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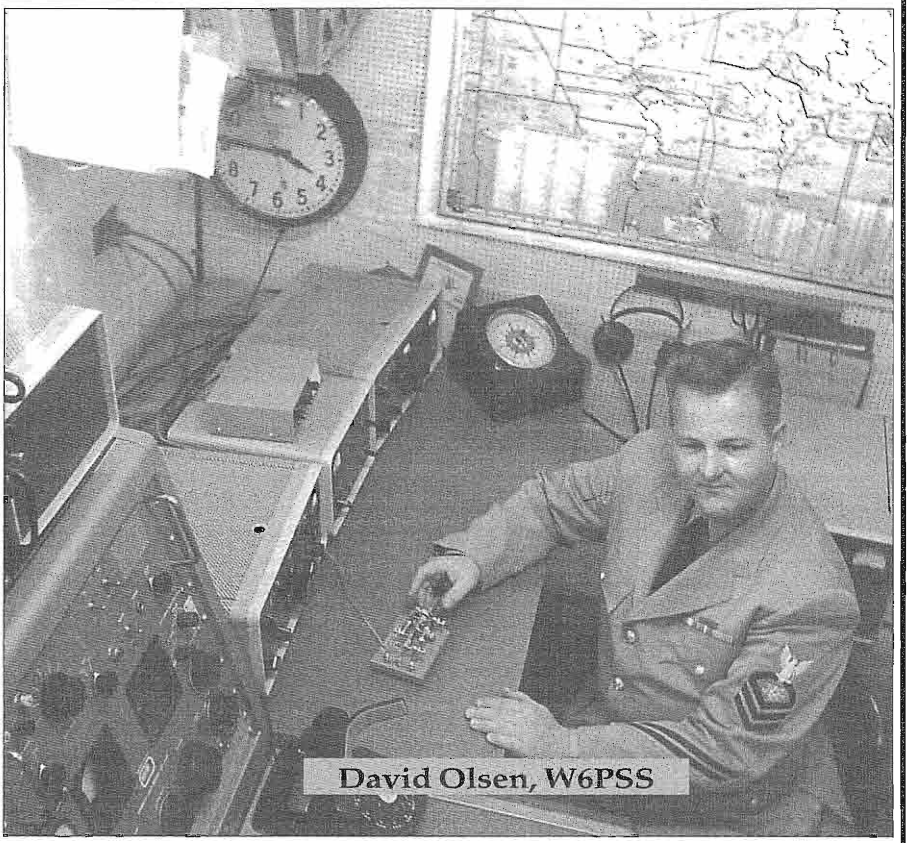
ELECTRIC RADIO

celebrating a bygone era

Number 171 August 2003



ELECTRIC RADIO

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Electric Radio is dedicated to the generations of radio amateurs, experimenters, and engineers who have preceeded us, without whom many features of life, now taken for granted, would not be possible. Founded in May of 1989 by Barry Wiseman (N6CSW) the magazine continues publication primarily for those who appreciate the intrinsic value of operating vintage equipment, and the rich history of radio. It is hoped that the magazine will also 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 and operating with a primary emphasis on AM, but articles on CW, SSB, and shortwave listening are also needed. Photos of Hams in their radio shacks are always appreciated. We invite those interested in writing for ER to write, email, or call.

Regular contributors include:
Bob Dennison (W2HBE); Dale Gagnon (KWll); Chuck Teeters (W4MEW); Bruce Vaughan (NR5Q); Bob Grinder (K7AK); Jim Hanlon (W8KGI); Brian Harris (WA5UEK); Tom Marcellino (W3BYM); John Hruza (KBØOKU)

Editor's Comments

Due to lack of additional space this month I am turning the mic over to Dale Gagnon (KW1I) for an important AMI update and some comments regarding recent FCC rulemaking action. 73, Ray.

AM International Update – August 2003
RM-10740 Information

The FCC assigned a RM number to this petition and accepted comments on it through the beginning of August. The petition submitted by two amateurs asked the FCC to amend Part 97 of the Communications Act of 1934 to limit the bandwidth of SSB emissions to 2.8 kHz and AM to 5.6 kHz. These amateurs were trying to address problems caused by two groups of SSB operators that were transmitting overly wide signals affecting nearby stations. No AM operations were criticized, yet the petitioners recommended mandating the 5.6 kHz bandwidth for the mode. The AM community submitted some excellent comments. If you have Internet access, log on to www.fcc.gov/cgb/ecfs/ Click on the "Search for Filed Comments" link in the "ECFS Main Links" box on the right and put "RM-10740" on the "Proceeding" line and click "Retrieve Document List" lower on the page. A reply comment period may be opened later in August allowing responses to specific comments. The reply comment period can be used to disagree with some comments and heartily agree with others. This can be very powerful to consolidate many voices behind well-reasoned arguments. Consult the AM Window Bulletin Board at www.amwindow.org/wwwboard/wwwboard.html for information on a reply comment period if one is announced, or send mail to aminternational@earthlink.net .

AMI Discovery Weekend

This year the weekend will start any convenient time Friday evening Septem-

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Cover: David Olsen (W6PSS) is on duty in 1963 at K4NAA, the official U.S. Navy Ham Station at Arlington Virginia. David had the call of W8PRA at the time, and the station was soon to become the Navy MARS station NAV.

A Report on the Winter 2003 Classic Exchange and the Fall 2003 Combined CX and AMI Weekend

by John D. "Mac" MacAulay
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"Although I've been a Ham since 1977, this was my first-ever CX. What a blast!" That's how Dean Hemphill (K5DH) described it. The CX is a low-key contest encouraging the restoration, operation and enjoyment of older commercial and homebrew ham gear. It has been going on for 28 years and it seems each CX is reported as better than the last. In the February 2003 CX, Jim Hanlon (W8KGI) set records by getting an amazing array of 24 BA ("boatanchor") receiver-transmitter pairs on-the-air and generated the high score. Jim is a regular contributor to ER and has written articles about many of those rigs. Rocco Lardiere (N6KN) "only" qualified 15 stations to come in second. He would have done better, but a girl scout selling cookies came to the door while he was tuning his Drake T-4XB; unfortunately the antenna was not connected and the key was down. Rocco reported that Thin Mints do not go well with smell of burnt resistors. Third place was captured by Rob and the gang from the Garden State Top Band Club (K2TOP) using an array of Navy BA gear including an RBA, RBB, RBM and TBW nicknamed "Pumper-Thumper" because of its 3 amp keying relay.

Top scorer Jim Hanlon ran the following gear: Transmitters: Central Electronics 100V, Collins 32V-3, 1941 Deluxe Meissner Signal Shifter, Drake T-4X, Globe Scout 680. Globe King 275, Globe Chief 90, Elmac AF-67 and AF-68, McMurdo Silver 701, Hallicrafters HT-20, Hammarlund 4-20, Harvey-Wells TBS-50D, Heathkit DX-20 and DX-60; Knight T-150A, Johnson Adventurer, Viking I, and Valiant; and Lettine 240, Millen 90711/90800, Military BC-459 and CBY52209 (Navy BC-457), and W8IB's Home Brew 6L6. Receivers: Collins 75A-3 and 75A-4, Drake R-4B, Echophone EC-1, Hallicrafters SX-28, SX-28A, SX-43 and SX-73; Hammarlund HQ-129X, HQ-170A, HQ-180 and SP-600; Howard 438, National FB7, HRO, HRO-50, NC-80X, NC-173, NC-200 and NC-303; Military BC-454/BC-453 and BC-455/BC-453, RME-69 and 70.

Other classic rigs making appearances on the air were: Transmitters: B&W 5100B and 6100; Collins 32V-2, 310B-3 and KWS-1; Drake 2-NT, T-4X, T-4XB and T-4XC; Gross CW-25; Hallicrafters HT-17, HT-18, HT-32A, HT-32B, HT-37, Heath AT-1 / VF-1, DX-40/H-B p-p 811, DX-100, HX-10 Marauder, SB-200, SB-401, TX-1 Apache; Homebrew: Hartley p-p 211 (WB2AWQ), 1921 parallel UV-201 (WB2AWQ), 6V6/807 (K5DH), Pair 1625 (W7FOX), Johnson Challenger, Desk KW, Navigator, Ranger I, Ranger II, Viking II, Viking 500; Kenwood T-599D; Lysco Transmaster 600; Military Surplus: BC-230, BC-696A, T-19/ARC-5, T-20/ARC-5, Navy TBW "Pumper Thumper"; Millen 90881; Sonar VFX-680; WRL Burnt Orange Globe Scout (BOGS) 680.

Receivers: Collins 51S-1, 51S-3, 51S-3A and 75A-2; Davco DR-30; Drake 2-B, 2-C, R-4A and R-4C; Hallicrafters SX-101A, SX-115, S-43, S-53A and S-76;

Hammarlund HQ-110 and PRO-310; Heathkit HR-1680, SB-301 and SB-303; Homebrew: 1932 Jim Lamb Superhet (WB2AWQ); 1934 Single tube regen whistler (WB2AWQ); Howard 435A; Kenwood R-599D; McMurdo Silver: 5C; Military Surplus: BC-348-Q, BC-348-R, Imperial R-390, RBA, RBB, RBC, RBM, RCR and TCS-12/BC-453; National HRO-50R1, HRO-60, NC-101X and NC-125; RCA AR-88d; RME 45, 69, 70 and 6900.

Transceivers: Collins KWM-2 and KWM-2A; Cosmophone 35; Drake TR-4C; Gonset G-76; Hallicrafters SR-150 and SR-400A Cyclone; Heathkit HW-101 and SB-101; Home Brew: SSB Transceiver 8072 final (K5AM); National NCX-5; Yaesu FTDX-100.

During this recent CX event the hours of operation were expanded, 160 meters was added, and 10 meters was given emphasis to help more folks get involved and bring more BA's on the air. The extra hours and 160 meters worked very well but 10 meters was dead. Mark, K3ZX tells it: "Started off on 10M AM this year, and got nowhere!"

The action moved from the higher frequency bands to the lower as the CX progressed. Since 10 and 15 meters were not open many CX'ers moved to 20 meters, which provided great mid day activity including a number of DX stations – some actually operating BA gear. 40 meters had the highest level of activity in terms of both stations and types of rigs. It was not uncommon to hear a single station on the band with two or three or more different receiver-transmitter pairs in succession. The 80 and 160-meter bands provided rich environments for those willing to stay up and enjoy them.

There were apparently a record number of stations active in this CX. Unfortunately, only a fraction reported their scores or comments. They are: W8KGI, N6KN, K2TOP, WQ8U, WB2AWQ, W7FOX, WJ9B, K3ZX, K9VKY, K5AM, W2AGN, AA4RM, KC8JX, W9STH, W2JEK, K5DH, N5OHL, W6XA, W5TVW, W8ZR and W2CQH. A partial list of others worked or reported running classic gear includes: K4IBZ, WY7W, AF1Z, AC5JH, K6LQI, WY7W, W8AU, WA2VMO, N2AK, K5JGU, N4UJ. WA8VTB, K9KEU.

More details on the February 2003 CX and prior CX 's as well as a rogue's gallery of CX operators and stations are available on the CX web site at http://qsl.asti.com/CX.

Fall 2003 Classic Exchange "CX" and AMI Discovery Weekend Event Announcement: September 26-28

The CX is a no-pressure contest celebrating the older commercial and homebrew equipment that was the pride and joy of ham shacks many decades ago. The object is to encourage restoration, operation and enjoyment of this older "Classic" equipment. See the CX website for history, rogues gallery and recent contest newsletters: http://qsl.asti.com/CX.

The Fall CX will be held concurrently with the AM International Discovery Weekend to encourage more participation in both events as well as addressing the desire for more CX operating time. The AMI Discovery Weekend brings many classic AM transmitters on the air and raises the awareness of the presence and fun of AM. AM QSOs exchanging the usual CX data may be made for CX score throughout the weekend.

The traditional CX contest, including CW, SSB and AM will be on Sunday. There will be CX recognition for high scores in AM, SSB and CW as well as overall.

You need not operate a classic rig to participate in the CX. YOU MAY USE

[Continued on page 17...]

Taming the Lettine 240

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The Lettine 240[1] was built in the decade from 1950 to 1960, the time when I was growing up with ham radio. My brother Bob (W4RXK) bought one to serve as his away-from-home rig when he went to Ohio State. He augmented it with two Command Sets to serve as 80 and 40-meter VFO's. Along with their power supply, they were at least as big as the Lettine itself. And he paired them with an NC-173 and a 67-foot center-fed Zepp antenna to round out his station. The little Lettine, with its 807 final and push-pull 6L6 modulators, was no match for the big guns on 75 meter a.m. phone. So, Bob and I used to keep a weekly sked in the afternoon after I returned home from high school. Bob was using the BC-610 that belonged to W8LT, the Ohio State club station, and I was running our home-brew, push-pull 809's modulated by 807's from home back in Fort Thomas, Kentucky. Even though it was relatively low-powered, that Lettine was a rugged little workhorse, or perhaps work-pony. I remember one time when it served on 10 meters as the hidden transmitter in a hunt run by Cincinnati's Queen City Emergency Net. We picked out such a good hiding place, down in the woods in the Ohio River valley where the signals bounced off the hills, that it took the last searchers at least two hours to find us, even when we started broadcasting directions to our location. The Lettine cranked out 29.6 mc RF all that time without a complaint.

I recently acquired a Lettine of my own thanks to the generosity of Mike Langner, K5MGR[2]. Mike shares my propensity to give forlorn ham gear a good home, and in a moment of fellowship he offered me the little rig that he had found. (I think his shack might have been overflowing at the time.) This rig was basically all there except for tubes, plug-in coils, and its cabinet. I had to remove the remains of a mud-dobber wasp nest from under the chassis – fortunately the inhabitants had vacated sometime earlier. My junk box readily produced the 5U4 rectifier, 6V6 oscillator, and 807 final amplifier tubes and also a 6SJ7, 6N7, and a pair of 6L6's for the modulator. A little more scrounging turned up a B&W Junior, end-link coils for 80, 40 and 20 meters for the 807. And I wound oscillator plate coils myself on junk-box 5-pin forms, so I was able to get the rig ready to go on the air. I even found a Bud cabinet of the right 8 x 14½ x 8¼ dimensions thanks to a friend on the Boatanchor Reflector. It is just like the original that came with the Lettine, except that it is painted black crackle rather than the Lettine's original blue-gray.

Firing up the Lettine was interesting. On 20 meters it wiped out the low-band channels on our family TV set. That is not surprising since its cabinet has several open slots (harmonic antennas) and there are no precautions taken to keep RF from escaping on the AC, key or microphone leads. And on 80 and 40 meters, even though it didn't bother the TV, the final had a nasty habit of taking off and singing on its own, completely ignoring the drive from the oscillator. That later behavior

was evidenced by multiple snaps and dips in the final plate current, by interesting, off-frequency burps and squawks in my receiver, and by screams from my SWR meter that it was being driven by out-of-band RF. With very careful tuning I could make the Lettine settle down on 80 meters for the Classic Exchange – at least part of the time. But it was definitely not a fun rig to try to put on the air.

All of this errant behavior made me think more about Bob's Lettine, which as I began to remember, behaved the same way. The problem is basically generic to the Lettine's RF layout and to the 807 in its final amplifier. The oscillator plate/final grid coil is only about three inches away from the final plate coil with no shielding in between them and with the unshielded 807 sitting between them. There are all sorts of magnetic and electrostatic coupling paths providing unwanted feedback. The 807 is notorious for long, unshielded grid leads between its base and its working elements. RF designers of the era soon found out that to keep an 807 stable, one had to shield it at least up to the bottom of the plate structure, and to shield or well-separate the grid and plate tuned circuits. The Millen 90800 and the Command Set transmitters are examples of successful 807 designs that incorporate these precautions. But the Lettine 240 violates all of these guidelines, and its 807 responds by oscillating merrily on its own.

I contacted Bob and asked him for suggestions. He advised me to change to an 807W (5933), a later 807 version with the elements much closer to the base, ala the much easier to tame 6146. I tried one, but the final continued to oscillate almost as well as before. Then I remembered that we had resorted to "link neutralization" in Bob's old

Figure 1: The 80-meter oscillator and final plate coils with their neutralizing links attached sitting in front of the Lettine 240.

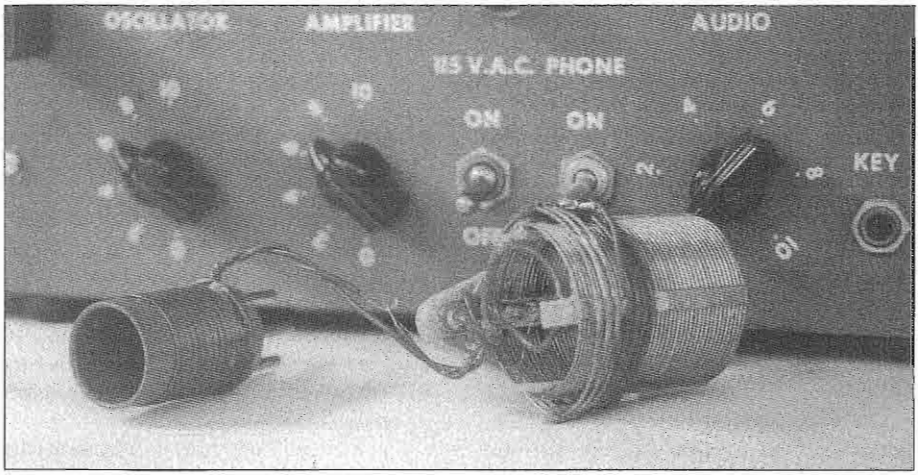

Figure 2: A closeup view of the 80-meter coils and neutralizing links.

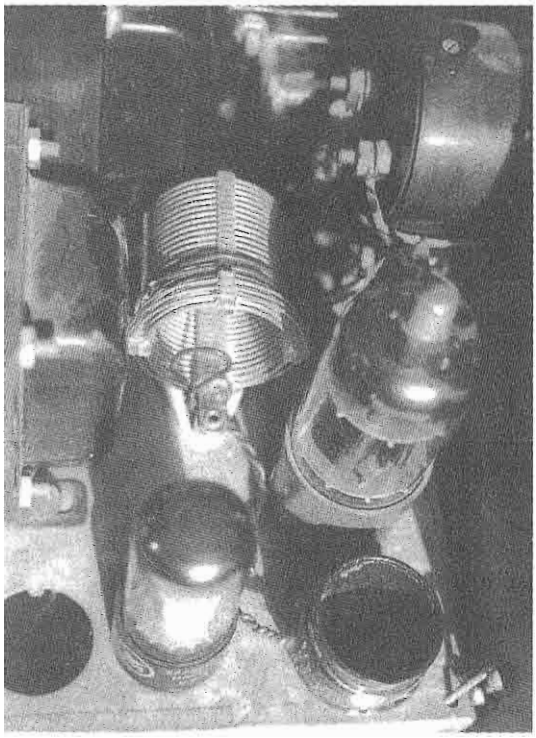

Figure 3: The 40-meter link-neutralized coil pair installed in the Lettine. The 6V6 oscillator is on the lower left, and the 807W amplifier is on the upper right.

Lettine, a scheme alluded to in our 1952 ARRL Handbook in which one couples out-of-phase energy from the plate circuit back into the grid circuit via a link winding on each coil. If you get the orientation of the links right, basically by twisting one of them by 180° if necessary, and if you adjust the amount of link coupling, you can cancel out the unwanted feedback that is causing the stage to oscillate by introducing just the right amount of out-of-phase signal via the link coupling. It has the same effect as traditional, capacitive neutralization, but you don't have to have a balanced, split-stator condenser and tapped-coil tuned circuit in either the grid or the plate circuit to get the required 180° phase shift.

With nothing but the Lettine's parasitics to lose, I decided to try link neutralization. If it had worked for Bob back in 1954, it just might work for me now. The pictures show what I did on both the 80 and 40-meter coil

sets. I wound a single turn link around the "cold," end (the end attached to the B+ feed rather than the end attached to the 6V6 plate) of the oscillator plate coil, and I glued it down to the coil form so that it wouldn't slip around and change its adjustment. I fashioned an adjustable link at the cold end of the 807 plate coil; and for the larger link on the 80-meter plate coil I glued some perf-board strip extensions to the plastic strips that hold the plate coil turns so that I could secure the link with more glue after I had adjusted it. Following the Handbook instructions for adjusting a capacitive neutralized amplifier, I disconnected the B+ feed to the 807 plate and screen, applied grid drive from the oscillator, and adjusted the link on the final plate coil for minimum output from the stage. I measured output by attaching a germanium diode (a silicon diode would work just as well) in series with my Simpson 260 on a current scale across the normal output link. Something told me to start with the Simpson on a higher current scale just in case, a wise decision as the initial reading was around 70 milliamps indicating quite a bit of net coupling through the final stage. I adjusted the position and orientation of the link by poking it with a plastic tuning tool, and I was able to get a very sharp, deep null in the output. Even though theoretically not having voltage on the 807 screen and plate does change the capacitive coupling through the tube somewhat, the adjustment I achieved was still been good enough to completely eliminate parasitic oscillations in the 807! I was prepared to try some slight tweaks in the link position with the B+ restored after getting an initial setting with the B+ disconnected, but that has not been necessary. I stabilized the position of the 80-meter plate link with more glue, and I'm careful when handling the coupled coil pairs not to move the link when I change coils to change bands. Amazingly, the once skittish Lettine is now as easy to use as my well-designed, un-neutralized Millen 90800.

So my advice to you, dear reader, if you have been pulling your hair out over an old rig like the Lettine with parasitics in its final, is to consider link neutralizing it. The circuit is easy to try and to remove if you aren't happy with it. And it just might solve your problems and turn a cranky rig into a dependable little workhorse, or pony, like my Lettine is now.

Footnotes:

1 – "Restoring a Lettine Model 240 Transmitter," Tajima, ER # 52, August 1993.

