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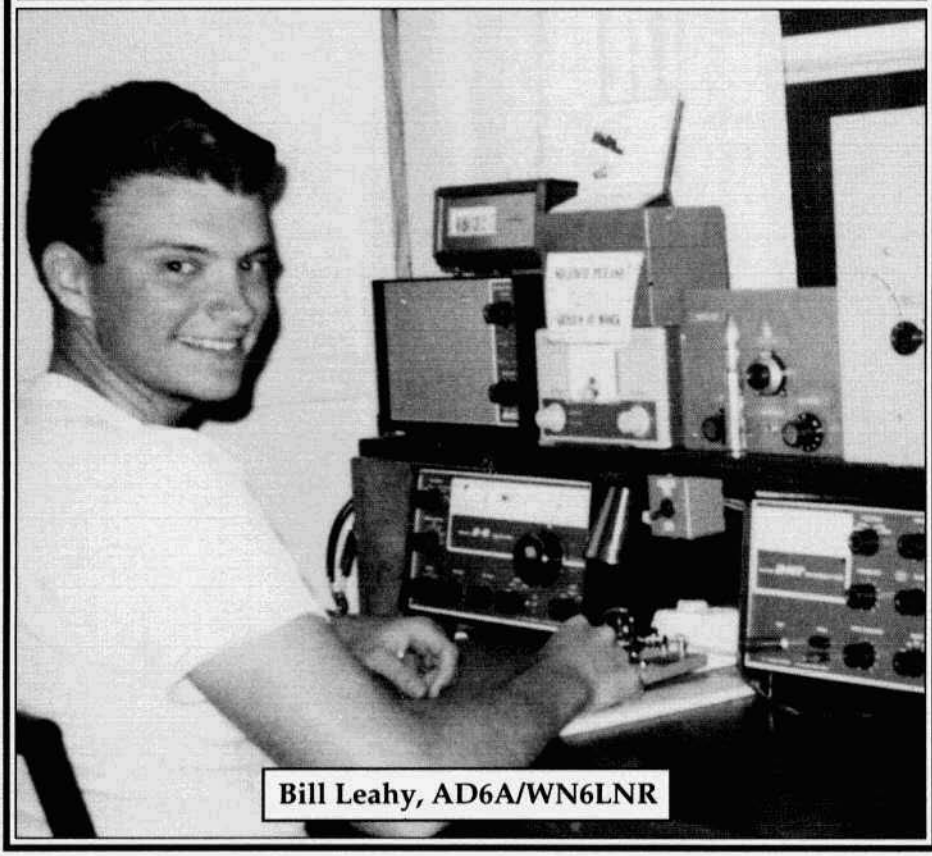
ELECTRIC RADIO

celebrating a bygone era

Number 63 July 1994



Bill Leahy, AD6A/WN6LNR

ELECTRIC RADIO

published monthly by Barry R. Wiseman and Shirley A. Wiseman

at 4 Aspen Place, Durango, CO 81301

Second Class postage paid at Durango, CO. and additional offices

Authorization no. 004611

ISSN 1048-3020

Postmaster send address changes to: Electric Radio
Box 57
Hesperus, CO 81326

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Office Manager - Shirley A. Wiseman

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

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

Regular contributors include:

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

EDITOR'S COMMENTS Barry Wiseman, N6CSW/Ø

I thought that this issue I might talk more about our move to our mountain property but every time I think of it my backache worsens. Maybe I'm too old for all the boatanchors I have. Anyway, let me say the worst of it all is behind us and I'll report on the move and our new QTH in a later issue.

July 22, 23 and 24 are the dates of one of my favorite events, the Flagstaff (Fort Tuthill) hamfest. If we get there this year (and we probably will) it will be for the third consecutive year. It's always a lot of fun. Besides all the guys (and gals) from Arizona, there is always a large contingent that travel over from California. And we always have a nice dinner get together. According to those I've talked to that attended the dinner last year, they would all be happy if we did it again at the same place on Friday night, July 22. I recall it was a Sizzler Restaurant that we went to but can't recall the address. That information will be available at the hamfest.

Another hamfest we've always attended and always enjoyed is the Duke City Hamfest (Albuquerque) that will be on August 20 this year. It's not big like Flagstaff but it is well attended and there is usually enough boatanchor stuff there to satisfy all the vintage enthusiasts.

The other day I received a notice regarding the Pratter's Mill Swapfest (just north of Dalton, Georgia) that will be on September 10th this year. This is one of the largest AM gatherings in the southeast. For more information call Sam, N4VIB, at (706) 695-5658.

I think that in the future we're going to try to do a better job of publicizing hamfests of interest to ER readers. If you're involved in or have knowledge about such an event send us the info and we'll get it the magazine.

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Cover: Bill Leahy, AD6A in his deluxe novice station (WN6LNR) in 1965. The receiver shown is a Drake 2C and the transmitter is a 2NT.

W. Robert Griswold, Silent Key

On Friday, May 20, 1994, my longest term work associate, and close personal friend, Bob Griswold, passed away.

Bob was the mechanical engineer for the Collins R-390 receiver. He designed for it possibly the most complex mechanical tuning mechanism of its type. Over the years, the R-390 earned a reputation for excellence that has contributed to Collins Radio overall image of quality.

Bob and I first became acquainted just after WW II, when we both worked at Honeywell, in Minneapolis. We worked there until late '46. Together, we left Honeywell and went to work in Fergus Falls, Minnesota, for a small farm equipment manufacturer. There we designed a number of equipments which were in short supply following the war. One of them was the swather pictured in the *ER* magazine issue of April '94, page 11. It was a design started and completed while Bob and I were there.

In Dec. '48 I saw an ad from Collins Radio looking for mechanical help. I knew of Collins from the Signal Corps where I served during the war. I interviewed and moved to Cedar Rapids because I had always been interested in the combination of mechanical and electrical things. Bob also found a Collins offer to his liking and he too came to Collins. That was early '49.

Over the years our families became close, and we did many things together. Our wives went through the penniless days with us and the kids got along well. It has been an association which I treasure.

Bob was always a role model for me. He was more experienced at design than I in the early years, and we consulted together on many design problems. Our roles at Collins forked several times over the years. We each had groups of mechanical engineers working with us, and shared the technical management of many Collins products. All who worked with him owe Bob a debt for the help he so willingly and capably gave us. Bob was a true gentleman.

Bob retired from Collins in 1982 where at the time he was responsible for aircraft instrumentation and communication products. He was active through the years with designs meeting ARINC (Aeronautical Radio Inc.) standards, and worked in the formulation of these industry standards.

I have lost a close personal friend. The industry has lost a strong contributor. The fact that the R-390 continues to be a desired product in the amateur radio area is a tribute to Bob's first design project at Collins. ER

Fred Johnson

Collins Collectors to Meet in Cedar Rapids

The Collins Collectors Association will be having a two-day meeting in Cedar Rapids, Iowa, Saturday and Sunday, August 13-14. They anticipate that this may become an annual event. Last year they also met in Cedar Rapids in conjunction with the 60th Anniversary of the Collins Radio Company.

This year the the Com. Center and the museum will be open on Saturday. Also on Saturday there will be a family-style dinner with speakers and special guests. The group will headquarter around the Longbranch Motor Inn which is about a half block from the Collins antenna farm. Non-members are welcome.

For more information call Bill Wheeler, KØDEW at (417) 532-7710 or 532-5008.

AMI Update

Dale Gagnon, KW1I, President
AM International
Box 1500
Merrimack, NH 03054

Membership

AMI membership is at 625 with about ten coming in per month. Regional Directors have been given a roster of members in their regions. If you have had a change of address or a change in call sign, please drop a note to AMI headquarters so we can keep the data base up to date. If our AM priveleges come under assault, we need to know where to contact you so you can help!

Armed Forces Day

I heard very little from other participants of Armed Forces Day. I had a great time with several other participants and a dozen or more visitors at Fort Burnside in Rhode Island. Terrific weather and acceptable band conditions made for a great day. Brown, WA1NZR, was a great host and had the whole facility ready to go. Most contacts were made early in the morning on 75 meters with the T-368, R-390A combination. Later in the day the GRC-46 (T-195, R-392) enclosure was used and Chris, AJ1G, put in time on the GRC-9 powered by a PE-162 generator. The day ended with a convoy of military vehicles making a short circuit of the local beach road. One notable event, Bob Merriam, W1NTE, arrived in uniform. He hadn't had it on in 46 years and it still fit!

FCC Denial of KW1I Request for Wavier on AM Transmitter Power

On May 6 the FCC released the denial of my request to the full Commission to review and reverse an earlier denial of a request to waiver my station from the 1500 PEP power rule. This denial closes the chapter on efforts started before the June 1990 AM power reduction went into effect. Here is a brief chronology of events:

September 1992 - FCC proposes new power measurement rule.

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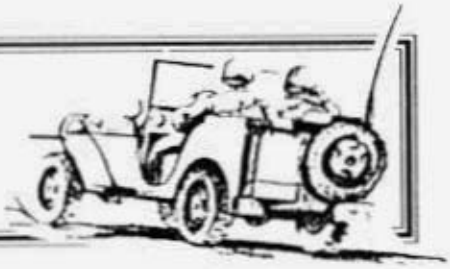
Brown Beezer, WA1NZR, on the left and Bob Merriam, W1NTE, curator of the New England Wireless and Steam Museum located in East Greenwich, Rhode Island. Bob is dressed in his WW II army uniform.

ELECTRIC RADIO IN UNIFORM



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

Military Radio Test Sets

If the military transmitters and receivers we usually visit in this column are the radio equivalent of rifles and fighter planes, test sets are the equivalent of field kitchens and forklifts -- essential, but not too exciting. However, military radio test gear is often good for general ham use, it is the 'authentic' way to troubleshoot your military sets, and some of it really is interesting as we will see this month, touring a sample of the units you might meet at a good-size hamfest. The prices given are typical for hamfests; you'll pay more if buying from a dealer.

Overview

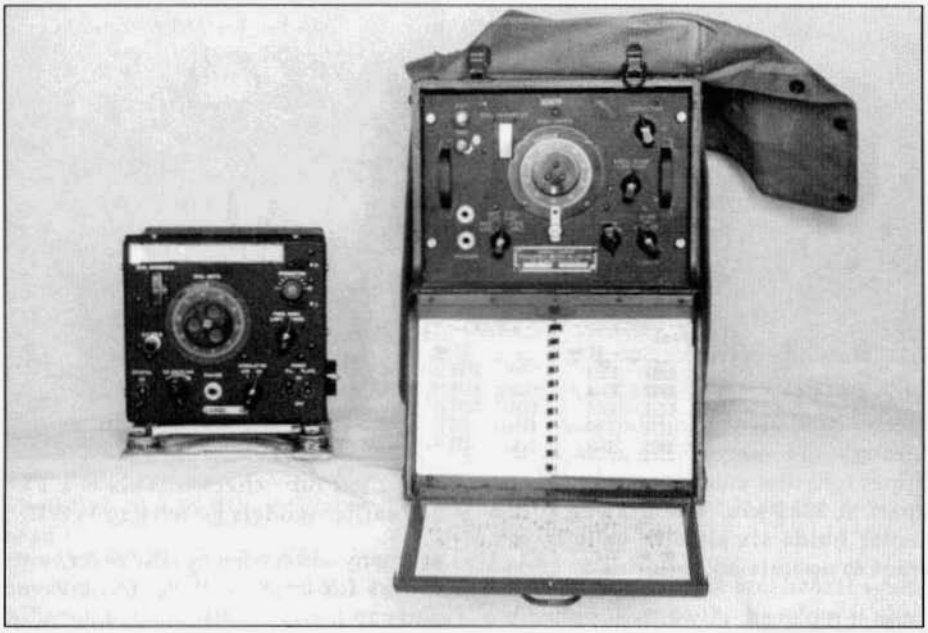
You can divide military radio test gear into two main groups: general purpose equipment for use on many set types, and equipment designed for use with a particular piece of gear. The general purpose equipment can be further broken down into copies of commercial test gear and units designed for military use. In most cases the general purpose sets are the ones most useful to the ham but there are some very interesting special purpose units. We'll look first at some general purpose gear, then visit a few of the others at the end. Although most of the units discussed are fairly common, we'll also look at a couple of interesting rarities.

The LM and BC-221 Frequency Meters

These would be the clear winners of any award for the military test sets that had the most effect on ham radio. Both are heterodyne frequency meters, that is, they pick up an external signal and mix it with a harmonic of a precision tunable oscillator to measure the signal's frequency within about .01%. They can also serve as signal generators, for example to set a receiver to a specified frequency.

These sets cover 125 - 250 kcs and 2 - 4 Mcs on the fundamental and up to 20 Mcs on calibrated harmonics. The dial is calibrated in arbitrary units; you use a calibration book to get the frequency. The calibration books are individually made for each meter. An internal 1000 kcs crystal oscillator lets you correct the dial to take care of aging or drift.

The LM was used aboard ship (we had one on the destroyer on which I served in the early 60's) and in shore stations; in these jobs they used an external AC power supply. They were also installed in WWII aircraft where they were commonly powered by the equipment that they were used with -- you will find a five pin banana connector labeled ACCESSORIES on the front panel of such gear as the ARB receiver. The Army used the BC-221 both aboard large aircraft and in portable applications; in these jobs they were powered by internal dry batteries. For ground use at transmitter sites and repair shops some models were furnished with an AC supply in the battery compartment.



The LM (left) and BC-221-AL (late model) frequency meters. This BC-221 was destined for installation in B-24M s/n 44 (the year of manufacture) 50,346 but judging from its condition, it was never installed. The canvas cover (folded back for the photo) not only protected the instrument but insulated it against the extreme cold at high altitudes. The calibration book folds inside the front cover when the unit is closed.

The built-in AC supplies greatly increase the frequency drift as do the home brew supplies often built in by hams.

Before the war, very few hams had any reliable frequency measuring gear. The opening of the surplus flood gates in the late 40's changed that, at least for the ham with a bit of money. Prices then were around $85 -- a good week's pay at the time. But many hams bought them, and for the first time in most shacks it was possible to measure frequency more accurately than you could do it with the receiver. Think about the ham receivers of the '50's and you'll appreciate what the '221 and LM did for us.

Prices for these units have been free to $25 recently. Even the cheapest modern frequency counter is easier to use and much more accurate so most hams who had a unit for shack use are now disposing of them. However, a vintage military station really isn't complete without one and they can sometimes be handy when you need an accurately calibrated signal source. All LM's let you modulate the output signal but only the later BC-221's have this feature.

Several variations of the BC-221 were made later to cover higher frequency ranges (TS-323 is one example); these units are too unstable for use with most modern gear.

The FR-149A/USM-159 Frequency Meter

This is the answer to "What replaced the BC-221 and LM when they became obsolete" -- which they did long before portable frequency counters became available. This transistorized unit is a bit larger, but the function and performance is far better than any of the equip-

continued next page

The FR-149A/USM-159 frequency meter. You view the film strip dial through the magnifying lens at the upper left; dial marks are only 200 cps apart at 3885 kcs. The drawer at top center holds six size 'D' cells if you want to operate on batteries.

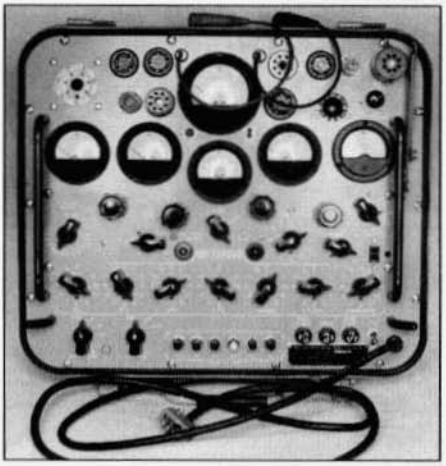
ment it replaced. Power is supplied by your choice of 115 to 230 VAC, 50 to 400 cps or six size 'D' cells. Frequency coverage is 125 - 250 kcs, 2.5 - 5 Mcs and 65 - 130 Mcs in three directly calibrated bands; counting harmonics (there's a book in a drawer at the bottom of the set so you don't have to figure them out), coverage is from 125 kcs to 1000 Mcs.

There's an internal crystal calibrator and tone modulation is provided. In effect this is the ultimate LM or BC-221; it is the one to get if you actually plan to use a meter of this type. Since the services were smaller by the time these sets were built and they were only used for a few years, they aren't very common. Prices are usually $35 to $75.

Tube Checkers TV-2 and TV-7

As far as I know, all military tube testers are 'hardened' commercial designs. These are probably the most popular two of a great many types used by the military.

At 35 pounds and 9" x 17" x 15" the TV-2 rates the term 'behemoth'; it isn't quick to use, either, because you have to set up each voltage separately, using the built-in roll chart. And the controls



The TV-2 tube checker. This is a TV-2C; earlier models go back to WWII.

are many and confusing. However, with meters for every voltage and current you can imagine this is a wonderfully flexible unit, able to test any receiving-size tube you can figure out how to hook up to it.

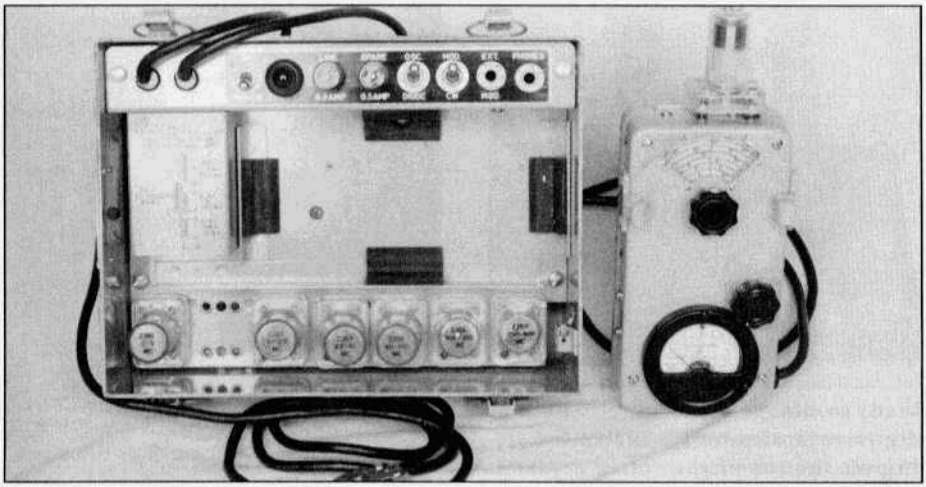
For day-to-day use the TV-7 (not shown) is a lot more practical. It weighs only 19 pounds and is a fraction the size of the TV-2. To test a tube you set nine rotary switches and a bias potentiometer; it is easy to use once you get the hang of it. The settings are in a book that should be in the lid of the set. There were several editions; get at least the 1962 one if you can because many of the later tubes don't show up in earlier editions.

Both the TV-2 and TV-7 are 'dynamic' testers, that is, they apply an input signal to the tube and measure its output; some simpler testers just check cathode emission, which isn't as reliable. Prices are $20 to over $100.

Grid Dip Oscillator PRM-10

I suppose truly modern hams use some kind of a digital thingamabob and get a more accurate answer in a fraction of the time we GDO freaks do, but, hey, are they having fun?

