wish I had more knowedge of the history and application of this set. Maybe there's some ER readers that have additional information. If so I'd sure like to hear from them.

At the present time the set is still under restoration. When I have it working I'll provide another article.

9. Description of Radio Frequency Oscillator 0-152/URA-13

(figs. 7 & 8)

a. Radio Frequency Oscillator 0-152/URA-13 is a 29 tube RF oscillator designed to operate in conjunction with Radio Receiver R-390/URR to produce a stabilized, modulated, exciting frequency, within the frequency range of 1.5-32 Mc, to an associated transmitter operating in the same frequency range. This radio frequency oscillator is designed for mounting in a standard, floor mounted 19-inch rack, such as Electrical Equipment Cabinet CY-1119/U, for fixed station use. The radio frequency oscillator may also be mounted in a shock-mounted, 19-inch rack, such as Electrical equipment cabinet CY-1216/U, for mobile installations. The structural parts of the radio frequency oscillator are of aluminum.

b. All operating controls are on the front panel (fig. 24). Two handles at the outer edges of the front panel facilitate withdrawal of the radio frequency oscillator from the rack. The front panel meters are the AUDIO LEVEL meter which indicates the phase deviation in radians during phone (PM) operation; the CAL IND meter which indicates the input level of the IF input signal during normal operation and indicates frequency deviation during calibration; and the LINE CURRENT meter which indicates the FSK relay current. Bar knob controls control the various functions of the radio frequency oscillator. These include the FUNCTION switch, the SERVICE SELECTOR switch for selecting FAX, FSK, PM (phone) or CW operation, the MOD TEST switch with switch lock, the DEVIATION control with control lock, the CARRIER CONTROL for selecting LOCAL or LINE operation, the ASSOC XMTR FREQ MULT switch for compensating for transmitter frequency multiplying, POLAR NEUTRAL selector for selecting FSK operating mode, AUDIO LEVEL control, and the LINE CURRENT control for adjusting the FSK relay current. The indicator lamps include the red POWER indicator which indicates that the line power is on, the yellow OVEN ON indicator lamp which indicates the discriminator oven is on and the green AFC indicator lamp which indicates that the radio frequency oscillator is tuned to the radio receiver frequency. The POWER ON-OFF toggle switch turns the line power on to both the radio frequency oscillator and the radio receiver. The LOCAL MIC KEY jack at the lower right of the front panel provides connections for local microphone or key.

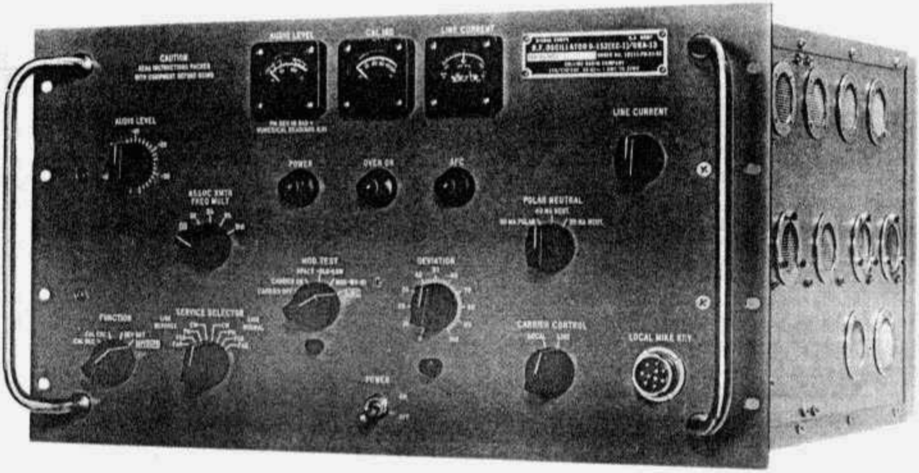

Figure 7. Radio Frequency Oscillator 0-152/URA-13, front view

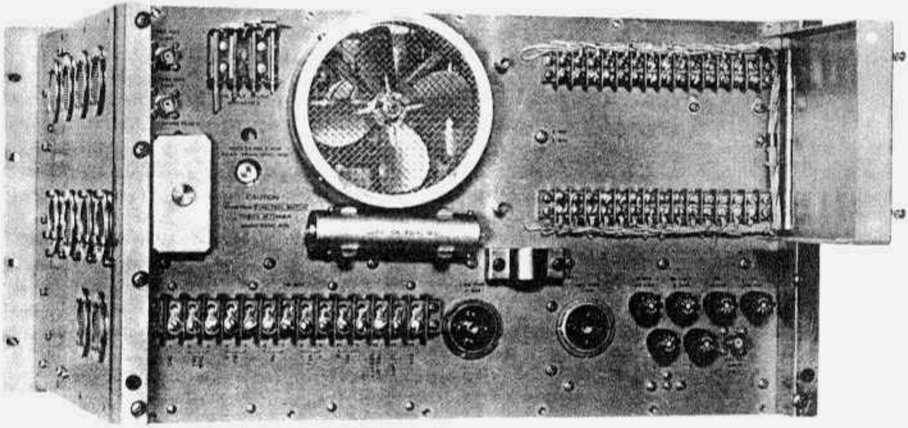

Figure 8. Radio Frequency Oscillator 0-152/URA-13, rear view

Frequency range................................ 1.5 - 32 mc (continuous).
Method of modulation..................... Reactance-tube oscillator.
Types of Service available
Line input... cw, fsk, fax and phase modulation for phone.
Local input..cw and phase modulation for phone.
Input impedance (if).........................100K.
Power output (rf)...............................3 watts to 50-ohm load
Input frequency for afc operation
Nominal... 455 kc.
Range for afc operation....................452 to 458 kc.
Input voltage for afc operation.......10 mv (minimum).
Power input
115/230 vac, 48-62 cps....................... 285 watts.
Number of tubes............................... 29
Weight.. 97 lbs

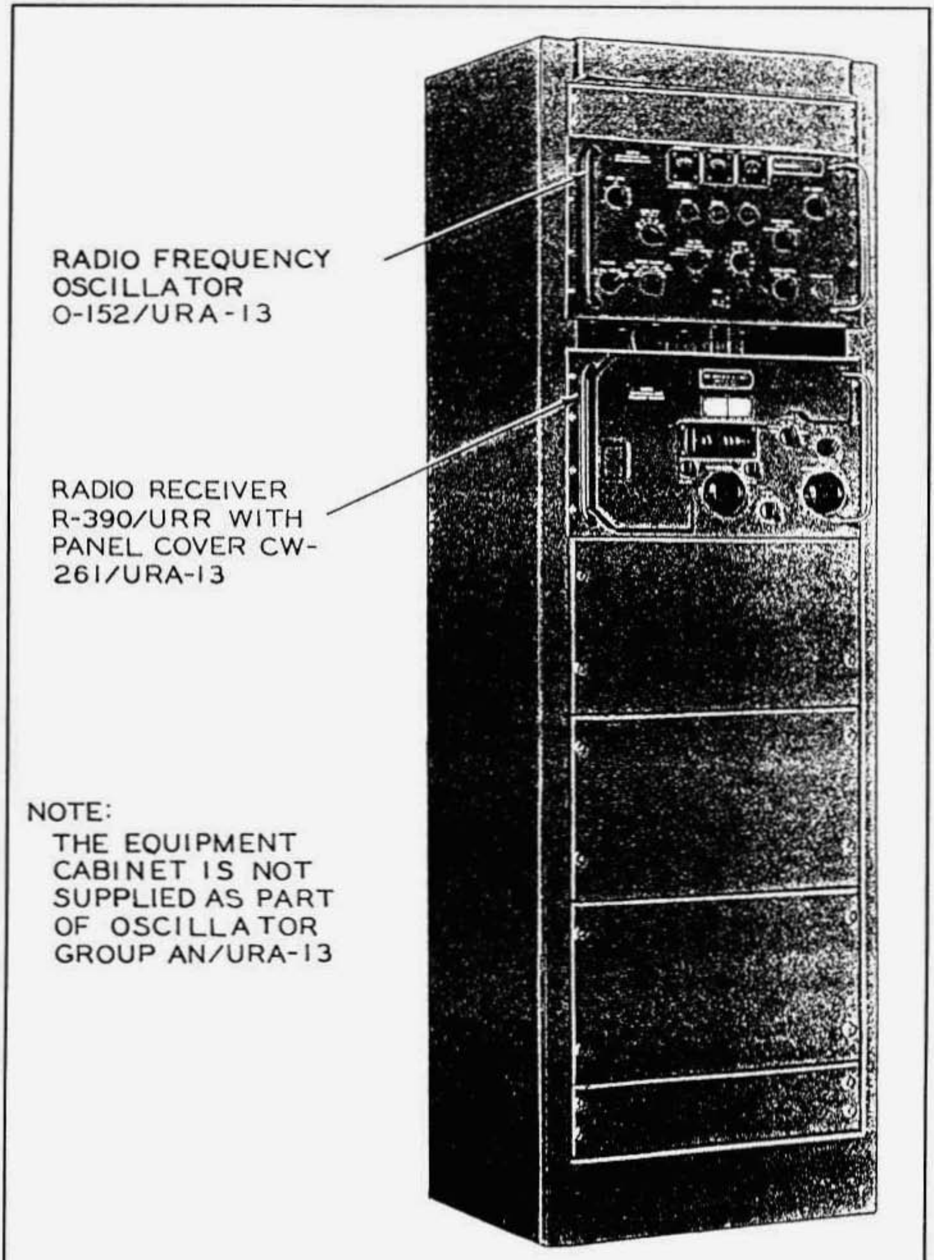

Figure 2. Oscillator Group AN/URA-13 equipment cabinet installation, front view.