2 – See ER #124, August 1999, page 17 for a picture of Mike Langner, K5MGR.

From QST, November, 1955

ER

A Hot Time in the Ham Shack

by Tom Park, W7EGN
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Hamilton MT 59840

In December 1933, Ellis Hamer (W7BQG) gave Fred Tintinger and me our Class C license examination. Fred was 16 and I was 13 and Fred was the brains of the team when it came to radio. In anticipation of the great day when our tickets would arrive, Fred cobbled up a station. The QTH was Fred's home on 1st Avenue North near 6th Street in Great Falls, Montana.

Nailed and screwed to a piece of apple box wood, the components of the rig were salvaged from junked radios dug out of repair shop trash cans. A single 201A was used in a self-excited oscillator circuit, theoretically capable of 5 watts but with our available power supply actual output was more like a tenth of that figure. The rig was a masterpiece of instability. No solder or soldering iron available, connections were twisted together. The tube socket was four holes drilled in the wood chassis, spaced to fit the tube prongs and wrapping the wire leads around the prongs made the connection. The doorbell wire tank coil was wound without a core so that it looked and behaved like the "Slinky" toy of later years, trembling with every footstep in the shack... Operating voltage was provided by a set of fruit jar rectifiers with aluminum plates in a borax solution, working directly off the 110-volt line. This electronic marvel was unencumbered by filter capacitors and produced about 80 volts of something vaguely resembling DC. Closing the key, (fabricated from a clothespin) prodded the rig to life, producing a faint glow in a loop-coupled flashlight bulb held close to the tank coil. For receiving we had a two tuber with a 24A regenerative detector and a UY27 audio to drive the Cannonball Dixie headphones.

The transmitter and receiver were placed on a rickety card table and the "power supply" was set on a board which in turn rested on a folding metal cot to elevate the collection of jars so that the short power cord could reach the only 110 volt source in the room, a light cord dangling from the ceiling.

We replaced the light bulb with a two-way socket, but had no male plug for our cord, so Fred came up with an ingenious solution. He knotted the power cord securely to the dangling light cord and then stuck the bare wire ends of the power supply cord into the slots of the female socket.

It was Mid-January, 1934, and still no ticket in our mailboxes. So, Fred came up with a great idea. His feeling was that the licenses were probably on their way, and we were practically legally licensed, so the temporary lack of the document shouldn't stand in the way of our debut on the airwaves. This struck me as good sound reasoning so we set about activating our powerhouse station. The ham shack was a tiny room on the third floor so we dangled a length of wire out the window for the antenna, coupling it to the rig by clipping it directly to the tank coil. Using the receiver as a monitor, we placed the signal approximately in the middle of the 80-meter band. It did sound pretty rough but we attributed that to "receiver overload"

Now came the problem of call letters. Several were suggested and discarded until Fred came up with W7BUN which, if followed by "K", seemed appropriate for our semi-legal operation. Then Fred keyed out CQ a few times on the still quiet early evening band and

ended with "W7BUN K".

Back came a huge phone signal! "W7BUN, this is W7BOZ. I don't know where you are but you are about R3 and the lousiest signal I've ever heard. You are Raw A.C. and drifting about 90 miles an hour and right in the middle of the phone band and you better shut down before the R.I. gets you!"

We were stunned! Fred was standing, (we had no chairs), and he exclaimed in a shaky voice, "Holy Smoke, it works!" Then, overcoming by the impact of the momentous event, his knees buckled and he collapsed heavily on the edge of the metal cot supporting the fruit jar rectifiers. The cot promptly collapsed and for a brief moment the sole support for the weight of the power supply was the dangling light cord, which had been connected to the house wiring protruding through the ceiling by merely twisting the two wires together. The unsoldered splice had been covered with a bit of electricians tape. This flimsy connection promptly parted company, the rectifier jars did a flip and hit the floor upside down, with a couple of gallons of borax solution spreading immediately across the floor and out the door. This bit of excitement was, however, just the preliminary to the main event.

When the light cord and the house wiring leads parted company the house wires touched and immediately welded themselves together. This would normally have been the signal for the fuse for that circuit to blow. However, as was the norm for those depression days, the usual 15 amp fuse, which cost a nickel, had been replaced by a "Lincoln" fuse, fabricated by unscrewing the blown fuse, sticking a penny in the socket and then screwing the dead fuse back in. This restored the circuit at a saving of four cents, and now you had a really rugged fuse that could carry a couple of hundred amps without melting.

Fred and I watched in a state of paralyzed fascination as, for what seemed forever, the two wires glowed and roared and smoked and dripped molten copper, until the 50 amp main house fuse finally opened. The entire house went dark and the fireworks ended, leaving an acrid haze of smoke in the now silent shack. The quiet didn't last long. In a few moments we could hear the heavy footsteps of Fred's mom, a rather substantial lady, as she charged up the front stairway from the now darkened living quarters. Fred and I both tried to get through the ham shack door at the same time and, once that momentary traffic jam was sorted out, flew down the back staircase, ten steps at a time. A few moments later we were cowering in a dark woodshed at the rear of the lot, where we bided our time until an hour or so after the lights came back on in the darkened house. We sneaked up the back stairs and found the spill all mopped up and when we ventured downstairs, the storm had blown over as though nothing untoward had occurred. You can be sure that no more clandestine operations were attempted and on February 9, 1934, Fred and I became, officially, W7EGN and W7EGM.

Fred has been a Silent Key for many years since that memorable day. I now sign W7EGN, Fred's old call, and feel very fortunate to be still enjoying every day on the air from my beloved Montana.

ER

Installment 2

W. J. Halligan
Newspaper Reporter and the State of Radio 1923-1924, Part 2
Vignettes Inspired by the Oncoming Radio Culture

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Full outline of Part 2:

A. Vignettes inspired by the 1923-1924 era
   1. Contemporary happenings
   2. Pertinent statistics
   3. Radio manufacturing in the United States
   4. Radio in other countries
   5. Musings—Bill Halligan
   6. Emerging need for an international language

B. Listener vignettes inspired by the advent of radio

C. Vignettes inspired by radio associated witticisms

D. Epilogue
   1. The Pallophotophone
   2. The patent mess
   3. Radio in other countries
   4. Wavelength or frequency?
   5. Reginald A. Fessenden
   6. Emerging need for an international language
   7. References

A. Vignettes Inspired by the 1923-1924 Era

Contemporary happenings

The vacuum tube has still another use as shown in the Western Electric public address system, which was introduced in Boston at a Chamber of Commerce luncheon recently at the Copley-Plaza hotel. To quote the description of the new apparatus: "A microphone so designed that every gradation of tone is faithfully produced, and so sensitive to the speaker's voice, that it will pick up his words at a distance of 10 feet, is placed in the back of the house where the speaker stands. His ordinary conversational tones are transmitted to the vacuum tube amplifier and thence projected to all parts of the stage and house by the loud speaking projectors." [3/21/23]

Who knows what a pallophotophone is? A recent definition describes it as a machine that photographs the human voice on ordinary motion picture film, by means of wavelengths and vibration intensities. The filmed voice is broadcast by throwing the film on to a specially sensitized screen, whence it passes through a series of vacuum tubes and into a regulation microphone. [3/31/23]

Here is a paragraph taken bodily from the Crossley [sic] Radio Weekly, which will undoubtedly prove of interest to all radio fans whether BCL or ham:

"Germany admits her mistake. In a magazine being published in Berlin, the name of which is 'Radio,' she insinuates that battles could have been won, lives could have been saved, etc., had her young men been trained in the art of sending and receiving wireless messages. Reading between the lines, it is plain to see the hand of the German

government, which evidently is trying now to rally the boys of the once great Teutonic nation and inspire them with a desire to master radio, thereby fitting them to be of 'future service' to their country. [7/10/23]

The United States Navy operates 533 ship radio stations and 52 land stations. The army maintains 180 land stations. [12/28/23]

Aviation and radio are becoming more closely allied every day. The government is experimenting daily with radio-equipped airplanes, especially in the mail division. It was during one of these tests in Texas that Louis Coba, of Dallas, heard the aviator in the airplane flying over San Antonio speak to the flyer who was leaving Fort Worth. The reception of the talk was clear. [1/24/24]

New radio units are installed in the giant air cruiser, the Shenandoah, to transmit messages 1000 miles. The equipment will include two transmitting sets, two receiving outfits and a radio compass. The call letters are "NERK." [3/10/24]

Sea disasters will be "enjoyed" hereafter, with radio receiving and sending sets fitted on lifeboats. The new North German Lloyd liner Columbus has six of its lifeboats equipped with radio sets for emergencies. [4/28/24]

An expedition from the United States to explore the Amazon and Orinoco rivers will have radio as the only means of communication. [4/28/24]

"Permalloy," a new kind of alloy, is going to be used to speed up the oceanic cables in competition with radio. It is an alloy of nickel and iron, very sensitive to magnetic changes and therefore more responsible to the touch of the telegrapher's key. [4/28/24]

The United States uses three stations to check up on the wavelengths of the broadcasting stations. They are the Bureau of Standards at Washington for the east, the University of Minnesota at Minneapolis for the middle west and Leland Stanford University at Palo Alto, Calif. for the west. [3/31/24]

A $12,000 loud speaker is to be placed in and outside of the Cleveland auditorium during the coming Republican convention. It has been leased by the national committee for use during the convention, and an option for its purchase thereafter has been offered to the city. [5/4/24]

German U-boats failed to locate American ships because of their talkativeness, according to Commander D. C. Bingham, assistant director of the naval communication division of the Department of Commerce. Talking to one another by radio, the U-boats disclosed their positions by means of direction finders controlled by the allies. So the troop ships were routed around the submarines. [5/10/24]

Radio sets in the next war will be carried by all advanced infantry units, tanks and airplanes, besides forming part of the equipment of all grades of headquarters and artillery brigades. [5/10/24]

Ambulances soon may be picking up emergency calls by radio, while on the road. Houston, Dallas and Forth Worth, Tex., are planning municipal broadcasting stations at police headquarters, whereby first aid calls could be flashed to the ambulances while the drivers are attending to other calls. [5/12/24]

Radio is helping ships in the Gulf of St. Lawrence and beyond to keep clear of ice. An ice patrol is maintained there, by which daily reports of ice conditions are sent out to navigators. [5/17/24]

Pertinent Statistics

Figures issued by the department of commerce show that there are now nearly 600 broadcasting stations and more then 2,000,000 receiving stations in the United States. [3/8/23]

Boston is recognized as one of the best radio cities in the country, and the

New Year is expected to find one set in every three families. [12/22/23]

There are, in the United States, some 600 newspapers that maintain radio departments. In addition to this there are 30 or more weekly, bi-monthly or monthly periodicals devoted entirely to this most popular of sciences. [5/31/23]

According to a recent census by the department of agriculture, there are more than 145,000 radio sets on the farms of the United States. [2/22/24]

Department of Commerce radio bulletin shows 95 broadcasting stations connected with educational institutions in the United States. Besides, 46 newspaper or other publishers have broadcasting stations and 20 churches are mentioned in the list. [3/19/24]

The radio epidemic is spreading through other countries almost as fast as here. Buenos Aires, for instance, reports 9,000 radio receiving sets in use, including nearly every known type. [3/28/24]

Radio apparatus exported to other countries amounted in value last year to $3,448,132, an increase of more than 20 per cent over the exports of 1922. Most of it went to Argentina, Quebec, Ontario, Australia, Panama, Mexico and England. [4/2/24]

Radio manufacturing in the United States

Apropos of the so-called tube shortage, manufacturers of vacuum tubes say demands for these products are so great that they are often unable to keep the market properly supplied. It is estimated that more than 300,000 tubes are produced each month. [3/8/23]

Manufacturers say the average cost of a radio set is $75. [3/12/23]

The General Electric Co. is coming out with a new amplifying tube, which is said to be far superior to any of their present products. The tube is efficient as a detector, but it works much better as an amplifier. The elements are much larger than in previous tubes. The vacuum is the "hardest" possible, having been obtained by a new process, which leaves the tube with a brilliant silver colored metallic coating. [3/14/23]

Radio jobbers and dealers in every state, estimated to number more than 30,000, are being canvassed by the National Radio Chamber of Commerce to ascertain the situation nationally regarding the vacuum tube supply. The survey it is stated, will require several weeks. Responses to the questionnaire are coming in from all sections of the country, but the results will not be publicly disclosed until the complete returns are in.

For many months there have been complaints that a shortage of the tube supply exists, and there has been much discussion of the effect of monopoly on the one hand and of competitive conditions on the other to the public and the industry as radio enters upon what promises to be an era of wide and rapid expansion.

The National Radio Chamber of Commerce undertook the survey as a result of action by its board of governors, which, in turn, acted at the request of the Chamber's membership and of other elements in the radio industry. The inquiry affects practically the entire tube supply including the popular WD 11.

The alleged shortage is described in some quarters as creating an "insistent situation" which requires clearing through a painstaking ascertainment of the facts by an impartial agency, which embraces all interests from manufacturer to listener.

The tube supply, it is stated, is but one factor in a general radio situation which must be dealt with as a whole and in which the interests of the public, of the government in peace and war, and of the industry, representing a large and growing investment of capital and

labor, must be safeguarded. International aspects of radio, it is pointed out, must be considered in relation to domestic policy.

Radio problems, in addition to the tube supply, confronting the National Radio Chamber of Commerce include broadcasting and the copyright controversy. The Chamber, it was stated will call a conference of all groups for the purpose of devising a plan which will reconcile these differences. [5/5/23]

Five years ago, two men, just out of college started a little radio plant in rooms over a doughnut factory in Cambridge. Their work, as one commentator would have it, "was done amid the fumes of fried cakes." The rent for their entire "factory" was $18 a month. Now these young transformer engineers and their products are nationally known, and their business is a million dollars a year.

This, according to Pearce W. Mack of Acme, is the real romance of radio. "Two years ago," says Mr. Mack, "there probably were not 15 manufacturers of radio apparatus in the United States. Today there are literally thousands, with an annual business totaling millions of dollars. The new industry has grown so rapidly that the old-timers in it are still young. Their careers are characteristic of its development. [10/7/23]

Mr. Mack also cites the case of William Murdock, whose telephone receivers are known of everywhere in radio. Twenty years ago Murdock had a little workshop in the rear of his home in Charlestown. He moved to Chelsea where he started the manufacture of telephone receivers for use with small telephone sets. His success in this line was at best mediocre. When the radio boom came, he was making radio headsets, and the public was soon bidding for his product. Today his plant covers acres of ground. [10/7/23]

Another example is that of a New York lawyer named as a receiver of a small phonograph distributing company, which had gone on the rocks. He saw the opportunity in radio and started a small retail store. He had less than $3,000 capital, and didn't know a variocoupler from an amplifying transformer. When a customer came in and asked for a transformer he had to look in the catalogue of the jobber from whom he bought his stock, find the picture of the article and then look on his shelves until he found the container with the same picture. Today he operates 12 stores and before January first will have 30. His monthly business is a quarter of a million. [10/7/23]

Harold J. Power, Vice-president and general manager of AMRAD, has issued an interesting statement apropos of the pending suit between the A.T.&T. Co. and the independents. Power, it will be remembered, is one of the earliest of radio broadcasters. He says: "The adjudication of the broadcasting suit will benefit the radio public and trade as it will clarify the extremely involved patent situation. If the result favors the American Telephone & Telegraph Company I believe we can safely trust that company because of its basic policy of giving maximum service to the public [and] to do nothing to jeopardize[s] their splendid standing in public opinion. Even if it is found they have a legal right to monopolize that phase of radio I am sure they will issue licenses for a nominal fee so that independent broadcast stations will be able to operate. In any event there will be no backsliding in broadcasting but a continual advance in quality of service for the listeners-in." [3/18/24]

Radio apparatus sold in 1924 may amount in value to $300,000,000, according to Roger W. Babson, economist. One manufacturer of insulating material alone expects to sell $4,000,000 worth of panels, knobs and dials this

year. [3/19/24]

Radio doctors have sprung up—amateurs offering to put up, repair and improve receiving sets [3/20/24]

A radio phonograph in popular style is promised by the combination of the Radio Corporation of America and the makers of the Brunswick phonograph. [4/28/24]

Radio manufacturers have entered a protest against the plan to tax radio instruments. The proposed tax, arranged by the Senate Finance committee, would bring in an additional revenue of $10,000,000 from this industry. [4/28/24]

Radio in other Countries

Canada has 1800 licensed amateur radio transmitting stations and 50 licensed broadcasting and commercial stations. There are 17,000 licensed amateur transmitters in the United States. [3/12/23]

In Germany Radio fans, most of whom are bankers and business men have to pay 500,000 marks annually for their radio broadcast service. A financial and commercial news service has been arranged for broadcasting by the Express Service Company of Berlin. This private company financed by Germans, has just secured partial use of the Koenigswusterhausen radio station from the government for broadcasting international news received via Nauen from the United States, Switzerland, Sweden and other countries. The news is re-broadcast over a radio phone circuit for about 800 subscribers, principally banks and industrial institutions, in about 200 cities. The company plans to handle New York quotations within 10 minutes after their dispatch from this country. Subscribers rent their receiving sets from the Express Company, paying an annual rental charge of 200,000 marks, and an annual service charge of 200,000 marks. Two and a half hour schedules are maintained every morning and evening. [4/30/23]

Several Japanese private concerns are now permitted to broadcast government reports, speeches, and music by radio, the government having relaxed it rigid policy. Only a few financially sound companies in Tokyo and Osaka, and perhaps one or two other large cities, will be licensed. A broadcasting tax is required by the government. The companies charge subscribers a fee for the service rendered, which the government collects, returning a percentage to the broadcasters. Individual users of broadcasting and receiving sets are not permitted to communicate with each other. [5/2/23]

Fans in this country who feel they are not being accorded proper treatment in the matter of broadcast listening should view the case of the German citizen. Until the middle of October the German government regarded broadcasting with such suspicion that it was prohibited for amusement proposes, and the public were not permitted to have receivers.

But even with the change in attitude, the lot of the German radio fan is harder than that of the Yankee enthusiast. Now no one is permitted to have a wireless receiving set who doesn't pay a sizeable fee and obtain a permit from the police. Only certain approved types will be given the police permit. [12/21/23]

Lowest priced receiving sets in Japan cost about $25 or $30. [2/20/24]

Great Britain has 580,000 broadcast listeners compared with only 30,000 a year ago. Three-fourths of the receiving set in Great Britain are of the crystal type.[3/20/24]

Largest radio station in Canada is said to be CKCH of the Canadian National Railways, at Ottawa. [3/20/24]

The most powerful radio station is not in the United States, according to latest information. It is said to be the 2400-kilowatt transmitting station in the Malabar Mountains, Java. [3/31/

24]

Turkey has not yet started popular radio, although a German firm has applied for a concession to operate a low-power broadcasting station at Constantinople. Sale of radio receiving sets is expected to boom if this is granted. [5/17/24]

Inhabitants of Italy are permitted to buy radio receiving sets. But it is practically impossible to obtain government sanction to use them. The famous Lombardy society is centering its efforts to obtain this approval. [5/17/24]

Musings—Bill Halligan

Scientists say that radio signals come in loudest at the point farthest from the station sending the message. [3/12/23]

Hiram Percy Maxim is responsible for the statement that 15,000 cycles per second is all that is necessary to separate two broadcasting stations. We hadn't figured it out, but it sounds reasonable. Incidentally, the band over which amateur transmitters are to be distributed is approximately 655,000 cycles per second. (It isn't stylish to talk in wavelengths any more, we're informed). [4/3/23]

The contention of Steinmetz, the electrical wizard, that radio installations properly made were a protection rather than a source of danger from lightning, was amply borne out when lightning entered the AMRAD station, WGI, not long ago. Investigation showed that it was attracted by the electric light wires which it completely demolished. However, the 320-foot steel antenna tower used in connection with the broadcasting apparatus was not touched. [8/1/23]

An interesting difference in the speed of radio and sound waves was brought out by Prof. A. E. Kennelly of Harvard in connection with the broadcast from WTAT, of a speech of Charles L. Edgar, president of the Edison Light Co. Professor Kennelly was listening to President Edgar's remarks and caught them on his receiving set as they were being re-broadcast by KDKA, the Westinghouse station at East Pittsburg. He had friends in his Cambridge home who were enjoying the talk by listening to the loud speaker. They commented on how clearly they could hear Pittsburg, and remarks were made about the speed with which the voice traveled. Professor Kennelly's curiosity was aroused and he did a little figuring which quickly showed that if Mr. Edgar's talk was heard in the Hawaiian Islands, as it is believed it was, the people there were hearing it more quickly than his guests sitting 20 feet away from the receiving set and listening in at the loud speaker. [12/28/23]

Did you know that the first trans-Atlantic radio broadcast took place in 1907?

Neither did we, until recently we had the pleasure of listening to a lecture by Prof. Reginald A. Fessenden, who, in the opinion of most American scientists, did more for the advancement of radio than any other living man, including Marconi.

Professor Fessenden told in his lecture of the trial which beset the paths of the early experimenters in wireless telegraphy. Prof. Fessenden is one of the very few scientists who were experimenting with wave transmission as early as 1890, and in view of his many contributions to science, he is able to speak with unquestioned authority.

Dr. Fleming, the British scientist, who is credited with many of the big things in radio, was one the leaders of the group which scoffed at the theories and contentions of Prof. Fessenden. Among the things claimed by Fessenden and which was derided by Marconi, Fleming and others, was the theory, now known to be true, that radio currents are high-frequency currents and not a "whip crack," as the others had claimed. Fessenden also

declared it was possible to construct a high frequency alternator to propagate these waves, and for this he was mocked. Today the trans-Atlantic stations maintained by the Radio Corporation all use such high frequency machines, most of them designed by Dr. Alexanderson, a pupil of Prof. Fessenden.