In any case a good GDO can be darn

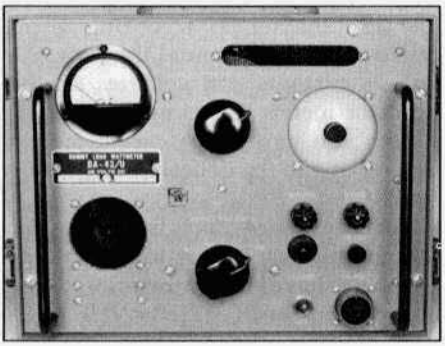


The PRM-10 grid dip oscillator. The 955 acorn tube oscillator is in the control head.

handy when you have to get a tuned circuit on a particular frequency or need an emergency signal generator. The PRM-10 covers 2 to 415 Mcs using seven plug-in coils. Output can be modulated for use as a signal generator and the unit can also be used as an absorption wavemeter to check for VHF parasitics or when tuning up a multiplier stage for the first time. The 110 VAC power supply is built into the case, with the meter and oscillator in a separate unit connected by a cable. Civilian GDOs are almost all smaller and lighter then the PRM-10 but this is a rugged, reliable and accurately calibrated unit that will give you many, many years of service. An example of its quality: a potentiometer ganged to the tuning capacitor is connected through various resistors in the coils to compensate the meter so that it remains on scale throughout the tuning range on each band. You don't find that in your Heathkit! Prices are $20 to $100.

The DA-43/U Dummy Load Wattmeter

Few practices so clearly mark the beginner in vintage set restoration as that of repeatedly testing a seriously ill transmitter on the air -- yet you hear it again and again. Part of the problem is that even most 'surplus' dummy loads will set you back $100 or more. For lower powered transmitters, however, the DA/43 is a good bet. This unit was designed for use with aircraft rigs requiring low resistance antennas; a panel switch selects load resistances of 4 to 40 ohms. Another switch lets you add a series capacitor if desired -- again, to simulate the usual short (capacitive) aircraft antenna. A meter reads the power up to 100 watts. If operated continuously at its higher power levels the unit should be connected to a 28 VDC source to run the internal blower.



The DA-43/U Dummy load wattmeter.

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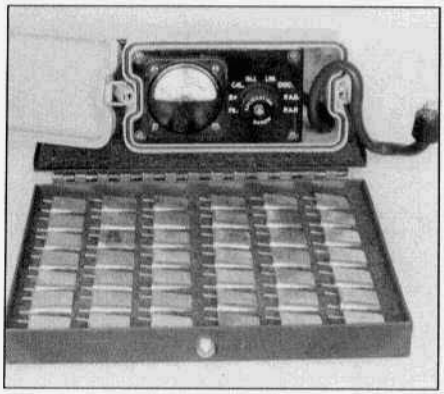


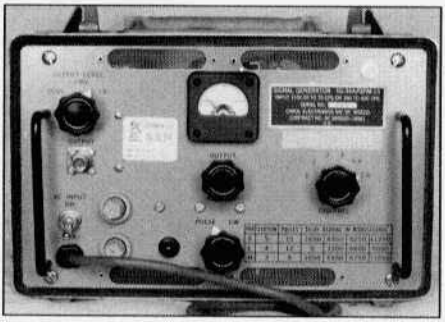
Ready to change the channel. Channel alignment indicator ID-292/PRC-6 sitting on the lid of the set of crystals, CK-6/PRC-6.

Most all ham sets will work into a 40 ohm load. Binding posts (rather than a coax fitting) are used to connect to the transmitter so readings may not be accurate on the higher ham bands. The light weight and ease of use of the DA/43 make it handy for general shack use and at $20 to $50 (Fair Radio has them for $75 in 'unused' condition) there's not much excuse for testing anything up to a DX-100 on the air.

Channel Alignment Indicator ID-292/PRC-6

An example of a special purpose test set is this unit, used with the PRC-6, our first post-WW II handy-talky. To set the PRC-6 to a new channel you open the case, plug in the proper crystal, and connect the cable from the ID-292. Then you tune the set up according to instructions in the manual, reading the various currents and voltages on the indicator meter. It is simple to do, although you have to be careful not to damage any of the delicate parts inside the PRC-6.

There are many such indicators for various military radios too simple or compact to have built-in metering. Some examples are the BC-611, the VHF ARC-5 transmitters, the ATB, the SCR-522 and many airborne jammers and radars. Perhaps the ultimate unit of this kind is ID-1189/PR, the channel alignment indicator for the PRT-4 and PRR-9 'helmet portable' transmitter and receiver of the Vietnam era. This unit not only provides metering for tune-up but checks the receiver sensitivity (with a built-in tunable signal generator) and battery condition as well.

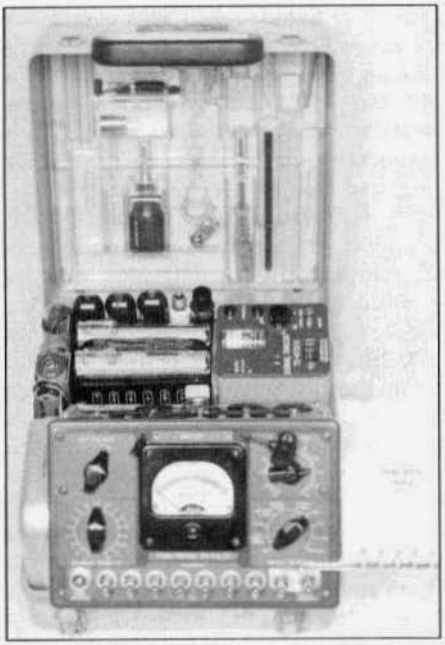


Signal Generator SG-34/GPM-15A.

Because they were never popular and many were used for parts, alignment indicators are hard to find today, which is a problem if you want to change the channel on your PRC-6 or other vintage military set.

SG-34/GPM-15

Remember LORAN? Pairs of stations operating on frequencies in the 160 meter band (and 100 kcs) transmitted synchronized pulses; by comparing the time of arrival of the pulses from the two stations of a pair you could locate yourself on a curved line (a hyperbola, to be mathematical about it) and with more than one station pair you could get a 'fix'. Accuracy was perhaps a mile or so in the daylight hours but much worse at night when skywave reception fouled up the timing of the pulses. Of course there were all those manned stations to maintain and not all parts of the world were well covered. When I was in the Navy in the 1960's we used LORAN for fixes when clouds prevented using the stars and we were out of radar range of land.



Test-Tool Set USM-3A with the TV-4 tube tester set up for use. When packed, the test setting book hinges back over the meter face and the TC-4 drops down into the case. The tube sockets are on the far side of the TV-4. The covered plastic tray in the lid should be filled with tools.

The satellite-based Global Positioning System requires only a central manned station and because it uses line-of-sight signals and modern digital technology it is much more accurate. Though LORAN C (100 kcs) is still in service, the 160 meter stations have been silent for at least a couple of years; I don't recall exactly. The GPM-15A is a signal generator that was used to align and test LORAN receivers. You might think the only ham use would be for the true nostalgia freak who wants 160 meters to sound as it did in the old days, with loud buzzing at 1850 and 1950 kcs. However, the GPM-15A is a gold mine of parts for the vintage homebrewer: a meter, switches, crystals and sockets (including a 100 kcs crystal), nine miniature tubes and sockets, terminal strips, small air variable caps, a 110 VAC power transformer and so on. You could build half of a small transceiver using the parts in this thing... in fact, that's what I'm doing, in between working on this article!

Test-Tool Set USM-3A

Okay, what are all the tools and instruments a 1950 radio repairman would need on a service call? Certainly a full set of small hand tools -- screwdrivers, pliers, alignment tools, socket and hex wrenches, a flashlight, a soldering iron and so on. Then he'd want a signal tracer, a voltmeter and a continuity checker. Better throw in a tube tester/capacitor checker and while we're about it, resistor and capacitor substitution boxes.

Maybe you are thinking "and an assistant or two, to carry all that gear"? Not if our repairman has a USM-3A. Everything listed -- and a few other -- is in there, in the most tightly packed (22 pound) 7" x 10" x 10" case you can imagine. A lot of the stuff is downright clever: ID-265/U, for example, is a probe the size of a fat cigar containing a meter reading 0-440 volts AC or DC with a separate needle to indicate 'tip +', 'tip -' or AC. Signal Tracer TS-673/U is an audio amplifier with an output meter and jacks for a scope or VTVM and headphones; this unit is only 5-1/2" x 3" x 3-1/2". You don't have to carry headphones, 'cause the USM-3 contains a phone and a coiled up headband that stow in less space than a pack of cigarettes. The TV-4 emission-type tube tester is tiny and easier to use than either of the common larger sets.

The set was made by Radio Frequency Laboratories, Inc. of Boonton, NJ; like the Aircraft Radio Corp. 'command sets', which were also made in Boonton, many parts hook together with midget banana pin connectors.

The better of my two USM/3As was missing most of the hand tools, the manuals and the test settings book for

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An HRO Story

Part 2

Jim Hanlon, W8KGI
P.O. Box 581
Sandia Park, NM 87047

The HRO was originally accepted principally as an amateur receiver. Commercial purchasers were likely to draw up their own specifications for a special receiver when a tough radio job had to be done. In the September 1941 *QST* ad, shortly before we were thrust into the War, W.A. Ready wrote the following: ". . .But gradually the HRO won the confidence of men who have to have the right answer, not just in this country, but throughout the world."

"We wish we knew and could tell you where all the HRO's have gone. Maybe some day we will be able to, but by then it will no longer be news. We can tell you where a few of them went, for what has been published cannot be a secret. Recently G5NI sent us a copy of the British magazine "*Picture Post*." Illustrating an article entitled "Inside the Admiralty" was a half-page picture with the caption: "The Wireless Room: Where the Navy's Voice is Heard. From this room the Admiralty controls the Fleet's movements throughout the world. To this room comes the SOS of a torpedoed vessel, the call of a commander for instructions." In this picture, before the tense operators, stand a row of HRO's. You may have seen the picture, for it also appeared in the *Saturday Evening Post* for July 12.

"We think that picture shows the hottest spot in radio in the world today."

The HRO Junior

You may not know that the HRO has a little brother. In 1936, National brought out the "HRO Junior." It was the same receiver as the original HRO, or "HRO Senior" as it was sometimes called after that, except that it had no S-meter, the crystal filter was replaced by a standard IF transformer, and the coil sets had no bandspread ranges, only general coverage. The cost of the Junior was reduced to only $99.99.

The HRO Junior was not particularly attractive to many amateur customers. For about the same price or less, one could buy a Hallicrafters SX-11/SX-15/SX-18/SX-25 with one RF (two in the SX-25) and the other features removed from the HRO. Granted, these receivers did not offer the superior mechanical construction of the HRO, but at this price level other features were probably more important. I have seen only one, genuine HRO Junior, and that was around 1980 in an exhibit of a vintage ham station in the Smithsonian Institution in Washington. Perhaps one of the guys who lives in the area can tell us whether it is still there.

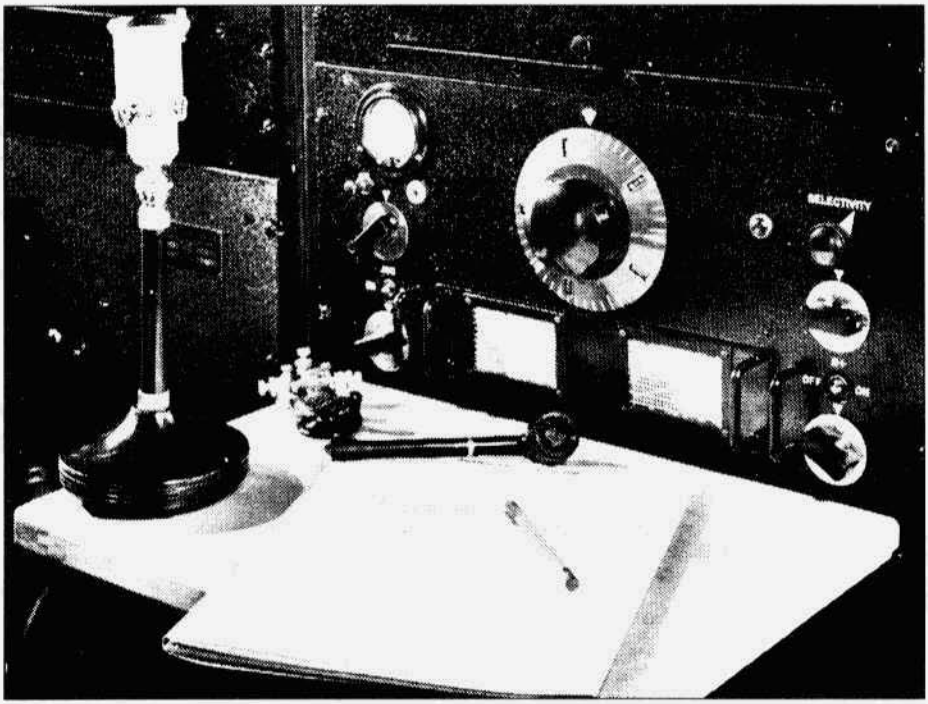
The Navy, however, liked the HRO Junior. It became the prototype for their RAS, RAW, RBJ and RCE receivers which were heavily used during WWII.

The "HRO 1-10"

You will occasionally hear someone talk about or see an ad for an "HRO 1-10." Don't be fooled, there is no such thing. The "National 1-10" and the 1-10A are superregenerative receivers that cover 1 to 10 meters. They do use the micrometer dial originally developed for the HRO which is perhaps where their misnomer has come from. But they are definitely not members of the HRO family.

Rugged Construction

Superior mechanical design and construction has been responsible for many HRO's surviving for half a century or more and enduring completely impossible environments. As Jim Millen explained in one of their full page *QST* ads for April of 1937, National (like Hammarlund) had a factory, not just an assembly operation. They made many



From National's (50th) Anniversary Photo Album, 1964. This is Jim Millen's personal HRO. This picture also shows up in a number of QST ads for the HRO. You can identify it from the wider angle shots of Millen's shack in QST for December, 1936. This receiver was in the AWA's warehouse annex when I visited there in August, 1988.

of the components for the HRO, tuning condensers, IF transformers, ceramic and Bakelite moulded parts, punched and drawn metal parts, the epicyclic dial and condenser worm drive, even the knobs for the panel controls; and they made them to suit the needs of rugged communications receivers. That's why most prewar National receivers are even now mechanically sound, whereas comparable receivers made by Hallicrafters, RME and Howard, who were assembling their units from parts built for the broadcast receiver industry, are for the most part pretty wobbly and squirrely at this point.

There are several stories I can tell about how that mechanical ruggedness paid off for the HRO. The first comes from an ad on the inside back cover of *QST* for August, 1942. It shows a rack mount HRO somewhat the worse for wear, having just been returned to National for refurbishment after being caught in a fire. The front panel is sooty, the knobs are a bit melted, the coil charts are partly burned and the S-meter glass is blackened and might even have some water inside. The ad, titled HELL - AND HIGH WATER, reads as follows.

"The HRO Receiver shown above was one of four in a building severely damaged by fire. The heat was so intense that it blistered paint and distorted Bakelite parts on all four receivers. Without any repairs, two of the four receivers tested normal in all respects except for some noise when tuning. This defect was eliminated by wiping soot from the rotor contacts. The remaining two HRO's required only minor resistor re-

continued next page

An HRO Story from previous page
placements, after which they likewise showed superb performance.

"Two HRO's being loaded on a ship were dropped into the salt water of the harbor when a loading sling broke. They were recovered and returned to us. One, without any repair or adjustment, showed performance that approached normal, except on one coil range which had an open circuit. The second receiver gave satisfactory performance on one coil range, after that coil had been baked in an oven. In spite of the delays in shipment to us, salt water still dripped form the coils when the equipment was received at our plant.

"Incidentally, we do not recommend this type of treatment."

And then there was a letter from a soldier, probably British, that showed up in the National full page *QST* ad for April of 1947. Some of the material was blacked out by a censor, but the story is still quite clear. It reads as follows (punctuation, spelling and all).

"Dear Sirs,

"This is a letter that I have often promised to myself that I would write, if I were fortunate enough to come out of the War "in one peace."

"The story begins in 1939, those remote days just before the storm clouds broke over Europe. A young "ham" after saving "pennies" after what seemed an eternity has managed to realize one of his pipe-dreams, he has become the proud owner of a HRO. This was no hasty decision lightly made, but the result of years of poring over copies of "*QST*."

"Unfortunately the joy of using this receiver for "ham" work (after years of Det and one L.F. (that's a regenerative detector and one "low frequency" audio stage in case you don't recognize the lingo), and home-made supers) was short-lived. The ban on transmitting was imposed for my country was at war with Germany.

"All through that winter and spring of "phony" war, the HRO was used to get news bulletins from all parts of the world. With the summer it was being used for a grimmer purpose and was bringing in the signals from Nazi tanks and planes as they over-ran one country after another.

"It was at this time that the owner joined the XXXXX and made the decision to take the HRO with him, perhaps it would provide entertainment for himself and his comrades. It did, and more - it was used also for more serious work, for at that time we were woefully short of precision equipment. For the next year the set was used practically 24 hours a day and 7 days a week on its work official and unofficial. The messages that it handled would provide material for a book that would stand comparison with any work of fiction.

"The next move was to an ocean linear once a link between our countries, now running blacked-out and full of troops. It was during this voyage around the Cape to the Middle East that the HRO enjoyed its only rest of the War years, its idleness was enforced as a security measure.

"For two years the HRO spent most of its time in the back of a 3-ton lorry (from whose tailboard it fell to the ground more than a few times), along with petrol tins, ammunition boxes, heavy implements, etc. The climate varied from the Western Desert in blazing midsummer, through the rainy seasons of Tunisia, to the snow and ice of the Italian Appenines in midwinter. This was followed by service in Normandy, Belgium, Holland and finally into Germany itself. It was operated in dug-in tents, luxury hotels, and wrecks of bombed villages. The anecdotes of this period are far too numerous to relate, but it might be worthy of mention that in the Ardennes it enjoyed the treat of a new set of 6 volt valves and a vibrator unit (perhaps it would be unfair to add that an American Sgts. taste for tea devel-

From National's (50th) Anniversary Photo Album, 1964. "A famous war-time compliment to National - the receiver on the right is an identical copy of the HRO manufactured by the Germans for their military communications." Note the similarity between the German coil set calibration chart and the HRO-7 calibration chart.

oped in England prior to "D" day and unsatisfied by American Army rations was not unconnected with this deal).

"Now the HRO and owner have been demobilized are back at the really serious business of "ham" radio which was interrupted by those long years of War. The HRO has been overhauled and re-aligned (though it does not seem appreciably better), the dents have been beaten out of the cabinet, foreign bodies have been removed from its interior (the locust legs that recall Benghasi, the dust of Sicily, the black mud of the Low Countries). It has had a coat of enamel and looks and works like new. During all those years it never gave any trouble, not a joint came unstuck despite the terrific hammering it had at times in military transport, from concussion of explosives, etc. The owner had many opportunities, especially during the later phases of the war of trying other communications receivers of all brands, but never found better.

"It would be appropriate at this point to suggest some improvement or modification born of hard experience, but it has not been honestly possible to do so. There is however one little gadget which has proved its worth over and over again in which you may be interested. On the back chassis was mounted an ordinary valve socket and connected to the heater and anode supplies. Into this outlet have been plugged a whole host of units at one time or another, especially when operating in the field from a vibrator supply. Some of them come to mind at once, a 100/1,000 kcs crystal oscillator, an acorn VHF adaptor, a signal-generator, a V.T. voltmeter, etc., etc. But you can no doubt imagine to yourself the uses that a Communications Section in the wilds can find for 6.3 v and a couple of hundreds volts of D.C.

"This is the end of the story, but not the end of the HRO which is going to put in many more years of hard work. It

continued next page

has not been written to flatter you, or with any idea of payment but rather to express in some small manner the gratitude of the owner for all the services that the HRO gave to himself and to his country.

I remain,

Yours Sincerely,

XXXXXXXXXX

XXXXXXXXXXX

"P.S. If you should want to publish any of this at any time please do, but don't add my name and address as I am still employed in XXXXXXX and they don't welcome publicity."