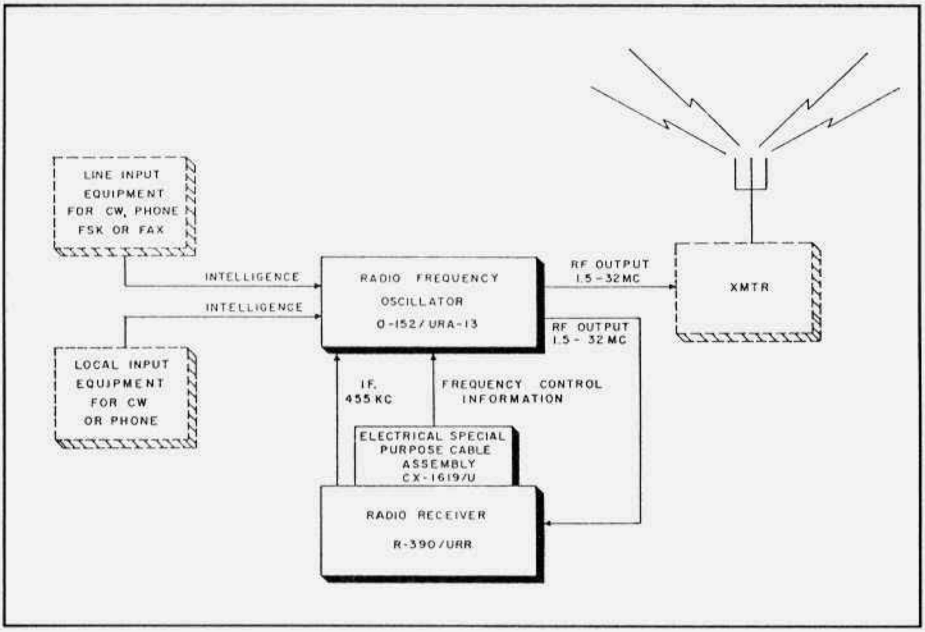

Figure 4. AN/URA-13 frequency controlled transmitting system, block diagram.

The author's URA-13.

Identification/nameplate enlarged

An HB Crystal Calibrator, the '6CAL6'

by Tom Marcellino, W3BYM
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Do you need a crystal calibrator for that receiver restoration project? Do you enjoy novel and practical construction projects? If you answered yes, then you may want to read further in this article and maybe try your hand at building the '6CAL6' crystal calibrator.

I recently purchased an NC-300 as a restoration project. After correcting the many wiring mods, some you wouldn't have believed, I wanted to install a crystal calibrator. Being the impatient type and believing that it would be a long wait for one of those XCU-300 calibrators to come along, I decided to build my own unit.

The circuit is by no means original and can be found in several issues of the 50's and 60's ARRL Handbooks or many tube type receiver manuals. The tube type isn't particularly critical and types like the 6AU6, 6BZ6 or 6GM6 are interchangeable and all work very well.

The crystal was the critical part in my project. I had two 100khz units in my junk box and another in my Drake 2B calibrator. Incidently, the 2B calibrator is essentially a "carbon copy" of this circuit.

I found, after much head scratching, that the crystal I initially used was offset by 10khz on the high side. This was discovered after changing capacitor values with no success and almost canning the project. Being a stubborn and persistent individual, I said to myself; "self, this is a simple basic crystal oscillator so why can't you make the darn thing work?" Well, isn't it great when you can talk to yourself and get answers!

The best I could do with the adjustment trimmer capacitor was roughly +/- 4khz. Now remember that gave the

The '6CAL6' calibrator installed in the author's NC-300.

calibrator a range of 106 to 114khz and not much value as a 100 khz frequency standard. It was time to experiment with the two other crystals in my stock. Both of these units worked very well with a range adjustment of 97 to 103khz. So beware of the operating frequency of 100khz calibration crystals.

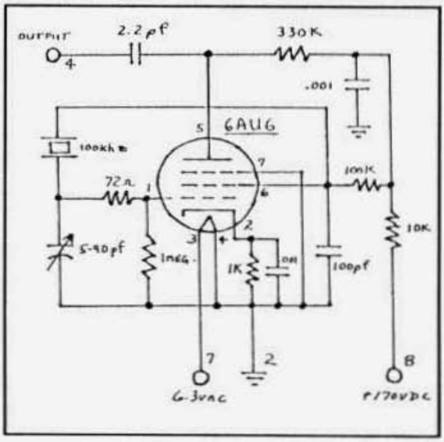
The remaining junk box crystal was my only choice because the 2B crystal was returned to its original home. I thought it would be a great idea to solder a small bus wire from the crystal can to the ground bus for construction stability. Well I was wrong again because the calibrator stopped oscillating. Apparently this crystal has one of its electrodes shorted to the case resulting in the use of insulating tape wrapped around the can. The crystal is plugged

The shell of the 6L6 removed showing construction of the calibrator.

into a socket and really doesn't need support so the wire idea was eliminated.

Now comes the novel part of the project; what could I use for a chassis? I wanted something unusual and at the same time functional. My first unit used a small aluminum box (real innovative) which scored a big zero in aesthetic value and a double zero in electrical performance; it didn't work.

Enter the vintage always faithful 6L6 metal tube. With only three in my stock and at flea market prices of $10 each, I wasn't particularly enthused about destroying one. Having never opened one of these tubes, I didn't know how much internal working space would be available. Well I decided to take the risk because my ham intuition said it would



'6CAL6' schematic

suit my needs.

The opening process was a success and the following describes the method used. Phase A, first de-solder all base pins and then using a small tough screwdriver pry up each of the four tabs from the shell that wrap the 8 pin plug. Now the plug can slide from the shell. What remains is the shell with the protruding glass vacuum sealing port, a inner metal ring and several small wires protruding through glass seals.

Phase B was put into effect and out came my Craftsman half horse grinder. Using the coarse wheel, the tube was slowly rotated while grinding away the bottom flange. Another point of interest is the shell material. This is some of the hardest steel I've ever encountered-perhaps it's stainless. Maybe a reader could educate me on this issue. After much grinding, I finally reached the interface seam between the upper shell and bottom metal ring. Be careful at this stage because you only want to remove the flange while leaving all of the diameter of the shell intact.

Using safety glasses and gloves, the vacuum port and the bottom glass seal were smashed. After dislodging the inner metal ring, the 6L6 guts were removed and discarded. Finally, some careful grinding and filing allowed the

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Heathkits That *Weren't*

Part Two, the SB-240 2 KW linear amplifier

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Front panel of the SB-240 linear amplifier.

This is the second part of a series of articles about Heathkits that never went into production. Unless you were a company employee, you probably never even heard of these products, much less saw them. Any information about these products was generally kept inside the walls of the company, and most existing units were destroyed. But now that several years have passed since their inception, and because the company is no longer in the kit business, I will let you in on some of these "secret" projects. This month, we will take a look at the SB-240 2 KW Linear Amplifier. The accompanying photograph is a picture of the author's SB-240. There are probably only about 4 or 5 of these units still in existence, including one owned by a non-Heath person in Ohio.

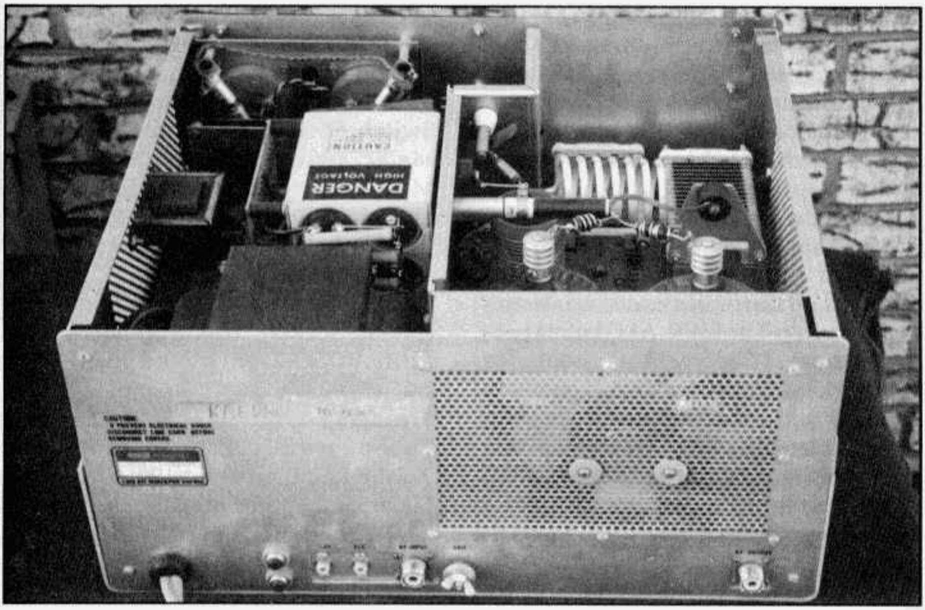
Like the antenna tuner described last month, the SB-240 amplifier is styled to match the SB-104 Series. This amplifier is electronically similar to the venerable SB-220 amplifier but features zero-idle current. With zero idle current, the tubes are completely shut off between words when operating in SSB.

Another major feature is its over-drive and over-SWR protection. Three status lights located between the meters indicate NORMal drive, OVER drive, and over SWR. Excessive over-drive or over-SWR causes the amplifier to automatically switch to the standby mode, which allows the exciter to operate straight-through with no operator intervention.

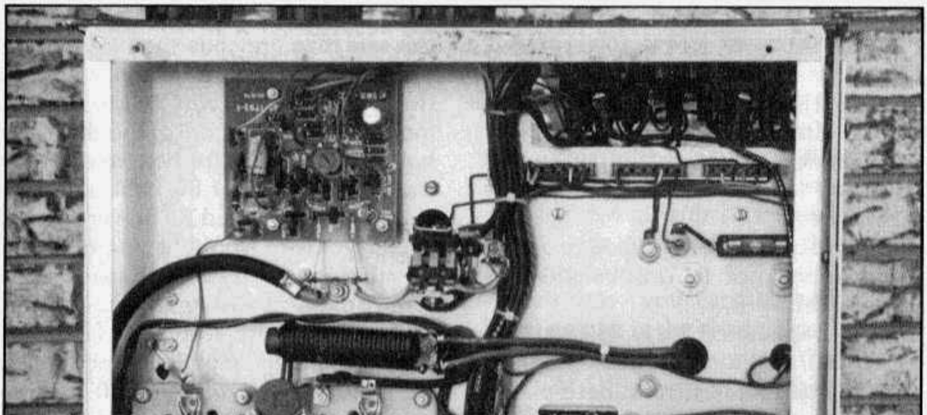
A row of push-button switches below the meters allow you read Plate Current, Grid Current, High Voltage, Forward Power, Reflected Power, and PEP Power. There is also a handy Standby switch that allows you to operate with just your exciter while the amplifier is turned on.