To return to the first long distance radio-phone reception, Prof. Fessenden had erected two experimental stations, one at Plymouth, Mass., and the other at Brant Rock, a little more than five miles away. In preparation for some code tests he was planning, a receiving station had been erected in Scotland. Communication between the Plymouth and Brant Rock stations was carried on by wireless telephone, which had been perfected by Prof. Fessenden. One night one of the engineers at the Brant Rock station was giving instructions to an operator at the Plymouth station by radiophone. It happened that the operator at the station in Scotland was listening on the wavelength being used by Brant Rock. He heard the voice, identified it as that of the Brant Rock engineer, copied most of what was said and mailed a report to Prof. Fessenden for verification. From that time on, one-way communication, at least, was a certainty. [4/7/24]

Emerging need for an international Language

One of the leading lights in WGI's program for tomorrow night is the lecture of O. C. Roos, AMRAD engineer. Mr. Roos will tell New England radio fans more about I.L., the new international language (I.L.) by which he hopes to link the radio fans and eventually citizens of the whole world.

Roos who is a member of the Institute of Radio engineers has been prominently identified with radio for many years. Just at present he is one of the leaders in the United States in the study of I.L. He is conducting classes at the Mass. Radio and Telegraphy school and at the Eastern Radio Institute. [12/18/23]

O.C. Roos, AMRAD engineer, who will broadcast a lecture on the new international radio language, I. L., has received several interesting letters in the language recently from I. L. students in different sections of Europe. One of the letters received from Berlin, asks for the solution of some knotty radio problems. This, Roos claims, is the first letter in the history of the language in which technical questions are asked entirely in I. L. [12/17/23]

In "Waves" for Wednesday, we quoted O.C. Roos, consulting engineer for AMRAD, as stating that a letter from Germany about radio matters in I. L. was the first in the history of the international Radio language to be written entirely in The language. Mr. Roos says that this is an error, as he has had dozens of purely technical letters during the last two years in I. L. The language, Mr. Roos says, is more than 16 years old. The letter referred to was the first of its kind received from Berlin. [12/22/23]

I. L., the international radio language, appears to be going over in great style. Radio men who have worked, or who hope to work European stations, are enthusiastically taking up the language. [2/12/24]

[Editor's note: Part 2 continues in the September 2003 issue of ER]

ER

[...CX continued from page 3]
ANY RIG in the contest, although new gear is a distinct scoring disadvantage.

You can still work the "great ones" with modern equipment.

WHEN - WHERE - WHAT

The AMI Discovery Weekend begins Friday evening September 26, and ends Sunday evening September 28, 2003.

The traditional CX will run from 1700 UTC September 28th to 0500 UTC September 29th (1 PM Eastern Time on Sunday to 1 AM Eastern Time Monday)

CW: Send "CQ CX"

PHONE: Call "CQ Classic Exchange"

SUGGESTED FREQUENCIES

CW: 1.810, 3.545, 7.045, 14.045, 21.135, and 28.180 Mc.

AM: 1.890, 3.880, 7.290, 14.280, 21.380, and 29.000 Mc.

SSB: 3870-3875, 7280-7285, 14270-14275, 21370-21375, and 28490-28495Mc.

During the QSO, exchange your name, RST, QTH (US state, province for Canada, country for DX), receiver and transmitter type (homebrew: send final amp tube or transistor type), AMI number if available (AM only) and other interesting conversation.

The same station may be worked with different equipment combinations on each band and in each mode.

Non-participating stations may be worked for credit.

SCORING

Calculate your score for each mode (CW, AM, SSB) and total those scores for your overall CX score. Individual mode score formula:

Multiply total number of QSO's (all bands) by the sum of the number of different types of receivers plus the number of different transmitters you worked (transceivers count both as a transmitter and a receiver) plus the number states/provinces/countries worked on each band.

Multiply that product by your CX multiplier, which is the total number of years old of all the receivers and transmitters used.

Each receiver or transmitter must be used in a minimum of three QSO's to be counted in the multiplier.

If the equipment is homebrew, count it as a minimum of 25 years old, unless the actual construction date or date of its construction article (as in the case of a "reproduction") is the older date.

Total QSO's all bands times RCVRs + XMTRs+ states/provinces/countries (Total each band and mode separately; add totals together) times CX Multiplier:

TOTAL SCORE = QSO's x (RX +TX+QTH's) x CX Multiplier

Certificates and appropriate memorabilia are awarded every now and then for the highest score, the longest DX, most exotic equipment, best excuses and other unusual achievements.

Send logs, comments, anecdotes, pictures, etc. to J.D. "Mac" MacAulay, WQ8U, at WQ8U@ARRL.NET or by mail to: WQ8U, 6235 Wooden Shoe Lane, Centerville, OH 45459.

The CX Newsletter and announcement of next CX will be posted at http://qsl.asti.com/CX and distributed via e-mail to those submitting reports via e-mail. If submitting report via regular mail, please note if you want a paper copy of the CX newsletter.

[Editor's note: I plan to operate both events this year and I have always learned a lot, met a lot of great operators, and had fun. I'll be using my recently completed homebrew receiver. During the CX, you get to hear and work a lot of equipment that just isn't on the air regularly anymore. Also, don't forget to look for new states during the AMI Discovery event, as the new Electric Radio WAS-AM award is now available.]

ER

The Mysterious TU-60

by Sam Kelly W6JTT
skellycp@aol.com

At a meeting of the Military Radio Collectors Group (MRCG) in San Luis Obispo, California, I was fortunate to meet August J. Link. He invited me to drop by and visit his collection in Carlsbad, California. Expecting the usual modest assembly of common equipment, I was overwhelmed by the material in his collection, its condition and his outstanding display.

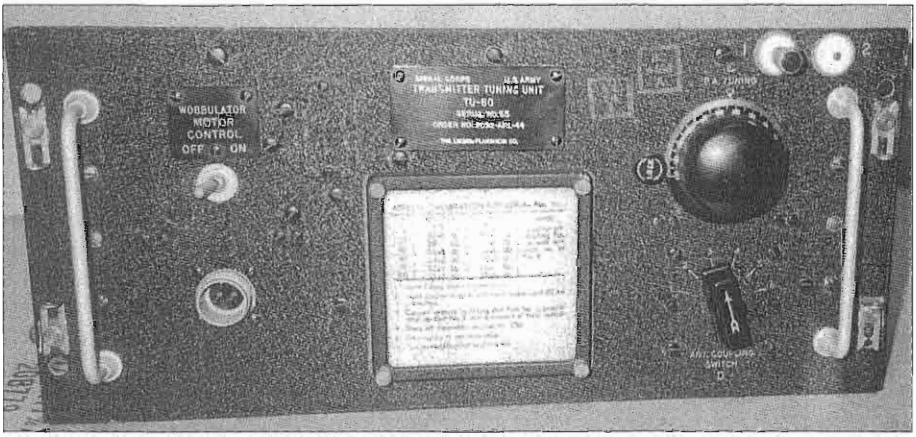
Link portrays himself as a "radio archivist" and preservationist, as contrasted to historians and people like myself, who are mainly interested in getting the old sets up and running.

The best words that describe his collection are impeccable quality, organization, and extensive documentation. The collection includes pre-World War I National Electric Supply Co. sets built for the U.S. Navy, brand-new German Luftwaffe fighter aircraft sets designed for export, and mint condition Imperial Japanese equipment.

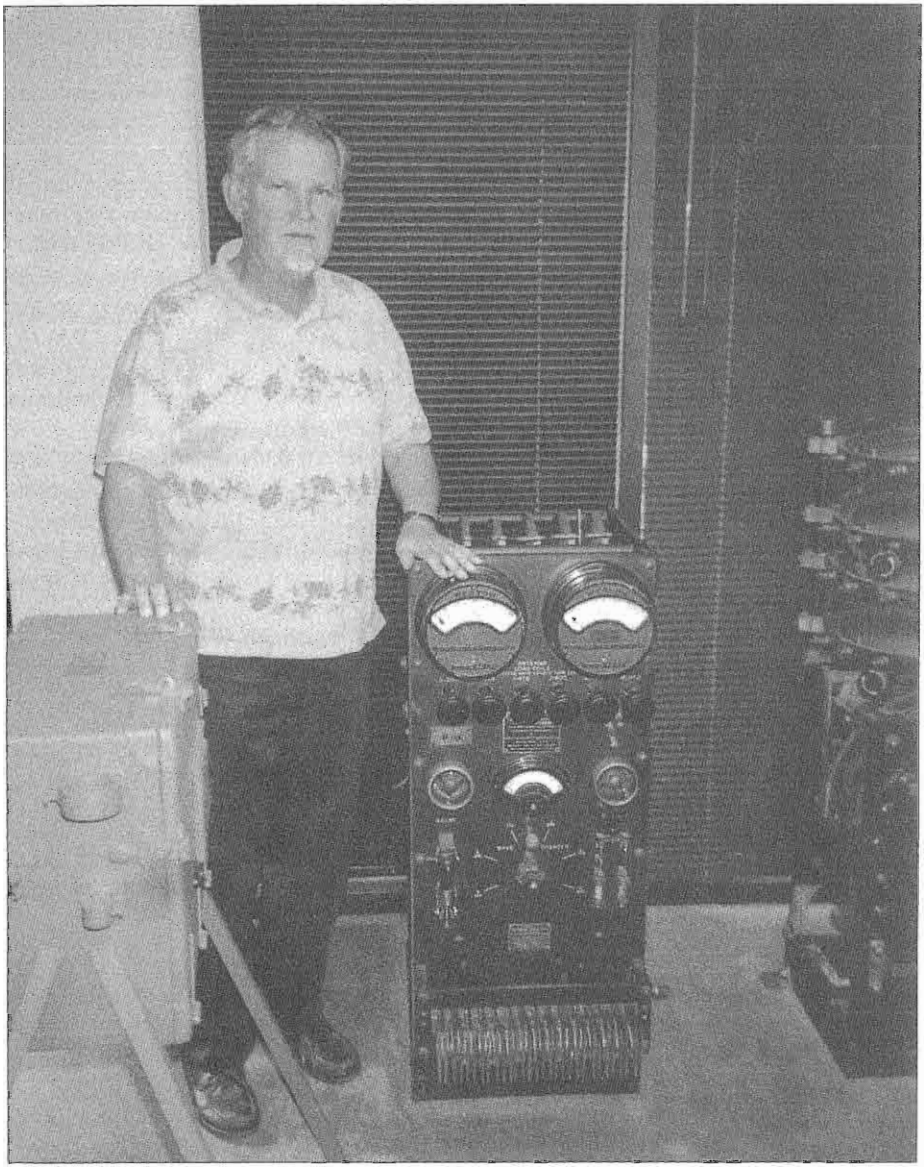
Browsing through his storage area he pointed out a very unusual BC-375 transmitter and associated tuning unit. The transmitter was quite ordinary with the usual tube makeup of a 10-Y and four VT-4/211 tubes. What made it unique was the plug-in tuning drawer.

The original BC-191, the forerunner of the BC-375 (and the 12 volt version used by the U.S. Army), entered service about 1935. Link has an original manual of that date for the BC-191-AA. By the time World War II came around the design was incredibly dated, but it still became the standard Army Air Corps large-aircraft liaison set until the AN/ART-13 came on line in 1943. The life expectancy of the BC-191/BC-375 sets was quite long. I used them in Korea in the 1950's and have seen photos of them in use in Vietnam.

The VT-4C/211 was pushing the limit



At first glance, this looks like any other BC-375 tuning unit. Closer examination reveals the differences, which include the front-panel antenna terminals.



August Link, the self-styled "radioarchivest" is standing to the right of his very rare U.S. Navy CR-1126 quenched-gap, 500 watt transmitter. This transmitter, built about 1918, is complete and is in excellent condition and could probably be operated, providing it were legal to do so! Other items in Link's collection are visible in this room.

to operate efficiently at the upper limit of the BC-375, 12 MHz, although some hams successfully used the set on 20 meters after WW-II.

The tuning unit TU-60, S/N 65, is radically different than other tuning units. Liebel Flarsheim manufactured it. The nomenclature plate doesn't contain any more information such as a date or contract number, which adds to the mystery. There is a calibration chart that simply states that the tuning range is from 15.3 to 21 MHz.

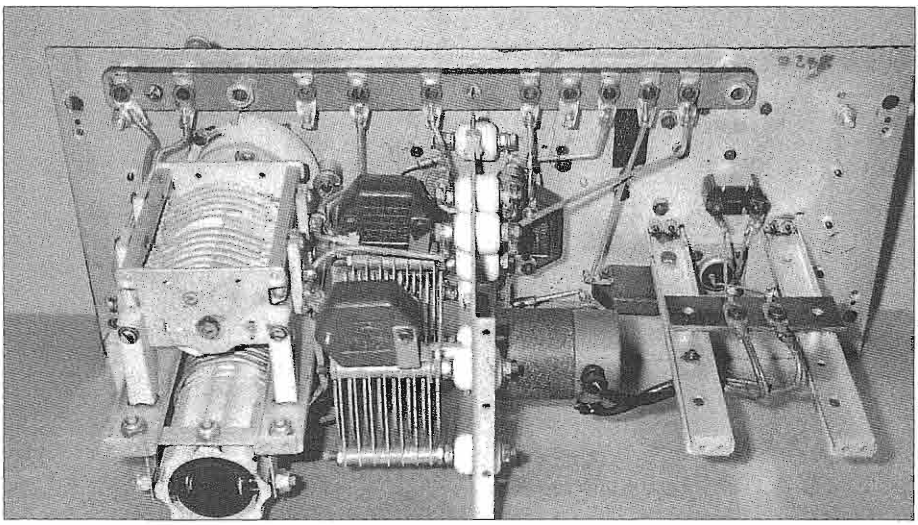
The unit is obviously a jammer. There is a motor driven butterfly capacitor that replaces the normal VFO tuning capacitor assembly. In fact, the interior appears to have been modified from a standard TU-10 (10-12.5 MHz).

A connector on the front panel is used to provide 24 VDC for the motor that tunes the butterfly capacitor.

The question is what was the war, and who was the adversary? Airborne AM jamming by the U.S. was used in World War II, most notably against German armor during the Battle of the Bulge. The German armored fighting vehicles used AM sets, which typically operated above 21 MHz. This seems to fit into the cold war era as Soviet tactical AM operated in this region. I would be interested in any comments or information you might have on this unit.

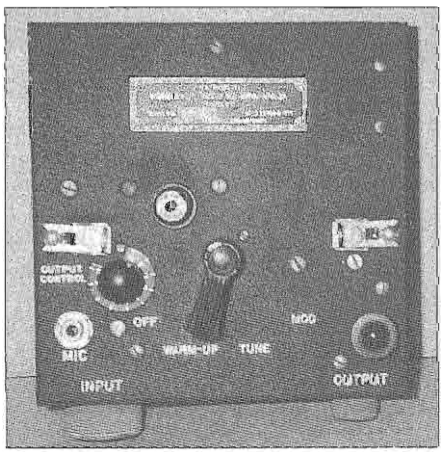
August Link has a number of other jammers. One that immediately caught my eye was the MD-188A/ARA-3A, which is a spot jammer designed to use the AN/ART-13 series of transmitters as the RF source.

August Link's collection is on display at his company, Surcom Associates in Carlsbad, just north of San Diego. Appointments are recommended and can be made by contacting August at 619-438-4420.



This interior view of the TU-10 shows not only some of the usual BC-375 parts, but also unusual parts such as the motor-driven capacitor assembly near the center that provides sweep-tuning of the master oscillator over the range of 15.3 to 21 MHz.

The special TU-10 tuning unit is installed in August Link's museum-quality BC-375-E transmitter, which itself is inside a glass-enclosed display case. To the left is the proper dynamotor and other accessories, which are also in new condition.



To the left is another rare jamming device in the August Link collection. This one is an MD-188A/ARA-3A, and was designed as a spot jammer for use with the famous AN/ART-13 aircraft transmitter. The ART-13 acted as the source of RF for this unit. A similar unit is the MD-23/ARA-3, which was used with the BC-375 series of transmitter. Except for the ART-13 and BC-375, there are few surviving examples of any of this equipment.

ER

The Multi-Band Tank Circuit- Another Balanced to Unbalanced Antenna Tuner

by Frank Van Zant, KOØR
Fvanzant@yahoo.com

An Old Circuit With A New Twist

In the December 2001 issue of Electric Radio, this author presented an argument that encouraged the Amateur community to return to the tried and proven doublet antenna fed with balanced open wire feedline. Such a feedline can be homebrewed, and with appropriate spreader insulators, is nearly lossless even under the high SWR conditions encountered in multi-band operation. A number of advantages were discussed including the fact that:

1. Within certain limits, the length of the dipole needn't be critical for installation on a normal city lot, even for operation as low as 160 meters.

2. With appropriate fixed or plug-in coils and capacitors, the antenna could be operated on any frequency between 160 and 10 meters.

3. The circuit illustrated in that article provided harmonic suppression, which the ubiquitous T-tuner would not do. The T-tuner is a high pass filter!

In this month's article, a different antenna tuner circuit concept will be presented. It is the old multi-band tank circuit which enjoyed some use back in the forties and early fifties. The National Radio Company manufactured it, and they offered the multi-band tank circuit as a capacitor/coil assembly that could be used by amateurs in the driver or final stages of their amplifiers (See Figure 1). Different sizes were offered in both balanced and unbalanced configurations according to the power level required. Use of this assembly eliminated the need for a bandswitch. This circuit was later modified and adapted to antenna tuner operation by the Harvey-Wells Company, which they introduced in 1954. Harvey-Wells called it the Z-Match.[1]

Figure 2 illustrates an inside view of the Harvey-Wells Z-Match.

Figure 3 illustrates a home brew version of the standard Z-match. An aircraft mechanic who riveted everything made it.

Figure 4 illustrates yet another homebrew version of the Z-match with some rather significant modifications that provide an extended range of matching. It is to be emphasized at this point that the major advantage of the Z-match circuit is that no bandswitch is required, at least for the 80 through 10-meter range of operation.

Figure 5 is a circuit diagram with notes covering the basic multi-band tank circuit with one major modification from the original: the addition of a dual differential tuning capacitor (C1a/C1b). The differential capacitor provides additional impedance transformation at the input. With a judicious choice of parallel and series capacitance and inductance values (C2a, L1 and C2b, L2 respectively), a range of 3.5 to 30 MHz can be tuned with one rotation of the main tuning dial; however, vernier dials should be used for smoothest tuning. Output from this tuner can be either routed through C3 to an unbalanced load or through a suitable balun for a balanced load. If baluns are used, they should be the large, heavy-duty powdered iron types

Modern Radio Components

by National EST. 1914

National radio components have been standardized in radio circuits for many years. They have been voted the favorite brand by thousands of amateurs and the National NC signature has become a guarantee of quality.

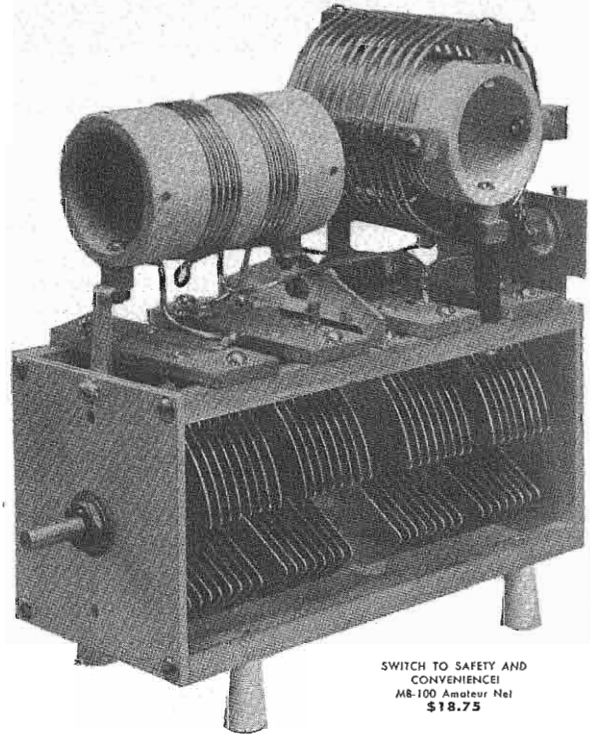
Listed in these few pages are typical National products. National's 1948 complete catalog of radio products, available in 1947, will feature new items, designed for present-day applications. In addition, hundreds of components will be listed and recognized as repeat performers by the designer or builder of radio equipment.

Get your copy of the new National catalog from distributor or write direct to factory.

NEW NATIONAL MULTI-BAND TANK

FEATURES

- Tunes amateur bands from 80 to 10 meters with single 180° rotation of capacitor from front-of-panel.
- Link pick-up coil matches impedances up to 600 ohms.
- Split-stator capacitor rated at 1500 volts peak.
- Input 100 watts for push-pull or balanced single-ended operation.
- Dimensions 7½" long — 7" high — 3" wide.
- Rugged construction with ceramic insulation.



SWITCH TO SAFETY AND CONVENIENCE!
MB-100 Amateur Net
$18.75

Figure 1: An advertisment from late 1947 introduced the National Multi-Band Tank to radio builders. The units were produced in several versions depending on the input power level required, and today are highly sought after by builders.