As a further testimony to the ruggedness of the HRO, I'll tell you a personal story. It was some time in the winter of 1956. I was a freshman Air Force ROTC Cadet at Ohio State, I had just completed an hour of outdoor drill in a bone-chilling downpour, and my "bus driver's" raincoat was soaked completely through. I had stopped off at the W8LT radio shack on my way back to the fraternity house to wring the water out of my coat and store up a little warmth for the long hike ahead of me. The senior ops were busy on ten meters, running sideband with LT's new Central Electronics 20A. Their receiver was a brand new HQ-140. They didn't particularly appreciate my dripping on them, so they suggested that I QSY to the back room.

The back room was a small workshop, well stacked with the "junk" necessary to maintain W8LT's BC-610 and other assorted items. Peeking out from one pile I saw it, an old HRO. Digging down a ways, I unearthed first the receiver and then in turn some coils, a doghouse power supply and a speaker. The receiver was somewhat the worse for wear. Its S-meter was missing and two wires were hanging from the hole.

I carried it out to the operating room to show the other guys what I had found. They assured me that it was just a piece of junk that had once been the W8LT station receiver a long time ago. "Let's see if it will still work," I insisted, and I set it down beside the HQ-140. I hooked together the receiver, supply and speaker and ran a clip lead over to the HQ140's antenna terminal. A dignified moment after I threw the power switch, some encouraging noise began to emerge from the speaker. Audio gain up, RF gain down, AVC off, CWO on, tune to the HQ-140's frequency and wonder of wonders, there was the guy they were working on sideband! The senior ops began to be more than a little impressed.

"Let's try one more thing," I suggested. I picked up the HRO about three inches off the table . . . and dropped it! They never did find the guy they were working on the HQ-140, but he didn't even wobble on the HRO. They finished the QSO using the HRO.

Hints and Kinks

I am aware of several articles suggesting "improvements" to the HRO such as substituting more modern, lower filament power tubes and adding a noise limiter, but I suspect that most owners of HRO's these days are not particularly interested in "butchering" an antique. Still, there are a few things that I know about or that I've done to my own HRO's that you might at least be interested in.

Using coils across the series.

The receivers from the original HRO in 1934 to the HRO-5A1 after the war used compatible coil sets. The early ones have paper calibration charts covered with a clear plastic, while the wartime and later ones switched to charts engraved on a metal cover plate. All of these coils have a handle at each end to aid insertion and withdrawal. The ones I have seen all have brown, Bakelite (or perhaps National's R-39, mica-filled Bakelite) coil support blocks.

With the HRO-7 in 1947, National made several coil set changes. They replaced the handles on the sets with four

studs located where the handles had been. These studs mated with two "crowbars" on the main receiver that helped both to seat the coils as they were being plugged in and to slide them out when they were being changed. The coil support blocks were changed to a white ceramic material, probably less lossy at higher frequencies. And the calibration changed from the two, side-by-side graphs used on the earlier HRO's to a horizontal ruler, calibrated with the dial reading on a center scale and with the bandspread and general coverage frequency readings on top and bottom scales. This scale is easier to read and more accurate than the earlier ones. As I mentioned earlier, it may have been borrowed from the unauthorized German wartime copy.

When the HRO-50 came out in December 1949, National finally introduced a calibrated, slide-rule DIAL! So coil sets for the '50, '50T1 and '60 models no longer had calibration charts. The '50 coil sets have white filled engraved letters and their frequency coverage range (A is 14 to 30 Mc, B is 7 to 14.4 Mc, C is 3.5 to 7.3 Mc, D is 1.7 to 4 Mc, etc). My recollection is that the HRO-50T1 and the HRO-60 coils have riveted-on metal plates with the same information. But Raymond Moore's picture of the HRO-50T1 in *Communications Receivers* still shows the engraved letters on the coil set. Another change in the HRO-50 coils was the introduction of a small butterfly switch on the top of each coil block for changing between bandspread and general coverage to replace the earlier method of moving a screw between two holes. I've never lost one of those screws, but I'll bet more than a few of the fellows did.

An important change that came in with the HRO-50 was a decrease in the height of the contacts on the coil support block. Users were cautioned that if they wanted to plug coil sets from earlier HRO's into an HRO-50, they should first disassemble the coils and insert a washer between the coil support block and its aluminum shield can so as to lower the contacts. Not doing this would risk breaking the ceramic bars that held the mating contacts in the receiver body. I have used a so-modified AC, fifteen meter coil set from an HRO-7 with my HRO-50 for forty plus years with perfect results.

If you want to use a coil set with handles from the HRO-5 and earlier receivers in an HRO-7, '50 or '60, just cut the front part of the handles off and finish the remaining stumps to the same height as the studs on the newer coil sets. With this and moving the coil support blocks down, they will fit and work well.

The HRO-60 went to double conversion above 80 meters, so only the lower frequency, single conversion coil sets, D, E, F, G, H, I and J which cover from 50 kc to 4 Mc are immediately compatible with the earlier receivers.

You may run across some of the older vintage HRO coil sets with a "J" preceding the other coil letter designation. I bought several "JC" coil sets from Fair Radio Sales once upon a time and stashed them away for future projects. These are HRO Junior type coils, perhaps that's where the "J" comes from, that offer only a general coverage range. They do not have the normal ham-band bandspread at the top of the range. They were made for the Military HRO's during the war. They are fine for use as is, and also a good vehicle for modification to other purposes, even though they do not have the full set of trimmer capacitors found in the bandspread model coils.

At the same Albuquerque Swapfest where Dave Mallery beat me to that rack-mount, L-series HRO, and indeed from the same vendor, I picked up two coil sets from an RAS-5. They look like HRO Junior coil sets, except that they have Numbers instead of Letters to in-

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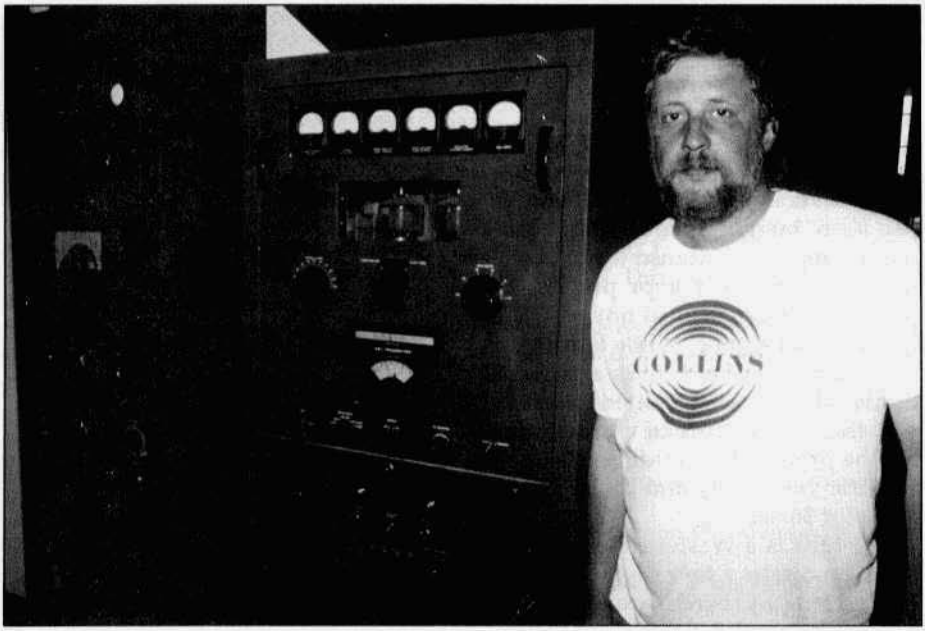
Domenic Correggio Jr, WA1AYY, at his vintage operating position.

Dear ER,

I am fifteen years old and have a father who is a radio fanatic. He has been subscribing to Electric Radio magazine for years now and he likes it very much. My dad does a lot for me and I would like to get his picture in Electric Radio for him to keep as a reminder of his favorite hobby. My father first obtained his novice class license at age seventeen, while still in high school. He has upgraded in his thirty years of radio to an extra class license and is currently working on his commercial certification. In my opinion, amateur radio is his life, other than working and devoting his time to our family. I also possess a tech plus license, I earned my novice at age eleven. My father always introduces people to the world of ham radio, including myself. I think he is very deserving of the joy of seeing his own picture with his radio equipment in his favorite magazine. This would really make him happy. Please consider entering the enclosed picture to a soon edition of Electric Radio magazine. My father's name is Mr. Domenic Correggio Jr, WA1AYY, of Saugus, MA. I greatly appreciate your time and understanding.
Thanks.
73,
Dom Correggio III, KA1WLF



Marty Drift, WB2FOU, with a KW-1 (serial number unknown) that he found in Dallas. It came from the estate of Art Collins.

Dave Parker, WB9WHG, gave a talk on collecting and operating military surplus radio at a recent dinner meeting of the Rock River Radio Club in Beaver Dam, Wisconsin. *W9BCV photo.*

A Real "Glows in the Dark" Project

by Cliff Kurtz, N6ZU
6727 N. Pershing Ave.
Stockton, CA 95207

For several years my XYL, N6NYB, had been "bugging" me to build a table lamp using a large transmitting tube as the center piece. I kept putting the project off because I had not yet found just the "right" tube. While bidding on various boxes of old tubes at a recent estate sale/auction I spotted what I felt was the tube worthy of consideration for the project. The bidding began but was not very lively and the prize was mine for $6.00.

The tube is a Western Electric 251A and also carries a four digit number of 5427. A lengthy search through various tube manuals did not shed any light (pun intended) on the subject. I remembered a WE tube manual I had gotten from a now deceased ham buddy. I found the tube listed therein with these specs:

Triode, Air cooled, Fil 10V @ 16 A. Plate V. 3KV, Plate Current .6A, Plate Dis. 1KW, Amp. Factor 10, 30 MHz Max F., 400 Watts out typical.

The tube stands 21-11/16" high and is 6-1/8" in diameter.

After determining that the filament was still intact I looked for a transformer to "make it glow". The best thing I could find was a surplus unit that put out 7 volts at 18 amps. I decided to use it since the filament would probably last indefinetely at that voltage.

Not having a socket I decided to build the base using solid oak, and drilling the top piece to accept the two 1/4" pins in a snug fit. After forcing the pins through the top piece I soldered two No 14 wires 6" long to the pins at their tips. These were later connected to the transformer secondary. A fuse and a SPST switch are connected in series with the primary to control the light. To support the tube and to keep it from wobbling in the base, I extended the sides of the base so it would engage a couple of large pins that form a part of the tubes outer structure. I had finally done it, and now the bugging has stopped!! A coat of clear varnish protects the wood, and enhances its beauty. I did not add a shade as it would have detracted from its beauty.

The lamp has drawn many favorable comments from visitors to the shack. It casts a very warm glow over the entire room, and somehow lets you feel you are not alone in the shack! 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: Wednesday nights at 8 PM PT on 3835.
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net control is Andy, WA4KCY. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: Recently started by Pat, K7YIR, this net is on 3875, Mondays and Fridays at 9:30 PT. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT.
Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours. Net control is Les, K6HQI.
Arizona AM Net: Meets Sundays at 3 PM MT on 3860. On 6 meters (50.4) this group meets at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AM'ers get together on 3875 Monday, Wednesday and Friday mornings at 7AM MT.
DX-60 Net: This net meets on 7290 at 2 PM ET, 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.
Military Radio Collectors Net: Meets Sundays at 4 PT on 3905. Net control is Tom, WA6OPE. It is not necessary to check in with military gear.
Grey Hair Net: The oldest (or one of the oldest) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8 PM in the winter and 9 PM ET in the summer.
Vintage CW Net: For CW ops who enjoy using vintage equipment.This is not a traffic net; speed is not important. The net meets on 14.062, Saturdays at 3 PM PT. Net control is Tracy, WB6TMY.
Vintage SSB Net: Net control is Chuck, N5SWO. The group meets on 14.293 at 1 PM CT, Sunday afternoons.
Collins Users Net: The oldest of the 'users nets'. It meets on 14.263 Sunday afternoons at 2 PM CT. The net control revolves. This group also gets together for an informal ragchew on 3805 Tuesday evenings at 7 PM CT.
Drake Users Net: Another relatively new net. This group gets together on 3865 Saturday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, WZ8O; Rob, KE3EE and Huey, KD3UI.
Heath Users Net: A new net started by Marty, WB2FOU/5. Net control is shared by Fred, AA5LW. It meets on 14.275 at 4 PM CT Sundays. Check in on either AM or SSB.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net has been meeting since 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
NBFM Net: 3885 at 10.30 PT, Thursdays. Net control is Dennis Petrich, KØEOO.
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.
Westcoast Broadcast Equipment Net: Tuesdays on 1959 at 9 PM PT. Anybody is invited to join the group, but the emphasis will be on broadcast equipment. Moderator is Mike, W6THW.

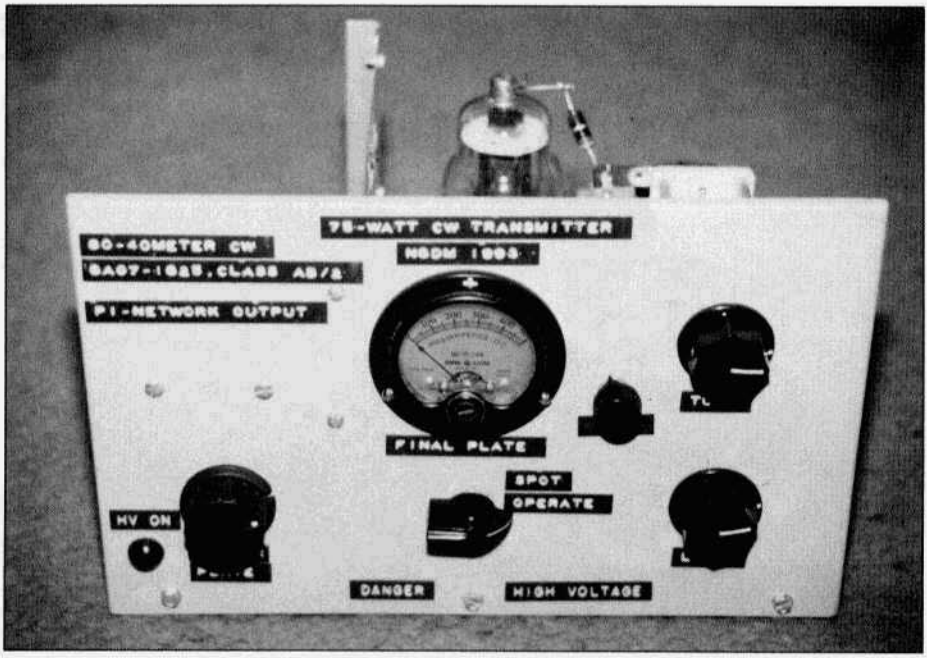
A Homebrew CW Transmitter--Breadboard Style

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

I homebrewed this transmitter in order to find out if 50-year-old 1625 tubes on an unshielded wooden breadboard can produce a state-of-the-art CW signal that doesn't interfere with the home TV set on an outdoor antenna. Breadboard construction was chosen for several reasons. The breadboard material costs very little and is easy to work with. Breadboards were standard in the earliest days of radio. Use of the breadboard probably peaked during the thirties, the decade which gave us the 807 tube, a time when a metal chassis, relatively speaking, was costly. Today, a metal chassis base has again become a rather costly item. Drilling holes in a metal chassis and panel for sockets, switches, controls and meters was -- and still is -- a tedious job without power tools. The main motive, though, for choosing breadboard construction was nostalgic -- an attempt to relive a bit of early radio technology. I discovered that such technology is still usable.

I'd guess that hundreds of unused 1625 tubes in original cartons are still resting in junkboxes around the country. The 1625 was perhaps one of the all-time great surplus tube bargains, sometimes being sold for as little as a dime each. Old timers will remember their two-in-parallel use in the output stage of the surplus Command Set transmitters. Only one commercial design using them comes to mind: Heathkit used a pair of 1625s as modulators in the DX-100. Except for its 12-volt filament, the 1625 is electrically identical to the 807. The only physical difference between them lies in the basing arrangement. The 807 base uses the standard 5-pin configuration. The 1625, on the other hand, requires a rather uncommon 7-pin socket. It seems that the 1625 socket is much rarer these days than the tubes themselves. In the following discussion, all references to the 807 apply equally to the 1625.

In its heyday the 807 was famous for its instability as an RF amplifier. Before the advent of the dip oscillator for exploring stray RF-circuit resonances, hams were never quite sure whether the tube's unintended oscillations were near the operating frequency or in some VHF parasitic mode, or perhaps both. Vintage circuit diagrams often show it without neutralization. Photos in old handbooks, in editions immediately preceding and following World War II, usually show it mounted in a metal cup. Sometimes one sees it in a recessed mount with its plate lying close to chassis level. Such mountings tended to stabilize the tube, it was found. Why was this so? These mountings tended to augment shielding between the grid and plate circuits. We now know that these mountings also increased the stray capacity between plate and ground, causing the VHF plate-circuit resonance to occur at a frequency below the stray VHF grid-circuit resonance, thus defeating the tuned-grid tuned-plate VHF parasitic oscillation mode. A tuned-grid tuned-plate oscillator must have its plate circuit tuned to a slightly higher frequency than the grid circuit in order to oscillate. One later learned via the dip oscillator that one could lower the VHF plate-circuit resonance through a simple parasitic choke in the plate lead, which stabilizes the tube equally well. If one uses effective RF bypassing of the screen and cathode to ground, together



Front panel of the 6AG7/1625 breadboard transmitter.

with shielding between the grid and plate circuits, the 807 or 1625 tube on a breadboard, without neutralization, should be completely stable when operated on 160, 80 or 40 meters.