A spring-loaded temperature sensor rests against one of the two 3-500Z tubes to control a 2-speed cooling fan.

The amplifier contains four circuit



A view of the SB-240 from the top rear



Bottom view.

continued next page

Heathkits That *Weren't* from previous page
boards. The input filter board contains two or more mica capacitors and a toroid coil for each band to provide input impedance matching. The power supply board contains the diodes for the full-wave voltage-doubling circuitry and multiplier resistors for high-voltage metering. The main circuit board contains the grid latching, plate current and grid current metering, tube bias supply, and transmit-receive relay control circuitry. The SWR-ALC board processes the grid-derived ALC voltage for feedback to the exciter. It also contains forward and reflected power sensing, the SWR latch circuitry (reset by pressing the STBY pushbutton), and the PEP (Peak Envelope Power) circuit.

Following are the Amplifier's Specifications:

Band Coverage: 80, 40, 20, 15, and 10-meter amateur bands.

Driving Power Required: Less than 100 W.

Maximum Power Input: SSB: 2000 W PEP, CW: 1000 W, RTTY: 1000 W.

Duty Cycle:

SSB: Continuous voice modulation.

CW: Continuous code operation (10-minutes max. keydown.

RTTY: 50% (maximum transmit time–10 minutes).

Third Order Distortion: –10 dB or better.

Input Impedance: 52 Ω unbalanced or less at 1.5:1 SWR.

Output Impedance: 52 to 75 Ω unbalanced at 2:1 SWR.

Zero-Signal Plate Current: Zero mA at approximately 2500 volts (low), zero mA at approximately 3500 volts (high).

Small Signal Idling Current:

Approx. 2 watts input (idling plate current should be 120 mA).

Grid Current Indication: NORM LED lights at approximately 160 mA.

OVER LED lights at approximately 180 mA.

Latchout occurs at approx. 200 mA or greater; with a 500 μsec delay.

SWR Latchout: Latchout occurs at an SWR of 5:1 for 1000 W DC input.

Cooling: Temperature-controlled 2-speed fan.

Front Panel Controls:Tune, Load, Band Switch. Power, CW/Tune – SSB switch. Meter switches: Operate/Standby, Multimeter (plate current, grid current, and high voltage), Power Meter: PEP (forward power only), forward, and reflected power.

Rear Panel:Line Cord, Antenna relay (phono socket), ALC (phono socket), RF input (SO-239), Ground post, RF output (SO-239), Two 10-ampere circuit breakers

Tubes: Two 3-500Z.

Power Requirements: 120 VAC 50/60 Hz at 20 amperes maximum. 240 VAC 50/60 Hz at 10 amperes maximum.

Cabinet size: 8-1/4" high x16-7/8" wide x 16" deep (21 x 42.9 x 40.6 cm)

Net Weight: 51 lbs. (23 kg)

The most popular reason the SB-240 never shipped was due to safety concerns. Not that the basic design was any less safe than previous amplifiers Heath produced, but there is an adjustment on the SWR-ALC circuit board that is mounted on the bottom of the chassis. A hole is provided in the bottom cover for this adjustment, but the control is very close to the amplified RF power-sensing circuitry. There would be no problem if the adjustment is made with an insulated screwdriver, but a hasty adjustment with a metalic screwdriver could be fatal. Two other reasons the amplifier never shipped were because the matching SB-104 was being phased out and an FCC ban against amplifiers that contained 10 meters was on the near horizon.

The author regularly uses his SB-240 amplifier and worked over 300 of his 333 DXCC countries with it.

This completes a look at the SB-240 amplifier. Next month we will take a look at the SB-645 (unofficial model number) External VFO. **ER**

Heathkit Manuals

Part 4

John Hruza, KBØOKU
2521 S. Holly St.
Denver, CO 80222

Since the publication of my last article on Heathkit manuals I have discovered a few more manual numbers. Again, all manual numbers except for the O-5 and V-1 should be preceeded by "59"; e.g., the full number for the GW-12 is 595-555.

As I said in the first article of the series, the complete list of all Heathkit manuals known to me is available free to anyone for a large SASE with two stamps sent to me at the above address.

Communications Equipment

Model	Manual	Equipment
GR-64	5-942	Shortwave Receiver
GW-12	5-555	CB Transceiver
GW-52	5-607	1W HH CB Xcvr
HA-10	5-402	Warrior Lin. Amp.
HP-13	6-M638	Pwr Sply Spec Sheet
HW-9	5-3059	QRP CW Xcvr
HW-99	5-3185	Novice CW Xcvr
HW-5400	5-2952	HF SSB Xcvr
HWA-9	5-3061	Access. Band Pack
HW-17A	5-1118	2-Meter Xcvr
HWA-17-2	5-1099	FM Xmting Adapter
HWA-5400-1	5-2856	AC PS/Spkr/Dig. Clock
HWA-5400-3	5-2968	Key Pad Access.
HX-11	5-499	CW Xmatr
HX-20	5-405	SSB Mobile Xmtr
PSA-9	5-3058	HW-9 Pwr Sply
SB-313	5-1330	SWL Receiver

Test Equipment

Model	Manual	Equipment
IM-2202	5-1573	Digital Multimeter
IM-2212	5-2187	Auto-Ranging DDM Assembly
IM-2212	5-2261	Auto-Ranging DDM Operation
IM-4100	5-1776	Frequency Counter
IN-12	5-571	Resistance Substitution Box
IO-10	5-346	DC Oscilloscope
IP-17	5-1156	Regulated High Voltage Pwr Sply
O-5	089B	5" Oscilloscope
TC-3	5-208	Tube Checker
TS-2	5-9	Television Alignment Generator
V-1	V54 & V58-V62	VTVM

Entertainment Equipment

Model	Manual	Equipment
AR-17	5-891	FM-FM Stereo Rcvr
PT-1	5-205	Professional AM-FM Stereo Tuner

The above information was supplied by KH6MM, Mervyn Ellsworth and myself. **ER**

R-390/R-390A Current Regulator Substitute

A hint for R-390 series RX's, and I presume this would cover R-390A.

When the current regulator tube gives out, as a replacement use a 12BY7 (A) tube. This tube is a 12 volt filament at 300 mA rating. The only change is to rewire the regulator socket so that pins 4 and 5 are paralleled with the present regulator pins.

That way, you can use either type tube, no one is the wiser. This hint was given to me by an old timer that was an Army MARS member. (the late Warren, WA2LVW).

My R-391 has operated for many years now with this mod and I have not noticed any significant instability or drift of frequency (even when operated in my garage with an octopus of extension cords providing power).

I have not seen this mod mentioned before, but Warren had many R390 and 390As over the years and this is what he did with good luck.

Dale, N2DM

Letters from page 29

power and efficiency, 350-400 volts are required for the screen. The screen voltage on the 9909's is about 250. I connected a separate rectifier/filter combination to the secondary of the low voltage transformer. The bleeder resistor was tapped to adjust the voltage. I've been using the 7094 for about two years with good results. The tube will yield up to 200 watts output if desired. I can supply complete details for this modification/upgrade.

So, if you have a Globe Champion 300/350 sitting in the corner collecting dust because you can't find those AX9909 finals, try the 7094. Let's hear some more Champions on the air.

Stephen Ickes, WB3HUZ

Dear ER

Sorry to hear some people were upset with the old list [ER Parts Units Directory] for various reasons. It was a great help to me and several rigs were brought to life here because of it. Wasting phone calls or postage is just part of the game. Most of us spend time, fuel and even a motel bill to attend a distant hamfest, but we don't complain to the hamfest sponsor when we don't find something we want or someone beats us to it. As to the complaint that the parts unit directory rigs should be "restored", anyone who says that should first personally inspect each rig on the list to see what they look like.This stuff isn't that rare yet!

Geoff Fors, WB6NVH

A HB Crystal Calibrator from page 35

shell to slide over the base plug with a press fit. I now had a case (shell) and chassis (base plug) for my project.

The first order of business was cutting a piece of component board to fit inside the shell. I used a board with copper traces on one side measuring 1 1/8" x 2 5/8". Mounting the board to the base plug was easily done by soldering a "U" shaped piece of #16 bus wire to the bottom trace on the board and routing the "U" down through unused pins 1 and 5.

The top of the board was notched to accept a 7-pin miniature saddle type socket. This is held in place using small bus wire threaded through appropriated holes and soldered to the ground bus.

Mounting and placement of the passive components isn't critical. Just do a little layout planning and try to make short lead runs. The last construction operations are cutting the two holes in the shell for the tube and trimmer capacitor openings. Use a small pilot drill to make the top hole for the tube which guides a 3/8" sheet metal drill. Next a 3/4" chassis punch was used to cut the tube opening. The placement of the adjustment access hole will depend on the capacitor position. A 3/8" hole will work just fine. The completed calibrator has a height of 5.25" from the bottom of the base plug to the tube top.

Using the NC-300 calibrator pin connections made my calibrator a plug-in-and-go unit. The only drawback to my layout is the position of the trimmer; it faces the filter capacitor making tuning a bit difficult. This was solved with the fabrication of a very short tuning tool.

Grounding of the shell is accomplished by soldering a 1 1/2" piece of 1/4" braid to the side ground bus on the board. The braid is fashioned in an "S" curve that contacts the shell as it slides down to rest on the base plug.