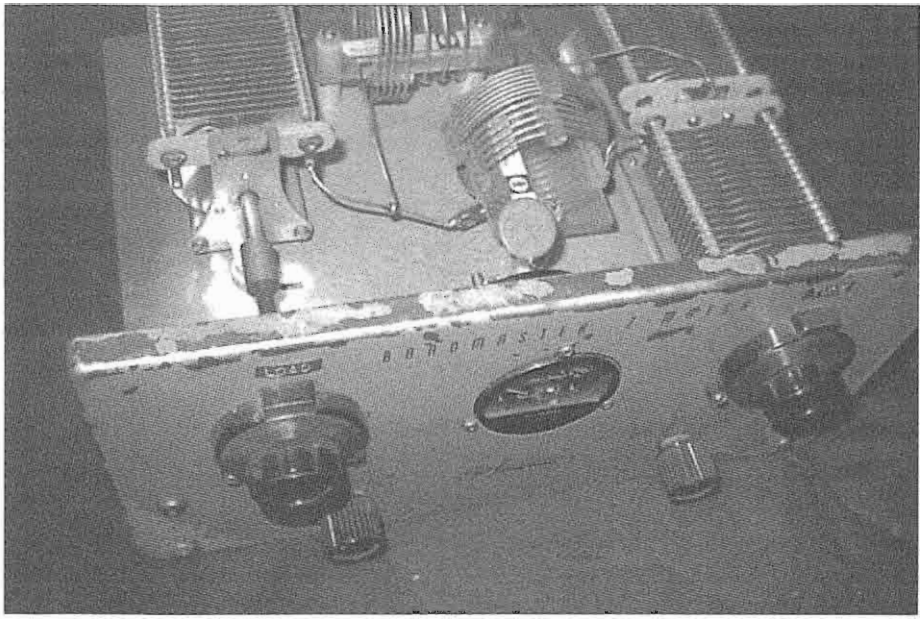


Figure 2: This is an internal view of the classic Harvey-Wells Bandmaster Z-Match. The differences and similarities to the National Multi-Band Tank are discussed in the text.

as shown in the photo of Figure 4.

Alternately, links can be wound over the two coils, L1 and L2, to provide balanced outputs for the low and high range of frequencies respectively. Harvey-Wells did just that. Link coupling to the feedline is the preferred method, since there are losses in the balun cores due to saturation when high power levels or high SWR's are encountered. The link on L1 will probably be the one most often used for coverage of 75 and 40 meters. If you extend the L1 coil for additional coverage of 160 Meters (using the Fair Radio heavy duty 6-position ceramic switch), then the link should be wound with more turns. The addition of an extension to L1 to cover 160 is illustrated in the photo of Figure 4.

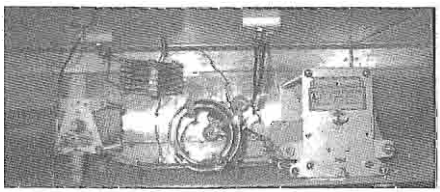


Figure 3: Here's an aircraft mechanic's homebrew version of the National Multi-Band Tank circuit.

Unbalanced coax output can be accommodated with the links by merely grounding one side of the link and the other side going to the coax center conductor (the coax shield also goes to ground). I made the differential capacitor (C1a/C1b) by disassembling a large dual stator transmitting capacitor and reassembling the rotor portion into the differential configuration, i.e., rotors of one section opposed 180 degrees to the rotors of the other section.

Theory Of Operation

Back in the golden age of homebrew, the 1950's and 60's, there were a number of articles in Ham literature dealing with the multi-band tank circuit. Some of the better ones appeared in QST [2,3]. The referenced articles provide considerable detail covering the elec-

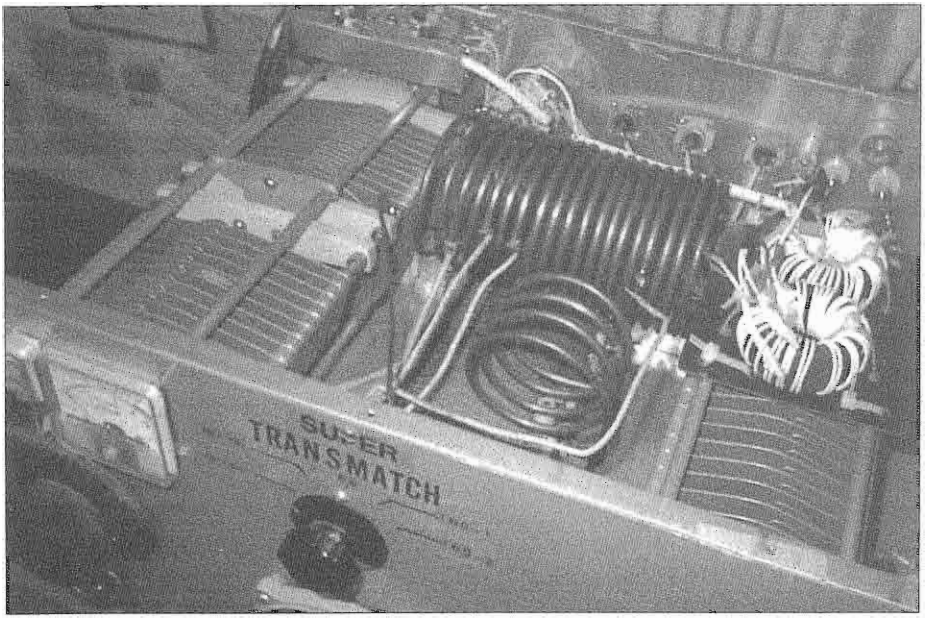
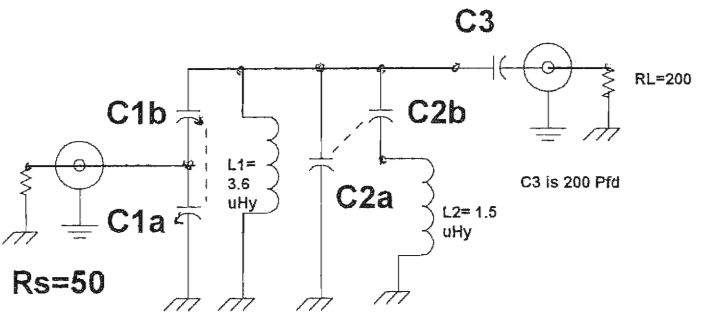


Figure 4: Here's another homebrew version, with significant modifications that are used to extend the tuning range.

trical interactions of the circuit parameters. A brief synopsis will be provided here.

With the proper choice of values for the inductors and capacitors, a range of 3.5 to 30 MHz can be covered. The L1-C2a parallel combination covers from approximately 10 MHz down to 3.5 MHz while rotating the main dial (C2a, C2b) from 0 (minimum capacity) to 180 degrees (maximum capacity) of rotation. During this same rotation, the series combination of L2-C2b tunes from approximately 30 MHz down to about 11 MHz. When a link coupled output is used, link 1 (over L1-C2a) tunes the 80 or 40-meter balanced feedline and antenna. Link 2 (over L2-C2b) tunes the 14 through 30 MHz balanced

Fig. 5 MULTIBAND TANK MATCHING CIRCUIT



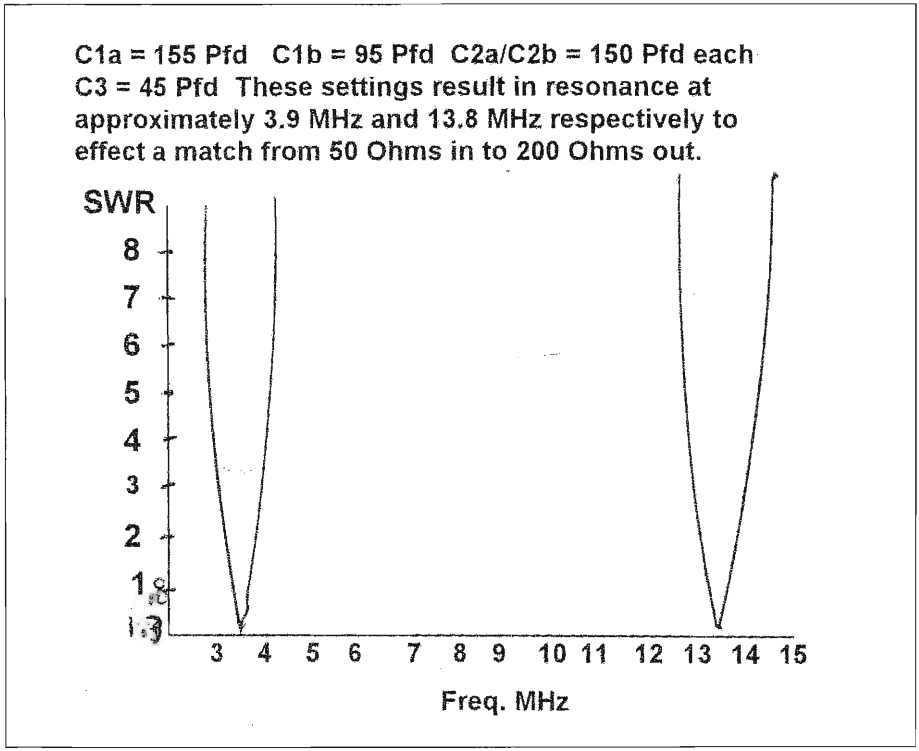


Figure 6: The results of the network in the homebrew multiband tank are shown in this plot of SWR vs. frequency.

feedline and antenna.

The input differential capacitor is a method of impedance transformation. It converts the 50-ohm output of the transmitter to a higher impedance value found at the top of the L1-C2a and L2-C2b network. It is equivalent to the autotransformer action of tapping into the low impedance end of an inductor near the ground terminal, with the top end of the inductor being the high impedance point. The tap point on the coil determines the impedance transformation ratio. The ratio of the difference between C1A and C1B determines the transformation achieved in the circuit of Fig. 5. A more detailed explanation of inductive or capacitive impedance transformation can be found in chapter two of the ARRL Handbook under the title, "Coupled Resonators".

The Q of the multi-band tank network obviously varies at different frequencies with their widely varying LC ratios. In practical terms, this does not adversely affect the operation of the circuit when used as a feedline/antenna matching device. The multiband tank circuit has been used as a medium power output tank circuit in RF amplifiers without undue heating or inefficiency [4].

Results

There was a great deal of enthusiasm for the multi-band tank circuit antenna tuner back in the fifties. Editorial comments about the May, 1955 Z-Match article stated; "This comes close to being the ultimate in multiband antenna couplers, from the standpoint of convenience and ease of operation. Using a multiband tank in an ingenious cir-

cuit arrangement, it offers switchless 3.5 to 30 MHz operation plus quick and certain adjustment to optimum coupling by means of a built-in bridge." As advertised, the original version would cover a matching impedance range of 10 to 2500 ohms at power levels of 250 to 300 watts (coils wound with #16 wire). The version with the differential capacitor input will cover an even wider range of matching.

The "Notes 4 Circuit Analysis" program by Etron RF Enterprises, Inc. was used to perform a wideband analysis of the Figure 4 configuration with the circuit values set for a low band resonance in the 75-meter amateur band. The impedance match was for 50 ohms input to a resistive 200 ohms impedance load. The setting for 75-meter resonance also resulted in a high band resonance (L2-C2b) below the 20-meter band. A plot of SWR is presented in Figure 6 along with the circuit values used to achieve the match. By changing the circuit values (rotating the knobs), resonance and matching can be accomplished on any band except for 10 MHz, and 10 MHz could be accomplished with an increase in the value of L2; however, this would sacrifice some coverage at the high end of 10 meters.

The home-brew multiband tank antenna tuner, shown in Figures 4 and 5, has been in use in one form or another at the author's location for over 40 years. Currently, we alternate it with the balanced antenna tuner described in the December, 2001 (ER #151) issue of Electric Radio. Despite the addition of the Fair Radio heavy-duty ceramic bandswitch to extend the range of the L1 inductor to cover 160 meters, the MB tank tuner has the edge in convenience, easy setup, and tuning. With the components illustrated (¼ inch copper tubing and wide spaced transmitting capacitors) there have been no problem with heating, arcing or other breakdowns at maximum legal power limits.

References:

1. The "Z-Match" Antenna Coupler, by Allen W. King, W1CJL, Project Engineer, Harvey Wells Electronics, Inc., QST May, 1955.

2. The Multiband Antenna Coupler, by George L. Thompson, W2JJI, QST, August, 1953.

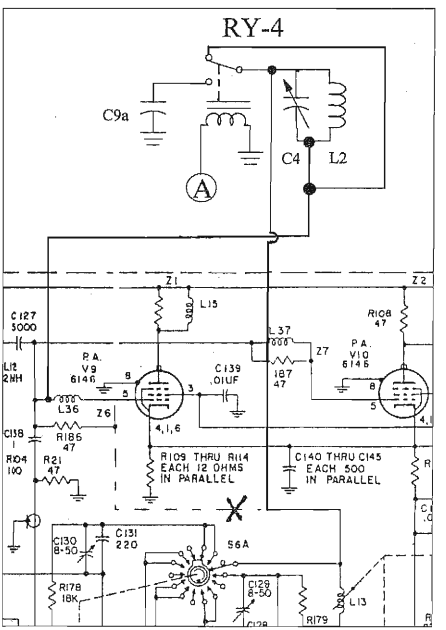
3. Single-Ended Multiband Tuners, by C. Vernon Chambers, W1JEQ, QST, July, 1954.

4. Multiband Tuning for the 6146 Amplifier, by Don Mix, W1TS, QST, May, 1953.

ER

Schematic update for the 160 Meter Collins KWM-2

Here is an updated schematic for "Using the Collins KWM-2 on 160 Meters" from July, 2003 Electric Radio. This schematic replaces "RY-4" on page 34 of issue 170.



Improving Modulation Acceptance

by Brian Beezley, K6STI
bb@n2.net

Modulation acceptance is the amplitude-modulation percentage a receiver's detector can handle without distortion. An ordinary diode detector can handle upward modulation well beyond 100%. But detector circuits with capacitive loads have limited ability to faithfully reproduce downward modulation. At some point they clip the waveform instead of continuing toward zero.

Figure 1 shows the output of a diode detector for a 100% amplitude-modulated sine wave. The trace appears inverted because the detector circuit is arranged to generate a negative output voltage for AVC. Zero volts, corresponding to no carrier, is at the top of the screen. The modulation acceptance of this detector is about 88%.

Clipping distortion on sine waves is easily audible. In fact, you can hear it just before you can see it on a scope. But casual tests suggest that clipping distortion on speech and music isn't objectionable as long as the modulation acceptance is greater than about 80%. Figure 2 shows an AM-broadcast signal demodulated and clipped by the detector of Figure 1. While the distortion in Figure 1 is obvious, it's not at all

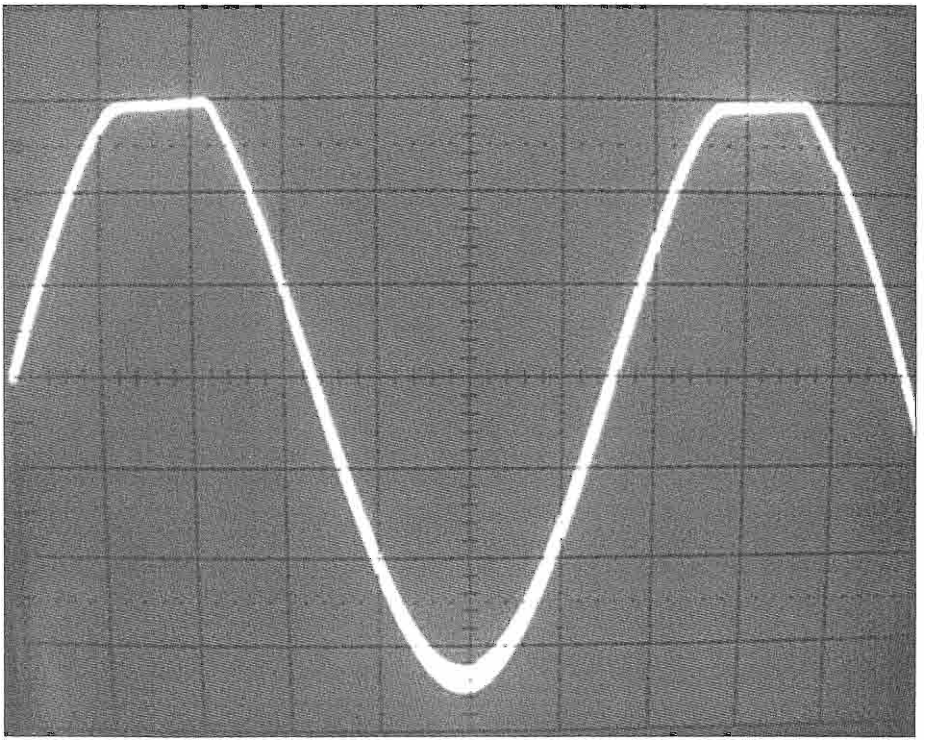


Figure 1: A 100% AM sine wave demodulated by a detector with 88% modulation acceptance.

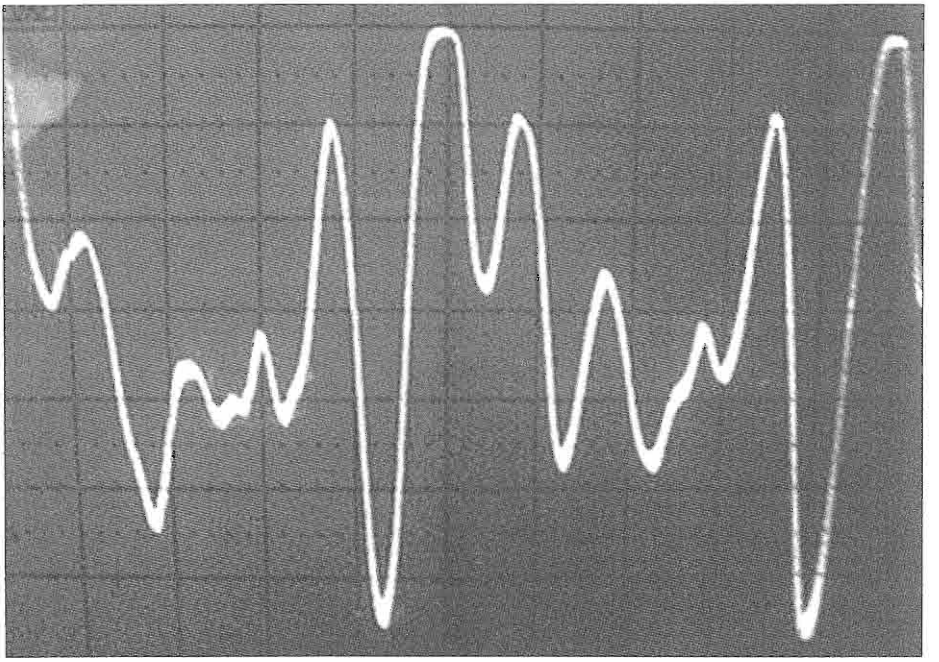


Figure 2: A Broadcast signal demodulated by the detector of figure 1.

clear whether the waveform in Figure 2 is distorted. In this case the ear responded like the eye. I was listening to the receiver when I took the photo and I heard nothing amiss.

Modulation acceptance somewhere in the low-80% range is typical of consumer radios from the 1930s and 1940s. But the communications receivers I've tested have been much worse, typically distorting at 60% downward modulation or less. Distortion at such shallow modulation depths is nearly always audible. The audio tends to lose its crispness and clarity, and in severe cases sounds downright grungy. I always modify any receiver I restore for a modulation acceptance of at least 90%; typically they approach 100%.

Measuring Modulation Acceptance

To test your receiver's modulation acceptance, you need a signal generator with variable amplitude modulation. If the modulation percentage isn't calibrated, you can measure it by observing the waveform on a scope. Modulate the signal with a 400-Hz tone and increase the modulation percentage until you can just hear distortion in your receiver (the character of the tone will change). You can also use a scope to look for distortion at the detector load (R2 in Figure 3). The percentage AM at the onset of distortion is your receiver's modulation acceptance.

Causes of Low Modulation Acceptance

Figure 3 shows a typical detector circuit of a communications receiver. Diode D1 conducts whenever the voltage across it is positive. When the top terminal of IF transformer T1 goes positive with respect to the lower terminal, D1 clamps the terminal near ground. The lower terminal then charges C1 negatively to the waveform peak. C1 partially discharges while the IF waveform reverses sign. R1 and C2 filter out the IF component, leaving a DC level corresponding to the carrier and audio corresponding to the envelope modu-

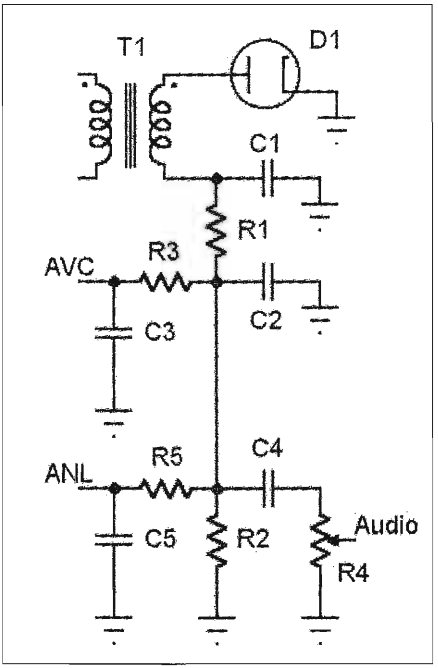


Figure 3: A typical detector circuit

lation across detector load R2.

The primary cause of low modulation acceptance is back-biasing of D1 due to capacitive loading. The AVC capacitor, the volume control coupling capacitor, and any ANL capacitor are the culprits. Focus on the AVC capacitor alone to see how the damage is done.

AVC capacitor C3 charges to the level of the carrier, and the voltage on it divides back through R3 to R2. R1 and C2 are absent in some receivers, and it simplifies analysis to assume that R1, typically 47k ohms, is zero. In this case the DC voltage on R2 appears at the lower terminal of T1. Now assume that R3 is 2.2 megohms, R2 is 470k ohms, and the detected carrier level is -6 volts. Under these conditions a DC bias of about -1 volt appears at the lower terminal of T1 due to C3, since R2 / (R2 + R3) is about 1/6. When the signal drops to about one-sixth of its unmodulated level at 83% downward modulation, it generates +1 volt across T1. Added to the -1 volt at the lower terminal, this yields 0 volts at D1. D1 stops conducting. It becomes back-biased and remains nonconducting for deeper downward modulation. R2 just sits at the -1 volt bias level. This creates a flat spot in the detected waveform. The detector has clipped and distorted the demodulated audio.