These tubes, driven by a 6AG7 crystal oscillator stage, on an unshielded breadboard can put out a clean 60-watt (750 volts at 120 mA input) CW signal on 160, 80 and 40 meters without TVI. Don't try this construction technique on the higher-frequency bands. The result will be ferocious TVI and almost certain self-oscillation, as the tube is not neutralized. The 1625 amplifier is coupled to the antenna through a conventional pi-network output circuit. The tube operates in class AB/2 with fixed-battery bias. Class AB/2 is a linear-amplifier mode where the tube draws grid current. A well-regulated grid bias supply is therefore required for minimum distortion. It turns out that four common 9-volt batteries in series at 36 volts provide near optimum fixed bias for the 807/1625 in class AB/2 if the screen sees a fixed voltage of around 300. A single tube with 750 plate volts and loaded to 120 mA rated plate current in this mode draws approximately 3.5 mA of grid current, key-down. These 9-volt batteries should be the cheap, standard items, not the alkaline type. The voltage of alkaline batteries in this bias application tends to decline with use. This is an observation without explanation. The charging effect of grid-current flow, on the other hand, will tend to maintain or slightly increase the voltage of the cheaper, non-alkaline dry batteries. For this homebrew project, use of fixed-battery bias, a principle though perhaps archaic, is perfectly congruent with the project's nostalgic motif. Battery bias proved to be mechanically simple, dependable, and cost effective. Let me quote, regarding this bias principle, from the 1962 *ARRL Handbook*, page 155: "The life of batteries in bias service will be approximately the same as though they were subject to a drain equal to the grid current, despite the

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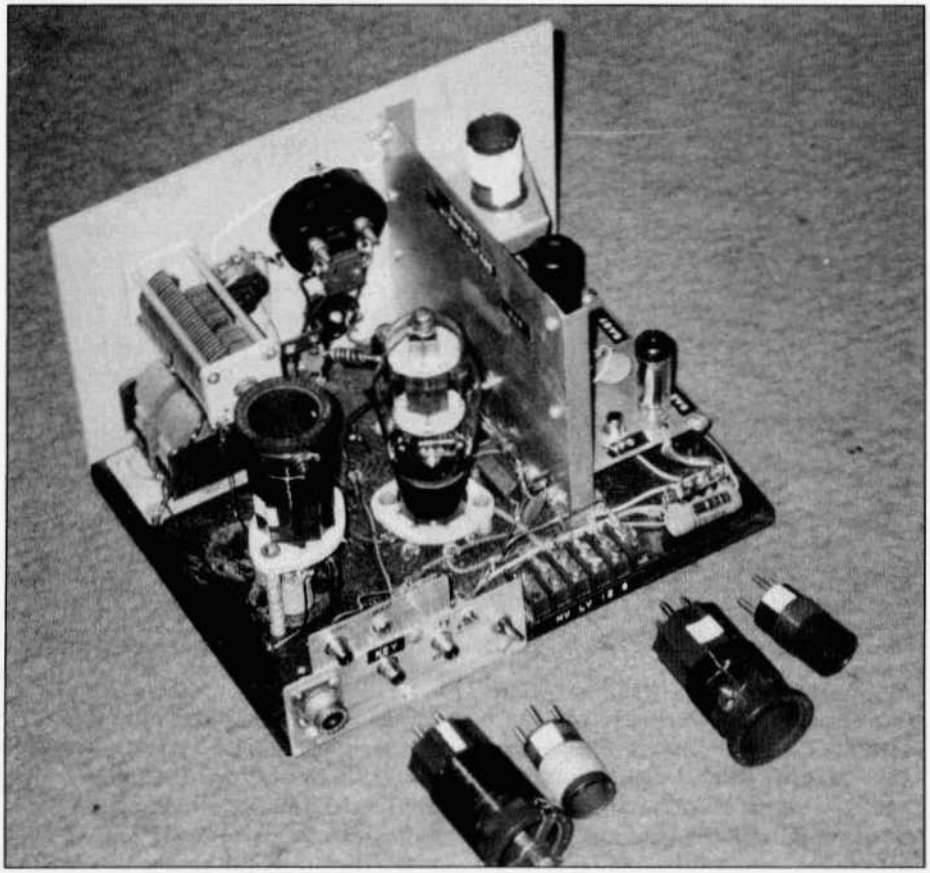
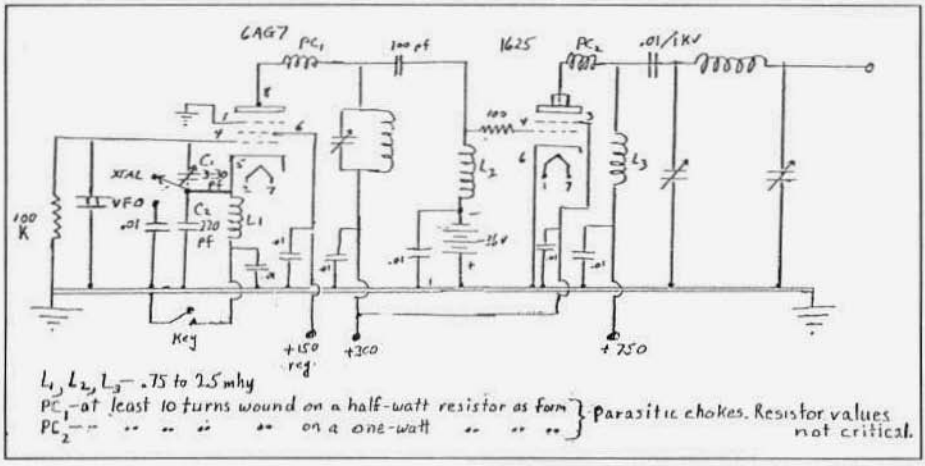


Rear view of the transmitter with plug-in coils.

fact that the grid-current flow is in such a direction as to charge the battery, rather than to discharge it." With minus 36 volts of fixed bias, the 1625 amplifier with about 300 fixed screen volts and 750 plate volts draws about 15 mA of plate current key-up. My breadboard transmitter is powered by a Heathkit HP-23 power supply. I made no attempt to filter the power leads for harmonics.

Traditional practice with simple two-stage transmitters such as this was to key the cathodes of the oscillator and amplifier stages in parallel and to operate the final stage in Class C. This permitted full break-in operation, did not require a clamp tube or special biasing for the amplifier, and masked any tendency of the amplifier to self-oscillate in the absence of drive. Class C operation of the amplifier also allowed for the option of amplitude modulation. A trade-off was often difficult in designing an effective key-click filter, as the key had to break simultaneously the sum of oscillator and amplifier plate, screen and grid currents. Also, compounding the problem, a class-C amplifier stage would sometimes, through its non-linear amplification of the driver's waveform, make its own contribution to key clicks along with increased harmonic generation.

Class AB/2 operation of the 807/1625 with fixed bias provides certain advantages for an unshielded breadboard CW



transmitter in today's electronic environment. The unkeyed amplifier, operating in a linear mode, does not distort the driver's waveform and thus simplifies key-click reduction. Since only the 6AG7 oscillator stage is keyed, the key needs only to break the oscillator cathode current. With a 6AG7 this amounts to about 40 mA at most. Also, class AB/2 operation, as opposed to class C, tends to reduce the tube's harmonic generation. Fixed-bias operation permits strapping the amplifier's cathode directly to ground. This enhances the unneutralized 1625's stability. Handbooks show that the 807/1625 tube with 300 volts on the screen, actually puts out slightly more power in class AB/2 than in class C with the same plate voltage.

If used with a correctly designed PI-network final tank circuit (consult handbooks for information) a breadboard transmitter similar to this one will probably be clean in the TV channels. The PI-network provides 35 dB attenuation of the second harmonic. Class AB/2 operation of the final stage reduces second-harmonic generation by another 6 dB. My unshielded breadboard 6AG7/1625 rig on 160, 80 and 40 meter CW doesn't bother our TV set and VCR 30 feet away (not on cable), which are protected from fundamental overload through hi-pass filtering in the antenna leads and by a ferrite choke in the power cords. Our outdoor TV receiving antenna is 90 miles away from the TV transmitting antenna.

The first version of this breadboard transmitter keyed both cathodes in parallel, operated the 1625 in class C, and used a series-fed plate tank circuit link coupled to the antenna, just like the configuration of yesteryear. Series feed does not require a plate choke and blocking capacitor to couple the tube's plate to its tank circuit. However, the tank circuit is always hot with DC plate voltage. Series-tuning the link provided adequate control of loading into a 50-ohm resistive load. The rig worked well, but it required very fine tuning of the 6AG7 and 1625 tank circuits to avoid being seen on TV, especially when operating on 40 meters. This unwelcome discovery meant a return to the drawing board. Use of a PI-network output circuit plus class AB/2 operation of the 1625 with fixed bias solved the problem. Restructuring the final plate circuit to a PI-network configuration required only two extra parts: the plate choke feeding the 1625 and a blocking capacitor. The variable capacitor originally series-tuning the link proved adequate to function in the output leg of the PI-network along with some fixed

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WRL's First Transmitter

by Jim Musgrove, K5BZH
400B Swanee Dr.
Austin, TX 78752

The WRL-70, introduced in the late thirties, was the first transmitter manufactured by Wholesale Radio Laboratories, later known as World Radio Laboratories. It was the catalyst that started the WRL product line.

Leo Meyerson, with the aid of handbooks and QST magazines, did the engineering for the low-powered transmitter. The design was completed in 1938.

The RF section contained a crystal controlled metal 6L6 oscillator driving a pair of 6L6G's to 70 watts input. A type 83 was used for the rectifier in the power supply.

After completing the design, Leo made a trip to Chicago and struck a deal with General Transformer to obtain surplus plate transformers and filter chokes. Purchasing the smaller components at good prices was another task that was well within his capabilities.

These low-powered CW transmitters were sold from late 1938 through 1941 for $35. They were built on a 8-1/2" x 15" x 3" chassis which included a power supply and a junior rack panel with dimensions of 10-1/2" x 16-1/2". Two Readrite meters were mounted on the upper portion of the panel. For another $4.50, Simpson meters would be substituted.

A push-pull plate modulator, designated the WRL-70 Speech Amplifier Modulator, also using 6L6G's, was designed to match the WRL-70. A 6SJ7 and 6N7 were used in the speech amplifier. This unit used a chassis that matched the size of the WRL-70 RF Section. It included a shorter panel with a height of 8-3/4".

The audio unit was also marketed to be used as a modulator for other transmitters with power levels up to 80 watts. This kit was sold, complete with tubes, for $25. Like the WRL-70, it was first nationally advertised in QST's Ham-Ad's in the April, 1940 issue. The WRL-

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LETTERS

Dear ER:

I have found a nearly-bulletproof way to defend the use of AM without sounding defensive.

Our challengers typically take the familiar line of "spectrum conservation." Yet the only activity that can pass a test of not wastefully consuming spectrum is that of emergency and essential communications.

Everything else in our hobby is on equal footing: It's all chit-chat, regardless of mode or activity.

Consequently, our strongest argument equates the use of AM with any other type of hobby communications taking up spectrum. However, it's important to show that equality without putting down other interests and activities.

When a critic comes along, consider a review of the strong level of cooperation seen among groups in the greater Amateur community, without a specific reverence to AM enthusiasts. Notice how hams make way for Field Day as it consumes much of the band, and how most hams tolerate the spectrum taken up by DX-ers as they stagger-tune in a pileup.

After establishing and illustrating how hams put aside their own interests from time to time, you can then question your critic as to why they aren't part of that positive way of interacting with other groups.

Directly ask that critic if they judge harshly any and all other groups outside their own interest. Yes or no, you can then conclude the person is narrow minded, and unlikely to contribute anything positive to the hobby.

We have a special responsibility to make sure hams see us as but one of the many facets the hobby can offer for the enjoyment and accomplishment of all. But all too often, narrow bandwidth often equals narrow mindwidth on the part of those who don't understand the spectrum is not created just for them.

Paul Courson, WA3VJB

Dear ER

The recent articles on the NULL METERS have been of great interest to me. When I started out in 1972, not knowing an awful lot, I needed a SWR bridge to use to match to my antennas. I built a resistive NULL BRIDGE from a diagram in an early 60's vintage ARRL Handbook.

However, I could not figure how to prevent the 50-ohm resistor from burning up. I used a homebrew 6146 TX, putting out about 30 watts.

Now with these recent articles, I see the error I was making. That is, I should have put a dummy load (e.g: HEATH CANTENNA) in the line to soak up the majority of the RF and let just a bit trickle through the bridge.

Since reading these articles, I wanted to point out there is a mil-surplus unit that has the SWR null bridge, dummy load and power meter built in as a compete unit. It is the ME165 and is available at a real reasonable price. It was an accessory unit to the T-368 transmitter. It has a 600 watt dry dummy load, power meter and SWR bridge built in. It also has a switch so that you can leave in the feed line and switch between these functions.

The only extra items you might want are two "N" to "UHF" adapters. The unit comes stock with "N" type fittings. This is a real neat piece of gear.

Dale Mecomber, N2DM

Dear ER,

I have always enjoyed operating AM and vintage equipment. Now that we are into the season for sporadic E propagation on six meters I've been operating these regularly. Recent QSOs include Ron, KO4FEK, NC, and WA8CEW, Bob

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Squires-Sanders (SS-1R, SS-1V, SS-1S, SS-1RS)

by Tom Hoitenga, K8NGV
3170 Kennesan View
Marietta, GA 30064

The name "Squires-Sanders" is an enigma to the majority of amateurs. It is a name that is known to some "old timers" and to those who have followed the "nostalgia craze". The company did not gain the familiarity of Hallicrafters or Collins because it was in the amateur radio business only from 1963 through 1967. Within these few years, however, it produced a line of equipment that remains fascinating today. It set new standards in tube equipment design, manufacturing, and performance.

Squires-Sanders first came to the attention of the amateur community through an ad that appeared in October, 1963 issue of *QST*. It was a public relations ad announcing the merger of Clegg with Squires-Sanders and introducing the company principles, D.F. Sanders, William Squires, W2PUL, and Edward Clegg, W2LOY. Also in this issue was a technical article written by Bill Squires, entitled "A Pre-IF Noise Silencer". The previous month's issue had contained an interesting article, by the same author, entitled " A New Approach To Receiver Front End Design". This latter article soon became a "classic" for technical references.

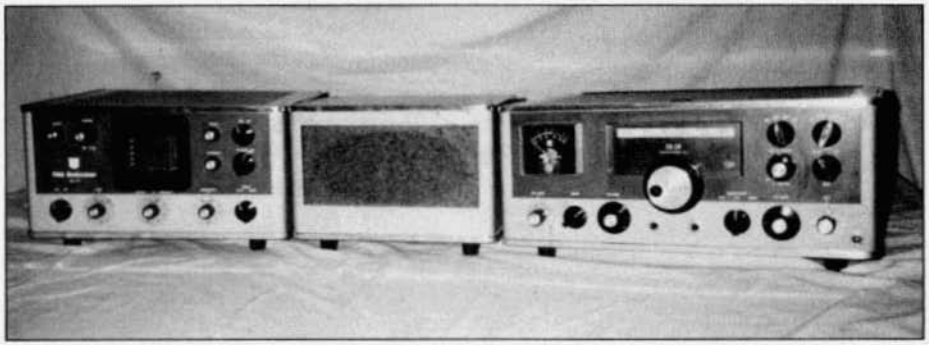
The two articles turned out to be technical introductions to a new receiver, soon to be announced. It was announced in November, 1963, as the SS-1R. The same *QST* ad announced the immediate availability of the SS-1RS speaker and the future release of the SS-1S noise silencer and SS-1V Video Bandscanner. These latter units did materialize and also proved to be excellent products.

All products were unique, relatively expensive, and designed to be part of a full complemented line of equipment (to include a transmitter and VHF transverter). The list prices for the four available receiver items totaled slightly less than $1600. This was Collins-type of money in the '60's. What was Squires-Sanders offering? How does it compare today?

SS-1R Receiver Specs

The first impression of the SS-1R is that it looks different. It is about the same size as an S-Line unit but it is physically different. The front panel is an integral part of the cabinet. Instead of being a separate piece of metal, the cabinet is "U-shaped" with the front and two sides forming the three surfaces of the "U". Another "U-shaped" assembly encompasses the top, bottom, and back for the cabinet. The top is "piano-hinged" so that access to the receiver can be achieved where tube replacement and 80% of any alignment can be done.

The chassis is not attached to the cabinet nor front panel surface. The chassis is comprised of a flat piece of heavy aluminum plate with one bend to form the rear apron and contains the antenna and accessory connections. All controls (with two exceptions) and indicators (except S-meter) are mounted on brackets attached to the chassis. The entire chassis assembly slides into "shelves" that are extruded on the cabinet sides and remains in a "floating" type of suspension. All control shafts protrude through oversized holes in the front of the cabinet and are not attached to any couplers, panel bearings, verniers, etc.; in fact, they do not even touch the cabinet. Operator knobs mount directly on the control shafts. The chassis assembly is held in place by two screws that prevent the chassis from backing out from its "suspension". This arrangement presents an added degree of mechanical integrity and stability. Flexing of the



SS-1V video scanner, SS-1RS speaker (with SS-1S noise silencer mounted inside) and the SS-1R receiver.

cabinet or pressing of the front panel does not "stress-tune" any of the controls.

The Antenna Trimmer and BFO controls are both calibrated and vernier tuned. Additional controls provide for adjustment of both a standard peak noise limiter (built-in) and a pulse noise silencer (mounted in the speaker cabinet and previously described as "A Pre-IF Noise Silencer"). Either or both can be used in any mode. The AGC control selects release speeds of "fast" (1 sec.), "slow" (.1 sec.), or "off" (attack is 1 ms.). It, too, can be used in any mode. While the fact that AGC and noise reduction circuits can be used in any mode is not a "big deal" by today's standards, it was quite a selling feature in the '60's. Not many receivers offered this flexibility.

The tuning of the SS-1R is one of its most notable features. The main tuning knob tunes at a rate of 10 kHz per revolution. 100 kHz segments are indicated by a dial pointer as it traverses a 5" slide rule dial. As the bandswitch knob is turned, the proper calibrated band appears in the window (similar to Collins 75A- and KWS- series. Central Electronics 100V/200V transmitters, etc.). Each band is tuned in 500 kHz ranges. The single kHz readout (accurate to + or - 1 kHz) is indicated in a small window below the slide rule dial. It is unique in that it is not a circular decaled dial but a mechanical counter that indicates 0 through 99 (similar to the R-390 dial readout). It goes through the entire count for each 100 kHz segment on the slide rule dial. 50 revolutions of the knob is required to tune from one end of the band to the other. . . . .or a front panel pushbutton can engage a motor to move the tuning mechanism over the entire band in about 7 seconds. As one of two buttons is pressed (one for each direction), an internal motor extends a rotating shaft to engage the VFO gear system. When the button is released, the drive shaft retracts and manual tuning can be resumed without any influence of motor drag.

There appears to be nothing out of the ordinary in the functional block diagram except for, perhaps, the unorthodox selection of IF frequencies. The SS-1R is dual conversion and designed for the 3 to 30 mHz range. It employs the concept of a crystal controlled converter feeding a tunable IF, applies the main selectivity immediately following the mixer stages, uses more than one IF stage and AGC for "gain distribution", and contains a noise limiter effective in all modes (AM, CW, and SSB). It boasts a sensitivity of better than .5 uV on ten meters (improved to .25 uV for 10 dB S+N/N in later models), stability of better than 100 cps, selectivity with a 2:1 (6 dB to 60 dB) on SSB, and an overload and cross-modulation immunity unmatched by anything else up to that

continued next page

Squires-Sanders from previous page
time. The specs were impressive and design concepts held to what was considered as solid design principles. This diagram, however, represents a receiver that utilized additional design concepts that have carried over into some of today's solid-state designs.

Because of the selected mixing scheme, all bands are calibrated against WWV. A crystal calibrator is required to calibrate only the upper three 10 meter segments (after it is, itself, calibrated against WWV). The calibration is about as accurate as it could have been in the '60's without frequency counter interaction.

SS-1R Design

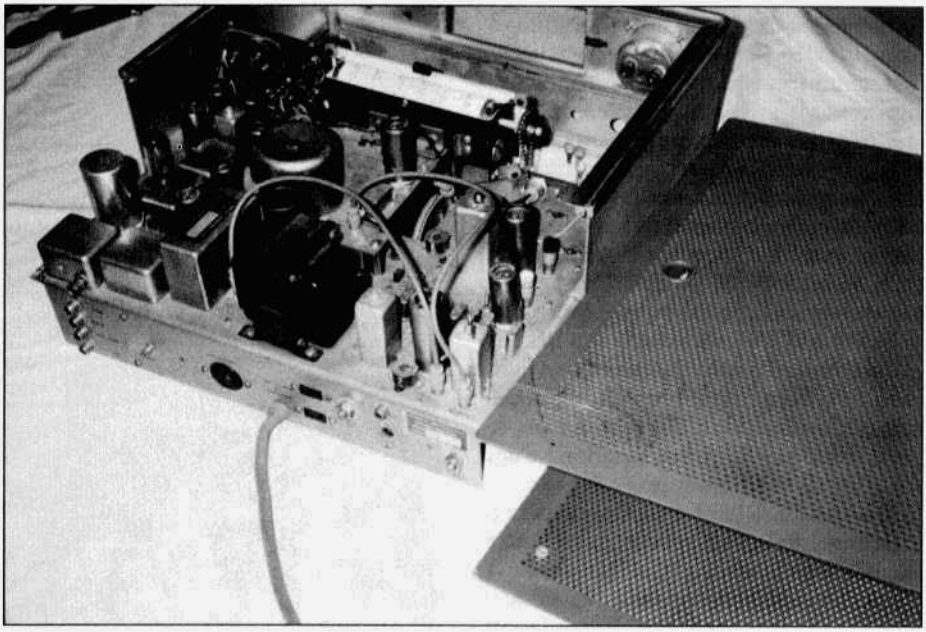
The receiver is void of any RF amplifier stage. The antenna feeds the first of two BALANCED beam-deflection tube (7360) mixers. The balanced output feeds a 5.0-5.5 mHz bandpass transformer and is fixed tuned. The local oscillator is fed push-pull into the deflection plates and this one tube becomes the crystal-controlled front-end converter.