The unit works very well, producing a bodacious 20+ over S9 signal on 160, 80 and 40 with S7 on 20, 15 and 10 meters. As I said in the beginning, if you like novel and practical you will have fun with this project. The idea can easily be adapted to just about any receiver that uses an eight pin octal socket for its calibrator. **ER**

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DEADLINE for the JULY Issue: JULY 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: Surplus military gear. New BA-386 batteries. SASE for current listing. Tim Banse, POB 2522, Iowa City, IA 52244-2522.

FOR SALE: "AM FOREVER" quality Haynes T-shirts, grey, blue, green & red. Sizes M, L, XL - $15 shpd. Rick, K8MLV/Ø, 1802 W. 17th St., Pueblo, CO 81003. (719) 543-2459

FOR SALE: New Ranger I, Valiant I & Navigator plastic dials, 160-10, freq. numbers in green, w/all holes, like orig. - $17.50 ppd. Bruce Kyder, 4003 Lauarawood La., Franklin, TN 37064. (615) 794-9692

FOR SALE: NC-303, spkr & manual - $350. Vern, WØVV, Box 187, Lehr, ND 58460. (701) 378-2710

FOR SALE: T47/ART-13, unmodified - $125. **WANTED:** Schematic or info on Gates SA-39, will purchase copy. Wayne, NØTE, 1212 17th Rd., NW, New Strawn, KS 66839. (316) 364-5353

FOR SALE: 2NT, scratch on panel - $50; RV-4 VFO, clean - $70. Jim Jorgensen, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (708) 852-4704

FOR SALE: Hallicrafters SX-115, exc. - $495; Ranger II, exc - $325; Hammarlund HQ-160, mint - $285. All w/manuals. Bob Needleman, KD4ZN, 395 Meadowbrook Rd., North Wales, PA 19454. (215) 661-9283 eves

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. (540) 822-5643

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

FOR SALE: Military rcvr/xmtr, Hughs RT 794/PRC-74 - $100 shpd. Zeutzius, 5059 Mesa Dr., Castle Rock, CO 80104. (303) 660-0232

FOR SALE: Heath AC-1 - $100 or trade for AT-1. **WANTED:** Repairable Johnson, Hammarlund gear. Larry, N4QY, 170 Heritage Ln., Salisbury, NC 28147. (704) 633-3881

FOR SALE: LM-13 freq. meter, w/AC sply - $50; HQ-100, w/clock - $125 + shpg. Don, WA5NKP, 5106 Red Oak Dr., Amarillo, TX 79110. (806) 352-4776 eves

FOR SALE: 275W Matchbox, VG - $95. **WANTED:** VG Globe Scout Deluxe; NC-300 calibator; VG Valiant II shippable. Ron, WØOIZ, 10701 W. 54th St., Shawnee, KS 66203. (913) 268-5973

FOR SALE: 300G Collins 250 watt broadcast xmtr, original - $1000. Evan Haydon, 4308 N. 15, Lincoln, NE 68521.

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

WANTED: Heathkit, Eico, Fisher, Dynaco or similar tube audio amplifier in any condition or manuals for same. Mike Nowlen, WB4UKB, POB 1941, Herndon, VA 22070. (703) 716-1363

WANTED: Still collecting early WW II radar equip. & manuals, what have you. Allan H. Weiner, 97 High St., Kennebunk, ME 04043. (207) 985-7547

WANTED: Meter historian searching for instruments, The Instrument Maker & other 1940s meter magazines. Chris Cross, Box 94, McConnell, IL 61050.

WANTED: KWM-1 and/or 516F1, 312B1 spkr, 312B2 console. Also parts radio. Randy, W9ZR, 3600 South B&K Rd., Galena, OH 43021.

WANTED: Collins 302C-3, DL-1, 62S-1, 51S-1, 55G-1, 312B-5, 399C-1, KWM-1, SM-1/2/3, 32V2, any Collins spkrs. Leo. KJ6HI, CA, (310) 670-6969.

WANTED: FRR59A rcvr extender part W-624; TCS-12 mic; Heath HW22 xcvr manual. Al Norton, K7IEY, 1008 Liberty St., Lynden, WA 98264. (360) 354-4622

WANTED: R-389 low freq. rcvr. Bill Michels, POB 3696, Milford, CT 06460. (203) 356-5729; mlemoine@snet.net

WANTED: GF-11 & GF-12 xmtr units; also tech and schematic info for same. Mike, WØBVA, Box 121, Scammon, KS 66773. (316) 479-2756

WANTED: Meter for Hammarlund HXL-One linear. Paul Wang, KU6T, 1047 21 St., #1, Santa Monica, CA 90408. (310) 825-1564; pkcwang@ee.ucla.edu

WANTED: Paragon type 10-R RF amplifier. Has only one tube. Pat Stewart, W7GVC, 1404 Ruth Ave., Walla Walla, WA 99362-3558.

WANTED: Schematic for KAAR 220A Porpoise marine mobile rig. Gary Kabrick, WA7WOQ, 1414 N. McKinley Ave., Tucson, AZ 85712.

WANTED: Johnson Viking mobile VFO. George, N2GBY, NJ, (609) 848-6699.

WANTED: Manual &/or schematic for BC-224C rcvr, photocopies OK. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407

MESSAGE: Thanks to all who sent info to me on the VM-1 mod xfmr. Carl, K1EYY

WANTED: QST, CQ, Radio Craft & Radio News magazines, 30s, 40s, 50s. Advise price + shpg. Beni Fernandez, KP4DN, 1674 Atlas St., Summit Hills, PR 00920.

WANTED: Low voltage pwr xfmr DX100. John Storie, W7KPA, 2445 S. Hillside Dr., Springfield, MO 65804.

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

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 13280, Maumelle, AR 72113. (501) 851-8783, FAX 851-8784.

WANTED: I buy ham rcvr's not working but worth saving. Ron, 10701 W. 54th St., Shawnee, KS 66203.

WANTED: Old ham desktop microphones, any condx.; separate mic heads & stands. Rick, KF5NU, 9031 Troulon Dr., Houston, TX 77036. (713) 774-5102

WANTED: WW II navy shipboard xmtrs & accessories, any condx. Steve Finelli, N3NNC, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211

WANTED: Heath xtal sets; early ham & shortwave equip., literature, accessories, broken or parts units; any Heath amateur gear. WA5THJ, Rt 9 Box 163, Alvin, TX 77511. (713) 331-2956

WANTED: Pre 1980 microcomputers for historical museum collection; early magazines & sales literature. Dave, KK4WW, POB 341, Floyd, VA 24091. (540) 231-6478/763-2321

WANTED: Fair to good condx. E.F. Johnson Valiant I or II . Will pay above average price. J. Costello, WA5HSI, LA (504) 889-2424.

WANTED: Valiant II & SSB adapter. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

WANTED: XCU-303, XCU-300 or similar xtal calibrator for NC-303 rcvr; Heath DF-2 navigator rcvr. Al Kaiser, W2ZVR, 713 Marlowe Rd., Cherry Hill, NJ 08003-1551. (609) 424-5387

WANTED: Mics: Turner BX/D, CX/D, VT-73; Astatic T-3, JT-40, Shure 705, 707A, 520, 545 models; EV 605, 619, 638, 641. Ready buyer. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225, FAX 328-4217

WANTED: Orig. antenna shunt capacitors for ART-13 xmtr. W7RBF, AZ, (602) 864-9987.

WANTED: Popular Electronics, Jan., May, Dec. 1969; book-Microcomputer Design by Donald Martin (1976). Dave Dameron, KG6BP, 819 Boundary Pl., Manhattan Beach, CA 90266-6621. (310) 318-5311

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

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

FOR SALE: Repair/restoration of vintage Drake, EFJ, Collins & others. Please call for info. Dee, W4PNT, (540) 949-8300

FOR SALE: UTC xfmr 5760-321, 4800 V @ 475 mA, 120/240V, NOS - $150. Joe, W6CAS, CA, (916) 731-8261

FOR SALE: Antenna tuning units, BC-939A for BC-610 - $45; BC-306B for BC-375 - $30; Hickok 600A tube tester - $60; B&K Precision #820 capacitance meter - $50; National NC-46 & mchg spkr - $140; Hammarlund HQ-140 - $140. All + UPS. Hallicrafters R-274/FRR (SX-73) manuals, NOS, 100+ pges - $13, priority mail. Dan Mason, R. RT.1, Box 204F, Santa Fe, NM 87501. (505) 455-3416

FOR SALE: Zenith Royal 1000D Transoceanic - $125 + shpg; Heath HR 1680 rcvr - $90. Jack, W9FQK, AZ, (520) 634-2028

FOR SALE: Central Electronics 100V xmtr, VGC - $325; Hallicrafters HT33A linear amp, VGC (uses PL172) - $450; Gates Level Devil broadcast compressor/limiter, GC - $200. U-ship. **WANTED:** Mod xfmr CMS-3 as used in Johnson Desk or KW-1, (I will pay your price)! P. Jay Spivack, N7JDT, 325 S. Washington Ave., #244, Kent, WA 98032. (206) 859-2680, FAX 859-0246

FOR SALE: CBS Labs "Volumax" model 420 - $75; RCA BW66F modulation monitor - $75; Thordarson mod. xfmr, 6900 ohm to 3750 ohm (PP 805's), 225W & 50H mod. reactor - $120; like-new Eimac 3-1000Z, socket, chimney, fil. xfmr and fil. choke - $300; Collins TCS-5 rcvr & AC sply - $75; Thordarson 11M77 300W multi-match mod. xfmr - $50; HB 304TL 160M PA in 5' rack w/Dahl HV pwr sply - $600, (PU only on this item); new Eimac 50T triode - $35. All plus shpg. James Owens, NWØO, 1363 Tipperary St., RR #3, Boulder, CO 80303-1621. (303) 673-9019

FOR SALE: Nearly complete set 'Ham Radio' & 'Ham Radio Horizons', 'Popular Electronics 60's - 70's. AAØWP, (507) 288-0242

FOR SALE: Collins 312B4, RE, - $100; Heath SB-620, 3395 kc - $125. John, Alaska, (907) 337-9157

FOR SALE: Utica 650 w/external VFO, beautiful chrome cases (6-meter xcvr) - $150; Fisher K10 Spacexpander tube reverb w/manual - $100. C. Zafonte, N1FRX, ME, (207) 834-6273 eves.