If you swap R4 and C4, which leaves their current unchanged, you can see that the volume control and its coupling capacitor develop back-bias in the same way. An ANL circuit typically connects an additional filter, represented here by R5 and C5, to the detector load. This is yet another source of back-bias for D1. In each case the value of the offending capacitor matters little. These RC circuits are designed to pass or filter most of the audio spectrum, so the capacitors develop little AC voltage across them. You can think of them as little batteries. What matters is the ratio of the detector load R2 to the parallel combination of resistors that connect to these capacitors. Voltage division by this resistive divider is what causes the back-bias on D1. You can increase modulation acceptance by reducing the resistor ratio.

The analysis above ignores the IF passband shape, IF source impedance, and the rectification efficiency of real diodes. These effects may actually increase modulation acceptance by lowering the effective modulation depth of the signal at the detector. However, these effects typically are swamped by detector back-bias in practical circuits. See the detection section of Frederick Terman's "Radio Engineers' Handbook" for more.

Increasing Modulation Acceptance

The easiest way I've found to improve modulation acceptance is to reduce the detector load resistance R2. Surprisingly, dropping the value by as much as a factor of four causes few

problems. It does lower the load impedance presented to the last IF stage, and this may alter its passband shape. But I've never found this to be a problem. Often the audio level will drop by a dB or two, but I find this a small price to pay for cleaner audio. Usually I wind up cutting the detector load roughly in half. (Lower audio may be caused by excessive IF ripple on C1. Check the waveform on C1 using a low-capacitance X10 scope probe. If you increase C1 until the peak-to-peak IF ripple is less than 20%, the audio level should be within 1 dB of the maximum possible. Making C1 too large will reduce the treble response.)

AVC resistor R3 typically is 2.2 megohms. I've increased its value to 4.7 megohms without problem. If you try this, it's a good idea to check for leakage current in the AVC circuit, particularly when several tubes are controlled. Any leakage current develops an offset voltage across R3; doubling R3 doubles the offset. Increasing R3 will lengthen the AVC time constant, but I've found that the AM time constant is way too short in most receivers, so this normally is not a problem. You can decrease C3 to compensate if you want.

Some communications receivers (and most consumer radios) replace R2 with the volume control R4, typically 500k ohms. C4 then connects the wiper to a grid resistor, typically 10 megohms. Because this AC-coupled load has much higher resistance than the volume control, this circuit configuration can greatly improve modulation acceptance. This technique applies DC from the detected carrier to the volume control. If it's dirty, rotation can generate scratchy audio noise. Make sure the volume control is clean if you try this circuit.

R5 typically is 1 megohm. This resistor, along with another 1-megohm resistor often used in series-ANL circuits and not shown in Figure 3, can be major contributors to poor modulation acceptance. There is a way to eliminate the R5-C5 network and any additional resistor, and use the AVC capacitor for the ANL function. Not only does this modification improve modulation acceptance, it makes ANL so transparent that you can leave it permanently engaged. It also automatically implements fast-attack AVC, which helps when you modify your AVC system to minimize selective-fading distortion. I'll cover ANL next month and AVC thereafter. For the moment, if you find your receiver's modulation acceptance unacceptable after applying the other tricks mentioned here, I recommend that you disconnect C5 and temporarily forgo ANL.

An alternative way to improve modulation acceptance is to use a separate diode for detecting AVC and ANL, leaving the existing diode for audio detection only. The second diode in a 6SQ7, for example, is often unused (or tied in parallel with the first diode). If you couple the anode of D1 to the anode of a second diode through 100 pF or so, you can connect the AVC and ANL resistors to the new diode, along with a second load resistor. D1 is then DC-isolated from the AVC and ANL capacitors, and only the volume control coupling capacitor can degrade modulation acceptance. I've tried this method and it works, but it always seems like more trouble than simply changing existing resistor values. Because of the high-level IF signal at D1, you must take care any time you modify its wiring. Unwanted coupling can result in IF feedback that may alter the gain and frequency response of the IF strip, or even cause it to oscillate. (In a future article I'll describe a simple way to neutralize a high-gain IF strip.)

ER

A Shortwave Radio Primer or Shortwave 101, Part 1

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The Basics

Do thoughts of shortwave radio make you think of dark, stormy nights in Eastern Europe with members of the French Underground trying to make contact with their American counterparts using a small radio disguised in the lining of a small suitcase? Do you picture a British reporter clad in a soggy trench coat with microphone in hand, getting 'the-man-on-the-street' reactions to local events while Big Ben solemnly chimes in the background?

Welcome the always varied and interesting world of shortwave radio. And, thankfully, your mental images are not that far off the mark. Small shortwave transmitters and receivers where used throughout the allied campaign during WW II to relay information from underground or resistance forces back to their American or British contacts in England. And the BBC (British Broadcasting Corporation) was one of the first communication organizations that recognized the need for establishing a worldwide shortwave radio network. And, the chimes of Big Ben are still occasionally played during station announcements.

What exactly is shortwave? Shortwave was the name given to a range of radio frequencies that were higher frequency, or shorter in wave length, than the AM frequencies being used in the United States, that demonstrated better skip characteristics and could travel great distances. Shortwave radio is truly an international medium and countries that wanted to broadcast over greater distances quickly established shortwave formats. Shortwave stations sprout from nearly country on the world map and most of the radios available to consumers outside of the US, usually offer reception on one or two of the shortwave bands. When the Freeplay Company first started producing the self-powered, windup radios in Africa, the design rightfully included those shortwave frequencies heard in the local area. Shortwave receivers allow listeners (SWL's) to literally tune in the world on a daily basis.

The international shortwave frequencies are grouped into designated bands and, like the amateur bands, are usually referred to as "meter bands". These bands generally include the following frequencies:

13 Meters	21.45 - 21.25 MHz
16 Meters	17.70 - 17.90 MHz
19 Meters	15.10 - 15.45 MHz
25 Meters	11.70 - 11.98 MHz
31 Meters	9.20 - 9.70 MHz
41 Meters	7.10 - 7.30MHz
49 Meters	5.95 - 6.20 MHz

The shortwave bands also include two longwave bands, called "the tropicals," that are utilized by local low powered stations in Central and South America, and parts of Africa and Asia. So if you picture a small transmitting station surrounded by palm or coconut trees with an overhead circulating fan turning in a small hut with the feed lines stung out back, try tuning in the tropicals for an unexpected treat. However, you should be prepared to exercise your foreign language skills because most of these low pow-

ered stations are broadcasting to the local audience in their native language and aren't concerned about beaming their signal in your direction. DX is the name of the game. Frequencies between 60 M and 120 M are the bands. And, look for stations to follow local time zones.

60 Meters 4.75 - 5.06 MHz

120 Meters 2.30 - 2.50 MHz

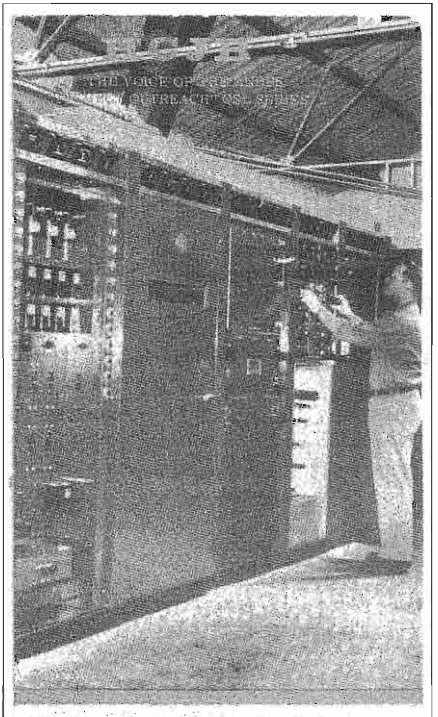
The Programs: What You'll Hear and When You'll Hear Them

Modern shortwave programs are international in flavor and are nearly as varied as the countries themselves. Were else but on shortwave radio are going to hear the reason why men in Lithuania don't wear hats during the frigid winters? Well, the reason is pride and I recently discovered this while listening a cultural program on Radio Vilnius, in Lithuania.

First of all, shortwave operates on the 24-hour clock based on GMT or UTC (Coordinated Universal Time). Add five hours to your local time on the 24-hour clock if you're on East coast standard time. Extrapolate for your own time zone and you're home free. Add only four hours for day light savings time. Since I'm writing this article in the frozen Michigan winter, my references to time from here on out will assume Eastern Standard Time.

Speaking of time, there are at least two stations that constantly report the correct time in UTC. WWV is the main timekeeper for the USA and is based in Fort Collins, Colorado. This station has the frequency multiples of 5 all tied up. Broadcasting around the clock, so to speak, the steady beat of time can be heard on 2.5, 5, 10, 15, 20 and 25 MHz. In fact, tuning in WWV is a great way to start your listening night and get your UTC clock properly set. WWV uses different power settings for different frequencies. 15 MHz seems to be the most prevalent in my location. WWV also broadcasts weather alerts at 8, 9, and 11 minutes after each hour, Geo alerts at 18 minutes after each hour and station ID's at 1 and 31 minutes after each hour. Get a good fix on WWV and you just might hear another time station, faintly, in the background just before WWV makes their time announcement. That's the sister station in Hawaii, WWVH. They stopped broadcasting on 20 and 25 MHz back in 1977. Radio station CHU is the time broadcast king in Canada, covering the time announcements in both French and English. Catch CHU on 3.330,7.335, and 14.670 MHz.

If you live on the East coast, the European countries should come in loud and clear. On the West coast you'll easily pick up the Asian and South Pacific broadcasters. Those of us in the central part of the country have to work a little harder for everything. There are always the exceptions, of course. What you hear will depend on the time of day when you're listening, propagation conditions, the type of antenna and radio combination you're using, and the intended target area of the station. For example, on a clear night last summer, Radio Egypt came in like a bell on my $30 portable while sitting on my front porch. One rule of thumb that usually applies when searching for any station, your best reception conditions



Phase #6 - RCA 100 Kilowatt Transmitter

One by one these electronic giants were put into operation during 1967 and 1968 with each one adding 100 kilowatts to HCJB's combined output power. When the fourth transmitter goes on the air, our combined power will be about 570,000 watts, enabling us to Herald Christ Jesus' Blessings with increased effectiveness.

One of the 100 kw transmitters at Radio HCJB

will generally exist when both the listener and the broadcaster are in the dark or in twilight conditions.

While it's prime time for the hometown TV crowd, modern English language programmers also realize the potential of the capturing the American listener and usually begin their English language programming at 8 PM or 0100 UTC (0000 UTC during daylight sayings time). Programs usually start at the top of the hour and begin with a station announcement, broadcast times and frequencies, and a brief summary of the intended program content. Many nightly programs start with international and local news. Then you'll most likely catch domestic musical programs, interviews, programs about the local country, and a mailbag or DX program featuring letters from listeners around the globe.

A few stations precede their scheduled broadcast with a brief, repeating, musical interlude. Radio Australia uses strains from Waltzing Matilda, Radio Netherlands and Deutsche Welle use tunes taken from local folk melodies. And the pacific powerhouses of Radio Japan and Radio China offer oriental musical passages. Listen for these features about three to five minutes from the scheduled broadcast time and you'll soon be able to identify a station by hearing the musical interlude. At the end of the broadcast hour, you'll hear a repeat of the broadcast times and frequencies and usually instructions on how to contact the station.

Most of the global powerhouse stations continue to offer programming around the clock and carry programs in many different languages. Having a published frequency guide is your best resource. Keep in mind that shortwave shares the same propagation peculiarities as amateur radio and is affected by the eleven-year sunspot cycle. 49 and 31 Meters lead the nighttime activities while 25, 19, and 16 Meters are more active in the day light hours. And shortwave signals exhibit a characteristic 'fading in and fading out' as the signals skip around the globe and dance through the poles. I won't delve any deeper in this topic since entire textbooks have been written on the subject of wave propagation. Frequency guides from the stations and shortwave compendiums offer the best information of what you'll hear at various times, so dig in!

Resources

I'm going to jump into the modern age feet first and list a web-based resource that I've recently discovered:

For basic radio frequency and schedule information, try Glen Houser's "World of Radio": www.worldofradio.com.

Part of what keeps the shortwave spectrum exciting is the fact that many stations have their own programs about the hobby, the listeners, and what's going on in the world of shortwave including information on DX. Most stations usually honor e-mail requests for station information and schedules. I've included some of my long time favorites:

DX Partyline from Ecuador's HCJB is a dynamic program geared towards the DX audience. HCJB's English language programming can regularly heard in North America on 9745 kHz at 0100 UTC. For a schedule go to: http://hcjb.org/english

Radio New Zealand's excellent *Mailbox* program is heard every other week at 0305 UTC on 17675 kHz. Consult the program guide found at: http://www.mzL.com

Radio Netherlands' *Media Network* can be found at: http://www.rnw.nl.media

There are two modern-day publications worth mentioning that are essential and excellent references to what's happening in the world of shortwave radio. *Monitoring Times* is the monthly publication from Grove Enterprises that covers scanning of emergency and utility frequencies and shortwave radio topics. The regular meat and potatoes section of interest to the SWL is the *Global Forum,* which includes general information on global shortwave stations, recent QSL's and broadcast logs from regular listeners. The all-important *MT Shortwave Guide* shows the English language broadcast times, frequencies, and selected programs for the worldwide shortwave stations. Other monthly features usually include equipment reviews, antenna topics, and a recently added column titled *Radio Restorations* that focuses on vintage equipment. *Monitoring Times* also offers the unique service of providing past issues on CD-ROM or receipt of the magazine through an Internet based subscription service. For subscription information, go to www.groveent.com. Or, contact them at: Monitoring Times, 7540 Hwy. 64 W., Brasstown, NC. 28902. As an added benefit, this web site will also link you to Grove Enterprises, which sells shortwave receivers, antennas, and also offers a bargain bin of used equipment.

The other most useful resource is the annual publication dedicated exclusively to shortwave radio titled *Passport To World Band Radio. Passport* contains an exclusive section on how to get started in the hobby, well researched product tests on currently available or soon to be marketed shortwave radios and antennas, and a very detailed section on broadcast times, frequencies and stations by country. Station addresses, websites and contact information are also listed for each country...the 'must have' information for requesting QSL's from your most recently logged stations. My copy of *Passport* is usually well dog-eared after about six months. Information on this publication can be found at www.passband.com. Or, contact *Passport* directly at: IBS North America, Box 300, Penn's Park, PA. 18943.

Clubs and Organizations?

There are several that are regularly mentioned in *Passport* or *MT.* One example is the North American Shortwave Association, P.O. Box 989, Altoona, Pa. 16603. They publish a monthly newsletter and sponsor annual DX expeditions.

Shortwave Radios - Portable, Vintage or Modern? The Choice is Yours

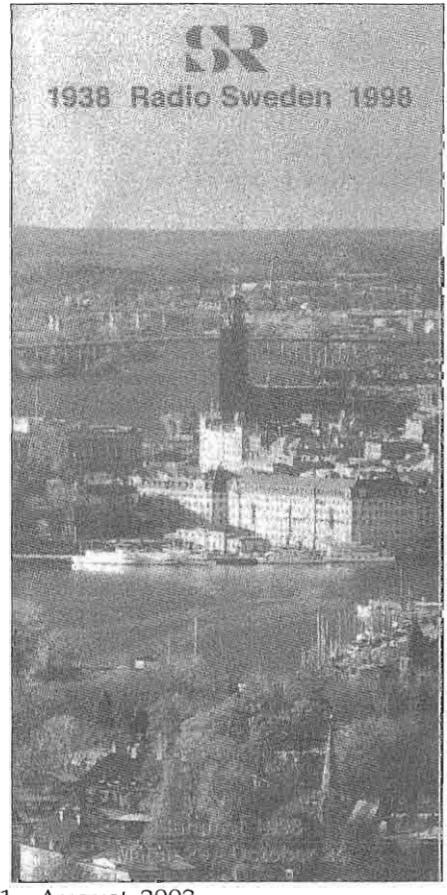
The recent increased popularity in

shortwave listening is due mainly to the availability of portable shortwave receivers and their modest price. Radios produced by Sony, Grundig, and Sangean, to name a few of the popular brands, offer AM/FM reception and also include many of the popular shortwave bands. While the smallest of these offerings will have minimal features and tinny sounding speakers, move up to the larger portables with the optional portable antennas and you approach the sophistication of the best table top shortwave receivers.

As with most other technical commodities, when looking for a portable shortwave receiver you essentially get what you pay for and quality counts. I highly recommend staying with the reputable manufactures and those retailers that offer reasonable return policies.

Portable receivers offer true 'portability' and are well suited for traveling. I'm going to mention a few cautions about taking your portable radio along when traveling. Always pack your radio in your carry-on luggage and be prepared to operate the receiver for the security personnel if asked. If the guards happen to raise questions about the radio (these instances are more prevalent when traveling overseas) I usually mention that it's a hobby. I always have the latest shortwave frequency guide packed with my favorite stations identified or highlighted. I also always try to pack an extra set of fresh batteries. Few foreign hotels offer the proper current converters and having several converters in your personal baggage gets a little cumbersome after a few trips. Batteries are also cheaper and are usually available in the hotel gift shop if you don't happen to pack a spare set. But, the benefits of being able to get the daily news, in English, from reliable sources, certainly outweighs the slight burden of packing a quality portable shortwave receiver in your carry-on luggage. And, listening to a shortwave broadcast from the balcony of your tenth floor hotel room, over looking Sao Paulo in the evening, is quite an experience to savor.

Looking for a vintage shortwave receiver to add to your shack? Older communication receivers covering shortwave usually offered continuous coverage from around 540 kHz to 30 MHz. At Hamfests, vintage shortwave receivers are sometimes relegated to the lowly task of holding down aging copies of *QST* or *Popular Electronics.* Boatanchor receivers, once considered as the pace setters of the industry, are fortunately still alive and well and play a major role in the hobby for the fix-it, antique,



or vintage radio crowd. Older radios may not provide all the sophisticated features of the modern, solid state, generation of receivers, but nonetheless, offer an enviable ambience to the shortwave radio hobby.

Receivers from the "Three H's", Hammarlund, Hallicrafters, and Heath, all produced stable, well respected, shortwave receivers from the 40's to the 60's that can still bring the world to your listening doorstep. Vintage receivers from Collins, Drake, National, Lafayette, and Heathkit also fall into this category. Top of the line receivers from these companies offered several advances in circuitry such as dual or triple conversion, crystal controlled filters, BFO, S-Meters for indicated signal strength, and bandspread tuning. Few experiences beat the sensuous drift of a Strauss Waltz broadcast by Deutsch Welle playing through vintage circuitry.

My trusty Hallicrafters S-120 produced back in 1964 has served me well for over 35 years with only general maintenance and cleaning. Hallicrafters produced the S-120 as a mid level receiver that offered continuous coverage from the AM broadcast band up to about 30 MHz. On a very clear and cold night this past winter I was able to log the English language programs from the following international stations using the S-120 with an attic mounted multi-band antenna: Radio Netherlands, Radio China, the BBC, the Voice of America (VOA), The Voice of the Andes (HCJB) in Quito Ecuador, Deutsche Welle in Germany, and Radio Canada broadcasting in French. Granted, some of these stations are considered 'power house' stations in the world of shortwave, but the thrill of using a 40-year-old receiver to bring them in is still hard to beat. As a kid, I spent many a night cruising the shortwave bands while camped out in front of my S-120. With the lights turned out and a wire antenna strung out my bedroom window, many hours crept by while Mom and Dad thought I was fast asleep. Radio dreams.

The Hallicrafters S-120 is an excellent example of one of the vintage receivers that still provides excellent shortwave performance. The Knight Star Roamer and Lafayette HA-230 and HA-700 also fall in this category. These receivers offer single conversion, superhet simplicity, and bandspread and BFO capabilities.

Your search for a vintage shortwave receiver will be greatly simplified if you use the proper road map. I suggest using Raymond S. Moore's excellent guidebook, *Communication Receivers for the Vacuum Tube Era:* 1932-1981. Pack this under your arm when hitting the Hamfest or your favorite radio haunt and you're sure to grab a winner. Look for receivers that offer continuous coverage from the AM broadcast band up to 30 MHz and you'll have the shortwave bands covered.

Radios being offered today offer previously unknown levels of affordability and portability. Modern receivers such as the Drake R-8 series or the Grundig Satellite 800 are a breed apart from their earlier brethren, offering notch filtering, synchronous detection, digital signal procession, key pad frequency entering, memory presets, and the inherent stability of solid state circuitry. Cruise the shortwave section of your favorite ham goodies catalog and you'll find the top choices from today's manufacturers.

ER

Radio's Golden Age-
Episode 25, Part 1

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Two Longs and a Short-Part One

As cold waters to a thirsty soul,
so is good news from a far country.
The Bible—Proverbs

When I arrived upon this small celestial body called Earth, the odor as you traveled roads in my area smelled more of horse droppings than of exhaust fumes. The yard of our small Baptist church on Sunday mornings was usually well filled. Horses, and horse-drawn vehicles, were more plentiful than motorcars.

I was about three years old when the first radio appeared in the neighborhood. However, the telephone was something I took for granted-just as my children do television. It is so easy to forget that at the beginning of the twentieth Century, things we consider a necessity today, had not yet been invented. Some like the telephone-while invented some years before-was just beginning to emerge as a convenience of the average American.

The thought occurred to me that a short history of how the telephone came to my small world in Northwest Arkansas might be of interest. The story of my area is the story of rural America-and that was most of America prior to the First World War.

Let's take a look at how the telephone came into our small community.

****

The Reverend Withrow took a white handkerchief from the pocket of his wrinkled pants. He stepped back from the pulpit, mopped his glistening brow dry, and then placed the wet handkerchief beside his worn bible. Damp areas under each armpit and down the back of his white shirt—clean and starched when he left home four hours ago—served as a visual indicator of the temperature of the small church house. Sunday morning services, particularly those in August, were more unpleasant for the minister than for his congregation. As the poorly paid servant of God raised his eyes from his worn bible and directed his gaze toward the small gathering, he gave silent thanks that he was nearing the end of this Sunday's service.