The output of the 5.0-5.5 mHz bandpass feeds the second of the 7360 mixers. A 6.0-6.5 mHz VFO is also fed push-pull into the deflection plates and a balanced output becomes the 1.0 mHz IF, working directly into the main selectivity filters.

The oscillators (xtal and VFO) are extremely stable. They are very lightly coupled at the output and the feedback for oscillation seems to be less than normal. Connecting a 10:1 Tektronix scope probe on the output of the matching circuitry is all that is required to stop oscillation. (I have yet to acquire a scope pattern of the oscillator output). The oscillators vary little in frequency during a line voltage change of up to 20% but the amplitude does. Therefore, the symptom of a line voltage variation is a slight change in gain. Overall stability is better than 100 cps and this is all accomplished WITHOUT ANY voltage regulation. The maximum voltage developed by the power supply is 140 VDC, which is slightly more than the line voltage. The receiver is completely void of any series current regulators, VR-type tubes, and zener diodes.

The bandpass coil assembly is a non-fancy cardboard tubular form with a tunable slug in each end. It contains two close-wound coils, one per slug, and the whole assembly is protected by an IF-can type of shield. The factory alignment instructions show that the output of this assembly should be fairly flat without much frequency overlap on either side. The schematic (and visual inspection) shows that the ground connections differ, however. A phenomenon called "ground loops" became quite prevalent in the late '50's and early '60's as circuitry became faster and operating voltages became smaller. Any potential difference, at all, produces a current flow, even minute differences from one end of a chassis to another. . or from one end of a coil to another. The result is internally generated noise. It plagues the computer industry today. Because of the relatively low signal levels this bandpass circuit handles (most amplification occurs after the selectivity), the chances for "ground loop" induced noise are minimized by connecting the bandpass ground connections at one common connecting point. This type of manufacturing concern (attention to detail) was used throughout the SS-1R design.

The VFO main coil is wound on a heavy-duty, large diameter ceramic form. It is securely mounted on a thick plate and covered by a round, dome-type shield. The shield has a knock-out plug to access a cross-over feedback loop wire on the VFO coil. The feedback tap is almost on the bottom of the coil (ground end) which indicates the light coupling and feedback used throughout the SS-1R oscillators. The variable tuning capacitor is one of the highest quality units I have seen in any receiver.



A view of how the physical construction of the cabinets allows the electronic chassis assembly to be removed and installed in cabinet 'slides' or 'slots'. This provides mechanical strength without causing 'stress related tuning' of the receiver through front panel pressure or mechanical twisting of the cabinet. The top, back and bottom is one U-shaped assembly removed by sliding it out of other cabinet 'slots'. The cabinet, itself, is another U-shaped assembly comprised of the two sides and front panel.

It has large brass plates with a high quality gearing system.

The antenna feeds directly into the first mixer through a series/parallel circuit. The series combination of coil and capacitor "grounds out" the image frequency and the parallel coil and capacitor "peaks" the desired frequency. It is simple, extremely effective, but REQUIRES a 50-ohm antenna feed. I corresponded with Bill Squires about the design philosophy he used to match this 50-ohms. He responded that that rationale was not used. He simply cut and trimmed inductances and capacitance for the best signal-to-noise ratio with a 50-ohm match; it was trial and error. So much for engineering theory being applied to all designs!

The IF amplifier is a three-stage system. It uses the standard 6BA6 tubes for the first two stages and a 6AX8 for the third and IF isolation (reduces BFO pulling). They are controlled by one of two AGC loops. One loop is fed to the front end on a delayed basis. The real AGC action occurs within the IF with the second loop. It is diode developed and holds the IF gain under tight control. During a QSO with a station producing an S7 indication, another station broke in and identified himself as a neighbor. It was then that I looked at the S-Meter and it was indicating better than 40 dB over S9. I could not tell any difference by the audio level nor distortion that would have occurred in either receivers. Although the S-Meter is calibrated at 50 microvolts on 15 meters for an S9 indication, the differences in the two signal levels is a good indication of the AGC effectiveness. The specs

continued next page

Squires-Sanders from previous page
claimed that a range of antenna voltage from 1 uV to 1 volt would be virtually distortion free. A "dual loop" AGC design was also used with success in the Hallicrafters SX-115 receiver.

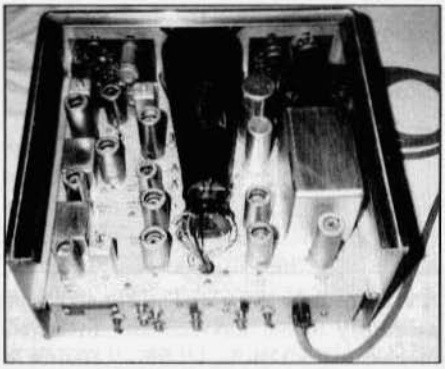
The IF transformers are a unique design. Each is comprised of two variable bobbin-wound coil assemblies about the size of toroids. They are isolated from each other, tapped low, and resonated separately with fixed capacitance. The primary and secondary coils are electrically coupled with .75 uuF (yes, less than 1.0) in the first IF and 1.0 uuF in the second IF. The third IF transformer reverts back to the more standard dual winding on a single form.

The combination of unique antenna matching, balanced mixers, low noise oscillators, and strong AGC action allow the receiver to perform with an immunity to overload and cross-modulation unmatched up to the SS-1R's introduction. The manual gives examples of a 10 microvolt signal being unaffected by a 100,000 microvolt signal 20 kHz away and a 1 microvolt signal experiencing a 3 dB reduction from a 1/2 volt (500,000 microvolt) signal 100 kHz away (remember that 6 dB is required for the human ear to detect a change of 1/2 the previous level). A 3 volt signal at the antenna connector is required to "force" its way through the front end rejection circuitry. The specs begin to mean more when situations are experienced, such as that mentioned earlier. This receiver continued to outperform solid-state equipment in this arena until the past few years. The TS-930S era began getting this performance issue under control.

Accessories

The SS-1R is "loaded" with tap-offs and test points. I think that some of the connectors labeled "test point" in the schematic were intended for other eventual uses. Tap-offs are available for the crystal controlled oscillator, first mixer passband, VFO, IF prior to the filters, and "AF Aux".

The accessories that were marketed already utilize many of these tap-offs and sockets. The "Pre-IF Noise Silencer" (mounted in the speaker cabinet) taps off the 5.0-5.5 MHz passband to sample received noise pulses. It inserts in series with the IF prior to the filters and gates the receiver off for short periods during high peak noise. The noise silencer is shown mounted in the speaker cabinet.



This is a back view of the SS-1V scope internals. Notice all the connections on the rear apron; it is a versatile unit capable of also being used as an audio scope and a transmitter monitor (with an optional but 'homebrewable' coupler).

The SS-1V Video Bandscanner also taps into the 5.0-5.5 MHz passband and uses it to display the entire band. The display does not change as the receiver is tuned. The display remains set at the operator's adjustment of both the spectrum width (up to 500 kHz) and the band segment to be displayed with either logarithmic or linear scaling. The SS-1V taps off the VFO to develop a "blip". As the receiver is tuned, the "blip" travels across the bottom of the display, tracking the receiver frequency. The "blip" indicates on the scope face what signal is currently being received. This unit could also serve as an audio scope (RTTY) and a transmitting waveform monitor (with an available feedline coupler installed).

The speaker assembly with the noise blanker option. The speaker is a high efficiency 4x8 unit mounted on an acoustically non-resonant wood 'plate' with decorative grille cloth.

The SS-1RS Speaker Console contains a 4X8 speaker. It is mounted on a 5X9 wood panel. The wood panel is covered with grill cloth and mounted in a cabinet front panel cutout. The speaker has a "clean" sound with concentration on the midrange voice frequencies. The cabinet, as are all accessories, has the same "U-shaped" reinforced construction as the receiver.

The receiver tap-offs are also convenient for operating transceive with a matching transmitter. The SS-1T was announced but never marketed. Rumors indicate that prototypes were built but were lost when Squires-Sanders ceased production. I followed every lead I received (some from Bill Squires) but was unable to locate any of the SS-1T's. Most of the leads were limited to companies that had purchased assets and they had not heard of the SS-1T. We all know that such units would never make it to a liquidation sale. I would be satisfied just knowing what the design features and tube lineups were. The information I have been able to assemble is that it was designed as two units. The transmitter, itself, was more like Drake's T-4 exciter. The VFO was separate and built into a cabinet to match the speaker (SS-1TF). I would venture to speculate that the RF speech processor they developed (the "SS Booster" for the Clegg Venus) would be available or integrated.

The VHF transverter, also announced, would probably have been developed and manufactured by the Clegg Division. Clegg was the premier VHF/UHF equipment manufacturer and would have produced an excellent unit for the line. I have not heard anything about what was planned, its price range, or if a prototype was even built.

Squires-Sanders also marketed a shortwave listener's version of the SS-1R called the SS-1BS. Selectivity was changed to 8.0, 5.0, and 2.5 kHz and non-amateur bands were standard. However, as with the SS-1R, the user could install crystals to add two additional band segments of choice between 3 and 30 MHz. Two bandswitch positions were "reserved" for this purpose. The SS-1BS listed in the $1200 price range. A receiving antenna tuner was available since these receivers REQUIRED a 50-ohm input match and adapters were also available for rack mounting the equipment (similar to the Collins S-Line rack mounts).

I was fortunate enough to have acquired the prototype for the IF section of the SS-1R . It was being sold for parts at a fleamarket and I purchased it for that reason. . . .until I realized what it was. The RF section described in the *QST* article was constructed as a separate unit and plugged into this unit for development purposes (the article shows a picture of it). It is interesting that the SS-1R IF was manufactured with an almost identical chassis layout. The prototype was constructed in a Clegg 22'er cabinet with the SS-1R S-Meter, SS-1R SSB filter, SS-1R control layout, and knobs similar to those on the original SS-1R version. It appears that the IF/audio sections had been designed well before the front end was.

The SS-1R had three levels of engineering. All three were excellent performers but each improved on the pre-

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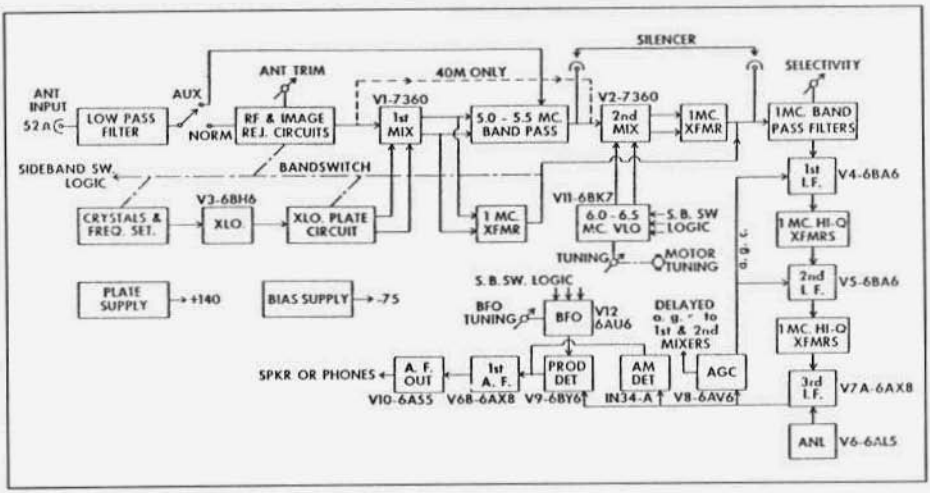

SS-1R block diagram

vious level. The first was the model the technical articles described. It is identified by all black knobs on the front panel and a 6BE6 for the product detector. An improved version was introduced in 1966 and called the "701-Series". It is identified by chrome-insert knobs and a 6BY6 for the product detector. The 6AL5 AGC was replaced with a 6AV6 and receiver front end sensitivity was improved by up to 6 db. Somewhere, I read that the low-pass filter was either reworked or eliminated; I cannot locate the source of this information to get additional details. (My "701" appears to still have the low-pass filter assembly.) The "701" brochure also indicates that the dial mechanism was improved in its design. It also added piston trimmers and a crystal controlled BFO. The third level was still called "701" but added a rejection filter (T-Notch type) to the features. The manual indicated that ". . .careful selection of components. . ." enabled the effective design of a rejection notch. . ..even in a 1 MHz IF strip. I have talked to only one person who has (or had) one with this added improvement. He indicated that it was very effective.

Comparison

Any listing of specs cannot be fully appreciated nor put into perspective until the unit is operated or compared. Just to help put the performance of the SS-1R into a frame of reference that many of us can relate to, I put it side-by-side with a Collins 75S3C. The Collins was round emblem, had three filters installed, and was connected to the matching speaker. Both receivers operated from the same antenna which was switched by a B&W coax switch. I have the "701-Series" without the rejection notch.

I compared them for three months, on all bands, different times of the day (and evening), and on AM, CW and SSB. My experiences were these (in spite of what any specs claimed):

Selectivity was on the side of the Collins. It is hard to beat the mechanical filter performance but the SS-1R was more than adequate and very effective. Signals moved in and out of the passband rapidly. The ultimate selectivity on the SS-1R was superior to most other receivers on the market. Collins gave the perception of signals "popping" in and out quicker (skirts).

Frequency readout accuracy is a matter of opinion and operating preferences. Some operators would prefer the Collins, others would prefer the Squires-Sanders. It is the difference between reading a circular dial with hairline markings and reading a mechanical counter. Both are extremely accurate.

Stability was perceptively identical on both.

Sensitivity was essentially the same; what I could hear on one, I could hear on the other. The intelligibility of weak signals was better on the SS-1R, however. Because of the lower internal noise level, weak signals could be understood while the 75S3C would allow me to hear just the presence of the signal.

The operating conveniences and subtle operating characteristics of the SS-1R led me to keep the SS-1R and sell the Collins. Today, I wish I had kept it but I needed to make a decision, at the time, and keep one or the other. With the exception of the Collins' notch filter, the SS-1R offers more operating conveniences, has better audio quality, lower internal noise level, and has a nice lineup of accessories. My evaluation remains the same today.

The SX-88 has been called the "high water mark" for Hallicrafters. The same analogy can be used to call the Squires-Sanders SS-1R receiver a representative of "the age of refinement" for tube equipment. ER

ER in Uniform from page 9

the TV-4 tube tester. The second had only the tube tester and the settings book. Both units were built in 1952. The serial numbers suggest a total production of under 10,000. Except for unissued spares it is hard to imagine that any of these escaped to surplus so it isn't surprising that I've seen only two of them. In fact my 'number two' unit has had the Navy markings removed suggesting that it went AWOL rather than mustering out.

As simple as the idea is, this set is impressive. Everywhere you look you see something clever -- either a way to do a good job in little space or a feature that shows real understanding of how a serviceman works. About the only thing I'd have done differently is to replace the resistor and capacitor substitution boxes with a VOM (or even a midget VTVM!) accurate enough for routine voltage and resistance checks. Badly out of tolerance resistors are a fairly common source of radio failures and when you find one, you're more likely to go get a replacement than to fool with a substitution box. The meters in the set have such small scales that they're good mainly as indicators so as the set is, you'd probably want to bring something like a PSM-4 multimeter with you.

The USM-3A isn't as convenient as a complete set of full-size equipment but it is outstanding for its size. When you consider lugging either the full sized test gear or the busted radio half the length of the ship it looks darn good.

This set leaves me with more questions than answers. There must have been a USM-3 (without the 'A' at the end); does anyone have information on it? What company built it? Was it a commercial set or was it designed for military use? Really clever equipment is often the work of one man; who designed these sets? Does anyone know anything about Radio Frequency Laboratories? Anyone got a UDM-3A manual?

Conclusions

No article of practical size can do more than scratch the surface of this subject; we haven't even mentioned signal generators, oscilloscopes or VOM/VTVMs. Clearly, however, military radio test gear is as large and interesting a subject as the radio equipment itself. This would be a good area for a collector: I don't know of anyone doing it, almost everything is still out there if you look and prices are reasonable. ER

An HRO Story from page 15

dicate the frequency range (Number 6 covers 7 to 14 Mc and Number 2 covers 450 to 900 Kc). Also the handles have been cut off, literally, and instead there are two flat links about an inch long, mounted on 3/32 inch spacers, at each end of the front panel. Since the RAS had a 175 Kc IF, these may or may not be immediately useful, but I'm still in need of spare parts for the 30, 18 and 12 meter bandspread coil sets I intend to build one of these days.

Oliver Wilson, VE6WT, detailed how to make a 15 meter, "AC" coil for the HRO-50 in *CQ* for November 1958. He used a "G" coil set as a starter, but any spare coil including the surplus "J" series will do. Oliver includes some good mechanical instructions on adding additional trimmer capacitors to coil sets that don't have them that I'll be following on my planned projects.

R.E. Moren, W4INL, treated the same subject in "21-Mc. Coils for the Grandfather HRO" in *QST* for July, 1965. He modified a set of general coverage coils for the 14 to 30 Mc range, though his instructions cover the use of any coil set.

And Loren Windom, W8GZ, of Windom antenna fame, showed how to make "Six Meter Coils for the HRO" in *QST* for June, 1950. Loren admitted that the image rejection was pretty poor on 6, but it was at the time a low effort way to get going on the band. I would be happy to supply a copy of either of these articles to any *ER* reader who sends me an SASE. I'd be delighted to hear from someone who has modified an HRO coil set for bandspread coverage on one of the "new" WARC bands.

Curing tuning condenser backlash and noise

Jim Millen's Micrometer Dial has anti-backlash springs built in, yet Bob Higgy's HRO had considerable backlash in the main tuning dial when I first got it. A little investigation showed that it could be cured by slightly tightening the two end screws that serve as the outer bearings for the tuning condenser shaft.

My HRO-50 would occasionally emit a little scratching noise during tuning. I found that rotating the round ceramic insulators that put tension on the springs which serve as the tuning condenser rotor contacts to increase the spring tension cured the noise. Some contact cleaner would probably also help. Incidentally, the HRO Senior does not have the same arrangement for rotor contacts, just one of the many small improvements made over the years.

Improving stability

Drift was always a problem with the HRO, from the very onset to the last of the HRO-60's. There were numerous, small improvements made as the HRO evolved to control drift. National found that certain brands of tubes were unstable and designed the receiver using RCA tubes. The original receiver introduction was held up so that improvements could be made in the metal piece parts of the padder capacitors in the coil sets. They were finally made with a combination of aluminum plates, brass spacers and steel studs so proportioned that the increased area due to thermal expansion of the plates was balanced by increased spacing due to expansion of the studs to minimize net drift. Later, temperature compensating capacitors were located near the oscillator tube. When the HRO warmed up, it was quite stable, but it could drift several kilocycles along the way and the extreme bandspread of the micrometer dial magnified the effect.

I finally cured the warm-up drift in my HRO-50 by utilizing a trick that a chance acquaintance at a Hilliard, Ohio, hamfest passed on to me. The basic idea is to draw a steady stream of cool air into the receiver from the crevices around the coil set and the other incidental holes in the front panel and the bottom. To do this, I mounted a muffin fan on the outside, back of the receiver,

just behind the heat producing rectifier tube; and I closed up National's vent slots in the back with aluminum duct tape. Now most of the heat from the tubes is vented out the rear, and the tuning capacitor and plug-in coils come to an equilibrium temperature in a very short time.