FOR SALE: SASE for huge list of military, ham gear, books, parts, etc. Gary Cain, POB 521, Shakopee, MN 55379.

FOR SALE: Homemade galena xtal radios & parts. Write for details. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150. (716) 873-0447

FOR SALE: Isolation xfmr, 120/240 VAC in and 120/240 VAC out @ 500VA - $60; USM-117 solid-state scope, w/plugin, very compact, available elsewhere for $175, my price only - $110; McIntosh 75 - BO. All VG/exc. U-ship. Bob Bakinowski, 1524 Saint Tropaz, Tucson, AZ 85713. (520) 624-8029

FOR SALE: Patchbay, professional ADC "Tiny Telephone" (See ER #69), 720 total patch points - $350. Gary, TX, (713) 787-0040

FOR SALE: Bench sply Electro #BJ, 12VDC/3.5A or 6VDC/7A - $20 + shpg. H. Mohr, 1005 Wyoming, Allentown, PA 18103.

FOR SALE: Tube radios and amps. Send LSASE for list. Hoover Noonan, Rt. 1, Box 187, Pineland, SC 29934. (803) 726-5762

FOR SALE: TBX xtal calibrator/monitors, w/xtals, see ER #49, pge 9 - $10 + UPS. Mike Bittner, 27215 Sunnyridge Rd., Palos Verdes, CA 90274. (310) 377-4797

FOR SALE: Heath MW-7, VG - $85; HW-22A, no cabinet, calib. or pwr sply - $40; TC-2 w/all papers - $20; Eico 320 sig. gen. - $15; Bogen C-35 - $30; Ray Jeff. 914, fair out, good in, minus 805s - $50; T-150 - $75; Stewart-Warner 9005A, OK - $25; BC-455B, missing stuff but unmodified - $15; Teletype 28, clean - make offer. All postpaid. **WANTED:** Weston 798 tube checker repair info; 6M FM S-S or hybrid channelized mobile rig; PP-448 & CX-1213 for RT-70; PL-279, CO-1086, GN-58 for GRC-9; manuals/schematics for 2-3 Mc marine mobile, esp. PortaMarine IV. Eric, N4TGC, AL, (205) 764-0675

FOR SALE: AM audio equipment. Collins 26W limiter - $200; Audiomax III ALC - $100; Volumax APC - $100; UREI 527-A EQ - $250; Micro-Trak PMS-MX mixer - $250; LPBS-2 compressor/limiter - $100; Electrovoice 605 mic (new) - $100. U-ship. W3HM, Rt #3, Box 712, Harpers Ferry, WV 25425. (304) 876-6483 after 6PM EDST

FOR SALE: CRTs 5HP1A, 5FP12, 5XP11A, 2J7BP7, 2JPA31, 5FP7, 5WP15 - $10 ea or trade for 100TH, 808, 830B. Jim Feasel, 13549 Morse Rd., Pataskala, OH 43062. (614) 927-2592

FOR SALE: "Tube Type Transmitter Guide", 550 pictures, 550 xmtrs, 104 manufacturers - $17.95 US, $19.95 Canada (21 oz), California add tx. Sound Values, POB 9 Dept. R, Auburn, CA 95604.

FOR SALE: New Release: Send 2-stamp LSASE for Olde Tyme Radio's latest flyer, No. 196 to: Olde Tyme Radio Company, 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910. Ph/FAX 301-578-5280

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

FOR SALE: CE-200 - $300; NC-100 - $200. **WANTED:** Tuning units and books for TMC-FRR-502. Ken Kolthoff, 5753 David Pl., Fairfield, OH 45014-3507. (513) 858-2161

TRADE: Millen NOS 90801 TX, 90881 amp. **WANTED:** HRO-5 rcvr, Millen 90711 Variarm VFO. Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062. (713) 376-3436 (h), 957-6420 (w)

FOR SALE: Magazines, QST-CQ-73-Ham Radio Horizons, Ham Radio, RSGB - prices from $1 each to $.50 each, for list send LSASE; Hustler mobile antenna, 75 thru 10 resonators - $95; Cushcraft 40-2CD, 2 el. 40M beam - $325. John Feltz, WA9LWJ, 973 E. First St., Junction City, WI 54443. (715) 457-2506

FOR SALE: Hallicrafters SX25 in working condx, has some missing parts, contact for better description. **WANTED:** Spkr for National NC183D, signal meter for National NC57. Mark Shoup, 27 Dogwood Dr., Newton, NJ 07860. (201) 383-6417

FOR SALE: Repair! Radio repair, tube or solid state, reasonable rates. Jim Rupe, AB7DR, Western Amateur Radio Repair Co., (WARRC), POB 697, Grayland, WA 98547. (360) 267-4011

FOR SALE: Heath AMI Classic Radio Log Book, not like any other log - $6.50. Marty Drift, POB 21, Blawenburg, NJ 08504.

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

FOR SALE: Misc. military equipment & accessories; ham/military manuals. List available. Henry, KD6KWH, POB 5846, Santa Rosa, CA 95402. (707) 544-5179

FOR SALE: R-390A orig. Dec. 1961 maintenance manual TM 11-5820-358-35, 189 pgs. - $28 incl. priority mail. Alben, POB 4118, Jersey City, NJ 07304

FOR SALE/TRADE: Hallicrafters S-37 UHF rcvr, very nice; S-36A VHF rcvr, very nice. Rack mounts, books. Fred Clinger, OH, (419) 468-6117 after 6PM Eastern.

FOR SALE: W.S. 19 MK3, fair condx, w/ps - $250; also BC-966A w/CB - $350. Steve Bartkowski, 4923 W. 28 St., Cicero, IL 60650. (708) 863-3090

FOR SALE: Sierra 125B, S25, HP310A - $50; CEI 354 - $300. **WANTED:** Collins 75S3C, 32S3A, F455 FA series filters. Ward, K8FD, 116 Fairway Dr., Belmond, IA 50421. (515) 444-4396

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

WANTED: Info on the old Allied Radio in Chicago. I'm researching the company for an article in ER. Need anectodes, stories, history, etc. Kurt H. Miska, N8WGW, 3488 Wagner Woods Ct., Ann Arbor, MI 48103. (810) 641-0044 wk. FAX (810) 641-1718. 76247,1422@compuserve.com

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

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

WANTED: Help. Docs for Link 500C, good 75TH tubes; address for Mr. Link himself. Larry, KF6WV, Box 1139, Occidental, CA 95465. (707) 874-1000

WANTED: HF-380, 45151, AC-3814. Koji Mitoshi, Japan. TEL/FAX 011-81475-24-9115, e-mail byj01726@niftyserve.or.jp

WANTED: Manual, schematic & pwr sply for Singer SB12b panadaptor; BC348 shock mount; RBC1 panel voltmeter (CV22354); BC1021C manual; SX73; SX88. Mark Lipson, KA7GIE, 7809 146th Ave. NE, Redmond, WA 98052. (206) 885-3589

WANTED: April 1963 CQ magazine. James T. Schliestett, W4IMQ, POB 93, Cedartown, GA 30125. (770) 748-5968

WANTED: Hallicrafters SR-46 (A) 6M; Knight C-11 CB, any condx. Al Bernard, NI4Q, POB 690098, Orlando, FL 32869-0098. (407) 351-5536

WANTED: Drake 2B multiplier in exc. condx. Bob Mitchum, N9WEZ, IN, (317) 881-9083

WANTED: Tube 7360, new not used; Workman FRT2 GGUW bar resistor. Weber, 4845 W. 107th St., Oak Lawn, IL 60453-5252.

WANTED: AK-5, matching spkr for Heath Mohawk rcvr. Les Lampitt, VE3HN, RR 2, Lansdowne, ONT K0E 1L0. (613) 659-4076

WANTED: Military cabinet for R-390A, front panel ID plate for R-388 rcvr. John B. Keil, 4618 Norwalk St., Union City, CA 94587. (510) 471-4838

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

WANTED: SP400, EH Scott rcvrs, only in very good condx. Jose Congas, EA4JL. Contact in the States, Kurt Keller, CT, (203) 431-6850.

WANTED: DXCC certificate stickers, old style translucent ones over 300. Dick George, WØTRF, 15245 Lynn Terrace, Minnetonka, MN 55345.

WANTED: Military technical manuals w/respect to space diversity reception; R390/391 or SP600 related. Peter, NY, (212) 725-7163

WANTED: Information, techniques & reference materials on solid state VHF & UHF super-regenerative rcvrs. Stuart, KI6QP, 308 Nevada St., Redwood City, CA 94062. (415) 369-0575

WANTED: Heathkits in either unbuilt or collector quality, unmodified condx: AC-1, AM-2, AR-1, AT-1, CA-1, DX-20, DX-35, DX-40, DX-100, HA-10, QF-1, RX-1, SB-10, TX-1, VF-1, VX-1. Dick, N1WJP, ME, (207) 767-5143. FAX 799-2505. rsmall01@aol.com

WANTED: GN-44 hand crank generator & filter box FL-10 for BC-474 radio; BC-474 parts set; ATD control box; manuals/schematics for REO, REP, REH entertainment radios of WW II. Henry, KD6KWH, POB 5846, Santa Rosa, CA 95402. (707) 544-5179

WANTED: EF Johnson Hamalogs & amateur radio catalogs, 1950-60s; manual SB-610. Bruce Hering, 41120 State Hwy 13, Waseca, MN 56093. (507) 835-5619

WANTED: Navy tube testers OD, OQ, OV & OZ & manuals; ATB, RBH manuals. Steve Finelli, N3NNG, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211

WANTED: manual for Systron/Donner freq. counter 6152A, orig. or photocopy. Offering $20. Ellsworth O. Johnson, 364 S. Coeur Dalene St., Spokane, WA 99204-1063. ph/FX (509) 838-2161