"There will be a special 'speaking telephone' meeting here next Thursday night. Everyone interested in discussing the advantages—and disadvantages—of this new device should attend. A gentleman from Springdale will be present to talk about the costs involved, and answer any questions concerning the instrument and its use in the home. I understand a number of business firms, as well as individual households in that City has been using telephonic communication since the early part of this century. Certainly the telephone has been in use long enough for those involved to evaluate the usefulness of Mr. Bell's invention"

"I would also like to remind you of our services tonight, and our regular

Wednesday night prayer meeting. Recently, attendance for our evening service has been rather disappointing. Please make an effort to attend this week-your presence is most important.

Reverend Withrow closed his meeting with a prayer, much shorter than usual because of the heat. He implored the Lord to extend His mercy to this suffering flock, to lift this terrible drought from their tired shoulders, and to bless northwest Arkansas with a genuine gully washing, toad strangling, rain.

The dismissed congregation rushed outside, in search of a breath of cool air—finding little relief, they gathered in small groups under the tall oak trees. Small groups stood here and there in animated discussions of Mr. Bell's 'talking telephone,' or 'harmonic telegraph' as it was sometimes called, and it's possible usefulness to the community.

Of course the above church service is pure fiction, based on stories told me by my grandparents. However, in the years between 1900 and 1920, you may be sure such meetings were taking place allover this country—our area included. Practically every village was eager to take advantage of this newly introduced marvel. Families in rural areas were often some distance from their nearest neighbor. Before 1915, there were few newspapers, no radios, and most people did not own an automobile—though many were considering the possibility of purchasing one of Mr. Ford's Model T's. Advantages gained when a rural neighborhood installed private phone systems were obvious. The phone was useful to summons help in an emergency, keep neighbors up to date on all the latest news, (gossip), and provide needed communication between friends, neighbors, and business associates.

Then, as now, there were always some individuals violently opposed to any new idea. Some thought the electricity carried in the telephone receiver was a health hazard. There were tales of 'electrical sickness' caused by telephones. Electricity was a new science-unfamiliar to almost everyone. Strange as this may sound, in the early 50's when TV was new to our city, one prominent doctor here in town, diagnosed a number of children's complaints as sickness brought on by radiation from their TV receiver.

As might be expected, a number of people came to the 'speaking telephone' meeting carrying their bibles. They were quick to quote scripture, and verse, condemning the telephone as an instrument of the Devil.

Some were troubled by reports of 'ghost voices' coming over the wires in the dead of night. It seemed the voices were usually accompanied by shrill cries and shrieks of pain. Such sounds were really no mystery at all. They were the result of simple electrical phenomena. My Great Grandmother was one of those who were violently opposed to any 'new-fangled' idea or device.

Matilda Hartley Kelley (1856-1934) Spring Valley, Arkansas resident:

"I'll tell you here and now, no good will come of all this new fangled idea. I told Mack when he put in that telephone that it was a lot of foolishness-all the men-folks runnin ' wires all over the country. The good Lord never meant for man to talk all over. There's enough trouble in the world as is."

"But Ma," I asked, "What about your Edison Graphophone sittin' over there in the corner?"

"Don't get smart with me young man, I bought that so I could play some good gospel music," answered my grandmother.

"I'd rather listen to "The Preacher and the Bear," and "The Two Black Crows," I replied.

"Those sinful old records came with that thing when I bought it," answered "Ma." "I'm gonna' take them out behind the house and throw 'em in the

trash where they belong."

Ma continued... "That telephone is another thing that I want out of my house. There is no good in those things. Downright evil. Last month- the day before Van Winkle's house burned to the ground, it rang twice. Both times I went to the phone, and all you could hear on it was cracklin' and poppin '- just like a fire a-burnin '. It was a sign I tell you. It still sends chills up my back."

"But, Ma, that phone ain't worked for six months. One of the poles is down and the wires are just out there layin' on the ground."

"You think you are awfully smart," replied Ma. "Someday you'll learn to listen. I know a sign when I hear one."

"I wish you'd told the Van Winkles, about your sign," I said "They might still have a house to live in"

"Young smart-alec," said my grandmother. "If you was my young 'un I'd wear your britches out with a good hickory switch."

Electrical induction, a property little understood by scientists of the day, was a total mystery to those installing and using rural telephone systems in the early part of this century. Country folk were less bothered by this interference than their city cousins. Streetcars and carbon-arc streetlights were among the worst offenders—often rendering phones in a wide area of a city useless at certain times of the day.

However logical the explanations were for 'ghost voices' a good many people maintained a belief that something weird and supernatural was occurring. I am sure a few pranksters devised ways to reinforce this belief.

At telephone meetings, the bottom line was the same then as it is now—the total cost involved. It was usually determined that if the neighborhood men all pitched in, cutting and installing the necessary poles, stringing the wire, etc., the cost to each household should be affordable—usually between $25.00 and $35.00. Best of all, after their initial investment, there were no monthly telephone bills.

Excessive cost cutting, a common and necessary practice during this time, often resulted in disappointment with the newly installed device. Voices heard over telephones were often weak and sometimes interrupted by squawks, pops, and a sound later to be called 'static.' I am sure this also contributed to more 'ghost voice' stories. Money spent on wire of sufficient size and composition, the use of good insulators where needed, clean, solid electrical connections, and fully charged batteries, would have aided greatly in chasing away the 'ghost voices,' and delivering a loud clear voice over the telephones.

The telephone, like most other inventions, did not meet with immediate public acceptance—many technical problems remained to be solved before it could hope to become a dependable, and practical means of communication. First patented by Alexander Graham Bell on March 7, 1876, the demand for home telephones was not great enough to warrant a single page in the 1902 Sears catalogue. The 1902 catalog did devote 31 pages to guns, several more to gun supplies, and even one page for telegraph sets. The telephone was not mentioned. However, those interested in learning Morse code telegraphy, or perhaps installing a private telegraph system, could buy everything needed, excluding batteries and wire, for only $1.65. The set consisted of a fine brass telegraph key, and a sounder, all mounted on a polished wood base.

By 1922, in their "Electrical Goods and Radio Apparatus" catalogue, Sears Roebuck and Company devoted six pages to telephones and telephone accessories. Five telephones, complete with batteries, were offered for only $87.80, approximately $17.50 per phone. It is interesting to note that the glass insulators used on telephone

poles, the ones that fetch several dollars each in antique stores today, were then sold by the barrel. A barrel weighed 300 pounds, and contained approximately 400 green glass insulators-total cost $24.50. Number 12 telephone wire was sold in 1/2-mile coils for $6.70.

If a community wished to go first class and install a switchboard, Sears would help with the design and sell everything needed for a central exchange. The prices seem exceptionally reasonable today. A 25 capacity switchboard, housed in a beautiful quarter sawed oak desk, was offered for only $121.70—and their largest switchboard with a 100 line capacity was only $142.30. A smaller switchboard with a capacity of five lines was priced at only $40.00. These smaller exchanges were housed in an oak cabinet designed for wall mounting—much like the telephone.

Communities installing local telephone systems faced a number of decisions. If there were only a few subscribers a switchboard, while a convenience, was not an absolute necessity. Telephone systems wherein all phones were connected to a common line was known as a 'party line.'

Perhaps, for the benefit of those born after 1930, we should give a very brief description of the telephones in use during the World War One era.

Commonly used home telephones were housed in a cabinet approximately 30 inches tall, nine inches wide, and seven inches deep. On the front of the cabinet, usually crafted from oak, was a shelf, tilted downward, for writing notes. Above the shelf, an adjustable metal arm held the transmitter. (The thing you talked into) This arm could be adjusted, up or down, to accommodate people of different heights. Above the transmitter were two nickel plated bells. On the left side of the instrument was a 'D' shaped arm that held the telephone receiver. When the receiver was lifted from its support the spring loaded arm closed a circuit, and turned on the 'telephone batteries.' When the receiver was 'hung up,' the circuit was automatically opened so no current flowed from the two 1 1/2 volt batteries inside the case. Thoughtfully, the manufacturers put hinges on the front of the instrument to allow for frequent changing of the 'telephone batteries.'

A crank on the right side of the telephone box was geared to a small dynamo, or electric generator. Turning this crank rang the bell of the operator on the switchboard. In systems not using switchboards, it rang the bells on every telephone in the community.

This is where the title for this episode originated. Each household was assigned a 'ring.' Ideally, those connected to the system would lift up their receiver only when they heard their assigned ring. A ring could be any combination of long and short rings. Lets say you wanted to call the Smiths, and their 'ring' was two longs. The caller would lift the receiver from his phone, grab hold of the dynamo crank, turn it several times and pause, then repeat the procedure. In other words, he rang the bells for a long period—two times. The Jones household might have a 'ring' of a short and a long, etc. Oh yes, there was a chance of someone picking up the phone and listening when the call was for another family on the line. In reality, before the days of radio, this was a primary source of entertainment for many rural families. One quickly learned to not say anything on the phone that was of a private nature.

Most systems reserved one very long ring for emergency calling—like when your house was on fire, or to announce the birth of a new baby, or when uncle Zeke was going to play a tune on his banjo.

Oh yes, local telephone services also served as an entertainment medium. It was common for talented members of the community to play the fiddle, sing, or offer any other musical talent they might possess. In the Spring Valley

area where I grew up, quartets were quite popular on the telephones. Entire families would stand around the phone when some of the better singers were entertaining.

Long Distance telephone calling was available between certain cities—and a few smaller towns, but of course not to these small, independent telephone circuits. It was necessary for the local system to become connected with companies offering long distance service before such calls could be made. This involved quite a lot of technical and administrative work. Once a local telephone system was connected to a 'long distance' service, anyone placing such a call needed a lot of patience, and even more optimism. Often, after waiting an hour or more for an open line, you would find it impossible to understand the voice on the other end. The cost was not modest-a call to another state could very well cost as much as $2.00-more than a day's salary for many.

Technical difficulties were, in many ways, easier to solve than the logistical and administrative problems.

Telephone signals—undulating electric currents carried on wires—become weaker each mile the signal travels. Any conductor has a property known as resistance. Resistance to the flow of the electric current is what makes the signals gradually become weaker with distance traveled. The resistance of copper is much less than that of steel, however copper wire is expensive, heavy, and easily stretched. Consequently, copper telephone wires have a tendency to sag under their own weight, often breaking. Steel is much stronger, and was widely used in small villages or rural areas where the primary use of the telephone was connecting neighbor to neighbor. Signals traveled well enough on steel wires—for relatively short distances. On a good copper wire, signals could travel up to 25 miles. This problem was solved early on—about 1880—with the introduction of hard drawn copper wire. Another wire popular at the time was 'high carbon core' copper.

Michael I. Pupin, in an effort to overcome this bothersome voltage drop, invented a loading coil that could be inserted at intervals on a long stretch of wire. It was helpful, but certainly not the final answer. In the years between 1915 and 1919, the Audion, or vacuum tube amplifier, was used with great success. Repeater stations placed at regular intervals throughout the phone system solved the problem and made transcontinental communications a reality. Repeaters are widely used today —though they are far different from those of the vacuum tube age.

Perhaps the biggest problem for small telephone systems was that those doing the actual installations had little, if any, knowledge of electrical circuits. In circuits carrying very low voltages such as telephone lines, losses must be kept to a minimum if satisfactory results are obtained. A basic understanding of conductors, insulators, and resistance is of prime importance if other than mediocre results is expected.

Most telephone poles cut by the volunteer help were too slender, too short, and not set in the ground deeply enough. Lines sagged dangerously low between these inadequate supports, often touching small trees and bushes growing along the roadside.

Sometimes, in an effort to save work and avoid setting another pole, trees were used to support the lines. While branches and leaves might be cut from the tree at the time of installation, within a few weeks the wires would be surrounded by the normal tree growth. The resistance of green trees and leaves is enough to seriously weaken signal current. Wet weather, ice, and snow compounded this problem. In dry weather dust will sometimes cause static, especially if it contains a high content of some metallic compound such as iron oxide. In northwest Arkansas this did not appear to

be a serious problem.

Lightning damage was a constant problem. A lightning strike, or voltage induced by a lightning strike, anywhere along the line would travel to every telephone connected to the circuit. After a few such hits telephone users made it a common practice to unhook their telephones when storm clouds gathered. This in itself was a problem. A lightning arrestor or a simple knife switch would cost about one dollar. Most users saved that dollar, and simply cut the wire about one foot from where it entered their house. A loop was formed on the end of the incoming wire and the wire entering their house was bent into a hook. To connect a phone to the circuit all the homeowner needed to do was pick up the wire and place the loop over the hook. This was best done with a long stick with a fork on the end. If someone on the line decided to ring up a neighbor while you had a telephone wire in your bare hand the jolt you received would not soon be forgotten. It would be interesting to take a resistance reading across one of those 'hook and loop' connections-especially after the wires had a few months of corrosion on them. It is a miracle that such telephone systems worked at all.

This method of disconnecting a phone line normally resulted in all phones on the party line going 'dead.' Stormy weather was usually accompanied by at least a moderate amount of rain. When the disconnected telephone wire was tossed on the wet ground (a common practice) the circuit was, for all practical purposes, grounded. Even if the wire was hooked over a damp tree limb the voice voltage was lowered considerably.

Even this did not prevent lightning damage. One local storekeeper always unhooked his telephone line whenever an electrical storm appeared likely. During one heavy spring thunderstorm the loose end of the telephone wire, tossed on the ground for safety, was soon covered with a pool of water. Somewhere along the line, lightning hit the 'party line', traveled along the wire to the pool of water, then through the water to John's house, setting it on fire.

When telephone wires were re-connected after our electrical storms the high resistance connections made by the corroded, 'loop and hook' resulted in a poor electrical connection causing intermittent, and noisy, voice communication.

What if the community decided to go first class, and install a switchboard? Well, the problems were increased by a disturbing factor. Each user had to have his own line reaching from his home to the switchboard. Poles had to support a lot more weight and the cost of wire became quite a factor. In addition, a switchboard was worthless unless there was an operator on duty.

Switchboards, therefore, were normally installed in one of the neighborhood homes with family members taking turns manning the switchboard.

At Spring Valley, they first decided to go with a switchboard. The board was installed in Mack Gibson's home with my mother as operator. She was in her early teens at the time and, like most young people that age, did not take her work seriously. When she decided to take an hour or so off for play or rest the switchboard was unattended. If someone kept 'calling in' my great grandmother would walk to the door of the room where the switchboard was installed and in a loud voice yell "Hazel ain't here...she'll be back directly." No amount of explaining could convince her that she must close a switch and then speak in the mouthpiece before anyone could hear.

Spring Valley discarded their switchboard about 1915, and converted their telephone system to a simple party line. This system was abandoned about 1930. Wires broke, poles rotted and fell, and 'the new wore off.' I feel the Model T Ford was a factor. When families

bought a Ford they no longer felt so remote, and if an emergency arose, they could always jump in the car and run for help.

One can only speculate how much more popular and useful the telephone might have been, especially in the beginning, if those responsible for each installation had received some practical training in basic electrical principles.

When telephone companies began connecting villages, towns, and cities together, many local party line systems were discontinued. Lines were upgraded and newer and better equipment made available. People were quick to take advantage of the greatly improved service offered by large telephone companies. Those who chose to do without this new improved service, and monthly telephone bills, had an alternative. It was common practice for the village store and post office to make available their phone for anyone who needed it.

As might be expected, certain areas of the country existed where it was unprofitable for larger phone companies to extend their lines to every member of a community. Even today, I suspect a few rural party line systems still exist, connected to telephone systems offering international long distance—if you can get your neighbor to hang up the phone. Such telephone systems do little to promote feelings of brotherhood, and a belief in the basic goodness of mankind. Many a house has burned to the ground, or a family member denied needed medical care, because a selfish neighbor insisted upon his or her right to use the phone because 'he was here first.'

[Editor's note: Part 2 will be featured in next month's ER]

ER

[...AMI Update from page 1}

ber 26 and end Sunday evening September 28. This event will run concurrently with the Fall 2003 Classic Exchange "CX" (see details elsewhere in this issue). Remember the purpose of this event is to have the rest of the amateur radio community "discover" that AM is alive and well on the amateur bands. New for this year is an encouragement to work as many states as possible. There are more people than ever before working on AM WAS, so this will be an ideal opportunity to get your state count up. To make the event interesting, certificates are awarded for three levels of participation. Level 1 requires 20 or more AM contacts on any band. To qualify for Level 2, Level 1 must be earned and an AM contact must be made on 20 meters, e.g. 14.286 kHz. In addition to Level 1 and Level 2, Level 3 requires one AM contact on a higher band, e.g.15m, 10m, 6m or 2m. "Participant" certificates are awarded to Level 1 achievers. "Participant Plus" certificates are awarded to stations attaining Level 1 and Level 2. The coveted "Participant Primus" is awarded to stations attaining all levels. The number of states you work during the event will be on your certificate as well. You do not need to be a member of AMI to participate. Logs should be sent to AMI, Box 1500, Merrimack, NH 03054. Please log AMI certificate numbers if available. Staff in the AMI operating event log evaluation section appreciates your neat record keeping as well as your totaling contacts for the various achievement levels. If you have lost your AMI number or have questions about the event, e-mail aminternational@earthlink.net or write AMI Headquarters. Impressive 5x7 award certificates, suitable for framing, are sent out to worthy respondents. ER

VINTAGE NETS

Arizona AM Nets: Sat & Sun: 160M 1885 kc at sunrise. 75M 3885 kc at 6 AM MST. 40M 7293 kc 10 AM MST. 6M 50.4 mc Sat 8PM MST. Tuesday: 2M 144.45 7:30 PM MST.

Boatanchors CW Group: QNI "CQ BA or CQ GB" 3546.5, 7050, 7147, 10120, 14050 kc. Check 80M winter nights, 40 summer nights, 20 and 30 meters day. Informal nightly net about 0200-0400Z.

California Early Bird Net: Saturday mornings at 8 AM PST on 3870 kc.

California Vintage SSB Net: Sunday mornings at 8AM PST on 3860 +/-

Colorado Morning Net: An informal group of AM'ers get together on 3875 kc Monday, Wednesday, Friday, Saturday, and Sunday at 7 AM MT.

Canadian Boatanchor Net: Meets daily on 3725 kc (+/-) at 8:00 PM ET. Hosts are AL (VE3AJM) and Ken (VE3MAW)

Collins Collectors Association Nets: Technical/swap sessions meet every Sunday on 14.263 mc at 2000Z. Informal ragchew nets meet Tuesday evening on 3805 kc at 2100 Eastern time, and Thursday on 3875 kc. West Coast 75M net is on 3895 kc 2000 Pacific time. **10M AM net starts 1800Z on 29.05 mc Sundays, QSX 1700Z.**

Collins Collector Association Monthly AM Night: Meets the first Wednesday of each month on 3880 kc starting at 2000 CST, or 0200 UTC. All AM stations are welcome.

Collins Radio Association nets: Mon. & Wed. 0100Z on 3805 kc., also Sat 1700Z on 14.250 mc.

Drake Technical Net: Meets Sundays on 7238 kc, 2000Z. Hosted by John (KB9AT), Jeff (WA8SAJ), and Mark (WBØIQK).

Drake Users Net: This group gets together on 3865 kc, Tuesday nights at 8 PM Eastern Time. Net controls are Gary (KG4D), Don (W8NS), and Dan (WA4SDE)

DX-60 Net: This net meets on 3880 Kc at 0800 AM, Eastern Time on Sundays. Net control is Jim (N8LUV), with alternates. The net is all about entry-level AM rigs like the Heath DX-60.

Eastern AM Swap Net: Thursday evenings on 3885 kc at 7:30 PM Eastern Time. Net is for exchange of AM related equipment only.

Eastcoast Military Net: Check Saturday mornings on 3885 kc +/- QRM. Net control station is W3PWW, Ted. It isn't necessary to check in with military gear, but that is what this net is all about.

Fort Wayne Area 6-Meter AM net: Meets nightly at 7 PM Eastern Time on 50.58 mc. This is another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.

Gray Hair Net: The oldest (or at least one of the oldest at 44+ years) 160 meter AM nets. Net time is Tuesday evening on 1945 kc at 8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn

Hallicrafters Collectors Association Net: Sunday on 14.293 mc, 1730-1845 UTC. Control op varies. Midwest net Sat. 7280 kc 1700Z. Control op Jim (WB8DML). Pacific Northwest net Sunday 7220 kc at 2200Z. Control op Dennis (VE7DH).

K1JCL 6-meter AM repeater: Operates 50.4 mc in, 50.4 mc out. Repeater QTH is Connecticut.

K6HQI Memorial Twenty Meter Net: This flagship 20 meter net on 14.286 mc has been in continuous operation for at least 20 years. It starts at 5:00 PM Pacific Time and goes for about 2 hours.

Midwest Classic Radio Net: Meeting Saturday morning on 3885 kc at 7:30 AM, Central Time. Only AM checkins are allowed. Swap and sale, hamfest info, and technical help are frequent topics. Control op is Rob (WA9ZTY).

MOKAM AM'ers: 1500Z Mon. thru Fri. on 3885 kc. A ragchew net open to all interested in old equipment.

Northwest AM Net: AM activity is daily 3 PM to 5 PM on 3875 kc. The same group meets on 6 meters at 50.4 mc. Times are Sundays and Wednesdays at 8:00 PM. 2 Meters Tues. and Thurs. at 8:00 PM on 144.4 mc. The formal AM net and swap session is on 3875 kc, Sundays at 3 PM.

Nostalgia/Hi-Fi Net: Started in 1978, this net meets Friday at 7 PM Pacific Time on 1930 kc.

Old Buzzards Net: Daily at 10 AM local time on 3945 kc in the New England area. Listen for net hosts George (W1GAC) and Paul (W1ECO).