National included a 4H4 current regulator for the oscillator and mixer filaments when they brought out the HRO-50-T1. I used another technique, suggested by Wilfred M. Scherer, W2AEF, in his November, 1968 *CQ* article, "Simple Heater Voltage Regulation," on my HRO-50. Putting 1.75 mFd of capacitance in series with the primary of an old, 5 volt rectifier filament transformer, I managed to drive the primary into saturation for line voltages above about 90 volts. The resulting secondary output is at about 7 volts and is quite stable, washing out all line voltage variations when I key my transmitter. (I use an appropriate 0.9 ohm series resistor to power the filaments at 6.3 volts.) I've used this source to power the local oscillator, BFO and mixer filaments, and I have zero frequency change now when the power line bounces.

For the "Grandfather HRO," which came to me a bit later when I was more enlightened and less inclined to mess up a classic receiver, I have added an 0A2, 150 volt gas regulator tube on an "L" bracket beneath the chassis. It controls the voltage to the local oscillator and mixer, and provides a real improvement to short term stability.

I've done a number of other things to my HRO-50 over the years, generally intended to keep it up with improvements in newer receivers. I have a product detector sitting in the NBFM adaptor socket using a circuit by W.M. Rowe, Jr., W4JDR, in *QST* for May, 1964. I even added a switch wafer to the BFO shaft that selects one of two crystals properly positioned for upper and lower sideband. The variable BFO and product detector are active on the CW setting of the function switch. I removed the entire crystal filter section and replaced it with a pair of mechanical filters providing 2.1 kHz and 300 hertz bandwidth. The former crystal filter selectivity switch now chooses between straight through coupling or either of the mechanical filters. I borrowed a Tee-notch circuit from the 75A-4 whose frequency is controlled by the former crystal phasing control. I modified the detector, AVC and noise limiter circuits a la those in the NC-303. And I have a (shudder) solid state crystal calibrator using some DTL dividers (that's how long ago I built it) that generate outputs at 100, 50, 25 and 10 kHz intervals. Close observers will note that I replaced the "100/off/1000" calibrator toggle switch with a rotary switch and genuine National knob to select the desired output frequency.

I rather doubt that any present owners of an HRO would want to "modify" it as I did to my '50, but if any of the above look interesting, I'd be happy to provide what details I have for an SASE.

So, now you know something of how the HRO came to be such a wonderful receiver. Please write up your own HRO experiences and send them to Barry. He just may find room for them in future *ER*'s if the classified pages don't wind up taking over everything.

Where do we go from here? Well, the HRO was a hard act to follow. Even so, Jim Millen and his crew at National developed one more great receiver family before he left in 1938. But that is yet another story. **ER**

Are you a member of AMI? If not send $2 to AMI, Box 1500, Merrimack, NH 03054-1500. AMI promotes and protects AM; we should all be members.

WRL's First Transmitter from page 24

70 was also featured in the WRL catalogs. It appears on page 63 of the 1941 catalog.

The complete 70 watt CW/50 watt phone rig was available for $69.50 and was housed in a Bud junior cabinet with dimensions of 21-1/2" high, 18" wide and 10" deep.

The RF section, modulator and complete transmitter were all advertised as kits; however, they were really wired and tested models.

The production quantities were believed to be in the range 100 to 200 units. Today none are known to exist, probably because hams later cannibalized them for parts.

It is possible that some may still exist and the owners simply do not realize they are WRL products. It is likely that the name WRL was not affixed to the transmitters. Today they may be a little rusty and thought to be of little value.

Many hams visualize the WRL-70 as being a much smaller unit, perhaps the size of a Globe Scout, though it's closer to a Globe Champion, and would consequently overlook one at a swapfest or in an old timer's collection, thinking it to be a homebrew transmitter.

Leo would like to have a replica of the WRL-70 built and placed in the Western Heritage Museum. To achieve this goal, some help is needed.

If anyone has any documentation, particularly schematic diagrams, for the transmitter or modulator, a copy would be greatly appreciated. Pictures of early stations using these transmitters are also needed, both for the museum project and an upcoming biography of Leo Meyerson.

If you can provide any information, please contact Leo Meyerson at (619) 321-1138 or Jim Musgrove at (512) 459-5564. ER

AMI Update from page 3

July 1983 - FCC adopts 1500 watt PEP proposal, but grandfathers AM kilowatts until June 1990.

January 1990 - ARRL Board of Directors is convinced by AM'ers to support continued AM kilowatt use after June 1990. Board decides to petition FCC on behalf of AM'ers.

Spring 1990 - Petitions favorable to AM received by the FCC from the ARRL, WB6TRQ and KW1I. FCC also recognizes a letter received over six months earlier asking for abolition of AM privileges as a petition.

July 1990 - After assigning rule making numbers to the four petitions and putting them out for a 30 day comment period, the FCC receives an unprecedented 800 comments, 99% favorable to AM.

October 1990 - All petitions denied by FCC. AM maximum power reduced to 1500 watts PEP, but FCC makes very strong positive statement about the AM mode and its place in the Amateur Radio Service.

November 1990 - KW1I files a petition for reconsideration of the decision.

July 1991 - Denial of the Petition for Reconsideration.

December 1992 - Upon advice of an attorney experienced in FCC dealings, KW1I requests a waiver for his station hoping for a positive decision which would set a precedent for other AM'ers with large transmitters affected by the 1990 power ruling.

April 1993 - Denial of waiver.

May 1993 - Request to the full Commission to review the waiver request.

May 1994 - Denial of waiver by the full Commission .

Proposal to create a New England, Mid-Atlantic and a Canadian AMI Region

The current Northeast AMI Region has about twice the membership of the other regions and it has been suggested that the region split into a New England and a Mid-Atlantic. Several Canadian AMI

members have also suggested a Canadian AMI Region. Drop me a note if you have an opinion about these suggested changes. The AMI Regional Directors, President and Treasurer who make up the AMI Board of Directors will consider this matter later this year and we would like to hear your thoughts.

AMI Discovery Weekend

Reserve September 10-11 for the 2nd annual Discovery Weekend. The purpose is to have AMI members discover each other by swapping certificate numbers. Other amateurs will hopefully discover the delight of operating AM as they hear us on, but they will discover one way or the other AM is alive and well on the amateur bands. More on this next month. **ER**

A Homebrew CW Transmitter from page 23

padding capacitors in parallel for 80 and 160 meters.

Some comments about this 6AG7/1625 breadboard transmitter circuit may be of interest. Experience has shown that the diagrammed oscillator, the "hot-cathode" Colpitts circuit, is most tolerant of crystals of varying activity. The optimum feedback ratio for crystal control is easily set by capacitors external to the tube. Referenced to the schematic, increasing the capacity of C1 relative to C2 will increase the magnitude of feedback. For VFO input the oscillator's cathode choke should be shunted to ground by a .01 mFd capacitor. A VFO with output of 5 or more RF volts will drive the 6AG7's grid adequately. A manual "spotting switch," not shown on the schematic, is used to open the 6AG7's cathode circuit when the transmitter is used with a keyed VFO. The 6AG7's plate is series fed, eliminating an RF choke plus blocking capacitor. The two parasitic chokes could be air-wound, but the resistors provide convenient forms which are mechanically stable and compact. The schematic's omission of assigned parts values for the RF tank circuits is intentional. Nostalgist homebrewers are encouraged to consult yesteryear's literature for precise guidelines. No meters are shown on the schematic. One designs metering according to junkbox resources, again referring if necessary to the literature. I've tried here to present the positive results of an experiment, to show what is possible. This is not a construction article describing an item to be copied piece by piece. My motive is to encourage other nostalgists to open their junkboxes, to reread yesteryear's records, to have a fling. Experienced homebrewers know that most values aren't too critical--one adjusts the design to fit what's available. Experimentation is the name of the game, part of the fun.

For breadboard construction projects like this one, a discussion of mechanical details seems unnecessary. Each project is a unique, experimental challenge using available parts. One is forced to apply known principles seasoned with a bit of creative imagination. The path to success involves trial and error, just as it did in the early days. Homebrewing on breadboards today, one might say, is the opposite pole to "painting by the numbers." **ER**

Letters from page 25

in Ohio. There are 5-6 stations operating 50.400 in my area about 50 miles south of Houston, TX.

Rigs include Gonset G-50's, Utica 650's, Lafayette's HA460 and Clegg 99'er. Hope more of your readers who have 6 AM rigs will look for us on 50.400 during band openings. One tactic that seems to work if nothing heard on AM is to seek QSOs on 52.525 FM and then QSY to 50.400 AM.

Steve, WB5UGT (EL 29)

CLASSIFIEDS

Advertising Information

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DEADLINE FOR THE AUGUST ISSUE: AUGUST 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: T-798 xmtr, 15W,3-30 MHz, tube unit, matches R1004 rcvr - $25; ME165B dummy loads, w/manual - $40; Collins CP1 xtal pack - $125. Bob, (315) 468-2691, eves EST.

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

FOR SALE: Manual copies for Eico 720, 730, HQ-110, Elmac AF-68; schematic copies for Knight 50-W xmtr, Ocean Hopper rcvr. Paul Vaughn, 2317 Williamson Rd., Williamson, GA 30292.

FOR SALE: NC-190, orig. manual - $90; Eico 324 sig. gen, manual - $30. + UPS. L. A. Locklear, 1122 36th St., Gulfport, MS 39501-7116. (601) 864-8384

FOR SALE: ARC-5 rcvr, 3-6 MHz - $25; R19J/TRC1 rcvr, C. Lorenz, Germany, unused - $40; T-14H/TRC1 TX, unused - $40. Mike Murphy, WB2UID, 38 N. Reading St., Hooksett, NH 03104. (603) 668-8549

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

WANTED: Johnson Desk KW amp; Globe King 500; Collins 51J-4; Tektronix 7A18 plugin scope amp; HT-32B; timing belt for SX-88 dials; manual for SX-100 (latest production run). **FOR SALE:** Drake MN-2000 w/manual - $175. Ben Deovlet, W6FDU, 933 Robin Lane, Campbell, CA 95008. (408) 374-0372

FOR SALE: Old WW II earphones, Signal Corps type R14, Kellogg S&S U.S. Army, good condx - $25. Cliff, W3LVC, (410) 796-1070

WANTED: HT-33B amp, mint or near; SR400A Cyclone III. Top price for top equip. Tom, WA4FJQ, (910) 887-0705.

WANTED: Manuals or copies for Tektronix T922 scope; Hallicrafters S-38D; Hammarlund HQ-110. Jim Alexander, KØHIP, 1511 N. Jackson, Russellville, AR 72801. (501) 968-7270

FOR SALE: Collins 651S1 (nixie), w/ 16, 6, 2.7 kHz filters and manuals - $1000 US; Collins KWM2-A (WE), w/PM2 - $550 US. Shpg xtra. Lorne Barber, VE7BOX, (604) 587-6305

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S-Line etc. and St. James boxes. Also have KHZ dials and hoods for SC101 and 312A-1. Butch, KØBS, (507) 288-0044.

FOR SALE: HQ-160 - $120; HQ-170AC - $150; HX-50A - $175. **WANTED:** Junker HQ-140AX. Al Culbert, KØAL, 328 Norman Dr., Cedar Rapids, IA 52402. (319) 377-4367

FOR SALE: .206 stereo plugs used for mics on Collins, Drake, etc. These are true mil-spec machined brass cut offs, like new. Two for $5. We also have a full line of C, HN, SC, SMA and other military connectors available. Call for information or send $.52 for catalog to Texas Connectors, POB 940375, Plano, TX 75094-0375. (214) 423-9625

FOR SALE: Collins manuals - R-390 (maint. 28 pages), R-390A (operating 34 pages), R-390A (maint. 196 pages), originals or copies. **WANTED:** Gonset G-66B rcvr w/pwr sply. Charles Zafonte, RFD 1, Box 75, Fort Kent, ME 04743. (207) 834-6273 (n)

FOR SALE: Variacs, Gen. Radio & Standard 0-120V, 130V, 1-1/4 amp - $15 or BO. WB2AUE, 378 Albany St., Saddle Brook, NJ 07663. (201) 845-6386

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

FOR SALE: Millen Variarm VFO, connector modified - $59; Gonset Comm. III, orig. mic - $69; Millen 90881 RF deck, no knobs, as-is - $55; 1935 All Star Junior rcvr (see last page of Moore 2nd Ed.), good - $179; Johnson Matchbox, bad relay - $59; RCA AVR-20A aircraft rcvr, paint chipped - $45; Meissner 9-1050 Signal Shifter, both pwr splies, untested - $119; Meissner 9-1008 Signal Booster (see 1940 ARRL Handbook), nice - $89; Hallicrafters S-36A VHF, nice - $109; R-44/ARR-15 (military S-36A) VHF, fine - $119; H-33 handsets - $10 each; ARRL Handbooks 1927 (loose cover) - $85, 1927 (edge frayed) - $95, 1929 (good) - $105, 1932 (water damage) - $45, 1932 (badly re-covered) - $45; RCA Chanalyst, near mint - $89; more - 2 stamp LSASE for big list. Don Merz, 47 Hazel Dr., Pittsburgh, PA 15228. (412) 234-8819 (weekdays)

WANTED: Knight T-60 and T-150 xmtrs, any condx, dead or alive. If you have any please write. Thank You. Dave Mantor, W9OCM, 2308 So. Fairlawn Way, Anderson, IN 46011.

WANTED: Hammarlund HQ-110AC or HQ-110A in VG or better condx. Reid Simmons, NZ8K, 1366 Catherine Circle, St. Joseph, MI 49085. (616) 982-5653 wkdys or 429-2147 (n)

FOR SALE: Central Electronics 20A, 100V, 600L; Drake 2A/2AQ; Gonset G50, GSB100; Hallicrafters HT-37, HT-40; Heath AR3, HW-16, TX-1, RX-1, SB-10. Steve, WB4IJN, (803) 873-7847 X 200 (d), 821-6931 (n)

WANTED: Help! Manual for Precision model 111 tube tester. $$ for copying, mailing and your trouble. Grant, NQ5T, (817) 491-2393, collect, eves.

FOR SALE: WW II gear, aircraft radios, loads of test equip., tubes and tons of parts. Can be seen July 16th and 17th from 9 AM to 6 PM at 1300 Gun Barrel Rd., Grand Island, NE. Send LSASE for list. Gary Reiss, WAØJRM, Rt 1, Box 141, Wilcox, NE 68982. (308) 263-3231

FOR SALE: 19" radio/equipment cabinets, Bug 22x10-1/2x14-3/4 - $25; Hallicrafters 20x9-3/4x16 - $40; Bendix radio compass bearing indicator MN-40E, NOS/MIB - $35; R-390 & R-391 AC pwr cables, new antenna 'C' connectors, Twin-ax connectors & various adapters, and Twin-ax cable - $.50/ft. And finally, if you like to tinker with 28 VDC military goodies, I have the ultimate bench pwr sply, 115 AC, 60 cps input, 28 VDC @ 25 amp output! Asking - .16/watt or $1.85/lb or $110 cash. Bob Bakinowski, 1524 Saint Tropaz, Tucson, AZ 85713. (602) 624-8029

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

WANTED: TecRad T-350XM owners/enthusiasts! Contact me with your call, address, serial #, etc. Every respondent will receive the list. Victor, 7224 NE 8, Portland OR 97211. (503) 289-6373

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

WANTED: Factory pwr sply for Harvey-Wells TBS-50 xmtr; S-meter for HQ-140X. Marc, WC1X, (401) 842-4733 (d), 846-6325 (n).

FOR SALE: "History, Theory and Practice of the Electric Telegraph" by Prescott, 1866 (508 page hardcover reprint), $18.95 ppd USA. Artifax Books, Box 88-E, Maynard, MA 01754.

FOR SALE: Topaz HV DC sply model C10WDG - $25; Johnson wattmeter #250-38 - $20; new G5RV's - $30. U-ship. Richard Lucchesi, WA2RQY, 941 N. Park Ave., N. Massapequa, NY 11758. (516) 798-1230

WANTED: Eimac 4W300B tubes (this is water cooled version of the 4CX250B). Wayne, N8MS, Rt 2, Box 1500, Fairmont, WV 26554.

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

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

FOR SALE: Please send SASE for list of radios 1940-1968 for sale; also 1000+ manuals available. Mike, KA7ASF, 112 E. Burnett St., Stayton, OR 97383.

FOR SALE: Hallicrafters HT-18 - $75; (4) JAN RCA 811-A - $140; (4) RCA 3B28 - $29 each. Tubes are NIB. Val Johnson, WA9DZJ, POB 51, Henry, IL 61537. (309) 364-3160

WANTED: Clock cover for Hammarlund HQ-170C. Bill, KO4XF, (404) 887-7567

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

FOR SALE: Post War communications rcvrs manuals by Howard W. Sams Volumes 1 & 2, with a total of 472 pages covering all the popular models produced from 1945-'52 by Heathkit, Gonset, National, Harvey-Wells, Hallicrafters, Hammarlund and Collins. Shown are schematics, alignment procedures, voltage & resistance charts, etc. These are quality 1994 limited edition reprints with a spiral binding. Price is $36.00 including postage for both volumes or $20 individually. New Wireless Pioneers, Box 398, Elma, NY 14059. Phone/FAX (716) 681-3186

WANTED: Callbooks, Dept. of Commerce "Amateur Radio Stations of the U.S. for 1924 and 1925. Bob, W4JNN, POB 166, Annandale, VA 22003. (703) 560-7161, collect

FOR SALE: Galena crystals - $3 ppd. Pat Person, Box 1063, Bothell, WA 98041.

FOR SALE: Repair! All makes and models, maximum labor per unit - $96. Dan Rupe, W7HBF, WARRC Repair, 1302 S. Uplands, Camano, WA 98292. (206) 387-6312

FREE: Refinished front panel for Hallicrafters SX-42. Prefer local pickup, but will ship for cost of packing/shpg. Jack, K6EVY, 19781 Waterview Ln., Huntington Beack, CA 92648. (714) 969-1147

FOR SALE: Collins KWS-1 + 75A-4; MBF xcvr; ART-13's - like new; R-390A, w/SSB adapter; ATD, complete - brand new system; BC-611 test set model I-135 - w/stand, test case & manual, new; Atlas 206 VFO; Electrovoice mics #630 NIB; BC-348 - shock mounts, NIB; Drake teletype #7000 - NIB; 637T1 & 637T2 dipoles; Atlas R110 rcvr. WA1DEJ, (617) 233-1414, late EST.

WANTED: Knobs for S-22R, SX-71, S-120. **FOR SALE:** Dynamotors - good DM-34D - $25; very good DM-35D - $35; exc. PE-103-A - $95. U-ship. John Hruza, KBØLQL, 2521 S. Holly St., Denver, CO 80222. (303) 758-4377

WANTED: 516F1 pwr sply for and any spkr console for my #7 KWM-1; 75A-4 lighted spkr. **FOR SALE:** 32S3 Magnum 6 - $150. San, K5YY, (501) 756-5010

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

WANTED: All items in WW II B-26 radio compartment, BC-461 antenna control box, clock lamps, oxygen, chair, etc. Greg Greenwood, WB6FZH, Box 1325, Weaverville, CA 96093. Msg. (707) 523-9122

FOR SALE: Johnson Thunderbolt, excellent condx - $525. PU only. Jim, W9UD, 2716 West 3rd St., Coal Valley, IL 61240. (309) 799-7447

FOR SALE: NOS tubes. SASE for list. **WANTED:** TMC SPU-2; Collins 26W; 7027A tubes; manuals for HQ-215 and RT-1113A/PRC-68A. Joseph Pinner, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

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: Clean, working SX-28A. Prefer within 200 miles of Milwaukee to facilitate inspection and pickup. Allen, AC9K, 741 N. Milwaukee St., #537, Milwaukee, WI 53202.