WANTED: Johnson Adventurer; Heath SB-640 VFO; SBE "Codapter"; Globe Chief 90 or 65 Scout. Greg Greenwood, WB6FZH, Box 1325, Weaverville, CA 96093. WK/HM (707) 523-9122

WANTED: Late 75A4, 51J4 or 51J3; filters X455Q200, X455KF300, or F455 FA05. K8FD, 116 Fairway Dr., Belmond, IA 50421. (515) 444-4396

WANTED: 8R1 xtal calibrator for 75A3/A2; 51S1 knobs; Collins Signal magazines; telegraphy items. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

WANTED: Collins 310A-3 exciter & 353-B31 or 353-B60 mechanical filter adapters for SP-600. Butch Schartau, K0BS, 5361 St. Mary Dr., Rochester, MN 55901. (507) 288-0044

FOR SALE: Taking bids for all of the following: Hallicrafters SX28 & 3 spkrs; Hickock RF generator; Knight RF generator; Accurate Instruments 257 tube tester; T368 VFO assy; Dow key relays; Leader LAB310 scope; Pyramid phase 3 PS; Ramsey CT-90 freq. counter; Global Specialties max 100A freq. counter; Palomar Tuner tuner; Heath patch & Q multiplier; coax & other adapters; Conel DF RX; box of xtals; various xfmrs; homebrew antenna tuners & parts; short rack cabinet; 100TH, 250TH, 2A3 & many other tubes, some for BC610; Autek WM-1 & other SWR meters; many boxes of components hardware & more! Pickup in the Boston area. Call for info. Dan, MA, (617) 736-9126.

FOR SALE: Hamm. Comet Pro, AVC, xtal filter, coils, exc - $290; R390A w/cabinet, good - $225, PU S.Cal.; Collins 310B xmtr, fair - $135; P & H LA400C linear - $125; Drake R4C filters: 0.5, 1.5, 4 kc - $40 ea; noise blankers for R4C, TR4, SPR4 - $50 ea; 3 ea NIB 4-65A's - $50. **WANTED:** TR6 AM filter, Cosmophone 35, 1000. John Hurst, KU6X, 2512 Euclid Cres. E., Upland, CA 91784. (909) 981-6759

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

FOR SALE: Yaesu FT-101 E w/matching VFO + spkr - $450; Yaesu FT-101EE w/Silver Eagle mic - $375; Yaesu FR-101S + FL-101 set - $475; Demco Sattelite 3 pc set - $300; Tram D-201A - $300; Imperial SSB base DSB-AM - $125; Maco Duster, new tubes - $200; Pal 200 MDX mobile - $250; Siltronix 1011-C - $225. Bill or Jill, CA, (800) 538-0109.

FOR SALE: "Ham Price Guide", over 3000 items of ham gear identified & described from model names &/or number. Over 6000 dated prices. Prices for over 2500 different items. Boatanchors through HT's, linears, tuners, xmtrs, rcvrs, xcvrs, mics, pwr splys, antennas & more. Use also to decipher those cryptic ad descriptions - $9.95 includes US postage. California add tax. Sound Values, POB 9 Dept. R, Auburn, CA 95604.

FOR SALE: SX-71, R-46 pkge pse; Matchbox 250-23; Millen 90800, 90281 in Bud cabinet. Ray, MO, (314) 428-1963

FOR SALE: Citizen Band Radio Schematics - $4 + LSASE. Send manuf., model & other pertinent data to: Marvin Moss, W4UXJ, Box 28601, Atlanta, GA 30358. (770) 494-5357

FOR SALE: Drake 2AQ spkr/Q-multiplier, VG - $25 + shpg. Chuck, NZ5M, TX, (806) 798-1452.

WANTED: McIntosh and Thordarson amplifiers any condx. Marcus Frisch, WA9IXP, Box 28803, Greenfield, WI 53228-0803. (414) 297-9310

WANTED: Help Vibroplex build its Company collection of Vibroplex bugs, keys and memorabilia. Call Mitch, WA4OSR, at The Vibroplex Co., (800) 478-8873

WANTED: Collins - Amateur catalogs, sales literature, manuals, promotional items & Signals. Richard, KD6CPE, POB 992, El Toro, CA 92630-0992. (714) 855-4689

WANTED: Collecting: Pre-1950 commercially built amateur gear; xmtrs, rcvrs & accessories. Dean Showalter, WA6PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: TMC GPR-92 HF Rcvr. Hank, W6SKC. (602) 281-1681 FAX: 281-1684

FREE: Free + UPS shpg to a good home: antique test equipment, early 1930s vintage. Includes signal generators, sweep generators, capacitor checkers. All restorable. State your intentions. Dewey, WØZUS, POB 540, Edgemont, SD 57735. (605) 662-7692

WANTED: RT-1 ballast tube for Gates M5693 modulation monitor. Barry, WB1FTJ, ME, (207) 947-1614

WANTED: Heath cabinet or parts unit for the Apache, Mohawk or Marauder; a working Seneca, HG-10 or HG-10B VFO. Pete Cullum, N9GED, 1332 Harlem Blvd., Rockford, IL 61103. (815) 965-6677

WANTED: Information from the following WRL catalogs: '37, '38, '39, '46, '47, '48, '50 & '63. If you can help call - Leo Meyerson, WØGFQ, CA, (619) 321-1138.

WANTED: ARC/5 equipment, R25 1.5-3 Mc rcvr, T17, T18 xmtr. Pete Hamersma, WB2JWU, 87 Philip Ave., Elmwood Park, NJ 07407.

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

WANTED: Any historical info on British "Voltron" tubes, circa 1925. Gary Payne, 5251 N. Fresno #202, Fresno, CA 93710-6947.

WANTED: A good modulation xfmr (250-300 watt multimatch) to be used in a Globe King 400. I need approx. 6,500 ohms primary CT & approx. 4,660 ohms secondry CT for a turns raito of approx. 1.18. Vern, WØVV, Box 187, Lehr, ND 58460. (701) 378-2710

WANTED: National log cabin pwr sply; 625I Collins transverter. Don Morris, N6IDY, 11553 Balboa Blvd., Grande Hills, CA 91344. (818) 368-7374

WANTED: TMC GPR 92; Hallicrafters SX28, SX42 rcvrs, collector quality, complete. John, NE6G, 7495 Gunter Rd., Pensacola, FL 32526. (904) 944-6563

WANTED: Hallicrafter SX99 rcvr/spkr, cosmetically clean, operational, at a reasonable price. Charles Glover, 2700 Ponderosa #137, Camarillo, CA 93010. (805) 389-1520

WANTED: Factory S-meter units for Hallicrafters S-20R & S-40 rcvrs; manual for Scott Navy RCH rcvr. Bernie, WA6HDY, 300 James Way, Arroyo Grande, CA 93420. (805) 481-6558

WANTED: Neon lamp #NE-1W 105-125V for Precision tube tester model 910 or 912. John Morrison, 1739 Old Camden Pike, Eaton, OH 45320. (513) 456-6852

WANTED: Mint, pristine condx.; SX-115, HT-32B, also needed SX-117, HT-44 for parts. Robert Struk, 1726 Kinglet Ct., Sunnyvale, CA 94087. (408) 991-3747

WANTED: Hallicrafters SX-100, SX-122A, must be working & in exc condx. Glenn Cuthrell, WB4VEJ, 910 W. 2nd St., Roanoke Rapids, NC 27870. (919) 535-5067

WANTED: Heath gear, unassembled kits, catalogs and manuals. Bill Robbins, 5339 Chickadee Drive, Kalamazoo, MI 49002, 616/375-7978. billrobb@serv01.net-link.net

WANTED: Gonset model 3201 pwr sply & modulator; Heath HO-10 scope; Eico 722 VFO. John Lewis, WB9NWO, 3526 N. Elmcroft Terr., Peoria, IL 61604. (309) 685-5865

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

WANTED: Hammarlund manuals, parts, parts units, from the series Comet, HQ, SP. Also accessories, catalogs, spec sheets, memorabilia. Robert, Amateur Radio Surplus, (517) 789-6721

WANTED: Collins 30J, 30FXB/C, other pre-1940 Collins amateur gear for my collection. John Firey, WB5HRI, 14818 Delbarton, Houston, TX 77083. (713) 5615-KW1

WANTED: Paying immediate cash for old Fender and VOX guitar amplifiers. Frank Czaja, AI9T, 8968 W. Forest Home #4, Greenfield, WI 53228

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

WANTED: RCA AVR5A, AR60, Western Electric, or equipment marked Civil Aeronautics or any airline. James Treherne, 11909 Chapel Rd., Clifton, VA 22024. (703) 830-6272

WANTED: Sharp, working Collins 32V2/3 to complete my station. Dave, K4IST, FL, (904) 477-8500.

WANTED: Knight-kit Bandspanner II, any condx. Willis, WOWI, AR, (501) 857-3366.

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

WANTED: To buy any lunch boxs & related items. Arthur Fritz, N3SFE, 104 2nd St., Montgomery, PA 17752. (717) 547-2674

WANTED: WW II Japanese military radio of any kind; pre-war Japanese QSL cards. Takashi Doi, 1-21-4 Minamidai, Seyaku, Yokohama, Japan. FAX: 011-8145-301-8069

WANTED: To buy, plug-in shafts for Mallory Sta-Lok volumn controls, AC switches for Sta-Loc controls. Will pay your price. James Fred, R1, Cutler, IN 46920. (317) 268-2214

WANTED: 1G4-1G4GT, 864, 1629 tubes, 4 pin & octal, amphenol, molded, black phenolic, tube sockets. James Fred, R1, Cutler, IN 46920.

WANTED: Any information on Navy rigs TAB, TAG, TAJ, TAQ, TAR; manuals, parts, etc. William Donzelli, 304 S. Chester Ave., Park Ridge, IL 60068. (847) 825-2630. integra@usr.com

WANTED: RBM Navy rcvr, low freq. version; RCA AR-88. Please state price, condx. Frank R. White, KBØTG, POB 3283, Olathe, KS 66063. whitefra@tyrell.net

WANTED: T-368 in good working condx. I will pick up within 1000 miles of Rockford, IL. Pete Cullum, N9GED, 1332 Harlem Blvd., Rockford, IL 61103. (815) 965-6677

WANTED: Need Heath basket case or restorable SB-300, SB-400, SB-101, HW-101. Mike, KE3OQ, PA, (610) 759-9257.