Southeast Swap Net: Tuesday at 7:30 PM Eastern Time on 3885 kc. Net controls are Andy (WA4KCY) and Sam (KF4TXQ). Group also meets Sunday on 3885 kc at 2 PM Eastern Time.

Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM on 50.4 mc. Net control op is Will (AA6DD).

Swan Nets: User's Group meets Sunday at 4 PM Central Time on 14.250 mc. Net control op is usually Dean (WA9AZK). Technical Net is Sat, 7235 kc, 1900Z. Net control is Stu (K4BOV)

Vintage SSB Net: Sunday 2100Z 14.293 & 0300Z Wednesday. Net control Lynn (K5LYN) and Andy (WBØSNF)

West Coast AMI Net: 3870 kc, Wed. 8PM Pacific Time (winter). Net control rotates between Skip (K6YKZ), DJ (K6RCL), Don (W6BCN), Bill (N6PY) & Vic (KF6RIP)

Westcoast Military Radio Collectors Net: Meets Saturday at 2130 Pacific Time on 3980 kc +/- QRM. Net control op is Dennis (W7QHO).

Wireless Set No. 19 Net: Meets the second Sunday of every month on 7270 kc (+/- 25 Kc) at 1800Z. Alternate frequency is 3760 kc, +/- 25 kc. Net control op is Dave (VA3ORP).

CLASSIFIEDS

Advertising Information

Subscribers receive 1 free 20-word ad per month. **Extra words are 20 cents.** Here is how to count the words in your ad: "For Sale" or "Wanted" and your contact information counts as 7 words. Hyphenated words count as 2 words. **Please count the words in your ad as described above, and if you are over 20 words, send payment for the extra words at .20 each.** Note: Not all readers use email, so it is a good idea to include phone numbers.

Non-subscribers: $3.00 minimum for each ad up to 20 words. Each additional word is 25 cents. Email ads are fine.

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VINTAGE EQUIPMENT ONLY!

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Telephone: 720-924-0171
FAX (call first): 303-838-3665
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Deadline for the September 2003 Issue: August 29

FOR SALE: Repair and restoration on all vintage equipment; 45 years experience. Barney Wooters, W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. 303-770-5314

FOR SALE: Military Radio manuals, origs & reprints. List for address label & $1. For specific requests, feel free to write or (best) email. Robert Downs, 2027 Mapleton Dr., Houston, TX 77043, wa5cab@cs.com

FOR SALE: Collins: 75A-4, speaker, manual. 180S-1. Test set I-139A, TV-7. Hallicrafters S-38C. National NC Sixty. ARC-3 & 67B. ARC-5, T-23. BC-624A. Bill Coolahan, 1450 Miami Dr. N.E. Cedar Rapids IA 52402-2933. 1-319-393-8075

FOR SALE: Full set of '73 magazine from issue Vol 1 number 1 (early 60's) to December 2002. Great BA reading. $300. Pickup only, Staunton Virginia. Dave Metz, dmetz@ntelos.net, (preferable) 540-886-0000 daytime

FOR SALE: Countermeasures receiving set AN/WLR-1D, 50-10750 MHz, 9 bands, simultaneous display of frequency, spectrum, and modulation info on dual displays, manual, 1200 lbs., $4,500. Carl Bloom, 714-639-1679, carl.bloom@prodigy.net

FOR SALE: Naval Receivers RAK, RAL, RAO, RBA, RBB, RBC, RBL, RBM. Some checked, pwr splys available. $75-$450 depending on condx. Many other types. Carl Bloom, 714-639-1679. carl.bloom@prodigy.net

NOTICE: NCX-1000 IF cans now available. George, 413-527-4304

FOR SALE: Heath Cheyenne MT1 mobile xmtr $75. Heath GR84 rcvr $35. Heath Oscilloscope 10-4205 $75. Gonset G28 10M xcvr. Hallicrafters S77A rcvr $65. Richard Cohen, 813-962-2460

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FOR SALE: Collins 75A4, #67X, excellent condition, two filters, photos on request. $1500. Bob Ryals, KIØGF, 3390 Blodgett Drive, Colorado Springs, CO, 80919. joebob1@adelphia.net

FOR SALE: Heath Mohican, IM-18 VTVM, RCA WV-98C VTVM, RCA signal generator. Carter, WD4AYS, 434-979-7383, CElliott14@aol.com.

FOR SALE: Stoddart TS-587/U Noise Field Intensity Meter, 15-400 Mc, w/RF 37 & RF 36 tuning heads. $75. Al Jenkins, WA1RWB, 5 Daley CT. Nantucket MA. 02554. 508-325-7122

FOR SALE: Large collection of General Radio test equipment manuals, catalogs, exc. condx. SASE needs. Stuart T. Carter, II. W4NHC, 680 Fernwood Drive, Melbourne FL 32904-1995, 321-727-3015

FOR SALE: Four inventors first day covers: Armstrong, Farnsworth, Tesla, and Steinmetz; $20 ppd. Ross Wollrab, 229 N. Oakcrest Ave, Decatur, IL 62522-1810. rewollrab@aol.com

FOR SALE: Who needs a meter for a Jackson Model 637 tube tester? $20. Contact: Mike Grimes, K5MLG; 3805 Appomattox Cir; Plano, Texas, 75023, 972-867-6373.Email: grimesm@flash.net

FOR SALE: Hallicrafters SX-88, HT-18, HT-40. Serious inquiries only. Ed, 1-662-746-2256 from 2400 to 0200 UTC only.

FOR SALE OR TRADE: QST, full years, excellent condition. 1950 thru 1960, plus 1944 missing September. $10 per year plus shipping from 10021. Or trade for CQ 1950 thru 1969. Ken, W2EWL, 212-288-1310, ken44@nyc.rr.com

FOR SALE: Drake TR-4 with power supply, speaker and manual $225, good condition. Bob, W1RMB 508-261-8231.

FOR SALE: Tube Collectors RCA 6181 1KW UHF tetrode and RCA 5820 image orthicon. Norman Hall, W6JOD, 661-399-4101, w6jod@aol.com

FOR SALE: SX-101 and HT-32. $150. Pick-up only. 307-325-9081 k7du@vcn.com

FOR SALE: Navy TDB xmtr. See November 2002 ER article. $250 OBO. Pick up only. SCARC PO Box 55069, Pittsburgh, PA 15207. W3SVJ@libcom.com

FOR SALE: Drake R-4A rcvr, good condx., works fine, unmodified. $130 plus shipping. Jim, W8HPL, 13549 Morse Rd., Pataskala, OH 43062 740-927-2592

FOR SALE: GR 1192 Frequency counter, manual copy, $50. GR 724-A Wavemeter, $46. Simpson 383-A Capacitor Analyzer, manual, $40. B&K 960 Transistor Radio Analyst, manual, $45. Sencore filament and fuse tester, $25. 7&9 pin tube pin straightener, $5. Ross Wollrab, 229 N. Oakcrest Ave, Decatur, IL 62522-1810. 217-428-7385 rewollrab@aol.com

FOR SALE: Morrow CM-1, BC receiver w/meter; Heath HD-15 hybrid phone patch; $20 ea + shpg. Henry Mohr, 1005 W. Wyoming, Allentown, PA 18103-3131

FOR SALE: MS-4, AC-4, T-4XC, R-4C, $400. Vibroplex original; 68,xxx. DX-1000 Bearcat rcvr $100. Allen Blackledge, N5YBF, PO Box 10, Soso, MS 39480.

FOR SALE: HP334A Automatic Distortion Analyzer, $100. HP190A Q-Meter $85.Both tested, nice condition. Kirk Ellis, KI4RK, 203 Edgebrook Drive,Pikeville NC 27863, 919-242-6000, e.kirkellis@netzero.com

FOR SALE/TRADE: Original manuals: TR4CW, R4B, 32V2, SR150, SR400, Valiant, Adventurer, 6N2, HQ-145, NCX3, others. Ni4q@juno.com 407-351-5536

FOR SALE: Send #10 SASE for large list of accumulated tubes. WB5UIA, 903 Madison Ave., Minden LA, 71055-2923

FOR SALE: Antenna tuners AEA AT300 $100, Ten Tec 4229 2kw $175, Ed Sauer 787 N.Peterman Rd. Greenwood, In 46142 317-881-1483.

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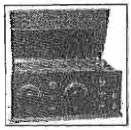

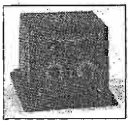

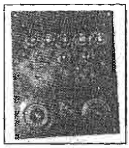

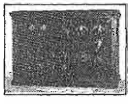

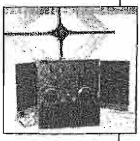

After collecting for many years, Donald Rossbach of North Canton has decided to pursue other interests. We are proud to be able to offer this fine collection along with The Sanford Deutsch Collection. The quality of both collections and the rarity of some of the pieces offered will make it an auction you will not want to miss!

Some of the items in Don's collection are:

Crystal Sets: Brownie #2, ET Turney, Hearever, Howe, Kodel, Levinsons, Levinsons Senior, Little Giant, Locke DC, Philmore, Revophone, Shield, Telfunkun, Wireless Shop and Two Loose Coupler Type.

Amateur Radio: Hallicrafters SX-76, SX-43, SX-62, S-38C, S-38EM, Sky Champion, Sky Buddy, SX-99, Hammarlund HQ-180A, HQ-129-X, HQ-140X, National HRO, HRO-STAI, SW-54, NC100A50, S-101, Dog House Power Supplies (2) Echophone, Signal Corp R-390-URR.

Battery Sets: Deforest SP-500, Federal 61, Federal Type 200, Type 102, Type 110, Grebe CR-14, CR9, Clapp Eastham HZ Amp, Clapp Eastham R4 Detector & Amp, Etherphone I Tube w/detector, Echophone, Radiola II, Radiola RS, Tuska 224, Superdyne Jr., Tri-City I Tube, RA-DA Unit, Zenith 4R, Zenith 2M Amp, Westinghouse 2 Stage Amp.

In addition, Don has many nice speakers, a Freed-Eismann Store Kit never assembled, a WWII German Nazi Radio, several Glass Front Home Brew Units and one in an All Glass Case. Don collected AC Sets also, so we will offer Tombstone and Cathedral Radios from his collection; also his Zenith Transoceanics.

Please watch our website -- pictures will be posted in the near future.
Make plans now to attend this fine auction.

Terms: Cash/Check/Visa/MasterCard
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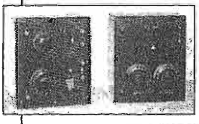

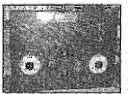

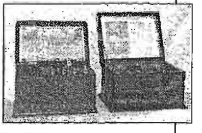

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Call Us to Sell One Radio or Your Entire Collection!

FOR SALE: Sunair Auto Tuner SAC69 $300. Collins VHF aircraft receiver R-540/ARN-14C, mating VHF transmitter VHF type 17L, both for $200. George Portell, 480-986-5797.

FOR SALE: ARC Type-12 parts. Two radios, mounts, control boxes and connectors. Mike, 510-732-0932

FOR SALE: ARC-5 transmitters 4-7 mc, unconverted, $50, PE-103 dynamotor $50. Ed, WN1I, 207-336-2858, Buckfield ME.

FOR SALE: QSTs starting late 20's, request list, or specific issues. $1 per, 3 for $12, six for $5, etc. + postage, most clean. Charles Graham, K2GVE, 4 Fieldwood Drive, Bedford Hills, NY. 10507. 914-666-4523

FOR SALE: Motorola and GE tube FM gear for sale, ask W2OQI@optonline.net, 631-878-1591, 17 Inwood Rd, Center Moriches, NY 11934

FOR SALE/TRADE: QST's 1915 to 1970's some years incomplete but dupes 20's to 40's, $1000.00 OBO or trade for communications receivers. K8CCV, Box 210, Leetonia, OH 44431-0231, 330-427-2303 Weekdays.

FOR SALE: GE mobile xmtr 40-50 mhz. 6V dynamotor 60 watts. Pair 807's. Mel, WØMLT, 970-249-1544

FOR SALE: KWM-2A plug-in relays K2 & K4 manufactured by Allied Signal, P/N T163-6C-115D and T163-4C-115D. $35.00 for a set + $3.85 priority mail. Mike Hutnick, 450 Riverview Ave., Bloomsburg PA, 17815, hutnick@epix.net

FOR SALE: Vacuum fixed and variable capacitors. Details at: http://www.isquare.com/personal pages/forsale-vacvar.htm Bob, WØYVA, Great Falls, VA. 703-450-7049.

FOR SALE: Clegg Thor 6 six meter AM/CW transceiver, $235: Lafayette HA-410 10-meter AM transceiver, $135. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973-728-2454. rprester@warwick.net

FOR SALE: NOS Tungsol 26Z5W as used in the R390A, $16.00 each. Electron Tube Enterprises, Box 652, Springvale ME 04083. 207-490-5870

FOR SALE: Military whip antennas NOS, handheld pilot radio beacon AN/URT-33, $40. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777, 989-595-6483

FOR SALE: Tube collectors. 1944 Jennings capacitor. Uranium glass glows bright green under your UV light. Mint condition. In original carton. $20 ppd. Bob Ryan, 1000 S. Gilbert St., Apt 132, Hemet CA 92543-7065

FOR SALE: Tested good globe 201A $14, 226 $15, 227 $10 and others. Slightly weak tubes guaranteed to work in early radios ½ price shown. Write or e-mail: tubes@qwest.net for a new price list or see www.fathauer.com. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281, 480-968-7686. Toll Free 877-307-1414

FOR SALE: Authorized repairs and sales of all types of amateur radio and communications equipment, and also test equipment. Please call us at LAND AIR COMMUNICATIONS, 718-847-3090 and visit our web site: www.landaircom.com. We have over 3,000 items in inventory and carry all types of communications parts.

FOR SALE: Repair, Restore, Sales of antique, vintage tube radios. John Hartman, NM1H, www.radioattic.com/nm1h

FOR SALE: Collins KWM-2 & "S" Line repair, Fast service. All work guaranteed 281-351-4953 WB7DYW@EV1.NET http://users2.ev1.net/~wb7dyw/index.htm

FOR SALE: Vintage Radio Service. We repair radios, record changers, radios home, auto, tube & transistors. 1930-1980. Ken Hubbard, KA9WRN, POB 792, Beloit, WI 53512. 608-362-1896

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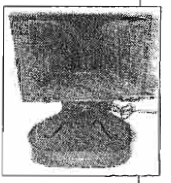
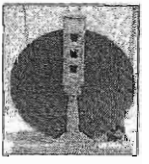
We are pleased to offer the collection of the late Sanford (Sandy) Deutsch of Yorktown Hts., New York. Sandy enjoyed all facets of radio and was also a ham radio operator. His collection will be combined with "The Donald Rossbach" Collection from Canton, Ohio to make an excellent auction for any collector.



Some of the items in the Sanford Deutsch are Federal 59, 61, Cutting & Washington 11A, 11B, Clapp-Eastham C-3, Grebe CR2, CR3, Paragon RD-5 with A-2 AMP, Tuska 224, 225, Western Electric 4A, Westinghouse SE 1012 A (1918), Western Coil & Elect. WC-15, Shepco T-12, Michigan Midget, NY Album & Card Nyacco Portable w/loop & speaker, Crosley Pup w/box, Crosley Ace, Erla K-8.

Also many early tubes to include: Von Lieben Triode (clear) & Von Lieben Triode (coated), Deforest Scillion Serial Number 125, and others.

Marconi Spark Gap, Deforest Crystal Detector, a Majestic Adv. Sign (electric w/rotating globe), Zenith 6' tall sign "Long Distance Radio" (ca 1935), McMurdo Silver 701 Transmitter, Daven TV Scanning Disc w/Motor & Raytheon Neon Tube, Pilot 3" TV, Colonial New World Globe, Pepsi Cola Cooler, Crystal Sets -- Beaver, Baby Grand, Howe, Lemco, Mengel, Murdock, and others.



Loop Antennas Deutsche Telephonwerke, Western Electric, 25 Horn Speakers including Western Electric IC-D, 521CW, 521W, Timber Tone, 6 Atwater Kent Breadboards.

Lots of A-C Sets, Tombstone and Cathedrals.
We will have photos on the web soon.
Make plans to be with us at this sale!

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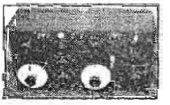

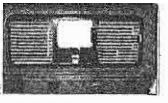

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FOR SALE: .Weston analyzer mod 779 a/o no cables, oak case @9 $60. General Radio output pwr meter type 583A, $25. Teck Inst. Co wide band amplifier (Acton MA) Type 500AR $16 oak case $25. Bernie Samek, 113 Old Palmer Rd, Brimfield MA 01010, 413-245-7174 FAX 0441. NOTICE: If I don't return your call, please call again because message was garbled on my machine or I copied wrong.

FOR SALE: Radio books, magazines, catalogs, manuals (copies), radios, hi-fi, parts. Send 2 stamp, LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857. ka1edp@juno.com

FOR SALE: Collins Radio stock certificates, 33 avail, 10-share (green) or 100-share (blue), issued to various companies. $20.00 each, limit one per customer. Check or MO. No choice on color. William O. Dean, KC7ICH, PO Box 3105, Tonopah, NV, 89049

FOR SALE: Your old QSL card? Search by call free, buy find at $3.50 ppd. Chuck, NZ5M, NZ5M@arrl.net

FOR SALE: New Ranger 1, Valiant 1, & Navigator plastic dials, freq numbers in green, with all the holes just like orig. - $17.50 ppd. Bruce Kryder, W4LWW, 277 Mallory Station Dr., Ste. 109, Franklin, TN 37067. bak@provisiontools.com

FOR SALE: Communications Receivers, Military Communications and some test equipment. SASE, Don Jeffery, 131 North Ivy Ave., Monrovia CA, 91016, boallan@aol.com

FOR SALE: KWM2/S-line metal logo pins. Meatball or winged. Excellent replica of the original. Put one on your hat, badge, or replace a missing logo on your panel. $6.25 shipped. W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029. 760-747-8710, w6zz@cox.net

FOR SALE: Send SASE for large list of excess parts. Publications, ham & test gear. K4AFW, 104 Glenwood Dr., Williamsburg, VA 23185

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

FOR SALE: R.L. Drake repair and reconditioning, most models including TR-7's, 35 years experience. Jeff Covelli, WA8SAJ, 440-951-6406 **AFTER 4 PM**, wa8saj@ncweb.com

NOTICE: Visit Radioing.com, dedicated to traditional ham radio & vintage radio resources. Let's Radio! Charlie, W5AM. http: / /www.radioing.com.

FOR SALE: Heath Nostalgia, 124 PG book contains history, pictures, many stories by longtime Heath employees. (See BOOKS inside back cover.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028

FOR SALE: DX-35, DX-40 reproduction crystal doors. $11.50 shipped. Texans add 8.25% sales tax. Glen Zook, 410 Lawndale Dr., Richardson, TX 75080 972-231-5011

FOR SALE: TX'ers, rcvrs, parts, manuals, etc. Send a large SASE. More at http://come.to/AF4K/ Brian Carling, 117 Sterling Pine Street, Sanford, FL 32773 Brian Carling, AF4K, 117 Sterling Pine St., Sanford, FL 32773.

FOR SALE/TRADE: Transmitting/ Receiving tubes, new & used. $0.55 & LSASE for list. I collect old & 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., 13406 W. l28th Terr. Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

FOR SALE: Treasurers from the closet! Go to www.cjpworld.com/micromart to find some unique items many hams would lust for! Gus, WA, 360-699-0038 gus@wa-net.com

FOR SALE: Books, send SASE. **WANTED:** Anything by Fairchild or Langevin. send SASE for my want list. Richard Robinson POB 1425 Wallingford CT 06492, 203-949-0871 or richmix@erols.com

FOR SALE: Vintage equipment at the K8CX Ham Gallery Classified Ads section. Visit the largest Antique QSL Card Gallery http:/ /hamgallery.com

NOTICE: T-368 Registry. For info w2zr@ao1.com Subscribe to the T-368 & BC-610 reflector at http:/ / groups.yahoo.com/group/T-368_BC-610

FOR SALE: Lots of old radio & related books. Eugene Rippen, WB6SZS, www.muchstuff.com

FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. 516-653-535

FOR SALE: Please visit RadioWorld-Online.Come to see our ham gear, parts, and more. Carl Blomstran PO Box 890473 Houston Tx. 281-660-4571.

FOR SALE: Spun Aluminum Knob Inlays for most Boatanchors. Collins Dial Drum Overlays. Dakaware Knobs. Charlie Talbott, 13192 Pinnacle Lane, Leesburg VA 20176-6146. 540-822-5643, k3ich@arrl.net

FOR SALE: Some unused obsolete Triplett tester transformers. Free List. Bigelow Electronics, POB 125, Bluffton, OH 45817-0125

FOR SALE: Build your own "Midget" bug replication by KØYQX, ca 1918, featured by K4TWJ in CQ Magazine, May '98. 10 detailed blueprints. FAX: 507-345-8626 or e-mail bugs@mnic.net

FOR SALE: Parts, tubes, books, ECT. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761 wb0cte@arrl.net

FOR SALE: Collins restoration. Everything inside & out to make it as Art Collins built it. 50 yrs experience. W9OJI / N4FZ, IL, 815-734-4255 or N4PZ@aol.com

FOR SALE: Convert any wattmeter to read PEP! Perfect for AM/SSB-$24.95 ppd for complete kit! HI-RES, 8232 Woodview, Clarkston MI 48348, 248-391-6660, info@hi-rescom.com

FOR SALE: Complete hardware set to connect Collins PM2 to KWM2 -$19.95 ppd. Warren Hall, KØZQD, FOB 282, and Ash Grove, MO 65604-0282.