WANTED: AN/PRC-74B for MARS use. Will pay market price and shpg. Harlan, K6JFW/NNNØBDF, (408) 996-2126

FOR SALE: Hallicrafters S-38B, w/orig. manual and schematic - $80; Ranger II operating manual - $24. Bill Richarz, 10035 Little Creek Rd., Charlotte, NC 28227. (704) 545-9368

WANTED: Hammarlund HQ-170 slot freq. coil, part no. K-42034-1 or junker chassis for parts. Gerald Liccione, W2TPL, 118 Hiawatha Trail, Liverpool, NY 13088.

WANTED: Hallicrafters SX-11 and SX-15. Robert Braza, N1-PRS, 49th St., East Providence, RI 02914.

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

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

FOR SALE: BC-348-R, modified - $65; Gonset GSB-201 amp - $225; RBC w/ps and cable - $135; BC-221 - $30; TS-175U - $20; SWR bridge - $8; GPT-750D - $1100 OBO. Parting out R-388, R-390A. Lotsa tubes, SASE for list. U-ship. WA7HDL, Rt 1, Box 178-A6, Salmon, ID 83467. (208) 756-4147 after 1730 MDT

WANTED: QST's. All issues before 1930. Feb., July 1951; July 1952; Sept. 1956; Feb. 1958; Jan. thru May 1960; Aug., Dec., 1961. Howard Weinstein, 15 Lakeside Dr., Malton, NJ 08053. (609) 596-3304

FOR SALE: Couple of transistors, Gemtronics CB base, S/C #920; older military mics/headsets; older RF xfmr/antenna coils. J.H. Jacobs, 60 Seaview Terrace, Northport, NY 11768. Phone/FAX (516) 261-1576

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

AM Broadcast:
Used AGC's, limiters, mixers, consoles, EQ's, mics & tube mic preamps. U-fix-ums to total rebuilds. Send for current availability.
Presley Travis, KA4NNN, Electronic Workshop, Rt 4, Box 36-B, Louisa, VA 23093. (703) 894-0406

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

WANTED: BC-348. I need one in exc. to mint condx. I know you've got one in the closet! N5OFF (318) 989-3430

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

FOR SALE: PRC-47 LSB and USB kit - $40; new machined coax antenna panel - $9. All restorable. Coming soon 28 VDC supply! Jay, WBØVNE, 321 West 4th St., Jordan, MN 55352. (612) 492-3913

WANTED: RME 4300 manual, will buy or swap; looking for Heath, Eico, Knight, etc. manuals, buy or swap.Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (908) 238-8964

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

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

FOR SALE: Tubes, capacitors, sockets, NOS and reproduction parts for antique radios and TV's. Large SASE for tube list or $2 for 20 page catalog refundable with 1st order. Vintage TV-Radio, 3498 West 105 St., Cleveland, OH 44111.

FOR SALE: Weston 785 multimeter, exc. - $30. **WANTED:** Full TCS-12 manual; VG to exc. TCS-12 xmtr; schematics/manuals for RCA WA44C audio generator; Colerad monitor (radio) CM-3. Carl Gottsmann, KN6AL, 3290 6th Ave., 1-E, San Diego, CA 92103. (619) 295-5611

TRADE: Heath AT-1 xmtr w/matching AC-1 antenna coupler and Heath S-2 electronic scope switch for nice old telegraph key. Rick Ferranti, WA6NCX, 254 Florence Ave., Arlington, MA 02174-7248. (617) 646-6343

WANTED

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

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

FOR SALE: Collins spkr - $200; Collins 302C-1 wattmeter, w/book - $300; 75A-2, works, needs to be cleaned up, w/cabinet - $400; 75A-3 parts radio, no filter - $150; very clean KWS-1 & 75A-4, w/2 filters - $2000; filter F455D60 - $75; Azden PCS 2000, doesn't work, no mic or bracket - $50; 8877, like new - $300; Drake C-line, w/3 filters, NB4, MS4, ps, clean - $550; 2.1 filter for R-390A - $50. Mike, KE8QG, (419) 669-3550

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

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

FOR SALE: Racal MA79 xmtr drive unit, 1.5 to 30 MHz, SSB/DSB/CW/PSK, ex. British gov't, matches the RA17 rcvr, 19" rack mounting, all tube, diecast chassis, VG condx - $450; Racal TA83, 500 watt SSB/CW xmtr, 3-15 MHz, all tube, unused and mint, stored since the '70's; Hal ST-6000 RTTY terminal unit, mint, orig. box and manual - $175. WANTED: RTTY terminal units and HF modems made by Frederick Electronics. Nigel, AD4AG, (404) 705-9220 (w), 949-1097 (h)

FOR SALE: Early telegraph books! The New Wireless Pioneers have acquired the technical library of Teleglobe Canada consisting of many rare and out-of-print books on telegraphy and telephony dating back to 1850. Also included are various trade catalogs, 19th century telegrams, and misc. ephemera. For catalog #14 to be published this summer, please send $2 ($4 foreign) to: New Wireless Pioneers, POB 398, Elma, NY 14059. Phone/FAX (716) 681-3186

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

WANTED: Speaker for Collins 75A-2. David A. Clark, K5PHF, 9225 Lait Dr., El Paso, TX 79925. (915) 591-4184

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

FOR SALE: Crystal filters from direct-to-line multiplex cards, 5.2 MHz corner freq., 3.3 kHz bandwidth (great for Hi-Fi SSB), w/USB carrier xtal (5.2 MHz), response graph, and termination specs - $25 ppd. Also 5.2 MHz xtal filter, 200 Hz bandwidth - $25 ppd. Both items - $40 ppd. Bob Miller, KE6F, 9655 Appalachian Dr., Sacramento, CA 95827. (916) 362-5481

WANTED: Hallicrafters S-76 rcvr, exc. physical condx, need not work electrically. Tom Rousseau, K7PJT, 23995 SW Drake Lane, Hillsboro, OR 97123. (503) 642-3679

FOR SALE: Viking I front panel refinishing this summer. Call or write for details. Ron Eisenbrey, KC5DFX, 115 First St., Sugar Land, TX 77478. (713) 491-7823

FOR SALE: Clegg Thor-6; Clegg 66'er and Clegg 99'er. All are in mint condx. Dusty Rhodes, W8MOW, 1324 N. Dorset Rd., Troy, OH 45373. (513) 339-1546

ELECTRIC RADIO PARTS UNIT DIRECTORY

If you need a part for a vintage restoration send $2 and an SASE (.52 postage) for a 7 page list of parts units. If you have a parts unit, consider putting it on the list. Your dead unit can help bring others to life!

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

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

FOR SALE: Collins plate xfmr, pri 115-230V, sec. 2250 VRMS CT @ .565 amps - $80; new tank circuit variable caps, 125-925 pFd at 15 KV - $70. All plus UPS. **WANTED:** Manuals for Racal RA-17, C-12 and RA-237B. Dan Mason, R. Rt. 1, Box 204F, Santa Fe, NM 87501. (505) 455-3416

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

WANTED: Hammarlund HQ-200, must be VG cosmetically, clean and at a reasonable price. Charles R. Glover, 2700 Ponderosa, #137, Camarillo, CA 93010. (805) 389-1520

FOR SALE: Service manuals. Photocopies $5, shpg $.50 per manual. Hallicrafters, Heath, Johnson, others. SASE for list. DSM Diversified (formally Miller Radio), 909 Walnut St., Erie, PA 16502.

FOR SALE: Hammarlund HQ-129, w/book, in good condx - $100. Buyer pays shpg and handling. Jim Barrows, W7BCT, 15121 41st Ave., SE, Bothell, WA 98012-6113. (206) 337-4880

WANTED: Two AX9909 or 6083 tubes. Grant, NQ5T, (817) 491-2393 collect, eves.

WANTED: Beginning collector needs anything Vibroplex. Send me your bug and key list. Mitch, WA4OSR, 11 Midtown Park, E., Mobile, AL 36606. (205) 476-4100, 342-7259

FOR TRADE: NOS tubes 6JE6, 6KD6, 6146B/W, 7815, 4X150A/W, etc. Sylvania, GE & mil. Also have NIB APR-4 radar rcvr, w/plug in unit. Trade for early transistor & pencil tube radios, shirt & coat pocket types, Hoffman, Sony, Regency, Toshiba, Motorola, Boy's Radios 2 xistor, etc. Dan Steele, Bob's Radio & Television Service, 2300 Broad St., San Luis Obispo, CA 93401. (805) 543-2946 , 8 AM to 5:30 PM

WANTED: Military radios. U.S. RT-136/GRC-13, R-1444/UR; British W.S. No. 62, W.S. No. 11; Canadian W.S. No. 19, MK II; Soviet R (P) 104M. Leroy E. Sparks, W6SYC, 924 W. McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123

FOR TRADE: Ex-Soviet clandestine set, w/toneburst + encoder. **WANTED:** WW II German ex-service equipment, suitcase sets. Swap? Why? Rag Otterstad, OZ8RO, Hosterkobvej 10. DK-3460 Birkerod, Denmark. FAX 011-45-4468 1514

WANTED: Schematics/manuals Heath TS-3, IG-42, Precision E200C, RCA WR-49B sig. gen.; Knight R55A rcvr; Ballantine 300H AC VTVM. Jack, WA4CSM, 8109 NW 58 Court, Tamarac, FL 33321. (305) 721-2337

WANTED: Heath SB-230/220 amplifier. Do not need tubes. Scott Johnson, KC7BGE, 5111 E. Sharon Dr., Scottsdale, AZ 85254-3636. (602) 953-5779 (h), 413-3302 (w)

WANTED: Radio Shack stereo Parametric equilizer model 32-1106. Michael Murry, KE2LH, POB 5141, Hempstead, NY 11550. (516) 489-4094 anytime

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FOR SALE: Orig. manuals - Drake TR-33C xcvr (exc.) - $12 ppd US; Hickok 505 scope (good) - $12; Rex Bassett Model 12 aircraft radiotelephone (fair) - $10; mic w/cord for Drake TR-33C, PTT, 500 ohms, NOS - $20. Ken Hodge, KB4CM, 42846 Cinema Ave., Lancaster, CA 93534. (805) 945-4702

WANTED: CVM-1 or CVM-2 UTC mod xfmr. Bill, KF2IU, 119 Ivy Brook Ln., Chapel Hill, NC 27516.

FOR SALE: WW II TCS radio, complete system - $375; spy radio AR 11 - $1200. Steve Bartkowski, 4923 W. 28 St., Cicero, IL 60650. (708) 863-3090

WANTED: Front panel plate amps/rel. output meter for Drake T-4XC. Bill Ewald, POB 12163, RTP, NC 27709. (919) 493-7608

WANTED: Eico 435 scope; 8950 tubes for my Swan 1200X. John, K6UU, Box 687, Ashland, OR 97520. (503) 488-1506

FOR SALE: Hallicrafters S-94 Civic Patrol, 30-50 MHz, GC, electrical VG, w/orig. manual - $10 plus shpg. John Vercellino, WB9OVV, (708) 964-3020

WANTED: Hallicrafters S-40A/40B; SM-40 S-meter; Viking Adventurer. Bob Braeger, WA6KER, 6634 Navel Ct., Riverside, CA 92506. (909) 682-5084

FOR SALE: RCA W10A; Stromburg Carlson model 920FF; RCA model 1-X-591; DX-100. Marty, (908) 359-4425

WANTED: Schematic for Motorola police/airport station console model nr. T1202ASP20. Unit has mic amplifier and VU meter. Don, WB5UIA, 903 Madison, Minden, LA 71055. (318) 377-0651

WANTED: Check those basements for WW II radar equipment. I buy units or complete systems. Allan H. Weiner, 507 Violet Ave., Hyde Park, NY 12538. (914) 471-9500

WANTED: Gates manual/schematic for MO 2639 mod. monitor; Gates SA-39B or SA-38 limiter; large script emblem for early Gates xmtr. Tom Smith, N5AMA, 13034 Elmington Dr., Cypress, TX 77429-2062. (713) 376-3436 (h), 957-6420 (w)

FOR SALE: DCS500 rcvr from 1961 ARRL Handbook, unwired, includes all major parts except tubes - $50 plus shpg. Don Knotts, W7HJS, 3158 NE Azalea, Hillsboro, OR 97124. (503) 648-1738

WANTED: Historical information, advertisements, manufacturers promotional literature on RCA Radiomarine rcvr model AR-8516. H.A. Weber, 4845 West 107th St., Oak Lawn, IL 60453-5252.

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

FOR SALE: R-390A completely restored to new specs by Rick Mish. Looks/operates like new. Includes: ops/repair manual, 3 spare ballast tubes, all R-390A ER back issues, ant. connectors, spline wrench set. Orig. shock mount cabinet, very rare. Heath SB-620 spectrum analyzer in exc. condx set up for R-390A use. All $975 or consider trade for Drake R8 (mid '93-'94) or JRC 535. Victor, (805) 583-4026

WANTED: Back issues of AM Press Exchange #1-75. Thomas Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (312) 262-5360

WANTED: EFJ Ranger or Valiant; 75A-4. Dan Martin, WB4GRA, in central Calif. (209) 734-0597

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

TRADE: Exc. Hallicrafters R-44 spkr for same National spkr for my HRO-60. Larry, WØOGH, (602) 892-4618

FOR SALE or TRADE: Kenwood Twins T599/R599, exc.; HW-8; Philmore code set w/box; Ameco AC-1 xmtr, w/manual, misc military spkrs. Joe Perratto, K2QPR, 1341 SW Evergreen Ln., Palm City, FL 34990. (407) 220-7362

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

FOR SALE: Unbuilt Ocean Hopper kit in Elgin Radiofest Auction Aug. 5th. **WANTED:** 1934 Allied Radio catalog; radio premiums. Bill Ross, KY9M, 875 Gordon Terrace, Winnetka, IL 60093. (708) 441-6462

WANTED: Collins 75A-2 and F455B08 mech. filter; B&W JEL coils; Viking Navigator. **TRADE:** F250A67 and F100Z4 mech. filters. Brian Roberts, K9VKY, 3068 Evergreen Rd., Pittsburgh, PA 15237. (412) 931-4646

TRADE: My Collins 270G-3 spkr (for 75A-4) for your 270G-1 spkr (chrome trim, emblem, for 75A-1). John Kelly, N3GVF, 17510 Sir Galahad Way, Ashton, MD 20861. (301) 774-8186

WANTED: Copy of manual and tube charts for Weston model 798 tube tester. Your help is much appreciated. Bob Puttre, 637 Stratford Rd., Baldwin, NY 11510. (516) 223-9667

WANTED: HRO-60 w/coils and spkr; SP-600JX; R-390 or R-390A. Must be complete and in good to exc. condx. Tom Tate, W7SUM, 306 View Crest Rd., Glendale, CA 91202-1333. (800) 869-8196

WANTED: CRV-4550 or 46034/RAA receiving equipment. Dave, (315) 446-1258.

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

FOR SALE: (2) 5V, 14.5A fil. xfmrs - $10 ea.; 2.5V, 10A fil. xfmr - $8.50; xfmr input , 50 ohm pri., 4200 ohm sec. - $7; 16,250 ohm pri., 500 ohm sec. - $7. Joe, W6CAS, (916) 731-8261

WANTED: Collins 75A-1 or trade 75A-2 or 75A-3 for 75A-1; socket chassis punch set, Grenle or similar; Johnson literature. George, (507) 288-0242

WANTED: Subminiature tube and hybrid portable radios, like Emerson 747, 838, 839, 856, Silvertone 4212, Motorola Pixie, Tom Thumb 528, 600, Crosley book type etc. Takashi Doi: 1-21-4, Minamidai, Seyaku, Yokohama, Japan

FOR SALE: Collins 30L-1, clean condx,tubes and HV tested - $350 ea., 3 for $1000. Sets for repair - $225 ea., 5 for $1000. Mike Murphy, (619) 444-7717, FAX (619) 444-6750

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: Cabinet for HQ-129 or HQ-140 and old commercial one or two tube xmtr, such as 6L6 or 6AG7 type. Need not work. Colin Lamb, K7FM, 29830 NE Mt. Top Rd., Newberg, OR 97132. (503) 538-4301

FOR SALE: Collins 918M commercial xcvr, 2.6 - 30 MHz, SSB, AM, CW, solid state,150W, w/manuals - $375 FOB. Stuart T. Carter, II, POB 033177, Indialantic, FL 32903-0177. (407) 727-3015

WANTED: Manual or copy for the Collins 516F-2 pwr sply; also Harvey-Wells TBS-50D in nice condx. Merle Crowley, W1GZS, POB 476, Sumterville, FL 33585. (904) 568-1676

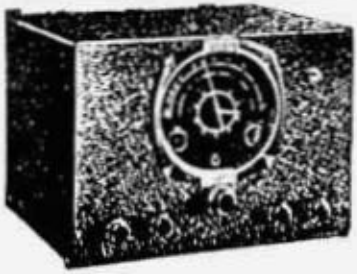
WANTED: Swan Eng. 117 AC pwr sply and 240 for parts; Swan DD-76; 516F-2 (RE); crystals for CP-1. Dean, (714) 643-7930

TRADE: BC-727, #19 VHF lead, new C-87/ART-13, CD-695-As, new BC-345's. **WANTED:** Navy stuff! Big, small, even useless bits. William Donzelli, 304 South Chester, Park Ridge, IL 60068. (708) 825-2630

WANTED: Fused plug as used on Johnson xmtr line cords. Thanks. George A. Flanagan, W2KRM, 42 Cygnet Dr., Smithtown, NY 11787. (516) 360-9011

FOR SALE: Globe King 500C - $700; National 183D, clean - $150; large vacuum variables - $50 to $100; Eimac airflow sockets - $30. Ed Prior, 159 Albany St., Clayville, NY 13322. (315) 839-5883

WANTED: Hallicrafters S-20R and SX-71 rcvrs. Hank, W6SKC, (602) 281-1681



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

FOR SALE: Mint Collins FM adapter for 75A-series rcvrs, model 148C adapter. Best offer over $25 plus UPS. Wes, W5DPM, 1950 Chevelle Dr., Baton Rouge, LA 70806.

WANTED: Parts or information on 1948 Ampex model 200 tape recorder. Gary, WA9MZU, 1751 Michon Dr., San Jose, CA 95124. (408) 266-2218

FOR SALE: Hallicrafters HT-32, SX-101, SX-101A - $225 each; R-48 spkr $35 w/rcvr; Hammarlund SP-600-JX17, in new cabinet - $700. All exc. RME152 converter - $25. All U-ship. John, W8VBQ, (513) 831-3195

WANTED: Late Navy LM freq. meter (painted gray) w/accessories. Also need orig./copy Navships 91277 LM main manual. Will gladly buy your LM to get manual. Don Kelly, 27973 Bush Ln., Scappoose, OR 97056.