WANTED: SCR284/BC-654A, manual & connectors; PE-103; TBY, all accesories. Norm, W6JOD, 6506 Jetta Ave., Bakersfield, CA 93308. (805) 399-4101

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. (503) 923-1013. klakin@aol.com

WANTED: Valiant II & SSB adapter. Robert Braza, N1PRS, 23 Harvard St., Pawtucket, RI 02860. (401) 723-1603

Dovetron NB-1 Noise Blanker

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

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

DOVETRON

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Telephone 520-281-1681
FAX 520-281-1684

FOR SALE: Centronics 20A exciter - $125; Heath Q-multi - $20; Heath HD19, HD15 patches - $30 ea. Larry, VE3RF, Box 509, Ayr, Ont N0B 1E0 Canada. (519) 632-7921 eves.

FOR SALE: USA/Russian, signal corps wireless sets, No. 19 MKII, including sply unit No. 1, aerial variometer, control units, radio compass BC433F, BC434F, indicator 1-81-F, cables, hydrators; also BC939 tuners. Radio Stuff, 1379 Ridge Rd., Horseheads, NY 14845. (607) 594-3512

TRADE: Hallicrafters SX-117, HT-44, PS-150-120; manuals for Collins 75A, 75S, or 51J rcvr. **WANTED:** Viking I or II parts units any condx. Collin Collier, N4TUA, GA, (912) 988-1276.

FOR SALE: R390A Motorola; NC183; SB301/401; HW16/HG10; AF-67/pwr; HB 813 amp, desk top exc, 3 KW&HB tuner; B&W T/R SW; Dowkey rlys; S38B; GRC/109 6 & 110 pwr; ARC5 TX & RX, & more. Joe Perratto, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-7362, anytime

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FOR SALE: Electricity/telegraph books, 1895-1920; assorted radio books, handbooks, callbooks & magazines, 1917-1929. SASE for list. Jan D. Perkins, 524 Bonita Canyon Way, Brea, CA 92621

FOR SALE: Collins 310C-2 VFO/exciter for 30K-1 VG-E - BO over $500. Eugene Rippen, WB6SZS, 105 Donnington, Auburn, CA 95603. (916) 885-6147, 7-9 PM PT. Device on 4th ring.

FOR SALE: Microphones: Astatic 788; amplified D-104; handheld D-104; Bruno MS; EV 505B, V-1, 623, 644, Turner 9D, 22, 77, 99, sidekick, SSB100; unknown old one; elements, connectors. Bill Coolahan, 1450 Miami Dr., NE, Cedar Rapids, IA 52402-2933. (319) 393-8075

FOR SALE: HRO, 51J4, RME VHF-152A, Heath Q-multiplier. Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383

FOR SALE: National NCX-1000, factory incomplete unit, w/meter, hardware, RF components, etc. - $35 shpd. George, K1ANX, MA, (413) 527-4304.

FOR SALE: Homebrewers, custom chassis & panel fabrication, 15 years prototype tech experience, vacuum tube literate. Brian, KA9BGW, IL, (708) 487-5359/FAX 487-5424.

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

FOR SALE/TRADE: Hallicrafters S118, VGC - $45; Globe Chief 90, VGC - $60; Gonset III CD 2M VGC - $60. **WANTED:** Elenco 77; Gonset IV 2M; Turner mics V173, 33X, 25X. National Select-O-Ject, dials MCN, ICN, AM, P, spkr emblem, orig. manuals, Ranger, NC173, 75A1. Rack mount NC173 & NC183D. 500 watt link couple coil 160 & 80. Sam Champie, KD7XX, 105 W. McKenzie, Hermiston, OR 97838. (541) 567-2879 Sat. or Sun. only.

FOR SALE: Heath KW antenna tuner, SA-2040 w/counter - $110; sig tracer IT-12 - $20; electronic keyer HD-10 - $35; Hallicrafter S-120 - $60; S40 junker restorable - $40; Collins mechanical filter F455J05 500 cycle CW filter - $150. Mel, WØMLT, 67750 Ridge View Dr., Montrose, CO 81401. (970) 249-1544

ELECTRON TUBES: All types - transmitting, receiving, obsolete, military--Large inventory. **Daily Electronics Corp.**, 10914 NE 39th St., B-6, Vancouver, WA 98682. (800) 346-6667, (360) 896-8856, FAX (360) 896-5476

FOR SALE: Pocketscope S11A; National NC66; Heath TC1 tube checker; 1938 handbook by Radio Mag; Galaxy mobile pwr sply; manuals RCA AR77, RCA xmtrs, ARC4, BC348, Allied data books; 220V Variac; ARRL manuals & handbooks, old & new. Howard Hood, 5670 SW 44th St., Port Orchard, WA 98366. (360) 674-2179

FOR SALE/TRADE: Heath HD-1410 keyer; various Command rcvrs; RAB-4 rcvr. Tom Brent, Box 1552, Sumas, WA 98295. (604) 826-4051

FOR SALE: B&W rotary inductor, new - $25; panel meters, SASE for list; pair 4-400s - $50. Frank S. Law, W8SET, 1 Wildacre Rd., Charleston, WV 25314. (304) 343-0415

FOR SALE: Collins KWS-1K, #325, looks good, not tested - $500; Eldico SSB-100A, 1 owner, #227 - $275; Eldico SSB-100F, #129 - $375. All + shpg. Fred, NC, (910) 883-0897.

FOR SALE: Galaxy R-530 rcvr, SSB/RTTY/AM filters - $775; Drake 2C - $150; 2CQ - $75; 2NB - $85; Hallicrafters SX100 - $200; SX71 - $200; Heath DX-60B - $85; Sixer & Twoer - $115/both; HW 101 & HP-23 - $225; Ameco TX-86 - $95; Hammarlund HQ-180A & spkr - $425; National NC-125 - $175; Dentron W-2 watt meter - $85; Bird model 74 coax switch - $85; R-390 IF module - $50; others, free list. Richard Prester, 131 Ridge Rd., W. Milford, NJ 07480. (201) 728-2454

FOR SALE: Vintage equipment manuals starting at - $5; Hallicrafters, Johnson, WRL, others. SASE for list. DSM Diversified, 909 Walnut St., Erie, PA 16502.

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

FOR SALE: "Teletype" T-shirts. The Teletype Corporation's "T" symbol in black on a yellow (what else?) Hanes shirt - $15 ppd. Sizes L or XL only. Jack, WA2HWJ, NJ (201) 927-7784.

FOR SALE: New orig. PJ-068 mic plugs for Collins S-line/KWM-2A/HF-380 shp'd in USA - $8 ea. Clint Hancock, KM6UJ, 6567 Ashfield Ct., San Jose, CA 95120-4502.

FOR SALE: Electronic Measurement Corp model 204 tube tester in wood case - $100; oscilloscope RCA model 825 - $75. John Miller, Alaska, (907) 337-9157

TRADE: QSTs, CQs, 60s Ham Radio for QSTs, CQs other mags, sales lit, etc. Newell, POB 2005, Point Roberts, WA 98281. 1-800-943-9886

FOR SALE: ART-13, fair - $100; TCS xmtr - $50; rcvr - $75; Kenwood TS-520 w/CW filter - $299; HW-101 w/HP-23B ps, desk mic, HS-661 spkr - $125; Halli S-41G rcvr - $45; HT-40, parts - $25; RT-18/ARC-1 - $50; BC-221 freq meter w/AC sply - $10; ARC-5 parts units - $5 ea; C-626/ARC-27 control box - $20. John Devon, KI6DQ, CA, (818) 799-0527.

FOR SALE: RME-6900 L/N orig. box, manual, owner - $195; new 4-1000A + socket - $175. Dave, W3KDD, MD, (410) 465-3884.

FOR SALE: Legends of Amateur Radio, a 42 minute video featuring W6HX, K6OJ and W6EA. "Tall Tales and Big Antennas", produced by the Southern California DX club "...enjoyed running it" - Hugh Cassidy, WA6AUD - $10 + $3 shpg. Please send check and make payable to: Harvey Laidman, N6HL, 4923 Encino Terrace, Encino, CA 91316.

FOR SALE: Collins 618T-2 HF 2-30 MHz aircraft xcvr - $250 or BO. Bill Gross, WB6WCW, CA, (805) 968-4227.

FOR TRADE: My TMC GPR90 receiver, excellent condition. **WANTED:** National NC400. Niel Wiegand, WA5VLZ, 12105 Mustang Chase, Austin, TX 78727. (512) 219-8548.

FOR SALE: Book - High Frequency Measurements by Hund, an old time classic - $8 ppd. R.J. Eastwick, N2AWC, 224 Chestnut St., Haddonfield, NJ 08033. (609) 429-2477

FOR SALE: NIB Amphenol 4-pin ceramic tube sockets, type RSS4 - $3 each + shpg; white porcelain egg insulators - $.75 each + shpg. James Fred, R1, Cutler, IN 46920

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

FOR SALE: PRC47 LSB/USB kit - $40; new machined coax antenna panel - $9. All restorable. Jay Craswell, WBØVNE, 321 West 4th St., Jordan, MN 55352-1313. (612) 492-3913

FOR SALE: Central Electronics: (untested) 10B, G -$55; 20A, G - $80; Eico 753, VG - $70, 751 ps, G - $45; Drake 2A/2BQ/calibrator, VG-G - $165; R4B, VG - $140; R4B/TX4B/AC4/DC3, VG - $425; Hallicrafters HT40, G - $55; Kenwood R599/T599/S599 (spkr), VG - $295; Knight T-150, G - $95; Lakeshore Bandhopper, G, untested - $70; National NC57B, G - $65; RME 45, VG - $150; 69, G - $250. Descriptions are appearance only. All + shpg. Eugene Rippen, WB6SZS, 105 Donnington, Auburn, CA 95603. (916) 885-6147 7-9 PM PT. Device on 4th ring.