FOR SALE: Repair, upgrade, performance modification of tube communications & test equip. Accepting most military, all Collins & Drake designs, & the better efforts from others. Laboratory performance documentation on request. Work guaranteed. Chuck Felton, KDØZS, Felton Electronic Design, Box 187, Wheatland, WY 82201. 307-322-5858 feltoned@coffey.com www.feltondesign.com

FOR SALE: New Release. For details send 2-stamp LSASE to: Olde Tyme Radio Co, 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910

FOR SALE: Military and commercial communications items. Murphy's Surplus, 401 N. Johnson Ave., El Cajon, CA 92020. 619-444-7717 www.Murphyjunk.com

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

FOR SALE: PANEL AND CABINET REFINISHING; Johnson, Hammarlund 180(a), R390(A), & others total restoration & sales; My updated web site: http://w4pnt.8k.com Patty & Dee's Marina; Dee Almquist, 534W. Main St., Waynesboro, VA 22980. 540-249-3161 Cell: 540-480-7179, FAX 540-249-5064

FOR SALE: RIT for Collins KWM-2/2A; No modifications needed. $79.95 SASE for details. John Webb, W1ETC, Box 747, Amherst NH 03031 bigspndr@bit-net.com

FOR SALE: Aluminum heat dissipating plate and grid connectors for all 3, 4 and T series Eimac tubes including 3-500Z, 4-1000, 304T's and others. Alan Price fixr7526@cs.com

FOR SALE: Ships radio room clock repros, boatanchor mugs and t-shirts, more. http://www.cafeshops.com/amradio,amradio2

FOR SALE: Galena crystal radios, with and without internal amplifiers, also radio tubes, all kinds, free list. Len. Gardner, 458 Two Mile Creed Rd., Tonawanda, NY, 14150. email: radiolen@aol.com

FOR SALE: I built hot-rod receivers; R390A, SP-600, R-388/51J. NC-183D...and transmitters: Valiant, DX-100, T-4X-A-B, HT-32. 51J-4 filter replacements, R390A Hi-fi AM $245.00 ea. Chuck Felton, KDØZS, Wyoming, 307-322-5858, feltondesign@yahoo.com

FOR SALE: Collins reproduction items available through the CRA on www.collinsra.com. Join the CRA and subscribe to the Collins Journal. Dave, W3ST

FOR TRADE: Two good RCA 833A's for one Taylor 833A. Also looking for Taylor 204A, 813, TR40M. John H. Walker Jr., 13406W. 128th Terr., Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

WANTED: Fully functional with manuals: Johnson AN/FRT505 transmitter, Swan F51 and FC76. Contact Ric at C6ANI@arrl.net

WANTED: 70' or 80' steel crank-up tower. Prefer KY, TN, W5, AZ, UT, W8, W9, WØ locations, others considered. Tom Berry, W5LTR, 1617 W. Highland, Chicago, IL 60660. 773-262-5360. Cell phone, leave message: 773-301-7640.

WANTED: Cabinet for Drake TR-4. I restored the rig, works great, but now can't find a cabinet! Steve Johnston WD8DAS, 11723 W. Jenilyn Ct. Boise ID 83713. sbjohnston@aol.com

WANTED: Gonset G-76, Hallicrafters SR-400, ART 13 transmitter and Accu-Memory II Keyer, KBØW, 916-635-4994; frankdellechaie@sprintmail.com

WANTED: WW2 Navy MBF transceiver, hopefully unmodified. John Svoboda, W6MIT 530-672-0903 or svoboda@directcon.net

WANTED: Hallicrafters PS-500 A-AC pwr sply for SR-400 transceiver. Bob, KL7HDY, 9501 Brien St. Anchorage AK, 99576, 907-346-1044

WANTED: Hallicrafters S-38, S-38A, S-38B, S-38C. Good or bad. $25 to $60 paid + shipping. Frank, 802-457-3482

WANTED: Collins 310B-3, basket case OK, 70E-8A PTO per 1948. Chicago CMS-2, pair of Taylor T-21. Jerry, W8GED, CO, 303-979-2323.

WANTED: Manuals: OE-4/GR, GRA-94, PRR-15, PPS-15B, RD-140/TNS, ASB-5, APA-11A, 8D-3 xcvr. William Van Lennep, POB 211, Pepperell, MA 01463. 978-433-6031

WANTED: HQ129X cabinet. Condition not important since I can strip and re-paint if necessary. Joe Fell, W3GMS, e-mail joseph.fell@Unisys.com or phone 610-648-4425.

WANTED: Top and bottom covers for FTDX-400 Yaesu, same as FT-401B, 560 or 570. Tom, tomN5ACA@juno.com, 281-996-5835

WANTED: CQ Magazine. April, May, and June 1945. Lynn Stolz 614-207-2280 or n8aj@arrl.net

WANTED: Power transformer for the Gonset Communicator IV, or a parts unit with a good transformer. Frank, WA6RBQ 541- 479-7935 or wa6rbq@aol.com

WANTED: DM-28 or DM-24 with filter assembly for the BC-348. Bill, KØRZ, 303-499-1936, billk0rz@aol.com

WANTED: Power supply front panel from a Wireless set No. 19 MK2, or a parts unit Power supply with a complete front panel with original connectors, I do not need the dynamotor. Frank, WA6RBQ, 541-479-7935 or wa6rbq@aol.com

WANTED: James Millen coils 42080, 42040, 42015, and 43015. Info and photos of Navy "RG" receiver. Gary Carter WA4IAM, 1405 Sherwood Drive, Reidsville, NC 27320. Phone: 336-349-1991. Email: gcarter01@triad.rr.com.

WANTED: Schematic or any information on Hallicrafters Model SS-55 AM/FM receiver. Colin K1IXU electric6@juno.com

WANTED: Parts, tubes, and accessories for National NCX-5 radio. WB5UIA, 903 Madison Ave., Minden LA, 71055-2923

WANTED: Drake 2-B parts unit. Al Lemke, KB7QQW, 1115 Merea Ln., Sultan WA, 360-793-6510

WANTED: Manual for a Gates "PRODUCER" Mono Mixer board. Copy will do as well. A schematic copy will help also. Bob Lydon AB3L AB3L1@aol.com 412-429-8413

WANTED: CQ Magazine. April, May, June 1945. Lynn Stolz 614-207-2280 or n8aj@arrl.net

WANTED: Large main tuning knob for Heath SB 310. Bob, WBØDMC. Phone # 507-331-5103.

WANTED: Sonar FR-104 30-50 MHz receiver, also any tube type C.B. made by Sonar or Olson for 10M conversion. Bill Smitherman, KD4AF, 336-699-8699, 9401 Hwy 67, East Bend NC, 27018.

WANTED: R9 receiver by Harvey-Wells in good condx. Richard N. Pann, W1SVJ, 2447 Yates Dr., Augusta GA, 30906-2587. 706-798-7279. RPANN@COMCAST.NET

WANTED: R-1051/URR top condition top price. IZ1FID federico.baldi@virgilio.it fax +390384672219

WANTED: Info/schematic on RCA Transcription Turntable Type 70-C-1 MI-4871-G.Denny Reeves, reeve06@texas.net, (512) 258-8473.

WANTED: Mint metal trim ring for the Collins S-line radios. Fred NE2E 1-732-257-0327 ne2e@ne2e.com

FOR SALE: Heathkit EK-2 AM/SW receiver, works, clean w/o manual or schematic. $30 includes USPS. Louis L. D'Antuono, 8802-Ridge Blvd, Brooklyn NY 11209. 718-748-9612, AFTER 6PM.Eastern Time

WANTED: Manual/tube list for B&K model 600 Tube tester. Copy OK. Dennis Olmstead, WB9EMD, 431 Ridgewood, Glen Ellyn, IL 60137 phone/fax 630-469-0531 email wb9emd@aol.com

WANTED: Correspondence with others (am incarcerated) on Military (especially R-390's & backpacks) and tube rigs. Also looking for copies of old surplus catalogs postwar thru 90's. W.K. Smith, 44684-083, FCI Cumberland Unit A-1, POB 1000, Cumberland, MD 21501.

WANTED: Manual for HP Down Converter 11710A. Richard Wieschhoff, 7 rue du Debuche, F-78120, Rambouillet France; T/Fax 0033 1 304 111 02

WANTED: Manual and/or schematic for Hewlett-Packard 1700B scope. Walt Tukkanen, box 254, Koza, Okinawa, Japan, 904-0021 billtukkanen@yahoo.com

WANTED: FRONT COVER for Tektronix model 475 oscilloscope. All Tek 270 and 460 series use same size cover. Please help me find one. Harry Grewlich, WA6IWZ, 442 S. Alpine Rd.

Orange CA 92868. 714-978-3121

WANTED: I need a 0.85-800 VAC capacitor as used with Sola transformers. W7SC, 3932 S. Mesa View Ln, Boise ID, 83706-6052

WANTED: Original tuning dial knob dial lock and name plate for my Hallicrafters R-274/FRR. Walter Iacobelli, 2147 Harmon St., Ridgewood NY 11385, 1-718-456-1988

WANTED: #33A and #35 Universal SW-3 coils for cash or other coils. Hank Bredehorst 2440 Adrian St Newbury Park, CA 91320. 805 498-8907 quailhill@earthlink.net

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WANTED: Coils Forms for National FB-7 and preselector. Mike Sanders 18169 Hwy 174 MT Vernon, MO 65712-9171 k0az@arrl.net

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WANTED: National NC-303 in great physical condx and working, also want B&W 5100S and 51S sideband adapter. C.J. Ryan, PO Box 164, S. Plainfield NJ, 07080

WANTED: Hammarlund HQ180X crystal deck with switch. Ed Cuevas, Fort Worth, TX, 817-222-5355, ecuevas@juno.com

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WANTED: National HRO-500-TS speaker for the HRO-500 and a Hallicrafters HT-32b.Bob, WØYVA. bobs@isquare.com; 703-450-7049.

WANTED: HRO 60 Xtal calibrator either original or home brew plug in. Phil, W9DVM 727-944-3226 plamarc1@tampabay.rr.com

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WANTED: "H" and "J" VLF coils for my HRO-50. Jack, W8JNH, Greenville OH, 937-548-4110

WANTED: Headset, mic, key, and AC power supply for the Navy/Marine Corps TBY transceiver. Ken Kolthoff, K8AXH, POB 215, Craig, MO 64437. Work #: 913-577-8422

WANTED: 23 channel tube-type CB radios for 10-meter conversions. Also tube-type 10-meter linear amplifiers. Ed, WA7DAX, 1649 East Stratford Ave., Salt Lake City, UT., 84106. 801-484-5853

WANTED: W.E. Type 215-A (military VT-5) vacuum tubes. Roland V. Matson, POB 956, Lake Panasoffkee FL 33538 1-352-568-1629

WANTED: Info on Electro Tone Labs M100. Maybe a screen modulator. Has volume control & 2 slide switches, CW-phone, Tone-mic on front. 4 terminal on rear plus adjustable control that controls voltage to 2 of the terminals. Randy, 411 Woodhaven Dr., Lynchburg, VA 24502, 434-239-6127. RWC-radiocollector@worldnet.att.net

WANTED: Eldico SSB-100F linear amplifier, good condx, working. Bill, W4TXL, 336-969-2057, W4TXL@msn.com

WANTED: Manual, info on Hallicrafters SX-96A (NOT SX-96). Jim Novak, WA9FIH, 2335 S. 2nd Ave., North Riverside IL, 60546-1308, WA9FIH@arrl.net

WANTED: Looking for the emblem of National "NC". Katsu JO1GEG/ ex.N8EYH, khirai@ieee.org

WANTED: One tuning knob for SX-96, SX-99, or SX-100. Herb, K9GTB, 6486 Bow Lane, Gillespie IL, 62033. 618-362-6539

WANTED: Meter for Hammarlund HXL-One linear. Paul, KU6T, 310-453-6631, pkcwang@ee.ucla.edu

WANTED: National HRO-500-TS and LF-10 preselector. Information on improving SSB distortion in the HRO-500. Bob, WØYVA. bobs@isquare.com; 703-450-7049.

WANTED: 111C telephone company repeat coils. Jim Alexander, K0HIP, 479-968-7270, ealexand@cswnet.com

WANTED: Audio transformers, with good windings, for Westinghouse RADA and Aeriola SR. amplifier. Paying $40.00 each plus shipping. Roland V. Matson, POB 956, Lake Panasoffkee FL

WANTED: Waters Q-Multiplier for Collins KWM-2. Claude Fleureau, F6GGF, 14 Sentier-Du-Buvier, 92130 Issy-Les-Moulineaux, France

WANTED: Anyone interested in forming an email discussion group on OS-8/U oscilloscopes please email Mike at: mikehardie@shaw.ca

WANTED: Power transformer for Collins 310B3 exciter—will buy junk unit if needed. Brian Roberts K9VKY, 130 Tara Dr., Fombell, PA 16123 724-758-2688 k9vky@arrl.net

WANTED: Marantz first power amp, uses EL39 tubes. Condx unimportant. Or pay well for photo of same. For use in upcoming "History of Audio" book. Charles Graham, 914-666-4523

WANTED: WW-2 Japanese Military Radio of any kind. Yokohama WW-2 Japanese Military Radio Museum, Takashi Doi, 1-21-4,Minamidai, Seyaku, Yokohama, 246 Japan takadoi@carrot.ocn.ne.jp http://www.yokohamaradiomuseum.com/

WANTED: Collins R-389 LF receivers, parts, documentation, anecdotes, antidotes. W5OR Don Reaves, PO Box 241455, Little Rock AR, 72223 501-868-1287, w5or@militaryradio.com, www.r-389.com

WANTED: HELP: I need information on an E.M. Sargent Co.Model 205A 5-band radio circa late 30's (?). David Miller, 307-754-4351 or K7ALR@arrl.net.

WANTED: Any TMC Equipment or Manuals, what have you? Will buy or trade. Brent Bailey, 109 Belcourt Dr.,Greenwood, S.C. 29649 864-227-6292 brentw@emeraldis.com

WANTED: Older rigs & accessories. Brian Carling, AF4K, 117 Sterling Pine St., Sanford, FL 32773. http:/ /come.to/AF4K/

WANTED: National NTE CW xmtr in working Condx. I love National. Sylvia Thompson, 33 Lawton Foster Rd., Hopkinton, RI 02833. 401-377-4912. n1vj@arrl.net

The Collins Video Library

The Collins KWM-2 Video (4 hours, $89.95) Highly detailed video on operation, rebuilding, alignment, troubleshooting, and neutralization of this classic! A must for anyone who owns and operates a KWM-2 or 2A. Printed documentation included.

The Collins 75S-3 and 32S-3 Video (3.5 hours, $74.95) An excellent in-depth examination of the most popular version of the S-Line equipment. Operation, modification, alignment, neutralization are covered and more! Much of this information applies to all versions of the S-Line!

The Collins 30L-1 video (1 hour, $39.95) This is a complete guide to the 30L-1 amplifier. Topics covered are operation and safety, updates, and a discussion of the classic 811A triode. Learn the secrets to greater performance.

The Collins 30S-1 video (1 hour, $39.95) Finally, here is the one everybody has wanted! This extraordinary video describes operation and user safety, maintenance and modifications of this classic Collins powerhouse amplifier. Very informative--truly a must for all 30S-1 owners. Complete with printed documentation.

The Collins Amateur Radio Radio Eqipment Video Spotter's Guide (1 hour and 40 minutes, $24.95) Close to 90 individual pieces of Collins Radio equipment are shown in the video. Examples of some of the gear covered are: KW-1, KWS-1, 30K-1, 20V-3, 75A-4, KWM-2, S-Line, KWM-1, 30S-1, 30L-1, KWM-380 and much more. Study up before that next hamfest!

The Collins KWS-1 Video (2 hours, $39.95) This video is the perfect companion to the 75A-4 video for owners of the "Gold Dust Twins"! Butch Schartau (K0BS) shows you how to operate, maintain and repair your KWS-1. Watch as Butch goes theough the entire alignment and neutralization process, as well as showing you how to properly operate this famous transmitter.

The Collins 75A-4 Video (4 hours, $89.95) This video is four hours of great information on how to repair, maintain and restore this classic receiver. Butch Schartau (K0BS) guides you through all aspects of keeping your 75A-4 running like a top.

R-390A Video (7 hours, $109.95) At last it's available! Long awaited by serious "boatanchor" enthusiasts this is a great video all about the ultimate receiver. Now you will have the ultimate video to go along with it. R-390A expert Chuck Rippel (WA4HHG) covers an absolutely incredible array of information in this "heavy duty" video. This video looks at operation, the receiver modules, complete circuit description, front and rear panel details, complete mechanical and electrical alignment, PTO details, and performance evaluation, modifications, troubleshooting, and restoration. There is nothing like this video available today, at any price!

R390A Addendum Video ($49.95) Another 3 hours and 40 miutes of R-390A information from Chuck Rippel (WA4HHG).

SP-600JX Video (4 hours, $89.95) In this video, Chuck Rippel takes us through all aspects of SP-600-JX servicing including repairs, restoration and modifications. This video is a must for any new owner needing to work on the SP-600.

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Produced by Floyd Soo, W8RO (ex-KF8AT)

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WANTED: Hallicrafters SX 88 parts chassis with cabinet, power,audio output, 50khz IF and 2mhz I F transformers. Ops service manual for Eddystone EC958. Allan, Norco CA, 310-812-0188, alan.royce@trw.com

WANTED: ARC-5 rcvrs, racks, dynamotors. Jim Hebert, 1572 Newman Ave. Lakewood, OH 44107.

WANTED: Top prices paid for globe shape radio tubes, new or used. Send for buy list or send your list for offers. Write or email: tubes@qwest.net See WWW.Fathauer.Com or send for catalog of tubes for sale. George H. Fathauer & Assoc., 688 West. First St., Ste 4, Tempe, AZ 85281. 480-968-7686, Call toll free 877-307-1414

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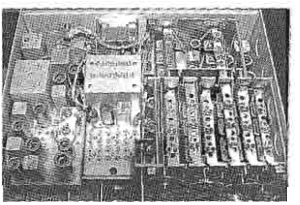

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WANTED: Old military radar displays, scopes, antennae, receivers, manuals, etc. Even half ton items! William Donzelli, 15 MacArthur Dr., Carmel, NY 10512. 847-225-2547, aw288@osfn.org

WANTED: Seeking unbuilt Heathkits, Knight kits. Gene Peroni, POB 7164, St. Davids, PA 19087. 610-293-2421

WANTED: Western Electric horns, speakers, amps, and mics. Barry Nadel, POB 29303, San Francisco, CA 94129. museumofsound@earthlink.net

WANTED: Manuals, manuals, and manuals for radio-related equipment to buy or swap. Catalog available. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. 732-238-8964

WANTED: Postcards of old wireless stations; QSL cards showing pre-WWII ham shacks/equip. George, W2KRM, NY, 631-360-9011, w2krm@optonline.net

WANTED: Stancor/Chicago PCC200, PCO/PSO15O, RC8150; Triad A-9-J, A-l0-J, A-1l-J, A-12-j. **FOR SALE:** Books, send SASE, Richard Robinson, POB 1425, Wallingford, CT 06492. 203-949-0871 richmix@erols.com

WANTED: R-390A rcvrs, parts rigs or restorable, will restore yours at reasonable prices. Walter Wilson, KK4DF, 706-733-8323 wewilson@knology.net, www.knology.net/~wewilson

WANTED: Info on xmtrs made by Clough-Brengle Co. Used by the CCC, in the mid to late 30's. Any help would be greatly appreciated. Ron Lawrence, KC4YOY, POB 3015, Matthews, NC 28106. (704) 289-1166 hm, kc4yoy@trellis.net

WANTED: QSL cards from old/pre WW II Ham DX countries; old regen kits. Hajime Suzuki, Nishikuniyoshi 1644-24, Ichihara-Shi, Chiba-Ken, 290-0231 Japan

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER

articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. 541-923-1013. klakin@aol.com

WANTED: Searching for RME CT-100 or 3R9 xmtrs and info about them. David Edsall, W1TDD, 156 Sunset Ave., Amherst, MA 01002. 413-549-0349, dedsall@crocker.com

WANTED: Orig Heath manuals for ham & test equip. Please state condx & price. Warren, K1BOX, NC, 828-688-1922, k1box@arrl.net

WANTED: WW II German, Japanese, Italian, French equipment, tubes, manuals and parts. Bob Graham, 2105 NW3Oth, Oklahoma City, OK 73112. 405-525-3376, bglcc@aol.com

WANTED: Heath Gear, unassembled kits, catalogs and manuals. Bill Robbins, 5339 Chickadee Dr., Kalamazoo, MI 49009. 616-375-7978, billrobb@net-link.net

WANTED: I wish to correspond with owners of National FB7/FBXA/AGS coil sets. Jim, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511 j.c.clifford@Juno.com

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. 501-318-1844, Fax 623-8783, www.boatanchor.com

WANTED: Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. 661-259-2011. FAX: 661-259-3830

WANTED: Any books featuring panel meters, gauges, or flight instruments. Chris Cross, POB 94, McConnell, IL 61050.

WANTED: Long wire antennas AT1O1, AT1O2, GRC-9; Bendix ATD tuning unit Type CRR 47211, 9050 to 15800 kcs; Gas engine generator UPG-12 (GRC-109) KA1ZQR, 348 N. Main St., Stonington, CT 06378.

WANTED: Manual (copy OK) for Tapetone Skysweep 345 Receiver; correspondence w/other Skysweep owners. Geoff Fors, POB 342, Monterey CA 93942 wb6nvh@mbay.net

WANTED: Power Supply for Gonset G-76 John Broadbrook, 20 Overlook DR. New Milford, CT 06776 860-354-6998

WANTED: Navy LM frequency meter and AC sply. Ken Kolthoff, POB 215, Craig, MO 64437 913-577-8422 daytime.

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Collins KWS-1, 32V series, and 75A series (A1 thru A-3), 42 pages, $15.00 plus $4.00 S&H

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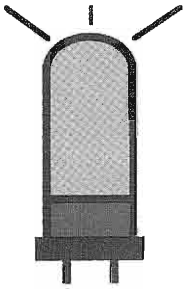

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