FOR SALE: Collins 75A-4 s/n 2102, w/spkr - $600, s/n 436 - $450; Johnson 275W Matchbox - $75/$60; Hallicrafters S-85 - $125; SX-146/HT-46 - $300; HT-45 - $450; HT-32 - $100; R-47 - $35. U pay UPS or pickup at Flagstaff hamfest. Wen, AD7Z (702) 297-1156

WANTED: Manual/copy for a Lysco 600-S xmtr. Tnx. Sam Ash, 207 Middleton Rd., Chatsworth, GA 30705. (706) 695-5658

FOR SALE: Elmac PSR-612 - $40; PSR-12 - $25; unused AF-68A cabinet, chassis & unpainted front panel - $40. UPS xtra. Kent Miller, K4IHN, 3155 Old Salisbury Rd., Winston-Salem, NC 27127. (910) 788-0670

WANTED: RF xfmr T19 for HQ-170 p/n K38932-1; 60 kHz IF xfmr p/n M42005-1 for same. Steve Gajkowski, RR 2, Box 2712, Saylorsburg, PA 18353. (717) 992-6768

FOR SALE: Bendix MN26Y - $50; Eico 730 modulator - $50; EV 635A mic - $50; National VFO 62 - $35; Yaesu FRB707 relay box - $25; orig. manual AN/SPR1/APR1 - $25; make offer - Pye VHF FM base, BC-604, BC-639. Mel Stoller, K2AOQ, 100 Stockton Ln., Rochester, NY 14625. (716) 671-0776

WANTED: Type E (900-2050 kc) coil for HRO series rcvrs; Johnson Viking 122 VFO. John Zitzelberger, WB6JJE, 5257 Lewis Rd., Agoura, CA 91301. (818) 991-8358

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FOR SALE: KWM/TH [illegible] Prices include shipping. [illegible] **WANTED:** [illegible] Bowman, [illegible]

FOR SALE: Used technical books: radio, electronics, mathematics, military, magazines, catalogs, handbooks, etc. $1 for big list (stamps ok). Softwave, Dept. LE, 1515 Sashabaw, Ortonville, MI 48462

WANTED: Hallicrafters HA [illegible] linear amplifier. Joseph Labrone, AA8HV, 3000 Town Center, Ste. 2370, Southfield, MI 48075 (810) [illegible]

HEATHKIT FANS: Don't miss [illegible] learning more about their past in history, pictures and personal insights from many company old-timers in 124 page book. $9.95 pp. Heath Nostalgia, 4320 196th S.W., Suite B-111, Lynnwood, WA 98036-6754

FOR SALE: Tubes, tested, boxed, lowest prices, good selection. Business size SASE for list. Bill McCombs, WB0WNO, 10532 Bartlett Ct., Wichita, KS 67212-1212

WANTED: For restoration project. Plate [illegible] for Viking Pacemaker, any condx. (206) [illegible]

AMATEUR RADIO SURPLUS

Hammarlund Collectors

I have the factory files from Hammarlund. Some files include various engineering blueprints & schematics. All but one have manuals. Some have technical notes, and more. Various promotional literature, blueprints & interoffice memos. Also the personal file of Wayne Cordell, who was administrative sales manager for Hammarlund, from whom I acquired these files. He can verify their validity. A one of a kind collection. I will sell this collection to the best offer I receive over $1000. I will stop accepting offers August 1st, 1994.

We also have almost 1500 NOS parts in stock for Hammarlund equipment.
Also in stock:
B&W, E.F. Johnson & [illegible] air inductors
E.F. Johnson parts, Eimac tube sockets
Eico NOS kits & NOS prewired including NOS enclosures for 730
Original manuals including Hammarlund, Hallicrafters & others.
And much, much more ... send SASE ($.75) specify equipment, Hammarlund or manuals list

Robert Fowle
1215 Winifred
Jackson, MI 49202-1946
(517) 789-6721

Buy & Sell NOS dealer inventory - vintage gear and parts

FOR SALE: Repair of TV-7 tube testers w/ calibration: I will fix and then verify calibration of your TV-7 tube tester for $45 plus all shpg or return it no charge. Please no units with bad meter movements, book clips or case handles. Unit must be repairable and not a basket case. Daniel Nelson, 1025 E. Desert Lane, Phoenix, AZ 85040. (602) 243-7421

FOR SALE: PRC-47 LSB conversion - mech filter only $45. Your ampl, mod unit converted - $55. Roger Leone, K6XQ, 136 Delta Cir., Vallejo, CA 94589. (707) 552-6659

WANTED: Hallicrafters SX-17, only in VG condx. Jose Cangas, EA4JL, contact in the States is Kurt Keller, (203) 431-6850

FOR SALE: Heath Mohican GC1A; Regency ACT T16Krec. None working - $40 each. Hoover, (803) 726-5762

WANTED: Question? Has anyone ever seen, used or owned and/or is willing to sell or share info or manuals regarding the National LF-10 tuner and Collins 55G1 tuner? If so call collect after 6 PM (609) 393-4122 and ask for Fred.

FOR SALE: Realistic DX-160 w/spkr - $75; National SW-54 - $35; Knight Star Roamer - $30. Ken Johnson, N5US, POB 10063, Austin, TX 78766.

FOR SALE: Popular Electronics - $1.50/copy ppd., send wants; RCA TV schematics, 1950-'51 TV's - $12 ppd.; Plantronics headset telephone SP04 - $30 ppd. R.J. Eastwick, N2AWC, 224 Chestnut St., Haddonfield, NJ 08033. (609) 429-2477

WANTED: Still looking for all of the military sets and manuals in my April & May ads. **FOR SALE:** National manuals; BC-611 parts; military radios & manuals. LSASE for lists. URM-13 - $22; DY-17A/ART-13 NOSB - $45; ART-13 plugs - $25 each; BA-38, new - $42.50. Plus UPS. Robert W. Downs, WA5CAB, 2027 Mapleton Dr., Houston, TX 77043. (713) 467-5614

FOR SALE: Manuals - RME 69 (operating) - $11, service - $11; Ameco SWR - $4, PT preamp - $6; Glove V-10 - $9; Johnson 122, C.E. MN-2 - $12; Lil Lulu xmtr - $10; NC-109 - $8; Johnson Matchbox (275W), Clegg 99'er, Conar 500 - $7; Drake Q-X'er, Collins vernier knob - $4; Lafayette HA90 - $5. Others page 49 of June ER. Copies ppd USA. Richard Prester, 131 Ridge Rd., West Milford, NJ 07480.

FOR SALE: F 455 15 Collins filter, new - $60; 75A-4 rcvr, 2 filters, WE, w/spinner - $475; HQ-170 rcvr, 160-6 meters, w/clock & manual - $145. **WANTED:** Harvey-Wells R-9 rcvr in good condx, will buy or trade, Hallicrafters S-108 for same. Mel, WØMLT, 67750 Ridge View Dr., Montrose, CO 81401. (303) 249-1544

FOR SALE: Johnson Viking Invader (missing cabinet and 1 meter), otherwise complete, w/ tubes - $100; Hallicrafters SR-400 Cyclone, no sply, cabinet white, looks and works fine - $250; Swan pwr sply 117XC, mint - $125. Craig Pitcher, WA9HRN, 1308 Kristin Dr., Libertyville, IL 60048. (708) 367-1599

FOR SALE: Collins S-line-32S-1, 75S-1, 312B-4, 516F-2, mics manuals - $700; Collins 30L-1, RE, late - $800 or all for $1250 plus shpg. Ruth Cushingham, 11654 E. Grande Vista Dr., Whittier, CA 90601. (310) 695-8633

FOR SALE: Wattmeters URM-120, 2-1000 MHz, to 1000 W, three couplers, meter, case, manual, 20 lbs - $120; URM-25D sig. gen. 10 kHz - 50 MHz, as-is for parts, 45 lbs - $25 each, 2 or more $20 each; Polarad 1108A 6.95-11 GHz, no output, 55 lbs - $50; HP cabinets from HP-606 type equipment, takes 19x10.5 in. panel, 13 in. deep chassis, side handles, used, 20 lbs - $25. Add shpg. Tartan Electronics, Inc., Box 36841, Tucson, AZ 85740-6841. (602) 577-1022

WANTED: Telegraphic apparatus and keys by collector, not a dealer. Will pay top dollar. Pete, WB2BYQ. (201) 818-4311

WANTED: Collins xmtrs models 30A, 30W, 30FX, 32B, 32G, 32RA, 40B. Pre-1940 HRO; Hallicrafters Silver-Faced Skyriders. Paul Christensen, N9AZ 11142 Raley Creek South, Jacksonville, FL 32225. (904) 721-9111

FOR SALE: HRO-500; AT-1. **WANTED:** Johnson T/R switch; dead Thunderbolt or Courier. Joel Thurtell, 11803 Priscilla, Plymouth, MI 48170. (313) 453-8303

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FOR SALE or TRADE: HQ-100 - $60; HT-37 - $80; DX-40 - $55; CE-20A, w/BC-458 VFO - $55; Drake 2B - $120; HW-101, w/pwr sply - $180; Dentron 160-10L amp - $425 OBO; Invader 2000 available in fall - $950. **WANTED:** Johnson SSB adapter & Ranger II in exc. condx. Cal, N6KYR, 330 Pico St., Morro Bay, CA 93442. (805) 772-4366

TRADE: Les Logan model 501 chrome Speed-X bug, fair condx. WANTED: Keys/bugs or National gear. Niel Wiegand, WA5VLZ, 12105 Mustang Chase, Austin, TX 78727. (512) 219-8548

WANTED: Panoramic Radio Products P.R.1 panadapter; also wanted Johnson KW Matchbox, w/SWR meter. Jay Spivack, 325 S. Washington Ave., Kent, WA 98031. (206) 859-2680

FOR SALE: NOS tubes. SASE for list. **WANTED:** Ranger II, PRC-77 modules; NC-300 spkr & manuals for RT-1113A/PRC-68A. Joseph Pinner, 201 Ruthwood Dr., Lafayette, LA 70503. (318) 981-7766

FOR SALE: Hallicrafters SX-101A - $130; Central Electronics 20A - $100; Collins R-388/51J-3 - $300; 51J-4 - $500; Hammarlund HQ-150 - $175. **WANTED:** Clean unmodified Viking I; Hallicrafters HT-20; Harvey 100T. Jim Jorgenson, K9RJ, 1709 Oxnard, Downers Grove, IL 60516. (708) 852-4704

WANTED: Any info on where I can get a professional quality black wrinkle paint job - please be charitable, take a moment to call me with this information. E.W. Polk, MD, WA1YIW, (904) 893-3936

FOR SALE: 75S1 - $190; 32S1 - $190; Tecraft VHF tx w/3 converters - $75. TRADE: HRO-50 J coil for F coil. Carter Elliott, WD4AYS, 1460 Pinedale Rd., Charlottesville, VA 22901. (804) 979-7383

WANTED: Pwr xfmr for HRO-60. Dave Williams, WBØZJP, 967 Hwy. 'P', O'Fallon, MO 63366. (314) 240-1870

WANTED: Collins 310B-3 and 70E8A; CMS-1, 500W & diagram Thordarson 21M75 mod. xfmr. FOR SALE: Collins 32V manuals, redone, nice, complete. Jerry, W8EGD, (303) 979-2323

Collins S-Line Gray Paint

New mix by original manufacturer. Part no. 097-6161-000 #180. $9.95 per can plus S&H. Omega Electronics, 101-D Railroad St., P.O. Box 579, Knightdale, NC 27545. (919) 266-7373

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

FOR SALE: New receiving tubes, special sale - all $2.75. Sales expires 10-1-94. Stock up now! SASE for list. TBE, POB 806, Lake City, MI 49651.

WANTED: RF xfmr T19, p/n K38932-1; 60 kHz IF xfmr p/n M42005-1 for HQ-170. Steven Gajkowski, KD3HT, RR2, Box 2712, Saylorsburg, PA 18353. (717) 992-6768

WANTED: Collins S-line console dimensions for 75S3, 32S3, 30L1 and accessories. Earl Russell, WR1Y, 98 Skyfields Dr., Groton, MA 01450. (508) 448-5822, FAX 448-9405

FOR SALE: Thousands of tested tubes w/ warranty! Both xmit and Rec tubes. 15% off current prices for all orders over $25 during June and July '94 if you ask. Buy those spare tubes for your tube radio, audio, ham and electronics at about 25% of new.I have bunches of octal, older, 7 and 9-pin tubes. All tested and boxed. I give a 30 day warranty. Send wants or SASE with two stamps for list. Daniel Nelson, 1025 E. Desert Lane, Phoenix, AZ 85040. (602) 243-7421

FOR SALE or TRADE: Heath SB-301 in good condx - $75 plus shpg. Fred Clinger, WA8KJJ, 417 Beechwood Dr., Galion, OH 44833. (419) 468-6117 after 6 PM Eastern

FOR SALE: Drake MN-2000 w/manual - $175; Drake R4-B - $150; Drake R4-B/T4X-B/pwr sply (w/o cabinet or spkr) - $300. Ben Deovlet, W6FDU, 933 Robin Ln., Campbell, CA 95008. (408) 374-0372

WANTED: Drake 2B meter; B&W 5100B meter; Heath Mohawk cabinet; info on Meissner Signal Shifter model 'EX'. Al Norton, K7IEY, 1008 Liberty St., Lynden, WA 98264

R-390A Sales-Service-Parts
SASE for info
Miltronix, POB 3541
Toledo, OH 43608

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

WANTED: SX-101A; 51J-4; Johnson Desk KW amplifier. **FOR SALE:** Drake MN-2000 - $200; (2) HT-32's (one for parts) - $125. Ben, W6FDU, (408) 374-0372

WANTED: Heath HR-10 manual, copy OK. Donald E. Moth, W2MPK, POB 73, Chittenango, NY 13037-0073.

FOR SALE: NIB Knwd TS-530S front panel - $40; RCA CRT's - NOS 902A - $15, used 2BP1's - $10; JAN 2" magnetic shield, as new - $10; Globe Chief Deluxe - $50. WANTED: 9.000 MHz xtal for Hallicrafters HA-5 VFO; VG/mint HA-1 keyer; matching VG/mint S-100 spkr; current meter for Heath IP-32 pwr sply; meter for Johnson Navigator and Ocean Hopper coil set. David W. Ishmael, WA6VVL, 1118 Paularino Ave., Costa Mesa, CA 92626. (714) 979-5858

FOR SALE: Collins spinner knob and 4:1 mechanism for 75A-3/4 - $125; Collins 651S1HF rcvr, w/manuals - $850. Mike, K5FZ, (713) 444-7737

FOR SALE: Viking I - $125; RAL-6 - $95; ART-13 w/dynamotor - $145. (602) 864-9987

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WANTED: Crystal calibrator for HRO-50T. James B. Geer, WB5LXZ, 1013 Overhill, Bedford, TX 76022-7206. (817) 540-4331

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FOR SALE: Radio schematics - $2.50. Also, tubes, books, Riders, extra Sams. LSASE for lists. Joseph R. Forth, WA2TRT, 321 Long Vue Acres, Wheeling, WV 26003. (304) 277-3154

FOR SALE: Collins 32S-3 - $350, 516F-2 (R) - $125, 312B-4 - $125, SM-2 - $120, equipment, parts, manuals, books, magazines, list - $1. Joe Orgnero, VE6RST, Box 32, Site 7, SS 1, Calgary, AB T2M 4N3 Canada, (403) 239-0489

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WANTED: Manual or copy for Subraco MT-15X xmtr, as advertised in late '40's QST. Also, info on Suburban Radio Co. of Rochelle Park and East Rutherford, NJ. Jerry Burns, K1GUP, POB 61, Carmel, ME 04419. (207) 848-3400

FOR SALE: RCA AR-88 rcvr, .535 - 32 MHz, w/ manual, very good condx - $100 PU only. Al Kaiser, W2ZVR, 713 Marlowe Rd., Cherry Hill, NJ 08003-1551. (609) 424-5387

FOR SALE: R-390A depot technical manual TM 11-5820-358-35, orig., good condx - $50 + shpg. Joe Bunyard, 1601 Lexington St., Waco, TX 76711-1701. (817) 753-1605

WANTED: Manual and main tuning dial for General Radio 605A sig. gen.; G-R equipment from 1930's and '40's. Stan, WA2NPL, 103 Wilson Ave., Blackwood, NJ 08012. (609) 435-8975

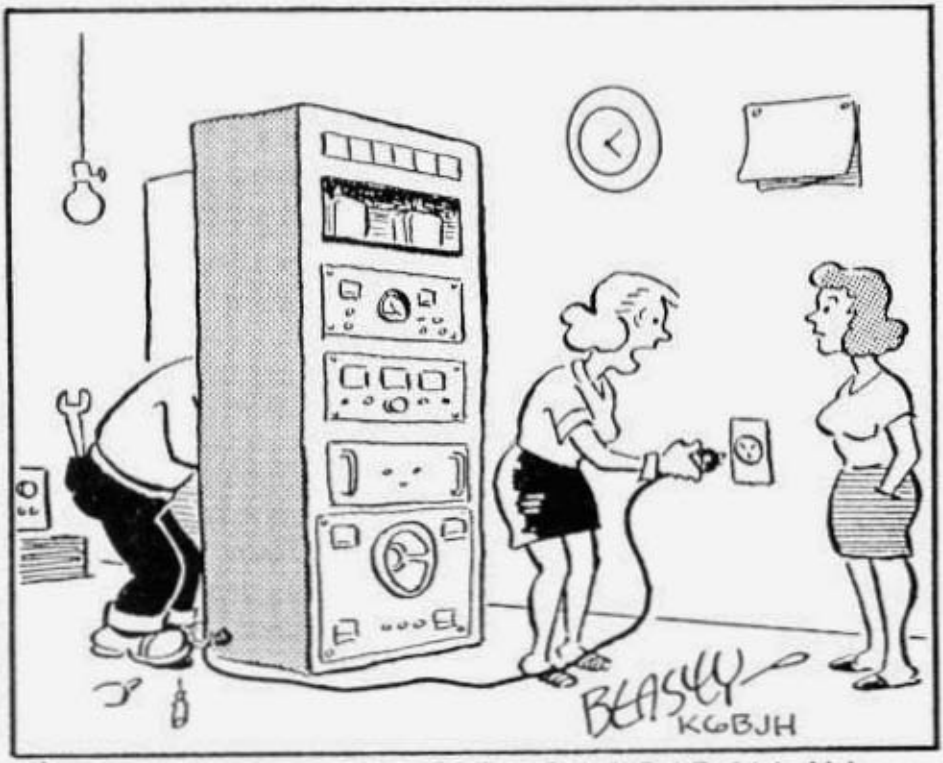
WANTED: WW II ART-13 and Bendix ATD xmtrs and dynamotors; 2Z2 tube; model G410 or G415 or G521 Temple portable. Harry L. McCall, KB4CSY, Rt 1, Box 244, Ennice, NC 28623-9641. (910) 657-8248

WANTED: Info on Communications Electronics, Watkins-Johnson, Racal and Nems-Clarke equipment. I am assembling directories. Any help appreciated. Terry O'Laughlin, WB9GVB, 306 Van Deusen St., Madison, WI 53715. (608) 258-1810

WANTED: ARC-5 rcvrs, 316, 619, Q5; BC-348; TCS xmtr (converted to 110/12 OK); HF manpack; sked for AM local QSO. WA5AAO, La Grange, TX 78945.

Messge: Read the positive review of "The Signal Corps" in the Antique Radio section, August 1994 issue of Popular Electronics. Sam Hevener, W8KBF, "The Signal Corps" 3583 Everett Rd., Richfield, OH 44286-9723. (216) 659-3244

FOR SALE: HQ-170A, VHF, Ex. ++ - $165; SX-122A, Hallicrafter's last classic vacuum tube rcvr, gem mt., - $195; Bud wrinkle finish desktop cabinet, 14x8x8, exc. ++ - $12; orig. Roberts model 90 tape recorder, mint - $30; Heath SB-600 spkr in cabinet, nr mint - $15; Hytron 2-meter RF xmtr from 1939, nr. mint - $30.



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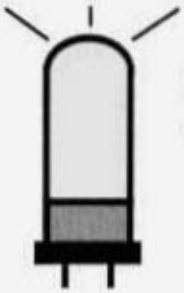

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