FOR SALE: Two Multi-Elmac model AF 67 xmtrs - $60 ea + shpg, or BO. Wes Chatellier, W5DPM, 1950 Chevelle Dr., Baton Rouge, LA 70806. (504) 927-2199 eves.

FOR SALE: Unbuilt Heath AM-1, antenna impedance meter, complete, in 1955 catalog - BO over $50 or trade. Sam Hevener, W8KBF, OH, (216) 659-3244.

FOR SALE: Sell out. Superior condx. SF area, with manuals: Globe Champ 300-A, rare AT-4 tuner, new finals, recapped, orig. - $600; Yaseu 101-ZD Mark III, AM board, WARC, FV-101, YD-148 mic, new display, 6146's, mint - $600; NC-300, cal., 2M - $300; Adventurer - $225; S-19R, rebuilt - $250; Atlas 210 X, blanker - $225; nice Collins 75-A2-A, 3.1, 400 cycle filters, product detector, spkr - $375; HQ-140-X, rebuilt - $285; Heath SB 300+400 - $140 ea; servicable, complete 12 volt AM mobile, trade for recent 2M rig or - $275. Life is short, no trades. Photos - $1 ea. SASE to Larry, KF6WV, POB 1139, Occidental, CA 95465. all info on your dime (707) 874-1000

FOR SALE: Drake C-line - $375; Motorola R390A in cabinet, beautiful - $350. Prefer PU. **WANTED:** Hallicrafters SX-88. James Geer, WB5LXZ, 1013 Overhill, Bedford, TX 76022-7206. (817) 540-4331

FOR SALE: M52 carbon mic, replaced T-17s, w/ PL68 plug, 6' cord, PTT, orig. manual, NIB - $15; HS-30 headsets, WW II dates, NIB w/extra earpieces, cordage, dessicant, instructions - $30 ea, 5 for $100. All plus UPS. **WANTED:** Military radio manuals, any date, quantity, etc. Military Marketing, Inc., Box 741, Norcross, GA 30071. (770) 729-9315

FOR SALE: Restored radios SX42, S38C, RCA T6-9 - BO on ea. **WANTED:** ARB rcvr. R. Haworth, W2PUA, 112 Tilford Rd., Somerdale, NJ 08083. (609) 783-4175

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FOR SALE: BC-614E new except top paint scratches & tube names written under chassis - $135. Clare Owens, N2RJB, 7635 Arnold Dr., N Tonawanda, NY 14120. (716) 692-8832

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FOR SALE: PMR-8, AF-68, ps, cables & manuals, in good working condx - $140. Barry, W7JKY, OR, (503) 631-3219.

FOR SALE: TRC-75 w/110 VAC sply, Vietnam era 1 KW SSB/CW continuous duty - $1000 OBO. Includes orig. manual, test sets & spare parts. Contact KE8HR or me. Vacuum tube list, SASE, used technical books; military and ham equipment manuals; handbooks; electronics magazines; etc., big list - $1. **WANTED:** QSL cards. Joe Holstein, N8EA, 1515 Sashabaw Rd., Ortonville, MI 48462.

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HELP: Need schematic for a Lafayette HB 115A and MAP xcvr. Dennis Baker 15113 S Blackfoot Dr. Olathe, KS 66062, E-mail wbfim@sound.net.

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JOHNSON Desk Kilowatt, just aquired from original owner, SN 286, owner installed Johnson kit includes AB2 linear @ 2 KW PEP; another Desk KW under restoration; **COLLINS** 75A-4 #4977, W3HM overhaul, excellent; **COLLINS** FRT-6,40 KW transmitter; 30S-1, (RE); **HEATH** Chippewa KL-1 2 KW linear amp w/KS-1 ps; KWM-1, w/516F-1, speaker, looks and works great; KWM-2A (RE) w/Waters rejection, 516F-2 (RE); 75S-3B, mint, (RE), SN #80,000+, CW filter; 75A-3 w/4:1 spinner knob, 3 kHz & 800 Hz mechanical filters; 51J2; **COLLINS** R-390, Miltronix remanufacture; R-725, under restoration; R-1051-B; SX-101 Mark III (with 160); **DRAKE** 2A, w/calibrator; SP-600-JX; HQ-100-A, (as is); GSB-100; **JOHNSON** Ranger; **WRL** GlobeChief 90 Deluxe; **LAFAYETTE** HA-225; souped up HW-100, w/SB-600/HP-23A; 312B-4 (RE); 516E-1 12VDC PS (KWM-2), w/complete mounting bracket, cables; **HARVEY-WELLS** Bandmaster Z-Match tuner; (6) ARC-5 Command receivers in military rack; **CENTRAL ELECTRONICS** MM-2; BC-221; **HEATH** SSB adaptor (as is).

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FOR SALE: New Johnson/Heathkit 2-pin mic connectors - $8 shpd; Johnson long cabinet screws (new manufacture) for Ranger - 3/$7.50, Valiant - 4/$8.50 shpd; coming soon Ranger PTT kit. Cal, N6KYR, 2337 Los Arboles Way, Los Osos, CA 93402. (805) 258-8703 ceustaqu@farad.elee.calpoly.edu

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FOR SALE: HRO-W, ACPS, spkr, 7 coils, 2 coil boxes, DCPS - $500; AF-68 - $50; Hickok #800 - $85; KWS-1 relay - $50; Morrow Falcon RX - $50. Joe, K7MKS, WA, (206) 747-5349

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FOR SALE: CQ mags, July '90 thru Dec. '95 - $20, complete. Francis Waggoner, W2PTI, 268 Barben Ave., Watertown, NY 13601. (315) 788-1621

FOR SALE: S-53A - $75 + shpg. **WANTED:** Hallicrafters SR-75; two good 860 tetrodes; RK-18; RK-20; RK-28. Sandy, W5TVW, (504) 836-2134; 70401.1344@compuserve.com

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

WANTED: Vintage tube CB's, ps/modulator for Johnson 500. Send card or call w/models you may have. Steve White, WB5UGT, Box 1086, Clute, TX 77531. (800) 374-6477-9008 leave message

WANTED: Orig. tube-type CB radio operating/owners manuals; also tube-type CB radios. Walter Ryan, 7114 Geyser Ave., Reseda, CA 91335. (818) 344-8735

WANTED: Viking II top & bottom covers, any restorable condx. Tim Casey, W1EII, POB 447, Pepperell, MA 01463. (508) 433-6727

WANTED: Kenyon xfmr catalog or copy. Fenton Wood, 109 Shoreline Dr., Star Harbor, Malakoff, TX 75148

WANTED: Collins 302C-1 wattmeter, 353C-60 mech filter adapter for 75A-1, 2B calibrator, RCA AR-88 S-meter. Joe Eide, KB9R, 2623 Clare St., Eau Claire, WI 54703-1002. (715) 834-4582

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FOR SALE: Heathkit, A Guide to Amateur Radio Products by Chuck Penson - $17 ppd. Ken Greenberg, 4858 Lee, Skokie, IL 60077. (847) 679-8641

FOR SALE: Hammarlund SP-600-JX26, 2 available, good condx. Victor, KE6VHI, CA, (805) 583-4026

FOR SALE: Globe VFO - $65; Drake 2B, repairable - $80; AC-4 - $95; Drake-Collins xtals - $8 ea.; CP-1 - $115; Hammarlund clock - $55. Bill, MI, (810) 781-9717

FOR SALE: Elmac AF68A xmtr, M1070 AC/DC sply, cable, VG - $125; Hammarlund HX50 xmtr, VG - $150; WRL Globe Scout 680A xmtr, exc. - $125. All w/manuals. Chase Hearn, 104 Glenwood Dr., Williamsburg, VA 23185. (804) 229-7263

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FOR SALE: Collins KWM2-A, (RE), PM-2, 312B-5 - $1200. George, K1ANX, (413) 527-4304

FOR SALE: HP-606A sig. generator - $95; Tek 503 scope - $65. Victor, KE6VHI, CA, (805) 583-4026

FOR SALE: Mint KWM-1 (has key lock), 516F-1, DX adapter, mic, manual - $1500. Greg Gore, 11528 Watermoss Ln., Charlotte, NC 28262. (704) 549-4719.

FOR SALE: Unmodified BC-453-B, VGC - $45; Collins mech. filter Y-120/12N2 - $30; Hallicrafters TU-53, TU-48 - $15. Jim Miccolis, N2EY, 126 Summit Ave., Upper Darby, PA 19082. (610) 352-5247

WANTED: Collins KW-1, 30S-1, KWS-1. WAØAKG, NE, (402) 464-8682

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WANTED: NC-183D rcvr. Harold Deppe, NY7Y, POB 31656, Tucson, AZ 85751. (520) 290-1190

WANTED: Manual for Bendix TA-12C xmtr; osc. tuning units for Bendix ATD xmtr esp. 9050 to 15800 kc unit; any parts, literature pertaining to Bendix gear. Greg Richardson, WA8JPC, POB 405, Gallipolis Ferry, WV 25515.

WANTED: The Radio Handbook, 1947, 12th edition by E&E; 1971 QST mag; June '63, '64, '66 73 mag; military TM for SCR-AN-183 or SCR-AO-283 (BC-230 or 430); The RTTY Handbook by Cowen; The Best of CQ, CQ anthology by Cowen; dual 100 Mfd xmitting variable cab. Wayne LeTourneau, WBØCTE, POB 62, Wannasko, MN 56761. (218) 425-7826

WANTED: Back issues of ER #1-72; Drake promotional literature, catalogs, etc. Thanks. Dave, KF8ID, 41537 Sunnydale, Northville, MI 48167. (313) 420-2612

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WANTED: Audio amplifiers (tube-type), i.e. Eico, Fender, Fisher, etc. Franklin Albanese, CA, (510) 845-2625

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